80micro 28/82 #31

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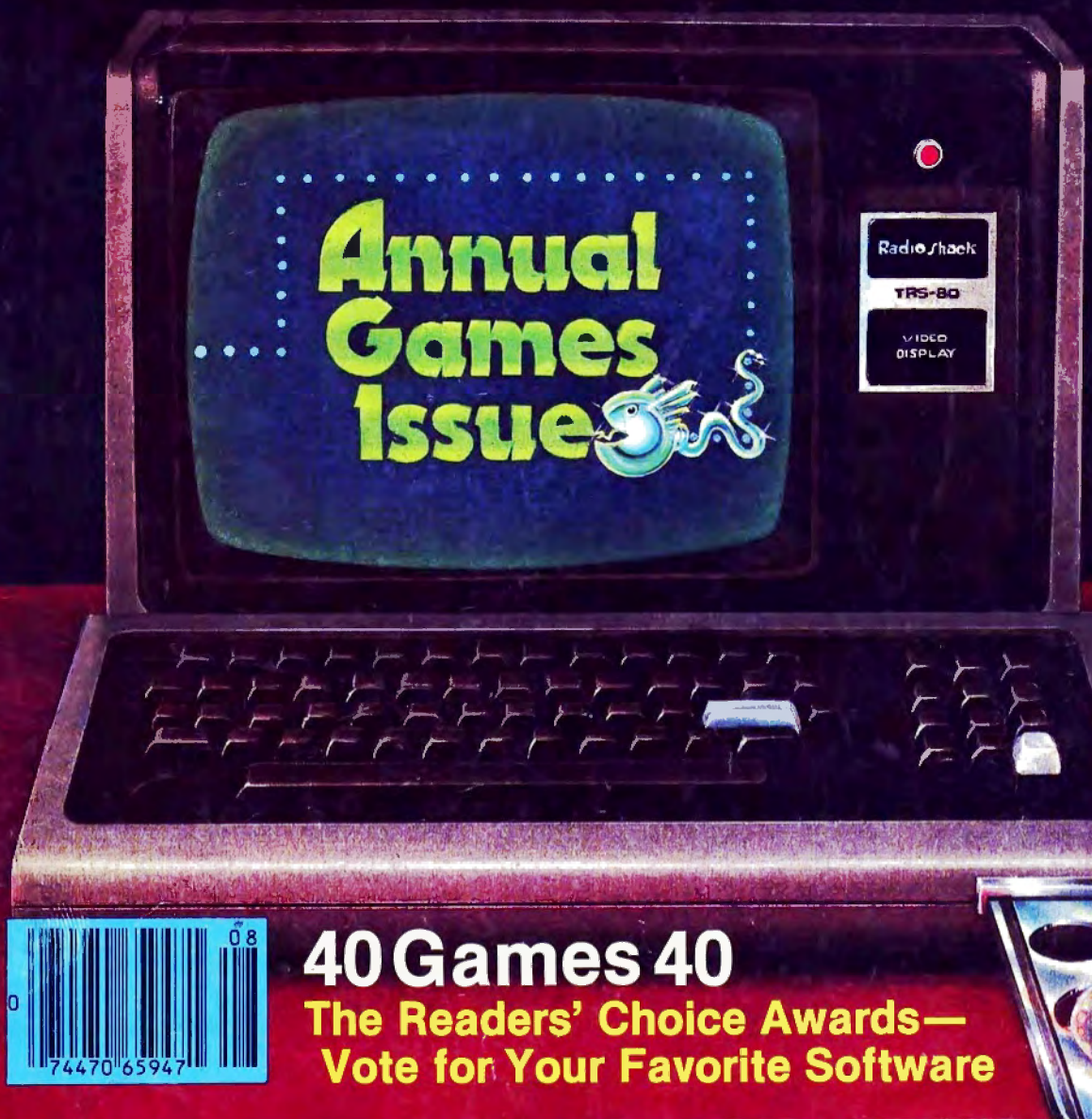
A WAYNE GREEN PUBLICATION

the magazine for TRS-80 users*

Arcade



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40 Games 40

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Victor T. Albino

80. Outdoor Computer Games? Yep!
LOAD 80 Summer is time for the great outdoors. But you find it hard to tear yourself away from your computer, right? With these two outdoor games for your 80, you don't have to.
Barry Adams

94. The Colorful Computer—Part I
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112. Ski Slalom
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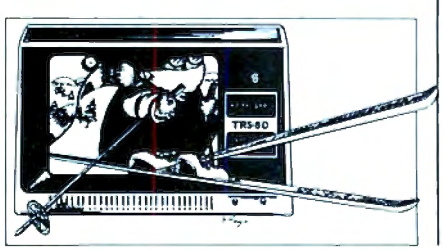
Jake Commander



120. The Graphics King
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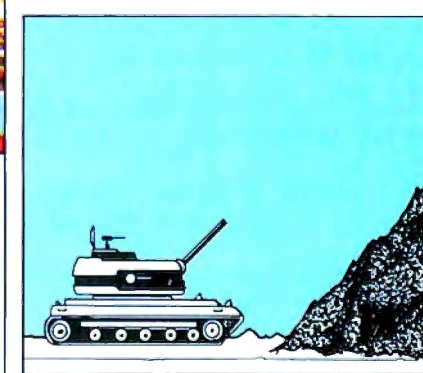

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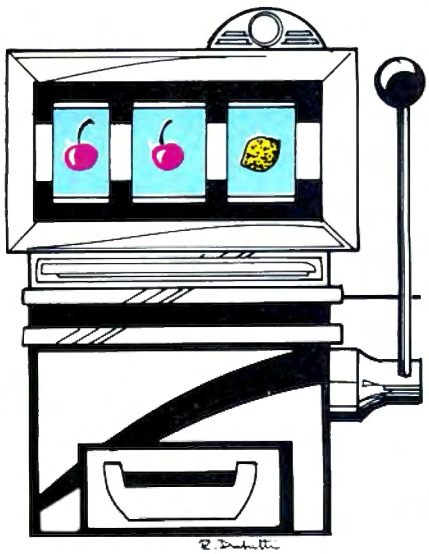
Ron Balewski



234. Cram
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Jonathan Falk

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Brice Hadlock

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Lynard Barnes

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Charles Weindorf

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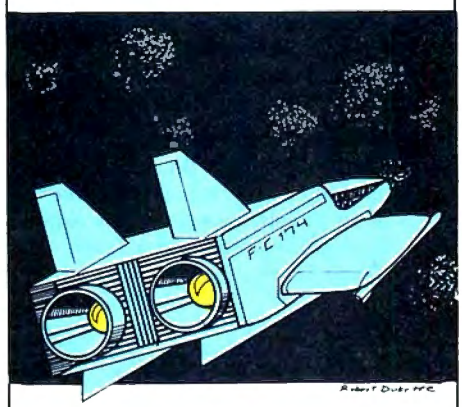
LOAD 80 No laser blasters or hyperspace to protect you in this overpopulated asteroid field. You have to guide your ship through the field to a landing base on the other side.
Joe D. Fugate



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Your chance to pick the best TRS-80 software on the market today.

80 readers' choice micro 1982

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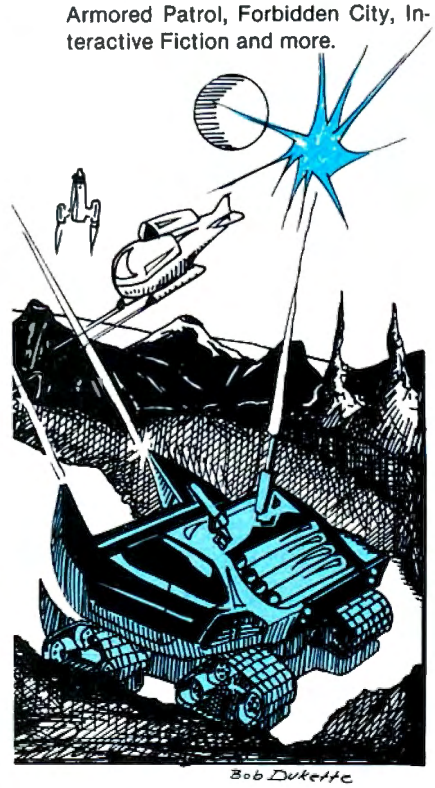
The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *80 Micro*, you should make this change.

80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writers' guidelines. Payment for accepted articles is made at a rate of approximately $50 per printed page; all rights are purchased. Authors of reviews should contact the Review Editor, 80 Pine Street, Peterborough, NH 03458.

36. Reviews
Armored Patrol, Forbidden City, Interactive Fiction and more.



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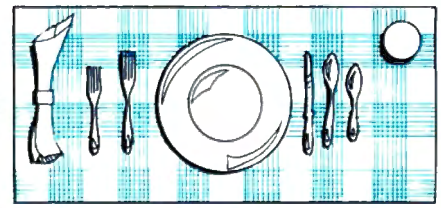

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386. New Products
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What's the greatest TRS-80 software in the world? This is a barroom question that's likely to cause a riot at the local users club. To add fuel to the fire, *80 Micro* is launching its annual Readers' Choice Awards.

You'll find a list of commercial software on page 378. We've included the Models I, II and III and the Color Computer, and every kind of software from accounting to word processing. Just make your choices on the accompanying ballot and mail it in. We'll announce the winners in our January issue.

Also, you'll find details on our first annual Young Programmer's Contest on page 373. This contest will give budding beepers 18 years and under a chance to strut their stuff, and pocket some spare cash to boot. The winning entries will be published in our February 1983 educational issue.■

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80 REMARKS

by Wayne Green

"The opportunities are there if women will see them. . . and act."

The Model II—Time for Support?

One of the discouraging aspects of the Model II is its lack of upward compatibility with software. It takes a major renovation of programs designed for the Model I or III before they can run on the II. This cuts off the prospective purchasers of the II from a wealth of software developed for the I. Worse, with the sales of the II running perhaps 10 percent of the I, the impetus for programmers to start all over and write programs for the II is reduced. Add to that the need for these programs to be far more comprehensive for this relatively expensive "business" system and you have the recipe for what has happened: very little support.

The lack of software support, in turn, has kept down sales of the II, further discouraging software firms from investing their money in developing the needed programs. Radio Shack appears to have been so wrapped up in the Model III that its software support of the II has been less than dynamic. And now, as if all that isn't bad enough, the Model 16 is coming out to replace the II. This, essentially, means that everyone has to start all over again.

Yes, I know that the 16 will run on II software. But once you have that 68000-based system, I suspect that there is going to be a great lack of interest in buying the system to run Z80-based (slower) software. That's kind of like buying a 12-cylinder car and turning off eight cylinders. No, programmers are back to square one.

The 16 came along at a poor time for the few programming firms that have chosen to support the II. I've been watching the software development for this system and I've seen some first-rate programs appear on the market recently. It takes a bit of selling to convince people that there really *are* some good programs for the II. The Radio Shack offerings have not been outstanding so far and that has discouraged the growth of interest in the II. Now, being in New Hampshire, it may be that I am insulated from the enthusiasm for Radio Shack software, but I have yet to get any letters from users claiming more than hohum feelings.

I gave a talk last year to a group of accountants who were using the II with an accounting package sold by an independent program house. They were certainly enthusiastic about the II when used with their program.

Quite recently a new accounting package from England has been getting top marks from everyone using it. And I've seen two medical office programs that hold great promise. Things *are* starting to move.

One of the more serious drawbacks of the II is its inability to accept a cassette input. If someone comes up with a relatively simple cassette interface for the II, this will be a needed product. While a cassette is slow for some uses, it's ideal for others. If programs can be transported on a cassette instead of a disk, the cost of the program can be reduced by about $10 to $15, just by the saving on the cost of the medium for loading the program. That can get to be a major difference when you're buying one or two new programs a month.

And since cassettes are simple to store and are almost impossible to harm (particularly when compared to a disk), they are a good medium for storing seldom needed archival records. They get through the mail a lot better than disks too, so they are a fine medium for sending programs or data somewhere. For these applications the speed of the cassette isn't relevant.

Old inventory records, names and addresses not immediately needed, and so on can be put onto cassettes and filed away. The cost is miniscule when compared to using 8-inch disks for this sort of archival storage. You don't use metal file cabinets for permanent records—you use those inexpensive cardboard file boxes.

So, readers, let's see some articles on cassette interfacing for the Model II. I'll make the space available in *80* for you if you do the work. And who knows, we may have another entrepreneurial business.

Another thing. Has anyone managed to interface some of the 5-inch disk drives to the II? This shouldn't be too difficult, so let's get some articles on it. We need to know how to go about it for both the hardware interface and the software patches needed to cope with the smaller disks.

And if that isn't enough, how about a protective power supply? It is worth a lot to any business to make the system so it won't lose the data being worked on if the power supply is lost. Let's see some articles on a small battery back-up system that will allow the computer to shut itself down without any loss of data when the power fails. ■

Micros Vs Women

When computers first started being used in businesses, the news for women was not all that good. Where they had previously had to sit typing invoices and statements all day, day in and day out, week after week, the computer changed this. Now they had to sit doing data input all day, day after day. Big change.

Of course, the increased efficiency of the computer made it so the typing of invoices and statements cost a lot less, at first paying for the computers and then bringing in extra profits for the firms, which permitted them to build even bigger and more gorgeous buildings. Eventually, as more firms brought in computers the bottom line was less expensive insurance or other products. It seems to take a long time for these benefits of computers to trickle down, if I am to judge by the proliferation of bank and insurance buildings.

None of this had much to do with smaller firms and their efficiency. Here, women still typed out the invoices and did steno work. Now, with smaller and less expensive computer systems, even the smallest of firms can take advantage of the time-saving benefits computers can provide. They reduce the work needed for accounting, billing, typing, record keeping, filing, and so on. They, in essence, are reducing what was chauvinistically called women's work in the office.

This is both a threat and an opportunity. With computers able to do routine work far cheaper than it can be done by hand, the day when women will be used for such drudgery is passing. This will either put women out of work or will free them for more challenging occupations. This will put women more into competition with men in white collar and managerial work.

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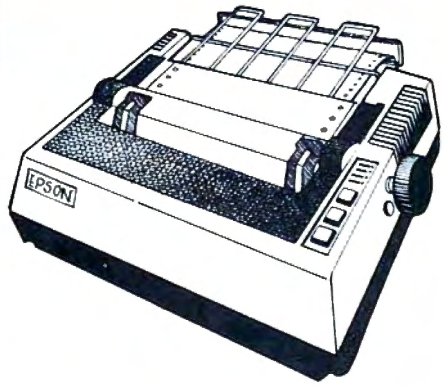

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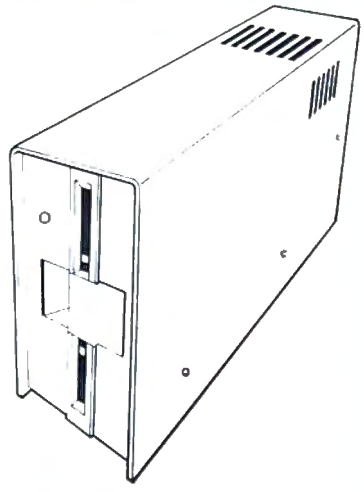

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This is higher paying work, so the competition is going to be tougher. There are great vacuums as far as the supply of some types of white collar work is concerned. Most firms are hurting for good managerial talent. On one side is an ever-increasing need for good managers. On the other is a pool of people, few of whom seem to want to improve themselves and take on more responsibilities. It's as if many of the women who are doing the work being replaced by computers are blind to what is happening and totally disinterested in developing their abilities so they'll have something to do when they are replaced.

Both women and men have to face one thing: everything is changing. The emergence of small computers is going to change the way we do virtually all business. For blue-collar workers it means the computerized control of robots to do the routine work. It means computerized testing and inventory.

In the office it means a continued step-up in efficiency in filing, letter writing and accounting as just about every function of the office is automated and made more cost effective. We've gotten way behind on cutting management and office costs, so we'll see the biggest changes here.

As the costs of production and overhead are reduced, this is going to make more money available for sales, marketing, promotions, advertising, and so on. This is going to call for people with experience in these fields. How many people are learning about purchasing today? Few, yet this experience is desperately needed by medium to large firms. There is such a dearth of good writers that it will take years for us to catch up. This lack alone is costing industry hundreds of millions of dollars in sales. Virtually every business needs some people who can write to help produce instructions, sales literature, material for salesmen and reps, and so on. The opportunities are there if women will see them...and act. Otherwise it could be a disaster.

It is a shame that our educational institutions are doing so little to help people cope with this extraordinary change. Where are the courses in speed reading, in public speaking, in writing reports, writing advertising? Where are the courses in management of personnel? Where can one go to school to learn about typesetting, graphic arts, printing, salesmanship, marketing, and all of the other skills needed to run small businesses? The fact is that there is little available. Yet this is where the need is and it is getting stronger.

One of the keys to success is to perceive a need and then fill it. If we look critically at what small, inexpensive computers are going to be able to do for us, we are going to see a wealth of ways we can benefit from going with the flow. No amount of fighting computers is going to help—they are able to do too much.

In the office, women, in general, have a distinct advantage over most men. Most women have already learned to type, so they are naturals for getting involved with computers. Men who have never bothered to learn to type tend to be put off by computers, where the entry mode is typing. Since in communications there is power, women can use this psychological advantage to great effect. But this does mean the need for women to be ready to try new things and learn.■

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We've never worked so hard. Sweat, toil, fatigue—stack them all up and it doesn't come close to the flat-out effort we dedicated to producing this issue.

You want to know how hard it was? I had to play every game submitted.

I can hear you chuckling. "Play? That's hard work?" Go ahead and scoff, but imagine what it was like to come to work day after day only to be shot out of the sky by fleets of submarines, zapped by hordes of aliens, and beaten at card and strategy games by a sleek gray machine. There were times when I considered leaving for less hazardous work—maybe as a soldier of fortune or Marvin Hagler's sparring partner.

This games issue has games for every TRS-80 computer—yes, even the Model II. Sub Destroy, by Patricia Steele, transforms your business machine into a watery battlefield. The Color Computer is also well represented. Larry Becker sent us one article with four individual games. Check out the graphics in Tank-Gun.

Speaking of graphics, Part I of Franklyn Miller's three-part series on the Color Computer includes 21 programs that explore some of the CC's special graphics functions. Apply them to your own game programs.

Hardin Brothers wrote Cram as a programming experiment. The program is short and simple, and the game is downright addicting. Addicting and frustrating would be a good way to describe Dennis Ridgway's Loco Motion. Although nothing like Rubik's Cube in appearance, the same logic is needed to solve the puzzle. You have to arrange numbers into preset patterns. That would be easy, except the numbers are constantly revolving around oval tracks. Termites is another frustrator. Charles Weindorf wrote it as an exercise to improve his memory, but wound up with a new bad habit—biting his nails.

And while we're on the subject on nail-biting, in The Conquest of Memory Alpha, L.L. Meyers has us playing the role of Buck Starton at the mercy of the evil Klaxons who have planted a mind controller in his brain. In this adventure you, at the bidding of the evil Klaxon ruler, are to steal the plans for a super dreadnaught.

Victor Albino also supplies adventurists with some fun in Assignment 46. Harry Flynn is the hero's name in this one, and his mission is to protect the Ring City and the Pila Stargate. Enjoy these adventures and then write your own. Albino also offers, in the same article, a step-by-step approach for writing an adventure, using Assignment 46 as an example.

Enter the Dragons, by Randy Hawkings, is a Kung-Fu type adventure. Your mission, little grasshopper, should you decide to accept it, is to save princess Syndi from imprisonment in a dungeon. But the hills are chock full of outlaws and mystics, so be careful.

One of my favorite games in this collection is Charles and Glenn Gillen's Subs n' Choppers. You're flying the chopper and dropping depth charges on the subs. The graphics are good, but even better is the sound: the thwunk, thwunk, thwunk of the helicopter's rotors sounds just like a helicopter going thwunk, thwunk, thwunk.

The Game of Kalah is an ancient game gone micro. And well done, too. Jonathan Victor's aim was to achieve a form of artificial intelligence. If AI can be defined as good enough to make you swear at the machine, then I guess he did it. The article discusses the philosophies involved in choosing the right game in to program intelligence.

In the same vein, Charlie Heath, author of Master Reversi (the best reversi game out), took time to muse on the game for us. Paul Wiener reappears this month in his Notes From Beneath the Keyboard column and discusses the programming tree logic used in computer reversi. Paul attended the North American Computer Othello Championship, held in May, where Heath's reversi won the world championship, and has some things to say about that.

I want to stop writing about the games, but I keep remembering ones you shouldn't miss. For instance, Jonathan Falk is a puzzle nut. To keep his puzzle supply high he wrote a program that generates acrostic puzzles.

I tried to persuade Jake Commander to write Star Trek 4.5 for the issue, but he opted for Ski Slalom, or Death Plunge, depending on your point of view. But figuring a games issue wouldn't be complete without a game for trekkies, we've included Save Our Ship by Randy Hawkins.

—Kerry Leichtman

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80 INPUT

"The main reason for failure in data processing is system design, not programming."

Meaningful Descriptions

Time is of the essence, particularly when skimming through *80 Micro*. For those of us who want to save time how about replacing the cute subtitles in the table of contents with a meaningful description of the article? This would allow a reader to more easily identify the article that is of interest.

Irwin Kaufman
Canoga Park, CA

We're one step ahead of you—check out this month's table of contents. You'll also note that the titles of Color Computer articles are printed in color, for the convenience of our CC owners.—Eds.

Excellent Investment Aid

As a small investor in the stock market, I was most pleased to see the MONEY DOS column by J. M. Keynes. The programs have helped me look at other types of investments that I had previously ignored. I liked the last column on options and am now starting to investigate this area as a result of the MONEY DOS column.

The MONEY DOS line, referenced in the April 1982 issue, is an excellent investment aid in the options area. I would like to thank Mr. Keynes for making that service available free of charge to small time investors such as myself.

This well done column is a big plus for your magazine and represents the type of articles that have direct applicability to the hobbyist and are most welcome at any time.

Please keep this column coming!

Michael D. Olson
San Jose, CA

Terrific Program

No one who programs in Basic should fail to type in the little program on page 206 of the April 1982 issue of *80 Micro*. Mr. O'Connor did a fantastic job that works. I'm surprised that Load 80 did not incorporate this little gem into its cassette.

Loc-Editor is great. I input it last night and ran it with a program I was having trouble debugging, and to my delight it found the little imp of a misspelled word.

Take the time to type it in. Loc-Editor is terrific!

Alfred L. Tripamer
Olympia Fields, IL

Easy Disks

James S. Shaefer's article "Do-It-Yourself Disks" (*80 Micro*, January 1982) intrigued me from first reading. I purchased a Model III last year and have been saving ever since to convert to disk drive operation.

Mr. Shaefer's excellent article and the photographs gave me the confidence to contact VR Data Corp. to discuss the purchase of disk drives. I requested MPI disk drives in the Disk III package based on the information in the 1982 Buyer's Guide section of the same issue of *80 Micro*. Using the instructions from the Disk III package and the article from your magazine, I installed the disk drives into my computer. My installation was successful. Indeed, as Mr. Shaefer claimed, this process was not overly complicated and was completed in a relatively short time.

Thanks to your magazine and Mr. Shaefer's article, my TRS-80 is now more versatile.

Daniel L. Cheraz
Twenty-Nine Palms, CA

Ridding the Galaxy of Klingons

I wanted to tell you how successful your Star Trek 4.0 game (*80 Micro*, August 1981) has been with our family. I entered it on my PMC-81 and saved it on disk shortly before Christmas. One son, home from college, has become an expert. His latest (and highest) score to date is 1105.26. Now that he is returning to school, the rest of us can get efficiency scores of 600-800 and not feel too inadequate!

Have you thought of a contest? Would you like to use the above score as a starting point for such a contest? Would you consider a one-year subscription to *80 Micro* as a fair prize for the above score?

Thanks again for the game.

Philip J. Hess
Missoula, MT

Editor's Log—Stardate 8/82

It would be more logical to promote friendly competition between Federation fleets. Ridding the galaxy of Klingons seems reward enough. But beam your results to Commander Jake at our starbase in Peterborough. Maybe, in a few light years, we will organize a competition among the fleet commanders who have best proven themselves in battle.—Starfleet Command.

Do It Better

In the April 1982 issue of *80 Micro* is an article I co-authored titled "Model I Do Files." One user contacted us and was confused about how to specify files and protect memory in Basic when using the Start program. To save other users effort in accomplishing this I would like to give more detailed directions. In the example given in the article, starting at location 6B31 are three OD codes (which are equivalent to three <Enter> commands from the keyboard). The second <Enter> gives the default value of three files. If a user wishes, for example, one file, he should insert before the second OD code the hexadecimal code for the ASCII character ↑ (which is 31). If a user wishes to protect memory above 31000, for example, insert the hexadecimal codes for the ASCII characters 31000 (which are 33 31 30 30 30) before the third OD code. It's easy to remember this if you note that in the hex codes for ASCII numerals a 3 always precedes the value of the numeral.

I have found another use for the Start program which should be of interest to

many users. When using a dot matrix printer (such as the Radio Shack Line Printer IV), most machine language programs will use only the 10 cpi printing mode. When using VisiCalc this limits the number of columns to eight. By turning on the printer and running a short Basic program you can set the printer to a compressed (16.7 cpi) print mode, giving up to 14 columns on a page (enough to show 12 months and some titles, for example). A variation on the Start program can simplify this task. The following Basic program gives the compressed type mode with the Line Printer IV (other printers may use other CHR$ codes):

```
10 LPRINT CHR$(27); CHR$(20)
20 DEFUSR1 = &H402D
30 A = USR1(X)
```

Lines 20 and 30 in the above program exit Basic and return to DOS Ready. This is a valuable trick anytime you need a Basic program to do some small task and immediately return to DOS Ready. (The entry point of 402D hex is for TRSDOS 2.3 and may be different with other operating systems.)

I saved this program under the name S. I then modified the Start program beginning at location 6B37 to the hexadecimal codes for the ASCII characters S and the required ender (22 53 22 0A) and used the TapeDisk utility to save this program under the name Small (line 10 in Fig. 1 of the article is changed to: F SMALL/CMD:0 6B00 6B3A 6B00). When I want small type for a VisiCalc report I boot the disk, turn on the printer, type SMALL <Enter>, and then VC <Enter>. You can also use Small with Scripsit and other machine language programs. By changing the CHR$ codes in the Basic program you can use other available type styles depending on what is available on the printer you use.

Philip F. Jackisch
Royal Oak, MI

Just Stringing Along

I was delighted by all the utility programs published in the April issue of *80 Micro* and immediately ordered Load 80.

There is an easier way to load machine language programs into a string than that given in the article "Memory Size?". Program Listing 1 shows how to do it with data statements and Program Listing 2 shows an even easier way to do it (I assume you have assembled 30-byte programs at FF00H). After running the Basic program, List will do peculiar things when it prints line 1 which holds the machine language program. The USR routine can now call the beginning of the Basic program plus 12 bytes (line 0 equals seven bytes, line 1 equals five bytes—two for next address, two for line number and one for the REM token). This solves the problem of string garbage collecting moving the program.

Burt L. Fenner
Lemont, PA

Shattered Mirror

I recently purchased a new Epson MX-80 printer with the Graftrax option for my Model III after reading the article "Mirror Imagining" in the March issue. I installed the Graftrax ROM according to the instructions and tried to run the programs as listed in the article but the printer didn't work. At first I thought I installed the ROM incorrectly but after recalling the differences between the Models I and III, I soon realized the problem. In Program Listings 3, 4 and 5, the characters are POKEd to the printer by lines 100, 1010 and 1010, respectively. For the Model III you need to route these characters to port 248. Change these lines to read OUT 248,A.

Bruce D. Gover
Orange, CA

In addition you should change the printer tests. In Listing 3 change line 90 to read IF PEEK(14312) AND 240<>48 THEN90. *In Listings 4 and 5 change line 1000 to read* IF PEEK(14312) AND 240<>48 THEN 1000.—*Eds.*

More Subroutines

In an effort to push *80 Micro* toward a public service for the newer members of the flock, I propose this fine magazine devote one full page each month to often-used routines. This would include Basic merges, Break locks, and so on.

Jon Mark O'Connor
Waterville, ME

We printed a collection of valuable subroutines in the article "Zubroutines" by Peter Ashley in the April 1982 issue.—Eds.

Utilities Update

We are grateful to your magazine for including our two utility programs in your Buyer's Guide to Utilities (*80 Micro*, April 1982), but we wish to clear up some discrepancies in the information you provided.

Program Innovations currently offers two utility packages, Macro Assembler and Disassembler. We have apparently misnamed Macro Assembler as it is not an assembler at all. It is an extensive macro library intended to complement Radio Shack's Editor/Assembler (Model II). The Guide states the Macro Assembler will run in a minimum RAM configuration of 64K. Both utilities will run in 32K or 64K machines as well as any Model 16 configuration available. We provide both packages on the latest operating system (DOS) available from Radio Shack (currently TRSDOS 2.0a).

Our Disassembler for the Model II/16 has output to screen, printer or disk. You can use the disk file in conjunction with

```
10 DATA 14,08,06,192,53,61,64,230,253,198,02,211,255,214,02,211,255,197
20 DATA 16,254,193,16,242,13,121,246,00,32,234,201
25 CLEAR 60
30 FOR N=1TO30
40 READ X
50 A$=A$+CHR$(X)
60 NEXT
```

Program Listing 1

```
0 GOTO 5
1 REM 12345678901234567890123456789O*
5 REM *** LOAD A MACHINE PROGRAM OF 30 BYTES FROM LOCATION 7F00
TO BEGINNING OF BASIC +12 WHERE IT CAN BE EXECUTED
10 FOR X=0TO29
20 POKE PEEK(16548)+PEEK(16549)*256+12+X,PEEK(32512+X)
30 NEXT
40 DELETE 10-40
50 POKE 16526,PEEK(16548)+12
60 POKE 16527,PEEK(16549)
70 Z=USR(0)
```

Program Listing 2

Doris believed herself the most "fully formed" character in the office.

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Printers Can Be Confusing. Sometimes, even the informed personal computer owner is caught short by the mound of technical differences in printers. Had Doris come to Orange Micro sooner, she'd know a *fully-formed character* was similar to the crisp, solid typestyle that came from her office typewriter.

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Macro Assembler or you can re-assemble it directly using Radio Shack's Editor/Assembler.

The Guide mentions a do-file under the heading Other Features. This means we provide a series of patches to eliminate password protection from TRSDOS 2.0 and 2.0a system software. This enables the consumer to disassemble any system file as well as user files.

John Beckner
Program Innovations
Lumberton, NC

Buyer's Guide Omissions

The 1982 Buyer's Guide to Utilities (*80 Micro*, April 1982) omitted Eigen Systems' Stripper at $7.95 from the compressors category. This utility for the Color Computer reduces the size of my programs by 10–15 percent. The Guide also omitted their Editor/Assembler for the Color Computer at $6.95. They advertise with you so why not give them fair play?

David Roper
Garner, NC

As I noted in the Buyer's Guide, only those companies responding to my requests for information in time to meet publication deadlines were included.

Address	Change contents to:		
4604H	FE	43	
4606	20	06	
4608	CD	42	30
460B	C3	DA	46
460E	21	A2	47
4611	C3	2B	47
4615	74	06	
4618	49	00	
4658	2B	00	
46B0	31	02	46
46DA	31	02	46
46DD	CD	F8	01
4728	C3	04	46
4742	C4	64	02
4755	3B	00	
4759	33	00	
4D45	CD	64	02
4D57	CD	96	02
4D5A	CD	35	02
4D6F	CD	35	02
4D78	CD	35	02
4D95	CD	35	02
4DA6	CD	2C	02
4DB3	CD	35	02
4DBA	CD	35	02
4F34	CD	87	02
4F39	CD	64	02
4F3F	F4	64	02
4F48	F4	64	02
59AE	CD	64	02
59B2	CD	64	02
59B6	CD	64	02
5CCC	CD	64	02
5CD2	CD	64	02

Figure 1

Keep in mind that there is a sizable lead time in the publication business (the Guide was typeset Jan. 3). It is futile to try to keep up with dozens of new companies as they pop up.—L.R.

EDTASM Patches

I have patched Radio Shack's EDTASM Ver. 1.2 to make it compatible with the Model III. The changes replace all driver routines with ROM calls. This shaves more than 750 bytes off the bottom of EDTASM and makes loading the program faster.

Figure 1 lists the changes you should make. They can be done with a monitor located in high RAM, such as a relocated T-Bug. When all changes are complete, punch a new tape as follows: 4604 5D40 468A EDTASM.

My thanks to John T. Blair (*80 Micro*, August 1980) for pointing me in the right direction, and Harold Zbiegien (*80 Micro*, September 1981) for adding the C command to EDTASM enabling selectable baud rate on tape loading and writing.

L.H. Fleming
Red Bluff, CA

MDX-2 Update

Ronald Cangro's review of the Micro-Design MDX-2 Interface Expansion Board (*80 Micro*, April 1982) was informative but contained a few serious errors. Mr. Cangro states: "The RS-232 port must be used for modem operation and is unavailable for other use." This is absolutely wrong. The serial port on the MDX-2 is a 110–9600 baud serial port that can operate RS-232 compatible and 20 milliampere loop devices. This includes serial printers, teletype machines and so on. The port is fully compatible with all Radio Shack and Radio Shack compatible software. I believe Mr. Cangro was trying to say that you may not use the serial port for the phone modem and another serial device at the same time. After all, it is only one serial port! If you plan to use the serial port for a serial device and the on board modem, you may install a switch in place of the jumpers provided. This allows you to switch between the two devices as you need them.

Mr. Cangro also states: "Technical assistance was only available after 5 p.m. Texas time." Micro-Design has two service centers to help with any problems the user may have with any of our products. Progressive Electronics in Lancaster, Ohio accepts calls for service from 8 a.m. to 11 p.m. EST! Also, we at Micro-Design are available for consultation.

Mr. Cangro states: "The floppy disk controller has a tendency for read and parity errors on the inner tracks. The circuitry is critical to disk alignment." The WD1771 used in the MDX-2 floppy disk controller circuitry (and also in the Radio Shack interface) does not give the greatest data separation, but we have found, through conversations with MDX-2 owners and our own experience with the systems on the market, that the MDX-2 gives a noticeably better performance in this area than the Radio Shack and LNW expansions! This leads me to believe Mr. Cangro may still have a problem with the alignment of his drives.

Michael B. Shapiro
Micro-Design
Manchaca, TX

Kudos

Kudos on your new products (boy, are they new) in the April (Fools') edition of *80 Micro*. With nearly 20 years in the editorial side of the publishing biz, I have come to expect that editors occasionally take advantage of April editions to have some fun with otherwise serious subjects.

But rarely have I seen it done so well. I was halfway through "Database Alternative" before I realized how hard I had bitten. Followed by 10 minutes of some of the most uninhibited laughter I've expended on a magazine since I accidentally picked up the *Harvard Lampoon* version of *Time* about 12 years ago at a newsstand under the impression it was the real thing.

I don't see any reason why you have to limit it to an April issue; that's the kind of enlivening humor I would like to see in every issue of even the most serious magazine.

Don Picard, Editorial Supervisor
Custom Publications
St. Paul, MN

April Fools' edition? What April Fools' edition?—Eds.

Wrong Medicine

In their article "Worm Pills for Basic" (*80 Micro*, April 1982) Keen and Dischert claim PRINTUSING statements will execute faster if the fielded variable is assigned to a numeric variable before the Print statement.

The second part of their sample program does execute faster, but not for the

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reason they claim. They are assigning a double precision fielded variable to a single precision numeric variable and then printing the latter.

PRINTUSING formatting of double precision variables is notoriously slow; they achieve a speed increase by printing a single precision variable instead.

I found no speed difference between the two parts of their program when I maintained consistency of variable type. The speed difference between variable types was as expected.

Needless to say I was disappointed, since a little magic is always welcome.

Bob Penny
Boulder, CO

Error Trap

The correct price for the Microproof spelling checker reviewed by Michael Flnefrock (*80 Micro*, April 1982) is $69, not $185.—Eds.

When I developed the name "Hiplot" for the program accompanying my article "Digital Doodles" (*80 Micro*, January 1982) I intended it to be an aid for remembering the contents of the program; i.e., a program for the plotter that uses the high end of memory. I didn't realize Bausch & Lomb had trademarked the name and had been using it since May 1978. I'll immediately cease using the name. My apologies to Bausch & Lomb for this infringement.—Alan Sehmer

---

The chart on page 141 of the 1982 Buyer's Guide to Utilities (*80 Micro*, April 1982) noted that Ultra-Mon lacked the ability to single-step through a program. This is in error; Ultra-Mon does single-step, displaying each disassembled instruction as it does so.

In addition, in the other features column, its ability to relocate itself and execute interpretively (emulating the ROM) was not mentioned. This feature was mentioned for our competition.—Mark C. Robinson, President, Interpro, Manchester, NH.

Service Data

As a microcomputer user, I find a fair share of the articles published in *80 Micro* of only a passing interest—not a complaint; just a statement of fact. For example, I didn't pay much attention to the disk drive buyer's guide published in the January issue. I already have two Percom drives for my Model I system and, at the time, was not considering buying more equipment.

Shortly after the January issue arrived, one of my drives stopped functioning properly. Since we have no repair services available in town, I contacted the Percom Data Co. They informed me it would take 2-4 weeks before they would be able to fix the drive. They suggested I send it to their nearest dealer. After contacting the dealer and being assured it would take no more than a week to fix the drive and return it to me, I blissfully sent it off. That was three months ago! I finally convinced the dealer to return the drive unrepaired (after I paid a $30 diagnostic fee).

What does this have to do with the disk drive buyer's guide? I believe an important piece of information is missing from the guide—service data (e.g., frequency of repair, service turnaround, and so on). As with any machine, a disk drive is going to need service no matter how good it is. *80 Micro* could provide a valuable service by compiling service data and including it in the next buyer's guide. It would have been a big aid to me recently. I just purchased my second micro system with one drive and service was a primary consideration in choosing a disk drive.

Jim Craig
Bowling Green, KY

Including service info in our buyer's guides is a good idea. Unfortunately, companies don't always follow through on their promises.—Eds.

Experience Is a Must

I'm writing in connection with James Keogh's advice to F.K. of Schenectady, NY (Input/Output, January 1982).

I've been a data processing professional for many years and have designed, programmed and installed on-line and batch systems utilizing large main-frame computers.

A year ago I contracted to implement a Vehicle Tracking System for a businessman involved in the brokerage of wrecked automobiles. The system involves 17 on-line screen transactions and a file where each vehicle record is 756 characters long and contains 91 fields. I have developed my own access method, a "main-index" resident in memory and a separate index file. I have done this in Basic on a TRS-80 Model II.

The businessman needs someone who knows how to design a business system and knows a high level computer language. No matter what language is used the system must be designed for the business' needs. In my experience, "local university students...or professors looking to moonlight..." are excellent for designing compilers and for saving 8 microseconds with some inventive routine but they have never had the experience of implementing a business system. This is an art which requires experience in design and an understanding of the man/machine interface.

My advice to F.K. is to stay away from the university's engineering and mathematics departments and approach someone who has worked for a large business as a programmer/analyst for at least three years and, most important, someone with whom the businessman can communicate. The main reason for failure in data processing is system design, not programming.

Bob Miller
New York, NY

Sour Lemons

Radio Shack CTR-41 owners who have purchased a LemonAid Loader will be interested in the following modification to their recorders. Without the modification, some CTR-41s may not reliably load weak tapes, or tapes with minor hits, even with the Loader installed. Originally we did not recommend using the LemonAid Loader with the CTR-41.

Fortunately, the modification is easy. Just add one resistor and the CTR-41 works as well as the CTR-80 or 80A which need no modifications. For detailed instructions contact us at the address below.

Wayne Lemons
Lemons Tech Services
M.P.O. Drawer 429
Buffalo, MO 65622

Chase Those Problems Away

Some readers have experienced problems with my program Subchaser (*80 Micro*, March 1982). The program begins

and then crashes with an "FC Error in 200" message. Line 200 draws a line and then comes to the command PLAY L$. In line 150 L$ is defined as "T255O4;AF. The problem is that some readers are entering the letter O as a zero. The Play command is to play at a tempo (T) of 255, octave (O) 4. The computer cannot play a note at a tempo of 25504, so the error message is created.

I have also found that a dual dimensioned array is not required for proper operation of the program. You can change the beginning of line 10 from CLEAR5 to CLEAR200 and change line 20 to DIM S(41),S1(28),S2(28):D = 0.

John Steiner
Riverside, ND

Conquer the World

There is a flaw in Adventure International's game Armored Patrol. Find the opening in the mountain and drive straight to it. Then make a 180 degree turn and back up into it until you hit the zone limit. Sit there and wait for the robots and tanks. When the enemy tank shoots at you turn to avoid the bullet. It will miss you even if it is straight at you. My top score is 317,000. I could have made a higher score but I got tired of playing because it was so easy.

Todd Anderson
Fayetteville, NC

By golly, Todd, you're right about Armored Patrol. Our high score jumped from 50,000 to 281,000 in one short afternoon—and editor Caron Taylor's coffee cup got most of it (see Photo 1). Sort of like shooting fish in a barrel, though.—Eds.

COM Systems

I just read the article entitled "Technological Destiny—Part I" (*80 Micro*, April 1982) and was rather amused at the section that dealt with COM units. I have been working with COM systems for more than 11 years and I am quite sure no system could create film at the rate of 214 million characters per second. As a matter of fact there is no device available which could deliver that data to the COM system at that rate.

The systems available on the market today fall into two categories. Most use a CRT to expose the film; the others use a laser, which, I suppose, is the pencil of light noted in the article.

Most COM systems use a reduction ratio of 48K, which allows 269 data pages to be placed on a single 4-by-6 inch piece of film. There are other common reductions available (24X, 42X, and 72X). At 72X the user can store more than 600 data pages on a microfiche.

COM systems generally create film at a rate of 2–3 pages per second, or in terms of characters, about 25,000. (A page usually contains 132 characters per line, and 64 lines.)

This is much faster than line printers, but falls into the same speed category as laser printers such as the IBM 3800 or the Xerox 9700. These devices were completely overlooked in the article.

Russell Fine,
Product Manager
COM and Duplicator Systems
NCR Micrographic Systems Inc.
Mountain View, CA

Greater Winnings

I made two changes to "The Trade Wins" stock market simulation game (*80 Micro*, February 1982) to make it more enjoyable. I am a commodity broker and consider selling short to be as acceptable as buying long. If you eliminate lines 370, 380 and 390 the program will allow for short sales.

I also included a ¼-second time delay to slow the high speed market action. This allows the player to visualize the trend (if there is one). To insert the time delay add two lines between lines 270 and 280; I used:

```
273 FOR Q = 1 TO 80
275 NEXT Q
```

This yields approximately a ¼-second delay. Use a number greater than 80 for a longer delay and a number less than 80 for a shorter delay.

J. Richard Tygrest
Hopewell, VA

80-Grafix Aid

Owners of the Programma International 80-Grafix programmable character board for the Model I now have someone to turn to. Since Programma is no longer in business, we at Micro-Labs Inc., the designers of the board, have decided to help the several thousand graphics board owners. A number of character programming and design utilities, pre-defined character sets, a graphics Basic, and games are now available for the 80-Grafix. An improved version of the board is also available for the Models I and III. We encourage all 80-Grafix owners to send us their name and address for free program updates and relevant information.

Ted Carter
Micro-Labs Inc.
902 Pinecrest Drive
Richardson, TX 75080

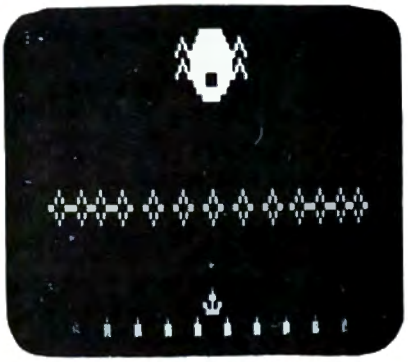
Photo 1

WHY IS THE ALPHA JOYSTICK SUCH A SUCCESS ?

Because of games like these.

THE LATEST BLAST FROM BIG FIVE...

NEW! **DEFENSE COMMAND**



Actual unretouched photos

DEFENSE COMMAND NEW!

Big Five has done it again! Now the most popular arcade game of all time has a fascinating new twist. The Invaders are back! You are alone, valiantly defending the all important nuclear fuel cannister stockpile from a convoy of thieving aliens who repeatedly break off and attack in precision formations. An alien passes your guard, swiftly snatching up a cannister and flying straight off. Quick! you have one last chance to blast him out of the sky. Great action and sound!

BEST SELLER

SCARFMAN

SCARFMAN BEST SELLER

THE LATEST ARCADE CRAZE now runs on your TRS-80.

It's eat or be eaten. You control Scarfman around the maze, gobbing up everything in your path. You attempt to eat it all before the monsters devour you. Difficulty increases as game progresses. Excellent high speed machine language action game. From The Cornsoft Group. With sound.

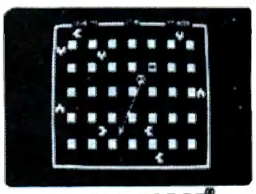
CAUTION: Played with the Alpha Joystick, Scarfman may become addictive.

SUPER NOVA®

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones.) Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine

LUNAR LANDER

As a vast panorama moonscape scrolls by, select one of many landing sights. The more perilous the spot, the more points scored —if you can land safely. You control LEM main engines and side thrusters. Absolutely the best use of TRS-80 graphics we have ever seen! From Adventure International. With sound.



ATTACK FORCE®

As your ship appears on the bottom of the maze, eight alien ships appear on the top, all traveling directly at you! You move toward them and fire missiles. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the "Flagship"... With sound effects!

COSMIC FIGHTER®

Your ship comes out of hyperspace under a convoy of aliens. You destroy every one. But another set appears. These seem more intelligent. You eliminate them, too. Your fuel supply is diminishing. You must destroy two more sets before you can dock. The space station is now on your scanner... With sound!

METEOR MISSION II®

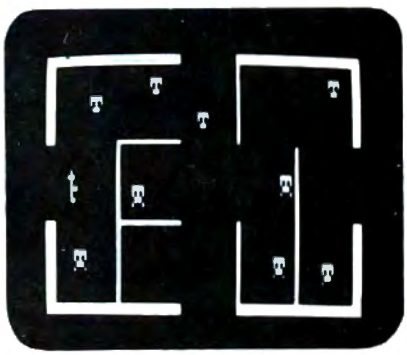
As you look down on your view, astronauts cry out for rescue. You must maneuver through the asteroids & meteors. (Can you get back to the space station?) Fire lasers to destroy the asteroids, but watch out, there could be an alien FLAGSHIP lurking. Includes sound effects!

TALKING ROBOT ATTACK

INCREDIBLE! This amazing game actually **TALKS** without a speech synthesizer, through the cassette AUX plug.

You are armed with just a hand held laser. In a remote section of the space station you encounter armed robots, some march towards you, some wait around corners. Watch out, the walls are electrified. Zap as many robots as you dare before escaping into a new section where more robots await you. The struggle continues. With Joystick action and **VOICE OUTPUT**, this game will amaze you.

VOICE OUTPUT!



GAME PRICES

16K Level 2, Mod 1 + Mod 3 Cassette: $15.95
32K Level 2, Mod 1 + Mod 3 Diskette: $19.95
All games on this page are "Alpha Joystick Compatible." They may be played with or without joystick (using arrow keys).

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(Model I version shown)

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MODEL I OR III. SPECIFY WHEN ORDERING. PRICE INCLUDES ATARI JOYSTICK + ALPHA INTERFACE + INSTRUCTIONS + DEMO PROGRAM LISTING.

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Joystick + 3 games: Deduct $14.00

The Alpha Joystick gives you real arcade action. Game producers know that it makes great games better. That's why each month more games from more producers are "Alpha Joystick Compatible."

There has never been a better time to get your Alpha Joystick. With so many excellent action games to choose from it's time to step up to joystick power.

You will find the Alpha Joystick simple to use. Just plug it in. No modification, wiring or batteries are required, and it's fully compatible with any other TRS-80 accessories. The instructions are clear and complete, we even show you how easy it is to experiment in BASIC (A = INP(0) reads stick) and to convert BASIC programs for joystick control.

MODEL I - Plugs into any Level II keyboard (40 pin card edge in the back) or expansion interface (left side, next to printer port). Our latest design has a "mode" switch for compatibility with the many different producers of joystick compatible games.

MODEL III — Works with any Model III BASIC system. It plugs into the 50 pin I/O bus (largest edge connector underneath, centered toward the rear). It will work with "Joystick Compatible" Model III games from any producer.

"If you purchase Alpha's Joystick you get the exquisite pleasure of enjoying (action games) to the limit of arcade-style realism."

– 80 Microcomputing
80 Reviews, Jan '82

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MONEY DOS
an operating system for financial survival

by J.M. Keynes

"I speak of the biggest tax break in history: the Universal Individual Retirement Account."

The Economic Recovery Tax Act of 1981 includes a provision that touches the life of every working American. This legislation provides a pension opportunity for every individual under the age of 70½ who has earned income, whether or not covered by another Corporate, Keough, or government retirement plan. I speak of the biggest tax break in history: The Universal Individual Retirement Account. You may not be able to retire to the likes of my 15 bedroom mansion in Palm Beach, but you can assure yourself a glorious retirement, free from financial worry. Before counting our profits, we must understand how the IRA works.

The major advantage of an IRA plan is the tax benefit. All of your allowed contributions are 100 percent tax deductible, which leaves you with more money to invest toward your retirement years. In addition, all capital gains, dividends and interest accumulate on a tax-deferred basis. You will not be required to pay any taxes on your IRA earnings until you distribute them. By then you will likely be in a lower tax bracket. Also, depending on how the proceeds are paid out, they may be excluded from your estate for estate tax purposes.

"This legislation provides a pension opportunity for every individual under the age of 70½ . . ."

Putting It In

Contributions of 100 percent of earned income up to a maximum of $2,000 may be made to your IRA up until the due date of your tax return (including extensions), usually April 15th.

If both you and your spouse work and are under age 70½, you each may set up your own IRA plan for a potential deduction of $4,000 per year for the two of you.

If there is a non-working spouse, you can contribute and deduct up to an additional $250 each year. The only requirement is that the non-working spouse's contribution be placed in a separate account, and the total amount must be split so that neither spouse receives more than $2,000.

Getting It Back

IRA funds may be withdrawn at any time. However, distributions before age 59½ will be subject to a 10 percent nondeductible tax penalty as well as ordinary income tax. In the event of disability or death, you or your spouse will have access to the funds at any age without penalty. Withdrawals must begin at age 70½. You may take the distributions as a lump sum or in periodic payments. Distributions are treated as ordinary income and qualify for the general income averaging calculation. At death, IRA distributions to heirs taken in a scheduled periodic with-

```
10 REM  WRITTEN BY J.M. KEYNES
20 Q$="########"
30  CLS: INPUT"YEARLY I.R.A. CONTRIBUTION";A:IFA<100,A=2000
40 INPUT"ESTIMATED AVERAGE YEARLY INTEREST RATE (ENTER 12% AS 12
)";I: R=I
50 INPUT"ESTIMATED TAX BRACKET (35% ENTERED AS 35)";TX:TB=TX:TB=
(100-TB)/100
60 INPUT"WANT PRINTOUT 1=YES";LP
70 CLS: R1=(R*TB)/100+1 :R=R/100+1: W=0: W1=0: T=A: X=A: X1=A*TB
: U=X1
80 REM NOTE: TAXABLE CONTRIBUTION IS REDUCED BY TAX PAID ON IRA
AMOUNT
90 PRINT@64,"FUTURE VALUE OF YOUR I.R.A. ACCOUNT VS. TAXABLE INV
ESTMENT
100 PRINT"YEARLY INVESTMENT OF $";A;" TO IRA  $";X1;" TO REGULAR
 SAVINGS
110 PRINT"COMPOUNDED @ ";I;"% YEARLY,  AVERAGE TAX BRACKET=";TX;
"%":PRINT
120 PRINT"YEAR #","$ CONTRIBUTED","   IRA","TAXABLE": PRINT
130 FORQ=1TO40: T=(T+W)*R: V=V+A: W=X :U=(U+W1)*R1: W1=X1
140 E=E+1: IFE=5 THEN E=0: PRINTQ,V,;: PRINTUSINGQ$;T;: PRINT"
     ";:PRINTUSINGQ$;U
150 IFLP=1THEN LPRINTQ,V,T,U
160 NEXT: PRINT: INPUT"TRY AGAIN ?  PRESS 'ENTER'";L: CLEAR: GOT
O20
```

Figure 1

FUTURE VALUE OF YOUR IRA ACCOUNT VS. TAXABLE INVESTMENT. YEARLY INVESTMENT OF $2000 TO IRA, $1500 TO REGULAR SAVINGS COMPOUNDED @ 13% YEARLY, AVERAGE TAX BRACKET = 25%

YEAR #	$ CONTRIBUTED	IRA	TAXABLE
5	10000	14645	10001
10	20000	41629	25925
15	30000	91343	51280
20	40000	182940	91653
25	50000	351700	155939
30	60000	662630	258302
35	70000	1235500	421292
40	80000	2290970	680821

FUTURE VALUE OF YOUR IRA ACCOUNT VS. TAXABLE INVESTMENT. YEARLY INVESTMENT OF $2000 TO IRA, $1500 TO REGULAR SAVINGS COMPOUNDED @ 15% YEARLY, AVERAGE TAX BRACKET = 25%

YEAR #	$ CONTRIBUTED	IRA	TAXABLE
5	10000	15507	10444
10	20000	46699	28243
15	30000	109435	58574
20	40000	235620	110251
25	50000	489424	198343
30	60000	999913	348445
35	70000	2026690	604236
40	80000	4091900	1040130

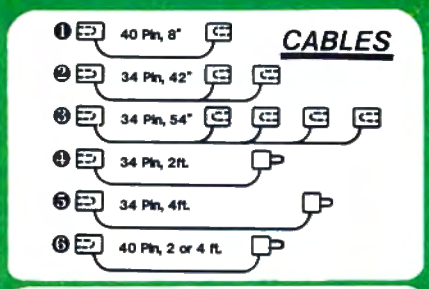
Figure 2

NOW MODEL I AND MODEL III!

Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus. MOD III/I BUS CONVERTER, complete with all connectors, only $39.95.

PRINTSWITCH

Have 2 printers on line at all times and select printer 1 or 2 by means of a conveniently located switch. End the problem of constantly plugging and unplugging printer cables. PRINTSWITCH is a compact module that plugs onto the parellel printer port of your TRS-80 and provides an edge connector for each of your two printers. It works with any two types of printers: dot matrix, daisy wheel, plotters, TRS-80 converted selectrics, etc. Assembled, tested, ready to use with connector and instructions. For Model I or III (please specify). ONLY . . $59.00



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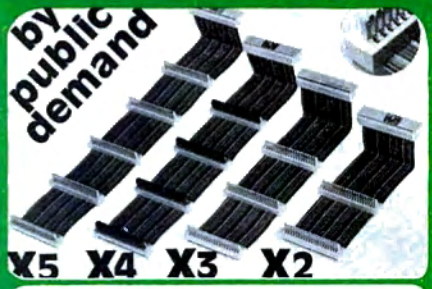
- ❻ 40 PIN BUS EXTENDER — 2 ft. . . $22 4 ft. . $24.

Custom cable configurations are also available. Call us



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8 DIGITAL MULTIMETERS PLUGGED INTO YOUR TRS-80!!! Measure Temperature, Voltage, Current, Light, Pressure etc. Very easy to use: for example, let's read input channel #4: 10 OUT 0,4 'Selects input #4 and also starts the conversion 20 A = INP(0) 'Puts the result in variable "A" Voila! Specifications: Input range 0-5V to 0-500V. Each channel can be set to a different scale.

Resolution: 20mV (on 5V range) Accuracy: 8 bits (.5%) Port Address: jumper selectable. Plugs into keyboard bus or E/I (screen printer port). Assembled and tested. 90 day warranty. Complete with power supply, connector, manual $139

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Keeps quartz accurate time for 3 years on 2 replaceable AAA batteries (not included). Gives MO/DATE/YR DAY of WEEK HR MIN SEC and AM/PM. Features INTELLIGENT CALENDAR and even provides for Leap Year. This compact module simply plugs into rear of Keyboard or side of Expansion Interface (may be slipped inside E/I). Includes cassette software for setting clock and patching to any DOS (including NEWDOS 80 2.0). Optional "Y" connector allows for further expansion. For Model I. Fully assembled and tested. Complete with instructions and cassette ONLY $95.00 "Y" option, add $12.00

GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING:** all Green Screens are not created equal. Here is what we found:

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs. One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks. Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty. Try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word. We think that companies, like ours, who are selling mainly by mail should list their street address, have a phone number (for questions and orders), accept CODs, not every one likes to send checks to a PO box, offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it?

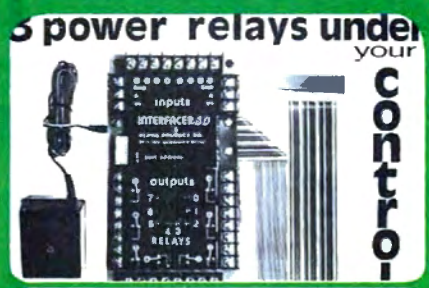
Order your **ALPHA GREEN SCREEN** today $12.50

DISK DRIVE EXTENDER CABLE, FREE YOUR MINI-DRIVES.

End the daisy-chain mess once and for all. Fits all mini-drives. Percom, Aerocomp, Shugart, Micropolis, MTI, Vista, Pertec, Siemens, BASF. East to install: just remove the drive cover, plug in the EXTENDER CABLE and replace the cover.

Now you can change and move your drives without disassembly. Keep the cover on and the dust out. High reliability gold plated contacts, computer grade 34 conductor cable. Tested and guaranteed.

Get one for each drive . . . ONLY $8.95



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CompuServe: What's in it for the 80s?

Plenty! First there's MNET80, a Special Interest Group (SIG) of TRS-80* users on the CompuServe Information Service. SIGs are active and growing groups of individuals who share a common interest and form an "electronic" club using the CompuServe Information Service as its communications medium. Share advice and exchange information with other TRS-80 users across town or anywhere around the country. TANDY services include an electronic newsletter, answers to your questions directly from Ft. Worth, product availability, tips and hints.

Secondly, we think you'll like the CompuServe Information Service: CB simulation, electronic mail, news wires, financial information, games, data bases, programming languages, big mainframe computer power and free data storage. All for a basic charge of only $5.00 an hour nights and weekends. All you need is your TRS-80, a modem and some inexpensive software. See a free demonstration of CompuServe in action at your Radio Shack* Computer Center. CompuServe Information Service, 5000 Arlington Centre Blvd., Columbus, Ohio 43220. (614) 457-8650.

CompuServe

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*TRS-80 is a trademark of Tandy Radio Shack.

134

MONEY DOS

drawal over 36 months or more normally are not subject to federal estate taxes.

The Rollover

If you receive a lump-sum distribution from a qualified retirement plan it can be "rolled over" into an IRA. By doing so, current taxation is deferred. The essential requirement is that the IRA be set up within 60 days after receipt of the lump-sum.

Investment Options

Contrary to what you may have heard, your IRA investments are not limited to savings accounts. You may begin your IRA or rollover a low yielding existing IRA to one of several major investment firms who will act as custodian, thereby giving you the alternative of choosing the investment which suits you best. If you are currently earning less than 15 percent on your IRA, you are losing money because, as this is written, you can get 15 percent, and it is guaranteed by the U.S. Government.

In past columns I have spoken of how

"Contrary to what you may have heard, your IRA investments are not limited to savings accounts."

negligent most investors are. Run the program in Fig. 1 and you will see the difference between 13 percent and 15 percent over the years. See in Fig. 2 how only 2 percent more = $862 additional profit in 5 years...$1.8 million additional in 40 years...Hmmmmmm...perhaps you will retire in a mansion.

If you have further questions, you may call the brightest member of my staff, Evone, and she will answer them. Please call between 1 p.m.–4 p.m. (E.S.T.) Mon.–Fri., 1-800-327-3389. In Florida, call 305-659-4017 (Palm Beach).

Next month I will discuss life insurance and show you how to save up to 90 percent on your premium, and maintain the same or better coverage. The April column on covered option writing stimulated great interest. In future columns I shall discuss other option strategies. In the meantime the MONEY DOS weekend option report is available from Friday at 9 p.m. to Monday at 8 a.m. only at the above numbers. ■

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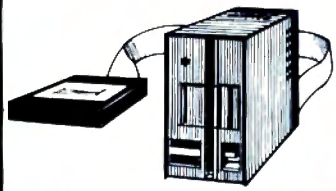

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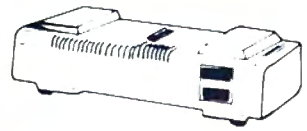

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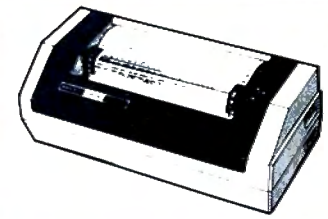

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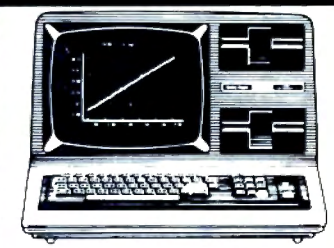

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80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

"It is a mark of pride for many professionals to achieve a reputation as the 'highest' biller in the firm."

After I completed last month's column, I received a note from F. Lee Radzicki, President of IMPACC (developers of the Tax Master tax preparation program). IMPACC has resolved the "file open" problem which caused me difficulty and they are working on a Model 16 implementation to be available prior to next tax season. Mr. Radzicki will also extend his excellent method of screen presentation to corporation tax return preparation next year. I inadvertently understated the cost of maintenance—system updates will be priced at $350.

The tax packages reviewed last month are good illustrations of special purpose software applications that are well suited to small business micros such as the Model II. Unfortunately, this is rarely true of the generalized business and accounting systems I have evaluated. Because these systems are designed for the largest possible market they often contain compromises in data acquisition, storage and presentation. Fortunately, the latest software offerings from Tandy reverse this trend. They have released a medical office system (#26-4505), a stock broker's system called the Electronic Broker (#26-4525), and a Time Accounting System (#26-4520). Other industry-specific systems are available in their current catalogue.

To see how well these new systems fit the Model II, I evaluated the Time Accounting System (TAS). I was interested to see how a time accounting system could be shoe-horned into a floppy-disk Model II. Our system requires an IBM 4331 with a staff of machine operators and programmers. To duplicate its involved functions on a micro seemed far-fetched.

Legal Problems

Legal time accounting systems have several unique problems. First, they are not entirely financial accounting systems. For a cash-basis taxpayer such as an attorney (or any other professional), a bill for professional services is an accounting non-event. Income is recognized only when cash is received. For the attorney who incurs non-time expenses and re-bills these expenses to his clients, the IRS requires that these cash outlays be segregated so that they do not affect income or expense.

Separate treatment of billable time and expenses has created unavoidable problems for designers of legal time accounting systems. In these systems billable disbursements must be classified as balance sheet items which do not affect period income. The system must keep careful control over these disbursements before and after billing, so cash received is properly applied. Misapplication of cash collections between time and disbursements will cause a misstatement of income for the period.

Legal time accounting systems are also often divided into two modules, a pre-billing module and an accounts receivable module. When billing is to be prepared, a summary of unbilled activity is developed by the pre-billing module. Often the receivable module is referenced to provide a total of amounts billed but not collected. When the billing attorney examines this report an invoice is prepared for an amount which may or may not agree with the details of unbilled activity to date. It is usually bookkeeping's responsibility to apply the amounts invoiced to the detail, relieve the pre-billing module's inventory and create an accounts receivable record.

Most legal time accounting systems generate reports, by attorney, of hours billed and collected. Because of the prestige and the income share to be earned these reports have enormous significance. It is a mark of pride for many professionals to achieve a reputation as the "highest" biller in their firm. Most keep careful independent records of their billing activities. This attention to billing accuracy usually results in many small adjustments as mispostings are corrected. Not all mispostings arise from operator error. Disagreements frequently arise as to which client is to be charged and in what amount.

In a large law firm, many attorneys with differing specialties may be required on a single matter. Although a specialist may not be the billing partner or associate on a matter, he is just as zealous in guarding the integrity of his time. Add this to charges for duplicating services and secretarial time, and the number of charge transactions that can accumulate in a legal time accounting system is enormous.

The Time Accounting System

The Time Accounting System offered by Tandy is aimed at the legal profession. For the reasons detailed above I am concerned that accounting for all the transactions indicated above could overburden a floppy-disk Model II. The manual indicates that the accounting system is designed to run on a three-drive system. As supplied, it can handle up to 14 employees, 1000 clients and 500 jobs or matters. There are provisions for up to 99 charge codes and the system will retain detail of up to 2950 transactions. Installed on a floppy-disk Model II, the system may provide inadequate storage to handle activity for 14 billing partners. Many courts are slow and thus may leave matters unresolved for months and years. Transactions will accumulate at an enormous rate. Exercise extreme care when projecting storage requirements prior to installing the system. Since the system runs on the hard disk unit, it may be desirable to put the system up on this device immediately regardless of the size of the firm. How this will affect the capacities indicated above is uncertain.

If a hard disk is used, all programs run much more quickly. This system is written in Cobol and in the floppy environment it runs *very* slowly. Unlike the three disk accounting systems reviewed earlier in the year, this system is supplied on a single disk. Therefore all system functions are accessible from menus without having to restart operations.

In common with all Tandy systems I have used in the past, the documentation is good and the programs are "user friendly." (User friendliness is relative to the user's experience. When running the system, I try to emulate an inexperienced

Convert to CP/M and Save

CP/M for the TRS-80

Converting to CP/M offers the TRS-80 owner many advantages. The TRS-80 immediately becomes capable of running twice the software of any other computer on the market. Perhaps more importantly, CP/M permits software portability. Unlike TRS-DOS programs, CP/M programs can be directly transferred to your next computer. The savings in time and software costs can be quite significant. CP/M conversion can easily pay for itself in the first few months. The sooner you convert to CP/M, the more you stand to save.

CP/M Acquires Unprecedented Support

Over the past year, a number of powerful competitors have introduced new microcomputers. Most people will instantly recognize the names of Xerox, IBM, Hewlett Packard, Digital Equipment, Wang and Zenith. The Japanese companies, NEC, Sanyo, Toshiba and Sharp, are equally well-known. Together, these companies have committed over a billion dollars to compete effectively in the micro market. TRS-80 owners should be aware that every one of these companies has chosen CP/M for their standard operating system. Over the next few years, these companies will sell millions of CP/M computers. Considering these facts, it is clear that CP/M is the operating system of the future.

Apple and Commodore Offer CP/M

In a recent press conference, the Apple Computer Company stated, "The largest installed base CP/M system in the world today is the Apple II with the Z80 card from Microsoft." In a recent full page ad in the Wall Street Journal, Apple announced CP/M for the Apple III. Commodore, refusing to be left behind, has recently announced their "Emulator" series of computers that support CP/M. There are even rumors that the new Tandy 16 will support a version of CP/M.

Software Development Follows the Market

The software market is rapidly changing. The proliferation of CP/M computers has produced a tremendous demand for CP/M software. This large and profitable market is attracting the best programmers from the rest of the computer industry. The newest and best software programs will support CP/M. Manufacturers that do not support CP/M will find it impossible to offer the software support necessary to compete effectively. CP/M will continue to gain support by virtue of a superior selection of quality software products.

Run CP/M on Your TRS-80

With the Omikron "Mapper" installed in your TRS-80, you can run both CP/M programs and TRS-DOS. You can continue to run all of your present software while you convert to CP/M. By the time you purchase your next computer, you will already have all of the CP/M software you will need. Also, by learning CP/M, you will have effectively mastered your new computer before you buy it. When you finally do purchase your new computer, your TRS-80 will have a new lease on life as a backup unit.

Compatibility Is the Key

Software compatibility offers the same potential that mass production offered the auto industry. Programs will continue to get better and cost less as the costs are averaged over more purchasers. When you purchase a "Mapper," you register your vote for software compatibility. Software standardization is the most effective answer to solving the software problem.

COUGAR . . . Omikron's Users Group

CP/M has always been the standard for business and professional use. This market has always demanded high quality and high performance. The high prices for CP/M programs reflect the additional effort required to develop top-quality software products. To help our customers afford CP/M software, Omikron has formed Cougar, our official users group. Through Cougar, Omikron can purchase software products in large volume. This allows us to offer our customers some of the best CP/M software in the industry at greatly reduced prices.

Omikron Puts It All Together

Omikron has sold more CP/M conversions than all of our competitors combined. Omikron was the first in the market with a CP/M conversion. Omikron has continued to lead the market for one simple reason—our total commitment to our customers. Only Omikron offers a "Works" type introductory package. Only Omikron has a "Cougar" type users group for long term savings. Our hardware has always been designed with reliability first. Our software is well designed, complete, and bug free. Our technical hot line assists those with problems. Finally, our exchange policy has enabled our customers to upgrade to our new designs for much less than the cost to new customers. When you buy from Omikron, you buy from a company with a proven record of dedication and success.

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user by trying it without reading the documentation. Although this is a very bad way to run a system, it alerts me to confusing displays which may trap the new user.) During evaluation, I had no major problems and was able to get the system running, enter transactions and print an invoice.

Getting Started

To begin operations, you need a copy of the systems disk and two formatted disks. The documentation provides a complete procedure to make these copies. Once they have been prepared and inserted in the drives they are initialized by a set-up program called TASETUP. Running this program initializes all the disks and allows the user to customize the system's reports. By entering appropriate data, the firm's name and address will appear on statements and reports. References to employee, client and job can be changed to attorney, client and matter. You can activate a trust accounting module if desired. This module keeps track of trust receipts and disbursements.

Once you have completed the setup procedures, you can access the main system menu by entering TAS. You can select all system functions from this menu, including file maintenance for the reference files, transaction entry, billing, statistical reports, month-end closing procedures and display of trust fund balances. The system contains four main reference files: the employee file, client file, charge code file and job file. You must initialize the content of these files before you enter transactions into the system.

The individual entrusted with establishing the reference file must understand how the system will use the data. Many calculations are performed automatically when data is entered. If the data files have been established correctly, the results of these calculations will provide useful reports and accurate invoices. However, if the underlying data has not been entered with care, the system will be difficult to use and the resulting management reports may not be informative.

A case in point is the assignment of charge codes. As I indicated earlier, it is very important to distinguish between cash receipts for time and cash receipts for expenses. For example, you can specify separate payment charge codes for expenses and time. If you overlook this it will be difficult to separate receipts for accounting purposes. Be sure to describe charge codes adequately. Because of the way the system posts activity to employee earnings records, you may need a separate manual employee activity recordkeeping system to maintain accurate earnings records.

The system credits all activity on a client to the designated billing partner. If more professionals work on the same client, the additional professionals will not receive credits for their work. When a billing partner is changed, the old billing partner's earnings records properly show activity up to the transfer point. However, the monthly report of employee activity details the old billing partner's activity under the new billing partner's name. This makes the two reports inconsistent and confuses the user. The activity reports are most valuable in a firm where each professional handles all of a client's work without assistance.

The method used by this system to record statistics of activity performed for clients illustrates one of the potential limitations of industry-specific software. This system may not suit firms such as accounting or contract programming where different specialists may be involved in client activities. For these firms, the employee activity reports prepared by the system will be useless. When you are considering a system such as this, see how the system fits before purchasing it.

If the Time Accounting System fits the practice, it has real advantages over a manual or service bureau system especially when billing time approaches. In a manual system, the time and expense records have to be assembled, extended by a billing rate and summarized on a worksheet. All details have to be totaled and carefully checked for accuracy. Finally the billing partner has to examine the whole worksheet and accompanying documentation. Based on the total and agreements with the client, a billing amount has to be calculated. The wording of the invoice and the grouping of expenses into billable tasks often requires creative thinking which you have to communicate to the typist who actually prepares the invoice. Bill preparation in a time accounting environment is a time-consuming activity regardless of who types the final invoice.

The designers of the Tandy Time Accounting System have studied the problems of professional firms' invoicing procedures. The Time Accounting System handles the mechanics of creating a pre-billing work sheet. This procedure alone should save enough time to justify purchasing the system. The real benefits of computerization become apparent when preparing the client's statement. With almost any billing system, you could bill the contents of the pre-billing file without change; however, with this system you

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TRS-80* COMPUTING EDITION

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Percom's DOUBLER II™ tolerates wide variations in media, drives

GARLAND, TEXAS — May 22, 1981 — Harold Mauch, president of Percom Data Company, announced here today that an improved version of the Company's innovative DOUBLER™ adapter, a double-density plug-in module for TRS-80* Model I computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER II™, so named, permits even greater tolerance in variations among media and drives than the previous design.

Like the original DOUBLER, the DOUBLER II plugs into the drive controller IC socket of a TRS-80 Model I Expansion Interface and permits a user to run either single- or double-density diskettes on a Model I.

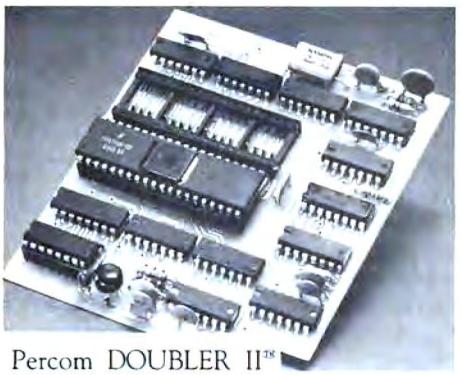
With a DOUBLER II installed, over four times more formatted data — as much as 364 Kbytes — can be stored on one side of a five-inch diskette than can be stored using a standard Tandy Model I drive system.

Moreover, a DOUBLER II equips a Model I with the hardware required to run Model III diskettes.

(*Ed. Note:* See "OS-80™: Bridging the TRS-80* software compatibility gap" elsewhere on this page.)

The critical clock-data separation circuitry of the DOUBLER II is a proprietary design *called a ROM-programmed digital phase-lock loop data separator.*

According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides *immunity to performance degradation caused by circuit component aging.*



Percom DOUBLER II™

Mauch said "A DOUBLER II will operate just as reliably two years after it is installed as it will two days after installation."

The digital phase-lock loop also *eliminates the need for trimmer adjustments typical of analog phase-lock loop circuits.*

"You plug in a Percom DOUBLER II and then forget it," he said.

The DOUBLER II also features a refined Write Precompensation circuit that more effectively minimizes the phenomena of bit- and peak-shifting, a reliability-impairing characteristic of magnetic data recording.

The DOUBLER II, which is fully software compatible with the previous DOUBLER, is supplied with DBLDOS™, a TRSDOS*-compatible disk operating system.

The DOUBLER II sells for ~~$219.95~~, including the DBLDOS diskette. **Now $169.95!**

The Percom DOUBLER II is available from authorized Percom retailers, or may be ordered direct from the factory. The factory toll-free order number is 1-800-527-1222.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. ↙1

All that glitters is not gold

OS-80™ Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80* Model I diskettes and the new Model III is about as genuine as a gold-plated lead Krugerrand.

True, Model I TRSDOS* diskettes can be *read* on a Model III. But first they must be converted and re-recorded for Model III operation.

And you *cannot write* to a Model I TRSDOS* diskette. Not with a Model III. You cannot add a file. Delete a file. Or in any way modify a Model I TRSDOS diskette with a Model III computer.

Furthermore, your converted TRSDOS diskettes cannot be converted *back* for Model I operation.

TRSDOS is a one-way street. And there's no retreating. A point to consider before switching the company's payroll to your new Model III.

Real software compatibility should allow the *direct, immediate* interchangeability of Model I and Model III diskettes. No read-only limitations, no conversion/re-recording steps and no chance to be left high and dry with Model III diskettes that can't be run on a Model I.

What's the answer? The answer is Percom's OS-80™ family of TRS-80 disk operating systems.

OS-80 programs allow *direct, immediate* interchangeability of Model I and Model III diskettes.

You can run Model I single-density diskettes on a Model III: install Percom's plug-in DOUBLER™ adapter in your Model I, and you can run double-density Model III diskettes on a Model I.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III.

And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80/III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update files. You can read *and write* diskettes regardless of the system of origin.

OS-80 is the original Percom TRS-80 DOS for BASIC programmers.

Even OS-80 utilities are written in BASIC.

OS-80 is the Percom system about which a user wrote, in Creative Computing magazine, "...the best $30.00 you will ever spend."†

Requiring only seven Kbytes of memory, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclusively for a system diskette.

And, unlike TRSDOS, you *can* work at the track sector level, defining and controlling data formats — in BASIC — to create simple or complex data structures that execute more quickly than TRSDOS files.

The Percom OS-80 DOS supports single-density operation of the Model I computer — price is $29.95; the OS-80D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLER II; and, OS-80/III — for the Model III of course — supports both single- and double-density operation. OS-80D and OS-80/III each sell for $49.95. ↙3

Circuit misapplication causes diskette read, format problems. High resolution key to reliable data separation

GARLAND, TEXAS — The Percom SEPARATOR™ does very well for the Radio Shack TRS-80* Model I computer what the Tandy disk controller does poorly at best: *reliably* separates clock and data signals during disk-read operations.

Unreliable data-clock separation causes format verification failures and repeated read retries.

CRC ERROR–TRACK LOCKED OUT

The problem is most severe on high-number (high-density) inner file tracks.

As reported earlier, the clock-data separation problem was traced by Percom to misapplication of the internal separator of the 1771 drive controller IC used in the Model I.

The Percom Separator substitutes a *high-resolution* digital data separator circuit, one which operates at 16 megahertz, for the low-resolution one-megahertz circuit of the Tandy design.

Separator circuits that operate at lower frequencies — for example, two- or four-megahertz — were found by Percom to provide only marginally improved performance over the original Tandy circuit.

The Percom solution is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit — some vendors supply an untested separator kit of resistors, ICs and other paraphernalia that may be installed by modifying the computer — the Percom SEPARATOR is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I EI disk controller chip socket, and plugging the controller chip into a socket on the SEPARATOR.

The SEPARATOR, which sells for only $29.95, may be purchased from authorized Percom retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1222.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. ↙2

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can make significant changes in the presentation of the items. You can add up to 150 characters of description on each item. You can also group up to eight transactions. Only the sum of the detail will appear on the final statement. For the grouped transactions you can enter up to a 50-character description and the resulting group totals can be adjusted if required.

Once you have prepared the tentative statement, you can run a billing simulation. This program prepares a test invoice without adjusting the system totals. You can review the test invoice, circulate it among interested parties, and revise it if necessary. You can repeat this procedure as often as required. Once a statement has been approved, you can prepare the final statement and adjust the system totals to indicate that billing has occurred.

Although it is not stated in the manual, this billing procedure appears to have been designed for a practice where the billing partner and billing preparer are one and the same. If you delegate the billing procedure to another party, you may not realize the benefits of this method of interactive invoice preparation.

"Data entered during a session can be altered until posted."

Entering transactions into the system has been designed to be as painless as possible. All transactions are entered during sessions. At the end of each session, a summary log is printed so that a permanent record is available. As you enter data, it is checked against the information entered in the reference files. Processing cannot proceed without a match. When the match has been made much of the information required for the transactions is extracted from the files and displayed. For example, entry of the case number automatically displays the client's name and the initials of the billing attorney or partner in charge of the engagement. Selection of a charge code defined as a time code automatically enables entry of time. When the time is entered, the value of the transaction is calculated based on the billing attorney's rates and charge code multiplier.

Unfortunately, if the work attorney is different than the billing attorney, the appropriate transaction lines must be changed with an edit procedure. You cannot override the system's automatic data insertion features. This is a small price to pay if there are few changes. Pre-coding much of the required transaction data speeds up data entry if editing can be kept to a minimum.

In this system data entered during a session can be altered until posted. However, once posted, changes require an offsetting amount. When posting occurs, the system prepares a transaction register and accounting summary. The accounting summary should be the source of posting to the books of account. Unfortunately, the only useful amount for a cash-basis taxpayer is the payments amount. There is no analysis of payments even though you may have used differing charge codes to separate payments of expenses from time. Transactions must be posted to be billed.

The reports contain an interesting statistic called the "cost" of the services rendered. To generate this information, code a cost figure into the employee file. This "cost" is then multiplied by the hours billed to develop the "cost" of the professional's time. This labor cost is added to the gross expenses billed and the markup percentage indicated on the system activity reports. This profitability information will only be of value if the professional's report costs approximates his actual cost to the firm. If you use this feature, reconcile the actual labor costs against the system costs on a regular basis. If you use a cost figure, make provision for time off and vacations.

Final Points

The Time Accounting System is not the only release of Model II software for the attorney. Tandy supplies a Westlaw communications package and a Litigation Support package (Cat. #26-4545). The latter is a Profile derivative with captions and reports designed to serve as an automated filing system for attorneys. Litigation support is an interesting application and, if a Model II is already on hand, could prove quite useful. A word of caution however—the danger of a micro such as the Model II is that there are too many applications where it can be useful.

The Model II is a *single*-user computer. It is also slow. If you use a single computer for time billing, litigation support, Westlaw and word processing, something will suffer. Prospective purchasers must scale down their hopes when installing this computer. It *cannot* do everything. Purchasers often hope to link applications together to improve work efficiency. This is rarely possible. Some are designed to work together (such as litigation support and the word processor), but Time Accounting and Westlaw are stand-alone systems.

It was inevitable that the matching of lawyers and microcomputers should spawn computer newsletters. The R.P.W. Publishing Corp., P.O. Box 1046, Lexington, SC 29072 has announced publication of "The Lawyer's Microcomputer." Their first issue covers such matters as what to buy, how to use, how to pay for your computer and other articles of interest. Subscriptions for the monthly newsletter cost $28 per year.

Attorneys are not the only targets of specialized newsletters. I know of at least one accounting organization that is planning a newsletter for its subscribers, and there are already several for physicians. These newsletters are valuable because they are written from the viewpoint of the user. If you have any experiences to share or good software packages which you recommend please do not hesitate to drop me a line. I receive letters addressed to the *80 Micro* offices, but they reach me more quickly if they are addressed to: Michael Tannenbaum CPA, 42 Bulaire Road, East Rockaway, NY 11518 ■.

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SOFT BITS
a basic/assembly column

by Roger Fuller

This month let's consider sorting strings in memory. One problem in any sort is exchanges—by reducing their number you can decrease sort time. For this reason non-bubble sorts work faster than bubble sorts.

Sorting Blues

However, all sorts require string exchanges at some point. In Level II Basic, string space is allocated dynamically—space is used as needed, instead of reserved and then used. More strings can be packed into a given area this way if the strings have different lengths.

Whenever a string in string space is assigned to a string variable, the string is duplicated in string space. This sometimes leaves holes in the string storage area.

These holes (or abandoned strings) are the reason for the infamous garbage collection routine. This Basic routine adjusts the strings in string space until no holes exist. Garbage collection time increases exponentially as the number of strings increases. (For example, it takes 100 times as long to adjust 10 times as many strings.)

A partial solution is to swap the string descriptors of the variables instead of the strings themselves. This takes longer than reassigning the strings but makes up for it by bypassing the garbage collection routine. This may mean a very considerable savings in large arrays.

Swapping the string pointers has a drawback—you must add offsets to the VARPTR addresses to get the least and most significant bytes of the actual strings. If the program runs in a 32K machine an overflow error results when the original VARPTR address is 32766 or 32767. I avoided the error in a program I purchased by adding an extra space to make the VARPTR addresses of the strings not span the 32K boundary.

Another Solution

A machine-language swap avoids the boundary problem and increases the speed of the swap (see the Listing).

This routine packs a string (U$) with code. Note the counter which determines the exact amount of space needed. An error trap in line 190 avoids a crash if you enter the data statements (lines 1000-1003) incorrectly.

Line 200 sets up the USR call and line 240 demonstrates the results. (I used subscripted variables to show you how easy they are.) Only line 230 is needed to accomplish the swap. Leave the rest of the code outside your loops.

The variable V$ is the key to this routine's ease of use. V$ must contain both variable names. Leading spaces are unimportant, but at least one byte must be free after the first name. I used a comma to accomplish this.

I transfer the address of V$ to the USR routine in line 230. The first instruction is:

```
CALL 0A7FH
```

This places the descriptor address in the HL register.

The next set of instructions is:

```
INC   HL
LD    E,(HL)
INC   HL
LD    D,(HL)
EX    DE,HL
```

This moves past the length byte of V$, and loads the least significant byte into the E register and the most significant byte into the D register. Then a register pair exchange leaves HL pointing to the first character in V$. A call to ROM (CALL 260DH) loads the DE register pair with the address of the variable. HL is left pointing to the first character after the name, a comma. The variable's data type will be in 40AFH.

The following instructions are needed to save this pointer on the stack and move past the comma. Since HL is now pointing to the second variable's name another call to ROM gets the pointer to the second variable's descriptor address. The address of the first descriptor is recovered from the stack (put there to protect it). Notice it was transferred from DE to HL in the process:

```
PUSH  DE
INC   HL
CALL  260DH
POP   HL
```

The final task is to swap the descriptors. Each descriptor is three bytes long so I set up a DJNZ loop to handle the iterations. The swap takes five steps (Fig. 1) instead of the usual three in Basic. Step 1 loads the A$(L) byte into C. Step 2 loads the A$(R) into A. (These are loads from

```
100 '  SWAP STRING USR ROUTINE   BY ROGER FULLER  PUBLIC DOMAIN
110 '
120 U$="12345678901234567890123456789012"' 32 BYTES FOR PACKING
130 U%=VARPTR(U$)                          ' U%=DESCRIPTOR ADDRESS
140 U%=PEEK(U%+1)+256*PEEK(U%+2)           ' U%=STRING ADDRESS
150 FOR L%=0 TO 31
160     READ BYTE : CKSUM = CKSUM + BYTE
170     POKE U% + L% , BYTE
180 NEXT
190 IF CKSUM <> 3063 THEN PRINT "CHECK SUM ERROR" : END
200 IF PEEK(16396)=195 THEN DEFUSR1=U%
      ELSE POKE 16526 , U% AND 255 : POKE 16527 , U%/256
210 V$="A$(L),A$(R)":L=0:R=1
220 A$(L)="LEFT" : A$(R)="RIGHT"
230 U%=USR1(VARPTR(V$))
240 PRINTA$(L),A$(R)
250 GOTO 230
1000 DATA 205,127, 10, 35, 94, 35, 86,235,205, 13
1001 DATA  38,213, 35,205, 13, 38,225,  6,  3, 78
1002 DATA  26,119,121, 18, 19, 35, 16,247,195,157
1003 DATA  10,201
```

Program Listing

SOFT BITS

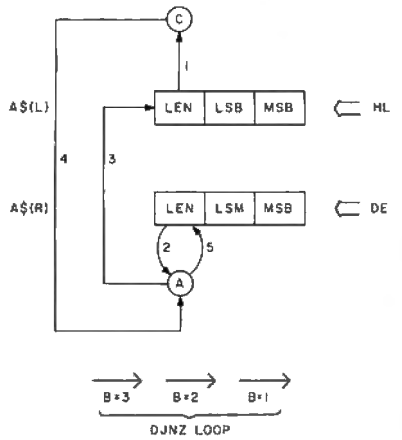

Figure 1

memory. The parentheses mean "outside the Z80.")

Step 3 puts the A$(R) byte into A$(L)'s descriptor. Since there is no LD (DE),C the A$(L)'s byte in C must be transferred to A before loading into A$(R)'s descriptor. The pointers DE and HL move up and the process repeats until B equals zero. The code for that is:

```
LD    B,3
LD    C, (HL)
LD    A, (HL)
LD    (HL),C
LD    A,C
LD    (DE),A
INC   DE
INC   HL
DJNZ  $-7
```

Finally, JP 0A9DH resets the data type flag to integer and returns execution to Basic.■

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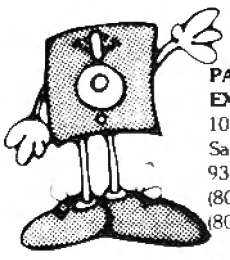

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80 REVIEWS

"Let's face it folks, zapping aliens on your $2,000 micro isn't far removed from shoving a Tonka dumpster up and down the driveway."

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by Silas Pike

I've yet to distinguish any real difference between arcade-type programs and any other basic children's game. Let's face it folks, zapping aliens on your $2,000 micro isn't far removed from shoving a Tonka dumpster up and down the driveway. Perhaps we rationalize our entertainment through sheer cash expenditure. The corporate executive who wishes to unwind at the end of a work day would hardly want to be seen by the neighbors battling imaginary alien forces on his front lawn—an expensive microcomputer is so much more, well, respectable.

However, if playing with little dump trucks were as much fun as Wayne Westmoreland's and Terry Gilman's Armored Patrol; I might be tempted to head for the front yard myself. Armored Patrol's command-chair perspective of the action is unique.

Your mission is to destroy enemy tanks.

In this age of interplanetary wars, hyperspace (ya gotta have hyperspace), and Carl Sagan, tank versus tank in a battle to the death seems almost *too* tame. What separates this from the ordinary and World War II-type games are plasma bursts instead of conventional shells, robots in lieu of human troops, and missions taking place on an alien landscape.

During the game the screen of your micro becomes your tank viewscreen. Through it, you look out upon a flat, desert-like area peppered with blockhouses. In the distance, mountains loom stoically, marking the zone limits. You move your tank forward or backward, left or right by using four keys (A , Z /). The space bar fires your plasma bursts.

The idea is to maneuver your tank throughout the area in search of enemy tanks and robots. Some of the tanks are out in the open; a goodly number of them are hiding behind the blockhouses where they are least conspicuous and vulnerable. Frequently, an energy-zapping robot rolls into position brandishing twin ray guns. When you are hit, it depletes your energy reserves by one unit (you begin with 20). Once your energy level falls to zero, you lose one of your tanks. (You have four tanks per game. An extra tank is awarded at 20,000 points.)

What impressed me the most about Armored Patrol is the amount of action going on off screen. The battle area is finite—your viewing area is limited to one narrow area—but throughout the entire battlefield, tanks are lumbering to and fro between blockhouses and across the open desert. Robots pop up now and then, dispensing their own deadly form of havoc. All of this creates a you-are-there feel to the game.

If the degree of action is Armored Patrol's best feature, then the 3-D-style graphics are a close second. By using the left/right controls, you are able to do a 360-degree sweep of the entire area. As your tank moves forward or backward, enemy tanks, blockhouses and robots dimensionally swing into and out of view. Distant objects appear first as specks on the horizon and gradually grow in size as you move toward them.

After selecting the number of players (one or two), your viewscreen activates and you are looking out across a bleak, level panorama. Your instrumentation consists of a graphic depiction of the number of tanks you have remaining in the game, your energy level, and an enemy radar made up of four arrows arranged in compass fashion. If an enemy tank is in the immediate vicinity, one of the arrows flashes on and off; you will need to maneuver your tank in the direction indicated to confront it. If the radar is clear, select a direction and go until you spot something on your viewscreen. Hopefully, you will find a tank positioned with its barrel aiming away from you. If this is the case, a well-aimed shot on your part is in order. If not (and the enemy's preparing to fire), you will have to make a quick decision whether to fire (hoping you get him first), or maneuver into a safer location. The trickiest part is dealing with a tank that fires just outside your periphery making a counter-maneuver impossible.

The wild cards in Armored Patrol are the energy-sapping robots. Frequently, these weapon-wielding mechanizations pop up with little or no warning whatsoever. They are particularly nasty when appearing with a tank, or if they materialize directly behind you. Since it takes about 10 seconds to rotate your tank 180 degrees, a robot may put a sizable drain on your energy supply before you can blast the little bugger.

The tanks fragment into pieces when destroyed, but a robot pulses on and off before it disappears into ionic oblivion. I haven't figured out if enemy tanks are actively aggressive towards the robots or if the robots just blunder into their line of fire. In any event, the robots can be destroyed by either side.

Armored Patrol's biggest failing is the sound routines. I think a tank battle should be accompanied by low, rumbling sounds—not the blips and whines evident here.

A second (and frequently irritating) problem is that one can be shot by an enemy tank within a split-second of the game's beginning. Some type of danger delay when the game initiates would be most welcome.

The final and most minor suggestion for improving the program would be making the blockhouse vulnerable to your fire. As it is, shooting a blockhouse with your plasma bursts has no effect. It would be nice if you could demolish one (over the course of several shots) with your plasma cannon and expose any tanks lurking behind.

Armored Patrol is a solid buy for the price. Its graphics are surprisingly realistic, and draw you into the game. It took me quite a few playings before I realized that there was a method to this interesting madness—strategy and thought are definitely in order to rack up a respectable score.

Armored Patrol is an enjoyable program and should be of interest to anyone who enjoys fine arcadia. ■

Basic Adventures
Bob Liddil
80-Northwest Publishing Inc.
3838 South Warner St.
Tacoma, WA 98409
Softcover, 252 pp.
$19.95

by Michael E. Nadeau
***80 Micro* staff**

Adventure games are a little like those Harlequin romance novels you see on the bookstands in the supermarkets; the plots and style change little from one game to the next, but once you are hooked you could find yourself playing them most of your waking hours. This may prove expensive for the adventure junkie who finds himself buying game after game, but Bob Liddil, a.k.a. Captain 80, has provided a fix that will keep those junkies on an adventure high for quite some time.

Basic Adventures is a collection of 18 adventure games by such well known authors as Scott Adams, Greg Hassett, Lance Micklus and Teri Li. The games are all available in software form, and include titles such as Dog Star Adventure, Atlantean Odyssey and Lost Dutchman's Gold.

These adventures are excellent representations of the genre, although not all are identical to the software versions. Atlantean Odyssey is written in Basic in the book, but the software version is in Assembly language. It appears virtually the same on the screen, but undoubtedly runs slower in Basic—a minor nuisance. Other adventures have been mildly refined; for instance many spelling errors appearing in the originals have been corrected.

For readers unfamiliar with adventure games, they require mental acumen rather than the digital dexterity needed for arcade-type games. (A Thesaurus also helps if you have trouble finding the correct command word.) The program sets a scenario and describes the situations you get yourself into. You must decide where to go, what to do, and how to do it. You could be a moonshiner running hootch; do you run the roadblock or turn around? How do you fix your souped-up '57 Chevy? How is it broken down? Can you avoid the "revenuers" long enough to make your delivery?

If moonshining doesn't enthuse you, there are space adventures, too. If that bores you, you could be a CIA agent on a deadly mission, or a prospector searching for a lost cache of gold, or a...The list goes on. There are just 18 choices in Liddil's book, enough for months of puzzle solving.

This book also gives advice on how to write and sell adventure games. An adventure generator program provides the bare bones for creating your own adventure; you just plug in the plot and its various twists and turns. Liddil gives hints on how to sell your creations and lists potential markets.

The veteran adventurer should be well aware of the quality of these games, some are industry standards, and the reputation of the authors. If these programs have proven themselves on the marketplace, why publish them in a book?

Liddil says he wants to expose more people to adventure games. He appears to have found a good way of doing just that. For the price of one software adventure, *Basic Adventures* provides 18 (of course, you have to do a lot of typing). Not only is this a financially painless introduction to adventure, but the listings are valuable as tutorials in how adventure programs work.

Basic Adventure is a good effort and should be of interest to anyone who plays adventure games or thinks they might want to.■

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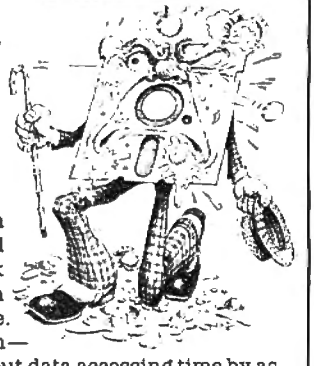

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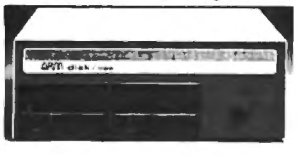

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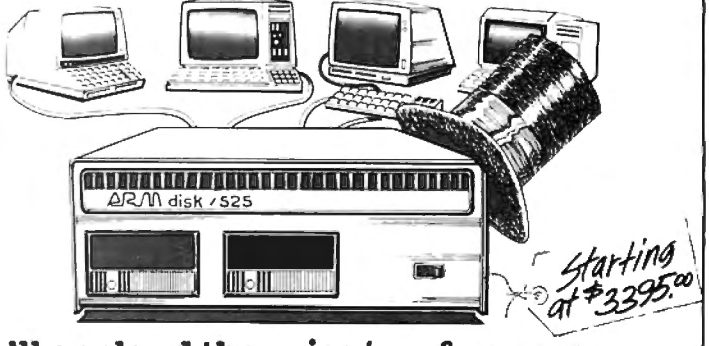

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Adventure International &
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Longwood FL 32750
Models I & III
$29.95 each, disk

by Mark E. Renne

The Maces & Magic series consists of three adventures; Balrog, Stone of Sisyphus, and Morton's Fork. The difference between this series and other adventure-type games on the market is their cross with role-playing games. Your character is unique in structure and events occur differently depending on your own attributes.

The games may be played in any order or separately. You begin in the general store. Here you will roll up a character and arm him for future battles against evil. Individual attributes are strength, IQ, luck, constitution, dexterity and charisma. If you've played Dungeons & Dragons or Runequest, you'll recognize these characteristics; they have the same function here as they do in those games. Strength is one of the most important as it determines how much you can carry and what type of weapons you may buy. IQ is handy for catching things that another adventurer, one with a lower IQ, might miss (perhaps a secret door or two).

Another important attribute is constitution. The higher the number here the more abuse you can take in battle. A clumsy person will surely fall into any trap that happens by. Dexterity will save you from that fate. It also comes in handy for climbing mountains or swimming rivers. Charisma is important even in the dungeon. Many a savage witch has been cooled by shiny teeth and blue eyes. The computer will keep rolling characters until it's gray in the case. If you see one you like, simply say that you'll use the character and on you go to stage two of development.

Now comes the time to choose a weapon. There are 80 different weapons. Each has a name and power, weight, cost, dexterity and strength ratings. Weapons do different degrees of damage depending on their power. You wouldn't take a slingshot against a giant. To use a particular weapon you must be able to afford it, carry it, and swing it. Gold does not grow on trees. Sometimes you have to fight a while, buy new weapons, fight some more and so on. Trade-ins are accepted at reduced rates. Armor is then chosen in the same way. The best costs more, weighs more, and protects more. There are more than 25 types of armor. If you happen to have some gold left, you may leave it at the general store or take it with you. It's always good to have mad money (in case someone gets mad at you).

Commands are all one letter and include (G)et, (L)eave, (P)ack, (H)elp, (S)tatus, (W)ait, (I)nventory, and (*)save game. Get and leave are for picking up and leaving items you find along the way. If you pick something up, it will be placed in your pack. By pressing P you will receive a listing of your pack. You pick the item you want and the computer asks, "What do you want to do with the...?" You respond with a verb or a verb and noun. Help will give you a summary of the commands. Status indicates your *current* attributes. In this adventure you may lose attribute points either temporarily or permanently. Wait is a handy command for catching your breath or watching bees buzz. Inventory lists your current pack items, weapons and armor. I will discuss saving the game later.

Playing the game is much like playing most adventures with a few twists. You find objects and try to manipulate them correctly. The rooms or locations are loaded one at a time off disk. This means the computer constantly accesses the disk if you're moving along quickly. Your options are all listed on the screen. For example, you're in a room and a dwarf throws a slime worm at you. The screen will indicate: 1-East 2-West or 3-Fight Worm. You choose what you'd like to do; run away or fight like a man. Remember, the secret to this game is finding treasure and getting out alive! Events will vary greatly depending on your individual characteristics. The battle is shown as the participants receive hit points. You have the option of running away, changing weapons or continuing every few turns. If you defeat the creature, you will sometimes find he carried treasure. Other creatures in the dungeon provide services for payment—sometimes good, sometimes bad, sometimes optional, sometimes mandatory. Some events you only get one shot at (you see five boxes—pick one).

Saving a game is a time-consuming process. If your character is in an adventure, the game saves all the details and you may pick it up there later. If you get out of trouble, your character will be saved and he may go to a different adventure stronger, wiser and richer. A running total indicates survivors as a percentage of total adventurers. Also, a record is kept of the largest treasure taken out and most gold carried out with the player's name. A score is displayed with a rating to indicate your proficiency. Then you must reload the game to continue if you save your character at a tight spot and now want to continue.

The game is fun and a nice blend of adventure and chance. My only complaint is that it's written in Basic; it's very slow. The game seems unbearably slow when saving a game as you must traverse different programs to accomplish this. It comes with excellent documentation and loading instructions. If you have a Model III and are using TRSDOS 1.3, patch your DOS to allow killing one file while another is open. Aside from the speed, I would recommend these games, without reservation to role-playing computerists.■

Robot Attack
Big Five Software
P.O. Box 9078-185
Van Nuys, CA 91409
Model I or III
$15.95 cassette
$19.95 disk

by Carl Kollar

Robot Attack is a cassette-based arcade game for one or two players that puts an Earth warrior against several Jidyan robots.

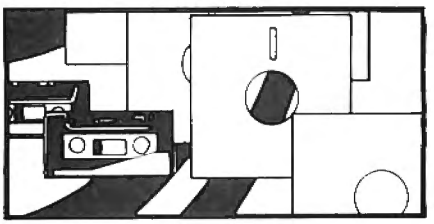
Your warrior roams the maze looking for robots. At first it seems too easy to destroy the robots without being shot at in return but suddenly the robots counter-attack and you're kept busy just trying to avoid their laser fire. A robot laser-blast can wipe out your warrior from anywhere on the screen as long as a clear path exists between your warrior and the attacking robot.

To keep you from becoming too familiar with the game layout, your warrior is in a different set of rooms (or maze) each time you play the game. You control your warrior's movement with the I,J,K and M or arrow keys; the F key or the space bar fire the lasers. Joysticks can be used instead of the keyboard. You cannot fire around corners.

Robot Attack comes with sound and speaks to you during the game, using such words as "player one," "player two," "chicken," "lucky," "game over," and "great score." Sometimes the words are used in sequence to form phrases like "great score player one"; the words are robot-sounding but understandable.

You're awarded an extra warrior after 5,000 points and another after 10,000 points.■

Laser Defense
Simon Smith
Med Systems Software
P.O. Box 3558
Chapel Hill, NC 27514
Model I or III
$14.95 cassette
$17.95 disk



by Mark E. Renne

I would order a product sight unseen from only a few companies and Med Systems is one. Laser Defense is their first attempt at an arcade-type game and they score big. This is not just another version of Missile Command; it's a totally original game.

Your mission is to keep missiles from destroying your cities while destroying Russian launching stations. This game is a combination of strategy and arcade fun. You begin with six cities and four hovering satellites while your computer enemy has 12 silos and an unlimited number of particle-beam weapons traveling on MX tracks. These weapons appear at intervals to fire at your satellites. Two views or maps are available to you: one of the United States and a Europe/Soviet Union map. Maps are switched by pressing 1. The U.S. map indicates cities and incoming ICBMs. To destroy a missile in flight, you position your sight with the arrow keys and fire with the space bar. If the nuclear blast is close enough, the incoming missile is destroyed and your city saved. When all the cities are destroyed, the game is over.

Your ultimate weapon against ICBMs is the eradicator. It is engaged by pressing E, and destroys any missiles in flight immediately. This is very handy in a pinch. The eradicator, however, also maintains your satellites' shields. If the eradicator energy, indicated at the bottom of the screen, falls too low, the satellites will be destroyed by the first blast of a particle beam weapon. Eradicator energy is only refilled at scoring intervals of 10,000.

Should you happen to survive the first wave of silos, you will be awarded a bonus of 200 points for remaining cities and 10 points for any remaining energy units. Laser energy is refilled and another wave begins. As you go through each wave, you face an enemy that becomes more difficult to defeat. Missiles are launched faster, in greater numbers and particle weapons appear more often. Scoring is as follows: missiles in flight get 10 points; missile silos get 100 points; particle beam weapons get 1000 points. Once in a while a nuclear power plant appears in East Germany. Should you destroy this target, you score 4000 points. All targets require extreme accuracy to destroy and the nuclear power plant requires your precious eradicator.

Fast reflexes, marvelous finger coordination, and a methodical plan of attack improve scores. Both maps feature full wrap-around, and mastering this aspect of the game makes a big difference in the latter stages. For example, a missile is about to destroy Los Angeles and you have just saved New York City. If you went across the U.S., you would never make it. However, it's just a hop across the ocean.

Since missiles leave Russia and cross over the Arctic Circle you can time how long it takes before your cities get into trouble. By wiping out the silos in northern Russia first, you will add precious seconds to the time you have to destroy the missiles. As the game progresses, missiles are constantly flying and particle beam weapons appear as fast as bugs in "perfect" operating systems. The strategy at this stage is to destroy one silo, switch to the U.S., save cities, switch to Russia, destroy one silo, and so on. If you get greedy or slip up, either your cities or satellites will be destroyed.

Other features of this game include a convenient pause key, P, which allows you to freeze the game should you have something more important to do than save the world. This is a machine-language game for one or two players, and the top five scores are saved on the disk version. The disk version also features the Brandon loader which allows you to "boot" the game on either a Model I or III. Complete sound effects are featured, including an indication that a particle-beam weapon has appeared. Games may be aborted by using the break key as well as the revolving demo that appears when the game is not being played.

This game has 10 degrees of difficulty. At the highest, it shows just how fast machine language can be. The game is fun, works well, and presents a challenge even after several hundred plays. It's a super original arcade game designed for the TRS-80. Maybe Med Systems can sell it to Atari for arcades....Hmmm.■

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Alcatraz II
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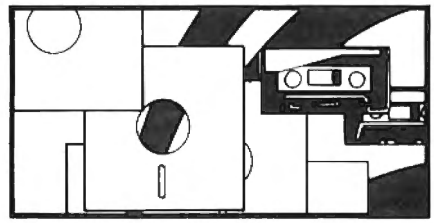
by Rich Petty



Alcatraz II is a beautiful example of the improvements in the quality of the products for Color Computers today.

It is a prison escape game, where by using a combination of skill, strategy, and a lot of luck, you might get out. As they say in the introduction, no one has ever escaped from Alcatraz II. After having logged over 25 hours on the game I believe it! Alcatraz II features numerous wings (or cell blocks). Your score increases with each one you make it through. Each wing, starting with wing number 2, becomes progressively harder than the one before it. Wings 1, 2, 3 and 5 are identical (except for the number of guards). They consist of five east-west hallways and five north-south hallways. (See Fig. 1.) The three locked gates between you and your exit point from the wing are your least serious problem; more serious are the laser cannons. They seem to fire down all north-south halls or all east-west halls at random intervals. You are warned by a 5 to 10-second audio alarm before they slowly protrude from the walls to take aim. If you watch, you have three to four seconds to determine the direction of their fire. This usually gives you time to change halls. The real rub is, the laser cannon firing mechanism automatically relocks all of the gates that had been unlocked. That can leave you in an impossible situation.

How do you get the gates unlocked? The guards will do it for you. They constantly wander down the halls opening gates as they go. When they come to an intersection they make a random decision as to which way to go. If they find themselves in the same hall you are in, they will pursue you, opening (and leaving open) any gates in their way. If they catch you the game is over. However, you can outrun and hide from them. Since their direction is unpredictable (when they can't see you) you are caught more times by accident than by design. The guards are not too smart, but they outnumber you. The fourth wing has no guards. It is a man-eating minotaur's den. A minotaur is bigger and faster than you are. Its lair has walls and force fields which only minotaurs can go through. When a minotaur crashes through a wall he destroys it, providing a path you can use later.

Keep in mind that there are switch boxes in each minotaur's lair. If you can get to a switch box, where you are safe from the minotaur, you can turn off the force field that switch box controls. I've been in a minotaur's lair three times. I got out twice. I've heard rumors that there are several minotaur's lairs and also that robots are used in some of the final wings. (I haven't been there to confirm that.)

I can confirm that this is one game you won't master in two or three hours. It is a very challenging, well written game that won't cost you an arm and a leg. The game is a combination of medium and high-resolution graphics (Your character is a small block containing a stick figure as are the guards and minotaurs). You move your character with either the arrow keys or joysticks. The color is great and the sound effects are super!

There are some irritating points you should be aware of. The tape comes with an instruction program which later loads the game program. I picked up an I/O error on my first attempt to load the game and had to load one of the three back-up copies. It was an irritation, but I was grateful the company sent more than one copy of the program.

There is a bug that may or may not affect you, but you should be aware of it. If the program loads, then errors after typing run, type run again and it will probably be fine. If it errors again, turn off and back on your computer, type PCLEAR 2, reload the program, type run and it should go. This bug is not in the program but in Radio Shack's Extended Basic ROM version 1.0. Radio Shack writes of it briefly in the February, 1982 *TRS-80 Microcomputer News*. What they didn't say is that the bug can crash a program.

Another thing, when you make it through a wing, you are given a score which from game to game varies. I haven't been able to tell why it varies, or how to get the top score. It's no big deal. I just can't figure out why my wife gets 600 points for going through the first wing and I get only 450.

I *highly* recommend the game, and for the price it's a steal! ■

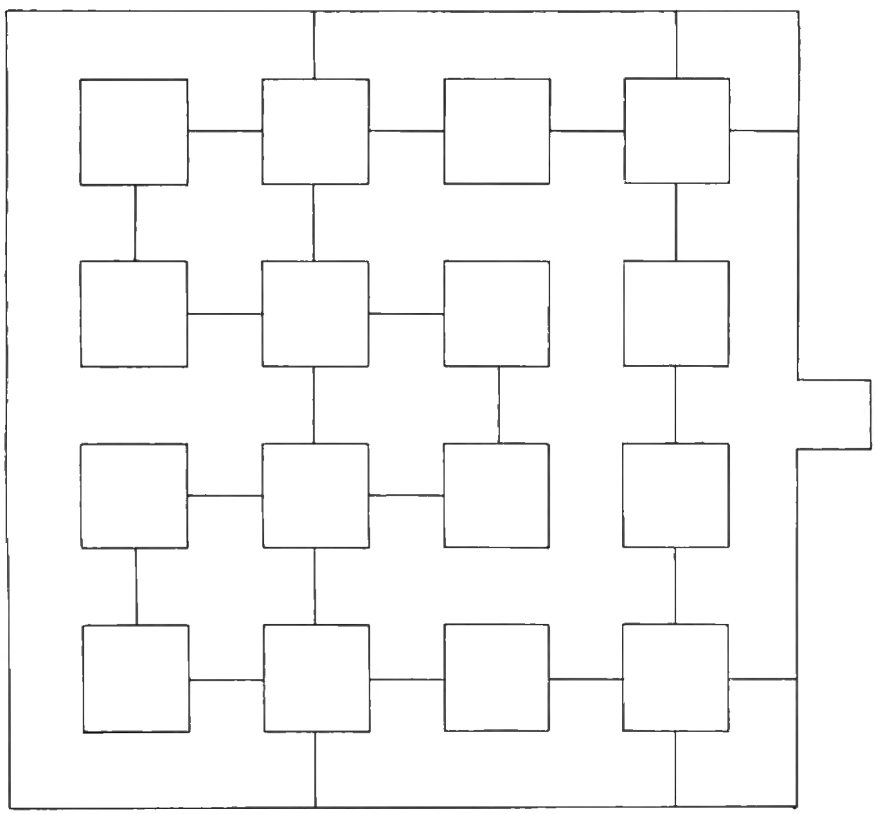
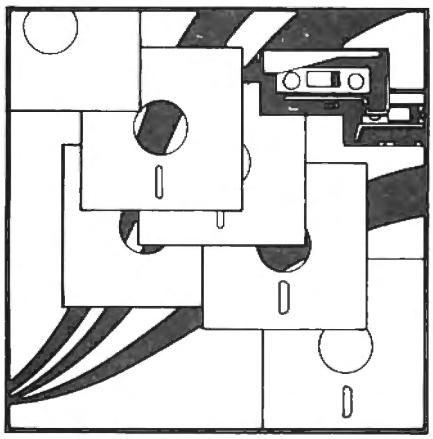


Figure 1

Forbidden City
William Demas
Fantastic Software
P.O. Box 27734
Las Vegas, NV 89126
48K Model I or III
$39.95 disk
by Mark E. Renne

"Arrgh, I'm dead!" my faithful amplifier spits at me in spite. "Play again?" asks another voice. I scream NO and hope this time the robots don't bump me off so quickly. That's right, Forbidden City is a talking adventure system. Not only does it have sound effects, but the game has three separate voices with gender and emotion.

Forbidden City is the second talking adventure from William Demas, coauthor of Scott Adams' Adventure #12. The first was Forbidden Planet. Although the story line is connected, you don't need one to play the other. The adventure is in machine language on a self-booting disk and requires 48K. Standard verb/noun commands are accepted and the split screen is used for display. The game has a vocabulary of over 140 words for input and a separate vocabulary for spoken words. Game saving is easy and up to 10 games may be saved at one time with comments for each. The game comes in a very convenient folding disk case with a hint sheet.



What sets this game apart from most adventure games is the voice. The voice is *not* meant to help or guide you through the adventure. It does, however, dispense critical information at times. The game may also be played with the voice off without missing any clues.

In Forbidden City there are three separate voices. One is a female voice of the city computer, she has an alluring voice and is usually looking for information such as passwords. The voice of your computer is pleasant and similar to the only voice in Forbidden Planet. This voice excitedly says "I found something" if an exam item is fruitful and "OK." It also sounds a little sick after radiation poisoning, you know death is certain without treatment. The last voice belongs to the robots guarding the city. Once you're spotted by guards they chase you shouting "Stop Alien" or "Stop Intruder." It's only a matter of a few turns before they kill you. I have not figured out how to deactivate them yet.

The adventure's style is similar to most of Adams' adventures. The robots make the game challenging and difficult. The three voices are a definite plus; their words are very clear and their emotions are convincing. Adventures may never be the same.■

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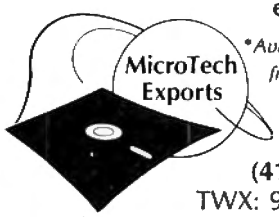

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80 REVIEWS

Starbuck 8882
Starbuck Data Company
P.O. Box 24
Newton Lower Falls, MA 02162
Complete System:
$180 Model I
$199 Model III

by Jake Commander

The Starbuck 8882 is a data acquisition and control system for the Model I or III. The purpose of this black box unit is to relay data between the real world and the TRS-80. The TRS-80 can receive analog or digital data and can respond by setting bits in an output port in the 8882. Normally, the only input the TRS-80 ever sees is from character-oriented I/O such as the keyboard, cassette and possibly disk units. The Starbuck allows data to be collected in two main ways: A continuously varying analog voltage can be sampled from any one of eight input lines, and eight lines may be polled to detect open or closed switches connected to the unit.

The documentation has all the information you are ever likely to need. It is 75 pages in length and although the print quality is of only medium quality, its contents should serve as a model to any manufacturer of peripheral hardware for the TRS-80.

Everything is covered from a description of installation and operation to fault diagnosis and calibration. The Starbuck Data Company people have had the good sense to realize their hardware is likely to be used in so many differing situations that anyone from a casual hobbyist to a specialist engineer needs to be catered for. The softbound manual is arranged in such a way that the engineers won't be disappointed; the more advanced information (including the circuit diagram of the 8882) can be skipped by the less demanding user. It's refreshing to see such information made available rather than kept under a shroud of secrecy.

The possible applications of the 8882 are well covered. Starbuck catered to people wishing to build extra interface circuitry by providing suggested schematics for measuring external parameters such as temperature and solar radiation (which makes the unit perfect for solar energy enthusiasts). If meteorology is your interest, a wind-speed monitor setup is suggested using a typical anemometer such as the Maximum A75-104. For newcomers to the field of analog interfacing, a short tutorial gives some background, though judging by a few references to certain terminology, some electronics knowledge is assumed.

The circuit diagrams in the manual are simple op-amp designs with a few accompanying components, amounting to about $5 worth of parts. One of the most exciting possibilities mentioned is interfacing to a Sears Roebuck BSR-X10 master control unit allowing ultrasonic control of household items such as lights and dimmers with your TRS-80.

The final section of the manual contains all the software listings required to use the 8882. This software is also available on disk as part of the complete system or separately if required. Included in the software package are test programs for submitting the unit to diagnostic checks, programs allowing the units to be used from Basic or from the machine code level, and a description of a method of use in an interrupt-driven mode. A couple of games (Brickout and Ping-Pong) are included enabling the use of joysticks normally supplied for the Color Computer. The use of the software is fully described in a 13-page section of the manual. The manual is extremely comprehensive and greatly enhances the usefulness of the hardware.

The hardware is literally a black box and acts in a traditional black box fashion: Signals are input through one side of it, and after being processed, emerge on the other side in a different form. The top of the box has three rows of eight screw-on terminal pairs; two rows are for digital I/O, and one row is for analog input. Two DIN sockets are provided for handling the joystick inputs.The box measures 8 by 7 by 3 inches making it a reasonable size to have next to your TRS-80.

Power is supplied in the form of 12 volts ac at 200 mA from a small wall transformer. I have reservations about this kind of power supply for a number of reasons. There is a small chance that by inserting or removing the 12-volt supply from the 8882 you could short out the mini-jack plug and damage the power supply transformer. You are warned against this in the documentation, but the problem could have been entirely eliminated by having the supply integral within the box. It also means you can't switch the unit off by removing ac power to it from a single switch unless you resort to a switched multi-way ac outlet.

The unit is nothing short of excellent as regards its use in data acquisition and control on a micro. The uses for this type of hardware are as many and varied as the uses of the computer itself. The inputs available can be either digital or analog and are addressed from the TRS-80 via ports 160 and 161 (A0 and A1 hexadecimal) on the Model I version. The Model III

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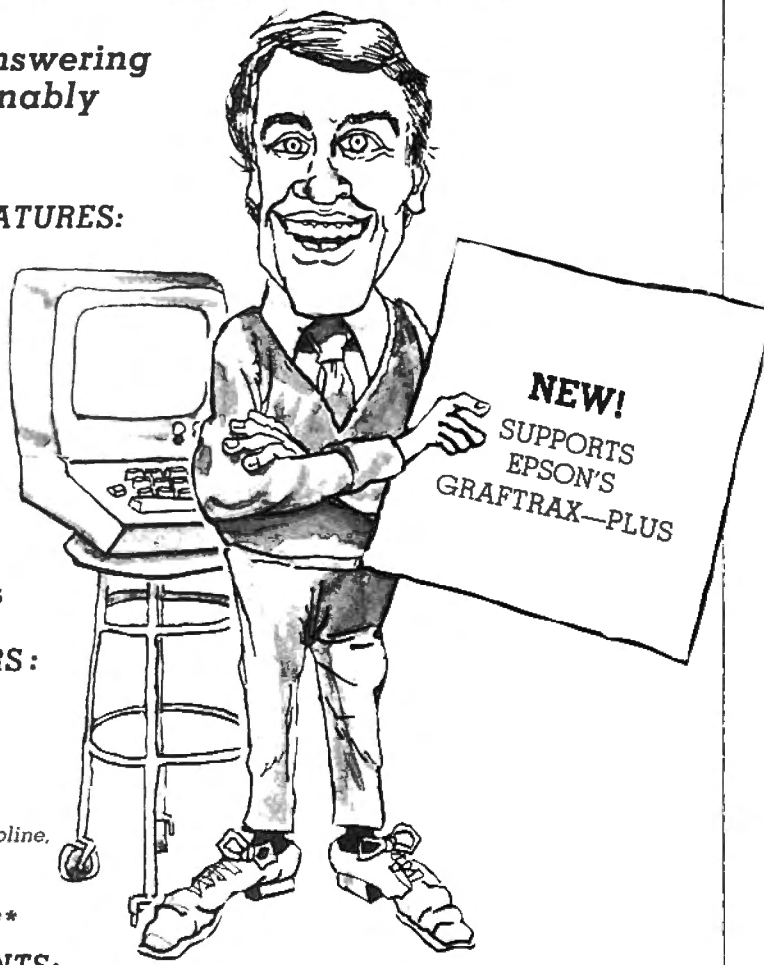

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version uses different ports, to be exact, 96 and 97 (60 and 61 hexadecimal), for the analog and digital inputs.

The port arrangement can be custom configured at the factory allowing the use of the unit where ports are already in use and giving the option of chaining units together for more than eight analog channels. The output from the 8882 is in digital form only (from the same port number as the digital input).

Although only a single port is used for analog input, eight channels are accommodated by a very sensible method: When an analog input is required by a program, a signal is sent to tell the unit to initiate an analog-to-digital conversion—this same signal also tells it which one of its eight channels is to be sampled. This is done by outputting the numbers zero to seven to the analog port.

The conversion from analog is done to a resolution of eight bits, meaning you'll get a number from zero to 255 proportional to the voltage present on that particular channel. The range of analog voltages handled is from zero to 5 volts and accuracy of the conversion process is plus or minus one bit or 20 mV—that is about 20 thousandths of a volt—and is accurate enough for most needs.

Inputs above 5 volts can be easily dealt with using simple voltage divider circuitry. The 8882 is protected up to voltages of 200 volts positive or negative so it forgives the slip-ups at the experimental stages of an application. The time taken for the hardware to sample a voltage and convert it to a number is a staggering 150 microseconds—and that is quick! Using machine code it's possible to read data at the rate of 4,000 inputs per second; I don't foresee many uses on any microcomputer that would require data gathering any faster than that.

Digital input and output is handled at the bit level. By reading the digital input port, a byte is returned in which each bit corresponds to a single digital channel. Simply stated, this means that with digital input you see a one if a switch is open and a zero if it's closed. By attaching microswitches to doors or windows, it would be possible for the computer to check if anything was left open, making simple alarm systems a real possibility.

Digital output is handled the same way except in reverse; each bit in an output byte controls a separate output channel. So, to output to a single channel necessitates keeping track of other output channels using a software mask. The mask ensures that changing one channel leaves the other channels in their predetermined states. When a digital channel is turned on, a current of 50 mA can pass through it; each channel is controlled by a latched optoisolated driver. The optoisolation means the unit is kept at a safe distance from any stray voltages which may accidentally creep into your control circuitry. This is necessary because it's possible to drive heavy relay-controlled equipment involving voltages hazardous to you or your microcomputer. Optoisolation provides protection from voltages up to 1,500 volts if you decide to tempt fate with such mistakes. The fact that the outputs are latched means once the channel is switched on or off, it remains in that state until another command is issued from the digital output port.

By now, you should be able to foresee many possible applications for a data acquisition and control unit such as this. The only extra that could have been provided would have been an analog output. Even this can be achieved by using an electronic ladder network on the digital outputs to sum the voltages; up to 256 different voltage levels can be attained. The sky's the limit—you can now control the world from your TRS-80. ■

Star Blaster
The Micro Works
P.O. Box 1110
Del Mar, CA
Color Computer
$39.95 cartridge

by Jake Commander

Star Blaster is a real-time version of the arcade game Asteroids written in 6809 machine code, and the action is as fast and furious as the original version. The game is played with joysticks or a predefined set of keyboard characters that move the mother ship and fire missiles. I enjoy the game more with joysticks; it's closer to an arcade game.

For those of you unfamiliar with Asteroids, it consists of a missile-firing spaceship located somewhere in an asteroid-infested quadrant deep in the uncharted depths of space. No one in his right mind would actually pilot a rocket ship to such a place, but that's where your ship is during the game. The idea is to shoot to pieces all asteroids in sight before they smash into you and destroy your ship. The ship can fire missiles and move around to dodge the debris.

Micro Works' version starts with a generous supply of five ships. Pushing left or right on the joystick (or pressing the appropriate keys) rotates the ship through 360 degrees, whereas a forward push gives the ship a kick of power that jolts it in the direction it's facing.

Like the arcade version, this takes a little skill, since the ship gains momentum and continues until it decelerates under some undiscovered law of physics. Unless you've passed your advanced space-driving test, you're likely to crash your ship into a lump of rock. This is where Star Blaster has its own custom trick. By pulling back on the stick, a bubble-like shield surrounds your ship and prevents any asteroids from coming into contact. This is only advised as a panic measure, since under these circumstances, the bubble containing your ship is gently nudged through space, leaving you to decide when to make a break for it.

As if this isn't enough to drive any normal space-pilot back to driving a bus on Terra Firma, various sizes of flying saucers randomly enter your quadrant and take pot-shots at you. It's just one of those facts of space-life, and naturally you have to defend yourself by counter-attacking or dodging the missiles raining down upon your ship.

Star Blaster awards points according to the difficulty of the targets you hit. Every time you earn 10,000 points, you are rewarded with a beep and an extra ship. If Micro Works had any compassion, an aspirin would also be awarded at this point.

The program uses only two colors, black and light-green. This is the equivalent video mode in Basic as PMODE 4 and SCREEN 1,1. It's not the prettiest of the Color Computer's displays but the software's designer has opted for maximum resolution.

The documentation is a card outlining the basic rules and scoring system. To be fair, this is no more or less than the instructions available on any arcade machine. Sound is also an integral part of the game, but is only a minor part of the overall package when compared with the quality of the display.

Star Blaster is only available in cartridge form, which accounts for its relatively high cost. Remember—this is not merely software but firmware; what you buy is a package consisting of a read-only memory (ROM) contained within a plastic cartridge. One attraction of this arrangement is the luxury of "instant software" with no loading problems. You just plug in, switch on and play.

I recommend Star Blaster to any arcadophile. It's a definite must for the game library. ■

Color Pac Attack
Computerware
Encinitas, CA 92024
16K Color Computer
$24.95 cassette
$29.95 disk

by Max Treece

Color Pac Attack is the Color Computer's version of the popular arcade game.

After a musical fanfare at the start of the game, the Pac person you control with a joystick tries to consume proton pellets around a maze while trying to avoid being caught by three muggers. The three muggers (Huey, Dewey, and Louie) start the game in a box in the center of the screen and chase the Pac person around the maze. If Pac person gets to a proton energizer (a large pellet) it gives you the power to attack, but only for a few seconds. During this short time, the muggers turn blue and white and flee from the Pac Person; but with your incredible energy you can travel faster to catch them. Catching the muggers gives you 200, 400 or 600 points and sends them back to the box in the center of the screen. You are chased around the maze as you consume the proton pellets, energizers, and muggers until you're caught three times. If you clear the screen of pellets and energizers, you're rewarded with another full screen and you start again.

If you just play for points you need to know about the apple. The apple sometimes appears on the screen below the muggers box, but only for a few seconds. If you consume the apple you get a 300 point bonus. Current score and the high score during any one game are displayed at the top of the screen. The game has three skill levels—easy, hard, and tuff; you set these by the joystick at the beginning of the game. The program comments on your choice, calling you a rookie if you choose easy saying "bad news" if you choose tuff. The higher levels of skill speed up the pace of the characters and also limit the number of proton energizers around the edge of the screen. The easy level starts with 10 energizers; the hard and tuff levels have eight and four.

The muggers travel as fast as the Pac person (except when he is energized) so you can always stay ahead of them. If you and a mugger are an equal distance from a proton energizer and approaching each other, don't try to beat the mugger to the energizer. The mugger will always win and will eat you before you get energized. After hours of play, I learned this the hard way. Pac Attack is similar to the arcade game. The pellets are larger and fewer in number but the maze is more complex, which makes this game equally exciting and challenging. There are more energizers at the easy skill level than in the arcade game, but that may be a welcome sight to the beginner. The Pac Attack game is played much faster at the tuff skill level than the arcade version. The color and sound on both versions are dynamic and add to the pressure as the game progresses. If you're looking for a game to provide hours of challenges and rewards without bullets, missiles and bombs, then I recommend Color Pac Attack.■

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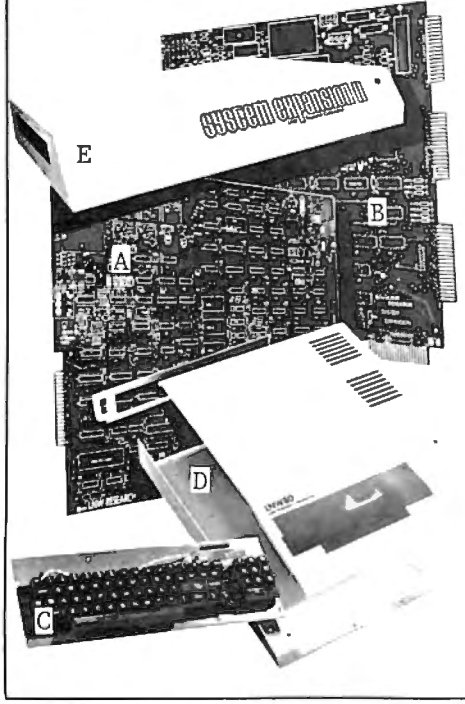

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80 REVIEWS

Tower of Orlandor
Compu-things
Suite #2
270 Broadway
Revere, MA 02151
$14.95, cassette Model I & III

by Aaron Silverstein

Tower of Orlandor, a new graphics-based adventure program, is not a Scott Adams-style adventure, but an invisible maze graphically depicted from an overhead view.

The game begins in an empty square, with the player represented by a blinking graphic block. Using the arrow keys, you blunder around in the dark until you hit a wall of the maze, which lights up, showing its location. Some walls have traps that, if activated, deduct life points from the player.

The tower has 10 levels. On each level is a hidden trap door that, once found, lets you pass down to the next floor until you reach the ground floor and (presumably) safety.

Much is left to the imagination. Missing is the verbal interaction of traditional adventure, the frustrating three-dimensional maze images of the Med-Systems series, or even the room shapes of Gauntlet of Death. There is the feeling of being lost in a dungeon (and there are treasures and potions to obtain), but author Dave Huntress would have us extrapolate every detail of the game except that which appears sparingly on the screen from time to time to tell us we've hit something or found something.

At $14.95, the program is aimed at the younger crowd, who need a game simple enough to play but complex enough to hold their attention. Tower of Orlandor does that. For the sophisticated Adventure/Deathmaze/Trapmaze player, this program will fall short of his expectations. ■

Conflict 2500
Avalon Hill
4517 Harford Rd.
Baltimore, MD 21214
Model I & III
$16 cassette, $21 disk

by Mark E. Renne

Conflict 2500 is a radical departure from first generation one-ship Star Trek games.

The first part of the game involves setting the scene. You may choose one to 10 hyperfighters for the good guys, one to 20 planet pulverizers for the bad guys, and up to 10 planets and 10 bases from which you get power. The object is to chase the bad guys attacking the planets and either fire at them or leave a mine for them to run into.

Play begins with a galactic report showing the universe as a 9 by 13 grid indicating your ships, planets and bases. Attacks on planets or ships are reported to you in verbal messages. The grid is then redrawn. You then move to one of your ships and get a 2000-by 1600-megameter tactical view. Each sector is 1000 square megameters. Planet pulverizers are not shown on the grid, but you may fire once at them. Any angle from 0-360 degrees is permissible. The energy used is 50 times the power behind the blast. You can then set a mine for the enemy to run into or you may take off. The planet pulverizers will return fire on you or your planet. To move, indicate heading (0-360) and velocity (0-5,000). Your ship will move in this direction and velocity until you change it. This is annoying because you have to change direction and velocity every move or your ship will miss its intended target.

To gain energy you can dock with a base, planet, or another ship. Planets refuel to 30,000, bases to 10,000. Ships may transfer any available amount among each other. Maximum energy is 30,000. You have twice as many mines as ships; each mine must be set and armed. To avoid being destroyed by your own mine, you must be 500 megameters away by the next move. Mines are most effective when positioned on top of the planet pulverizers.

The game is well-documented and the instructions are clear and concise; however, playing the game is very dull. There is no real time. Graphics are slowly drawn set-reset graphics and redrawn each time you change ships. If you play the game one-on-one, the computer's ship is not drawn and you must wait for it to appear; or you can search 117 sectors looking for it. If you use multiple ship scenarios the play becomes intolerably slow as individual ship information must be fed in and all previous information neutralized. Planet pulverizers are difficult to destroy and the game seems endless. There is also no way to save a game in the middle for future play. A summary at the end of the game indicates the outcome based on fleets, bases and so on. All in all this type of strategy game needs more excitement or should be left to pencil, paper, and the user's imagination. ■

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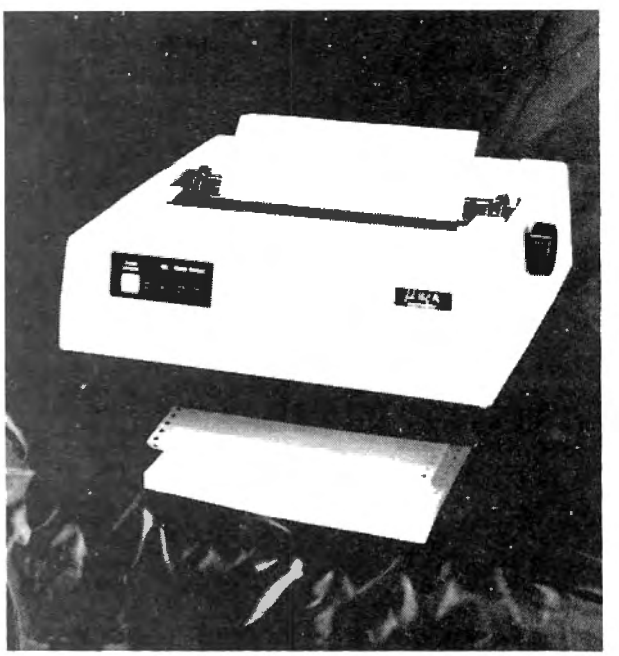

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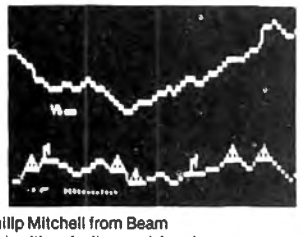

By Phillp Mitchell from Beam
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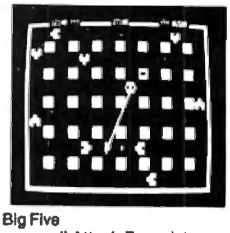

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By Jeff Zinn from Big Five
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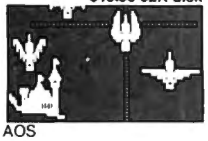

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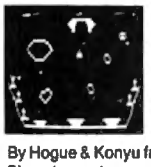

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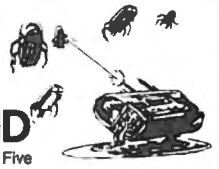

DEFENSE COMMAND

By Hogue & Konyu from Big Five
You are the lone defender of 10 Krotnium fuel cells essential for the survival of the planet. Aliens swoop down from above to steal the fuel; it's your job to destroy them. You can still save the cells after a raid, but you must shoot the alien and simultaneously move under the cell to catch it. If things look bad you can set off one of your 4 antimatter bombs and destroy all enemies on the screen! Arcade fun with action and sound. Joystick Compatible.
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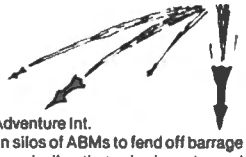

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By Philip Oliver from Adventure Int.
You must use your twin silos of ABMs to fend off barrage after barrage of enemy missiles that rain down toward your cities. As your skill increases so does the difficulty and speed of this machine language arcade game. Watch the skies and may your aim be true! MISSILE ATTACK has sound and fast-moving graphics galore.
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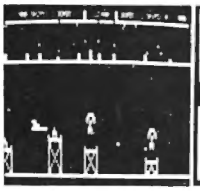

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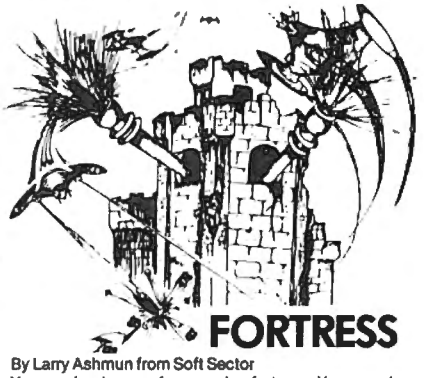

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By Carl Miller from Acorn
A fast machine language approach to this classic (and addictive) space game. The aliens drop bombs and move from side to side trying to overrun your bases. You choose the speed, enemy bomb frequency and accuracy, your number of shots on screen and bases. Unlike most such games, you can move your base and simultaneously fire at the invaders. Full sound effects add even more excitement to the incredible action of INVADERS FROM SPACE. Fun for all ages and skill levels.
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ALIEN ARMADA

By Waldron Hodsdon from Liberty
Hmmm. Looks like another "Space Invaders" type game. Nice neat racks of aliens poised over your defensive base... but WATCH OUT! Here they come, swooping down with their bombs and Kamakazi-like dives. There are individual attackers plus group flights—all intent on destroying your three bases before you destroy them. ALIEN ARMADA allows up to two players and has three levels of difficulty from beginner to expert.
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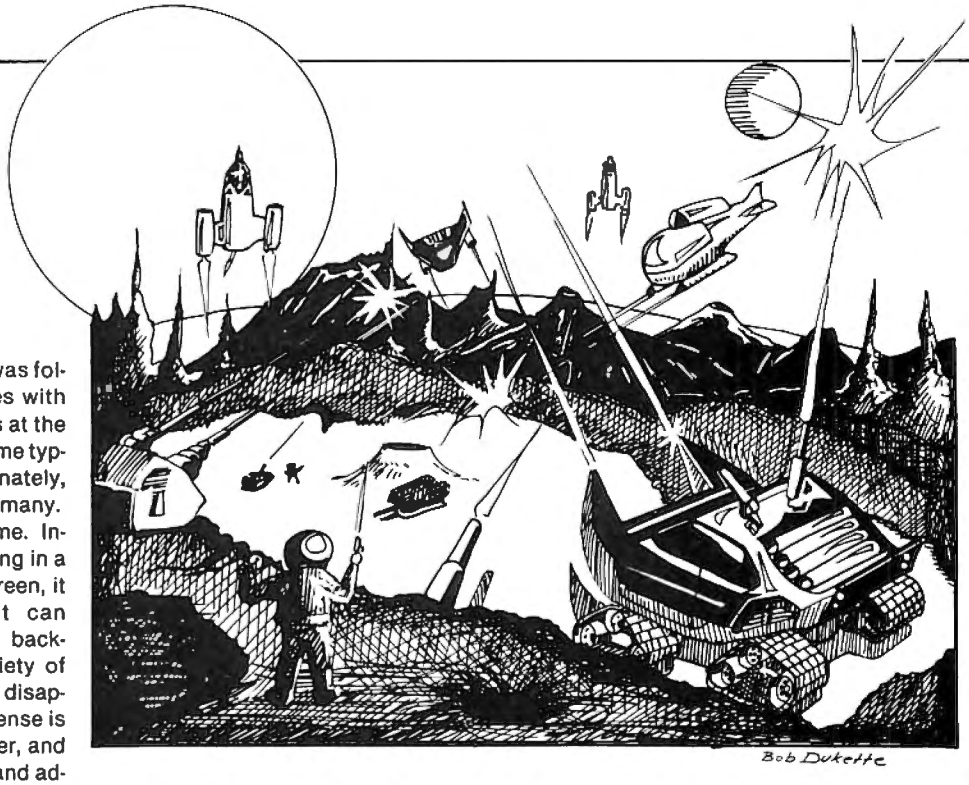

Alien Defense
Soft Sector Marketing
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Models I & III
$15.95 16K cassette
$19.95 32K disk

by Tim Knight

The legendary Space Invaders was followed by a multitude of games with good guys at the bottom and aliens at the top of the screen. This format became typical of most space games. Unfortunately, this format also became boring to many.

Enter the vertically played game. Instead of the player's spaceship being in a position near the bottom of the screen, it is located near the middle. It can maneuver up, down, forward and backward. The player shoots at a variety of deadly aliens and has the option of disappearing into hyperspace. Alien Defense is based on the arcade game Defender, and is just as interesting, challenging, and addictive.

How to Play

Thanks to the author's consideration of the user, there is a small demonstration of the ship shooting at the different types of aliens. The first to appear is the lander, which is worth 100 points. The lander is the most common and easy to shoot down. The mutant is worth 150 points. It bounces around quickly, requiring fast reflexes to destroy it. The cruiser, 200 points, can follow the player at incredible speed and is one of the most dangerous aliens. The 250-point bomber is simple to hit, while the pod is worth a full 1,000 points.

The pod, incidentally, has the nasty feature of breaking into six smaller aliens known as swarmers, which are 150 points each but very difficult to hit.

You can rescue a man captured by a lander. After destroying the lander, fly toward the man and bring him safely to the ground. Avoid bombs; they can easily be shot down but are worth nothing in point value.

Model III Graphics

The Model I version uses letters and symbols to indicate your ship and the different aliens. But the Model III version uses the special characters to the utmost. The special character graphics capabilities on the Model III are very appropriate and much more realistic. The man looks like a man rather than the letter "I."

The other Model III graphics are excellent. The moving mountains below the spaceship are very well done and change constantly. The laser fire from the ship is not a thick graphics line, but rather a line produced by the cursor character. This provides a smooth, straight, thin line for laser fire.

Sound is also a big plus. Never before have I heard so much sound utilized, and the variety of sounds within the program make it more exciting. The sounds have a very human tone.

Flight Controls

The controls are not easy to master. There are many controls to mind: the numbers one through three, the numbers eight through nine, and the Enter key and space bar. I found it easiest to manage by using my left hand on the regular keyboard numbers (1-3) and my right hand on the keypad numbers (8-9). From this position I can access both Enter and the space bar.

The 1 key changes direction. Keys 2 and 3 move the spaceship up and down respectively. The 8 applies thrust and 9 fires the laser. The space bar sets off one of three smart bombs (bombs that destroy everything on the screen except you). Enter is for hyperspace.

I highly recommend Alien Defense to Model I users and even more strongly to Model III owners. The fast action, exciting graphics and sometimes humorous sounds add up to a lot of fun.■

Defense Command
Big Five Software
P.O. Box 9078-185
Van Nuys, CA 91409
Model I or III
$19.95 disk
$15.95 cassette
by Tim Knight

Incredible graphics, sound and voices add up to fun in Defense Command, Big Five's latest contribution to the games market.

The game is in machine language and loads with the System command. It will work on the Model I and III computers, and comes on tape or disk. The programmers made sure that if the program is run on a Model III, it takes advantage of special characters. The Model I and Model III versions are identical and they both check for the model type to use the applicable features of either machine.

After loading the game, you are asked for one or two player games. To see the top scores press Clear.

A New Idea

The game is unlike any arcade game I have seen. The player is placed at the bottom of the screen, and is guarding highly important Krotnium fuel cells in the Kromforkrom galaxy. A whole slew of nasty aliens comes down and tries to steal the fuel cells from you.

You are transported to the area by a mother ship. Several other ships escort you down, including a flagship, which is worth a lot of points later on. After transporting down, you wait for the aliens to

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come, or you take a couple of shots at the aliens who escorted you. If you accidentally hit the mother ship, it sends down solar-energy crushers, which will inevitably smash you.

Once the aliens start coming down, you must dodge around trying to shoot them. If you accidentally run into one, they'll destroy one of your three ships. The aliens look similar to those of previous Big Five games, though there is an interesting one that pulsates like the aliens in Midway's Space Invaders, part II.

In addition to the regular aliens, a dangerous slicer will fly down, ignore you, and slice up your fuel canisters. You must kill the slicer before it gets to the bottom of the screen, or you lose.

The Controls

The game controls are standard. Use the arrow keys to move back and forth, and the space bar to fire. There are some substitute combinations of keys, but those mentioned are the most popular. You can also use a joystick.

Besides shooting the aliens, you have another defense against them: the anti-matter bombs. Any number key (0-9) destroys every alien on the screen. This is great, but you have only four anti-matter bombs. You receive an additional bomb with every 5,000 points, and an extra ship for every 10,000 points.

If all your ships are destroyed, the game ends. If you're foolish enough to let your fuel canisters be taken, the mother ship sends down those solar-energy crushers to flatten you.

You Can't Win

There is no way to win, but if you get a high score, an amazing graphic Great Score appears. Every letter of the words Great Score is like the Fourth of July.

One of this game's most impressive features is the voice. The voices are clear and loud and are far superior to the old Robot Attack game. They even change pitches (both squeaky and low voices) and are present during different points of the game.

The other sounds and the graphics—lasers, explosions, and blips—come through your computer's amplifier. The graphics are smooth and fast and offer exciting times for players of Defense Command.

Defense Command is a superb game and an an orginal idea. The sounds, graphics, and voices are excellent. Instead of being an imitation of some other arcade game, it is new and a great deal of fun. ■

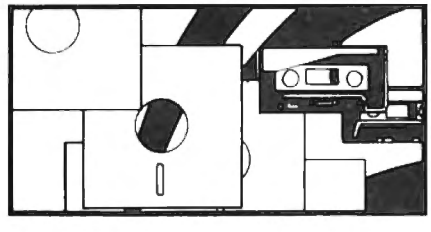
Interactive Fiction:
Two Heads of the Coin
Local Call for Death
On Her Majesty's Ship Impetuous
Dragons of Hong Kong
R. Lafore
Adventure International
Box 3435
Longwood, FL 32750
Model III, 32K
$29.95 disk

by John P. Mello Jr.
***80 Micro* staff**

Who wouldn't jump at the chance to be a famous detective prowling through London high society at the turn of the century attempting to solve a devilish murder? Or command a 64-gun ship-of-the-line through hostile waters during Napoleonic wars? Or how about be a hard-nosed gumshoe hot on the trail of a modern-day scourge of mankind? And if one of those roles weren't enough, how about being a novelist, too? That's the promise of Adventure International's Interactive Fiction series. However, as is often the case in a would-be Walter Mitty's world, a shadow frequently falls betwixt the delivery and the vow.

Interactive Fiction presents a person with the framework of a genre novel and lets him be a character in the book. (If you're a woman, forget it. The programmer's warning in "The Dragons of Hong Kong" applies to the entire series: "This story has a rather male perspective. We suggest you adopt a male outlook and a man's name.") As the plot thickens, you write your own dialog and make decisions influencing the outcome of the story. In the first two offerings—"Local Call for Death" and "Two Heads of a Coin"—there is only one outcome: solving the mystery at hand. In "His Majesty's Ship Impetuous" and "The Dragons of Hong Kong" there are at least three possible endings.

"Local Call" takes place "a few years after the Great War." You are called on to assume the role of a reputed American detective in England rubbing shoulders with the crust of London society. Programmer R. Lafore offers some nice touches of high living here: You dine on Filet De Boeuf Strassbourgeoise, drink



1913 Chateau Doigt de Pied, and tool through the city on the Thames in a Hispano-Suiza, one of the finest automobiles ever made.

Although the plot of "Local Call" is engaging (an apparent suicide tickles your deductive instincts), in many cases characters fail to interact with you. On several runs of the novel, when financier Major Wormsley asked Alec Deepgrave (this reviewer's persona) his occupation, responses such as a brain surgeon, injection mold engineer, grave robber and gigolo triggered the same response from the major: "Oh, I see."

A more subtle device used by Lafore is to force a user's protagonist into a "yes" or "no" response. When Deepgrave was asked if he'd like more wine after finishing dinner, he replied yes, only to be upbraided for hitting the sauce heavily. When he replied no on another occasion, he was chastised for being a prohibitionist. His dinner companions found unintelligible a response without a yes or no in it, such as, "I'd rather have a Between the Sheets."

When interaction becomes more complicated in "Local Call," the give and take between characters can become nonsensical. At one point, Deepgrave accuses one of the suspects of being a murderer based on a handwriting sample the American detective has in his possession. The murderer's reaction: "If you think I'm going to write something for you after your libelous (sic) insinuations, then think again."

On the procedural level, the documentation for converting "Local Call" to Model III format was fine until it explained building the "DO" files. The docs left out a reminder to take the Model I version of the game out of drive one before you create the files; otherwise, you will get a CRC error.

In the second "novel" in the series, "Two Heads of a Coin," James Conway, a middle-aged, well-groomed, prosperous businessman, enlists the help of a Sherlock Holmes-style detective to find his missing wife Georgina. However, Two Heads also proves to be irresponsive. Not only does it serve up the old reliable "I don't understand your meaning," but sometimes resembles the proverbial broken record. Here Conway is questioned by

detective Basil Trufflehound:

T: Did you ask her mother if Georgina paid her an unexpected visit?

C: Georgina spends every Friday night at her mother's. She's done it for years. Really, I admire her sense of duty.

T: Did Georgina visit her mother the Tuesday she disappeared?

T: Georgina spends every Friday night at her mother's...

Two Head's irresponsiveness eventually provided the clue that helped Trufflehound crack the Conway case:

T: Why were Georgina's friends scandalized by her disappearance?

C: Georgina doesn't know that Chantelle even exists as far as I know.

Up to that point, there had been no mention of the voluptuous Chantelle. Why Conway volunteered the information in response to Trufflehound's question was the real mystery in this "novel."

Both Local Call and Two Heads have a drawback inherent in their genre. Once you solve them, there isn't much point in reading them again. But that's less of a drawback for a $3 mystery than a piece of software. (Adventure International may be aware of this. A spokesperson said the firm will release in June all the adventures and a short story, "Encounter in the Park," in one $29.95 package.)

"On His Majesty's Ship Impetuous" and "The Dragons of Hong Kong" are more ambitious and challenging than their predecessors.

In HMS Impetuous, not only must you pilot a ship-of-the-line through enemy-infested waters, but command a temperamental crew. Your troubles begin when a junior officer affronts your authority. How you handle this situation seems to determine the outcome of the novel because it has a profound affect on the behavior of your crew.

Although Impetuous doesn't appear as irresponsive as the earlier games, it can frustrate you at times. Take this exchange between the protagonist, Captain Captain, and the insubordinate Lt. Fallow:

C: I've decided to let you stay here on the island, Fallow, as punishment for your insubordination. If you're lucky, you'll be found by the French.

F: That's too complicated, sir. You have to hang me, pardon me, or...

C: All right Fallow. I'm going to leave you.

F: I'm sorry, sir, I don't understand. Are you going to hang me or pardon me?

C: I'm going to do neither.

F: I'm sorry, sir, I don't understand. Are you going to hang me or pardon me?

C: I'm going to demote you.

F: I'm sorry, sir, I don't understand. Are you going to hang me or pardon me?

Captain Captain became so frustrated he hung Fallow.

Lafore warns interactive novelists to "play it straight" to get the most fun out of the software, but outrageous behavior can yield some entertaining results in the face of the program's boilerplate ambience. Take this exchange between Admiral Wormwood and Captain Captain:

"So, Captain Captain, your little 'Impetuous' has done very well." The Admiral favored Captain with a supercilious smile.

Captain wondered what was coming next. "Up your nose."

"You will address me as 'sir,' Captain. A serious breach of etiquette, but I will overlook it this once."

Although Impetuous has several endings and you influence them with your decisions, it seems you will always make it to the final chapter where your ship-of-the-line confronts an enemy armada of 40 ships, most of them superior in firepower to yours. You can't cleanse every sin you've committed to that point, but you will always salvage a measure of glory if you exhibit a stout heart.

That isn't the case in the "Dragons of Hong Kong." It is as Byzantine as a good adventure game full of traps and dead ends. If you're really lily livered, you may even end up as an accountant and nothing of interest ever happens to you for the rest of your life. Unlike its predecessors, Dragons makes you feel you're interacting with something more than a thinly disguised adventure game—not only that you're interacting but also creating.

In Dragons, Lafore's prose walks the line between spoof and parody giving the "novel" the flavor of the hardest boiled fiction:

"Not even a real estate agent would claim Big Al's Bar had a prestigious location. An iron mill crowds up on one side, and on the other is the kind of transient hotel guests tend to leave feet first.

"You cross a railroad siding and push open Big Al's door. The welterweight match on the tv is making a nice counterpoint with the jukebox blaring 'Born to be a Redneck,' and the smell of stale beer probably couldn't be cut with hand tools."

Dragons and its predecessors don't quite live up to the hype Adventure International advances in their cause: "Lafore has succeeded in eliminating the static structuring often found in entertainment programs in favor of a refreshing format which allows the player total involvement within inventive fictional situations." Even Lafore, quoted in *Omni* admits that. "The interactivity in these stories is now somewhat limited," he said. But as Dragons indicates, the series is in evolution and getting better all the time.■

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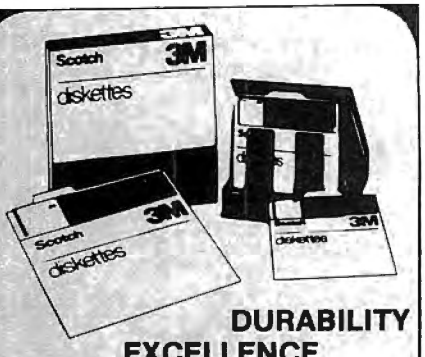

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$19.95 32K disk
$22.95 48K disk

by Mark E. Renne

What would the ultimate football game for computer play contain? Perhaps it would be a 48K game which fills a disk with program modules and loads each at certain times. How about an opponent with four skill levels? Graphic cartoons would break up dull times now and then. It would be filled with cute comments about stadium fans and tv cameras. It might even play a darn good game of football. The Super Micro Pro Football is all this and more.

The game starts with nine pages (screens) of instructions. Instructions are complete and easy to understand. The game uses over 100 random number generators so you can expect the unexpected. The computer reviews your strategy and nails you to the wall if you use only a few plays. Quarters range from 5–15 minutes long and you may chose whether or not to use the play timer. The screen shows a standard football field and indicates ball location with a pair of parentheses. The screen also shows score, direction of travel, time remaining, quarter, play timer, down and ball location.

Complete statistics appear whenever you call a time out or at the end of the game. They include passing, scoring, fumbles, rushing and all other standard stats. Momentum even comes into play when things are going right to give you that extra edge. You may play one of four different teams ranging from good to very tough. After you enter your team name and skill level the computer creates a file with this information and remembers it from then on.

There are 18 offensive and 8 defensive players. Offensive plays include: quarterback sneak, fake pass/quarterback rollout, center plunge, draw play, sweep right, sweep left, drive through guard and tackle, halfback option, reverse right, reverse left, screen pass, the bomb, long pass, short pass, time out, punt and field goal attempt.

Defensive plays include: rushing, passing, general purpose, pass blitz, right-side rushing, left-side rushing, punt and field goal defenses. The correct defense will not always stop the offense, just like real life, but the chances are good. Gains may be 99 yards on kick-off returns, interceptions, or punt returns. You have 10 seconds to enter a defensive play and 30 seconds to enter an offensive play. If you wait too long on defense the computer uses a general purpose defense. On offense you will either fumble the ball or receive a delay-of-game penalty if you wait too long.

The game also has graphic cartoons for the coin toss, field goals, kick-offs, injuries, scoreboard and even a message from the opposing quarterback. There is a graphic half-time show and a streaker. (Sorry, no graphics.)

Anything can go wrong. You can have a bad pass from center, run the wrong way, have the defense beat the ball downfield, have an illegal procedure called or even have pass interference. Kick-offs may be standard or onside. Safetys are possible as well as sudden death if the score is tied.

To play the game, you enter your play number or letter and the computer takes over. The game narrative is very fun and always full of surprises. You never know when a player may get crunched or when someone might throw Howard Cosell on the field. It is fun to throw the bomb on the first down just to confuse the other guy (the computer). The game plays extremely well and is error free. All the football options are here as well as all the problems. If you have a 48K machine and enjoy football, you will enjoy this game. ■

The Eliminator
Wayne Westmoreland & Terry Gilman
Adventure International
Box 3435
Longwood, FL 32750
16K Model I or III tape $19.95
32K Model I or III disk $24.95

by Mark E. Renne

You are the pilot of the starcraft Eliminator. The controls of your ship are simple to learn, but difficult to master; to defeat the enemy, you must have split-second control of your ship.

The arrow keys are used for forward, reverse, up and down. Firing a plasma burst requires pressing the space bar, and a tap of the Clear key throws you into hyperspace. Hyperspace transports you to another part of the planet. Your last option is a disruptor charge, which destroys everything on the screen except your men and yourself. Since this is such a powerful weapon you have only three charges.

Your goal is to keep the aliens from cap-

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You can quickly generate a new program when you want it. You can generate thousands of different unique programs, each one standing alone as a complete program that runs in Basic. Best of all, *you* do not have to be a programmer to do it. The *Quikpro* software becomes your personal programmer, waiting to do your work for you any time of day or night you choose to use it.

The custom programs you generate from this software provide for: Data Entry, Additions, Changes, Record Locating & Searches, great variety of Computations, and Report Printing (if you have a printer). It lets you decide what data to manipulate and how to manipulate it. It lets you decide the formats you want to appear on your screen and/or to print out in a report. It lets you use differing formats on the same data base. It lets you make calculations from data within records without altering the data base. It lets you report results with or without including the base data from which results were calculated.

All this is included in the ability/power of the program you create. You do it by simply answering questions that appear on your screen. Instantly, the *Quikpro* software instructs the computer to perform complex and error free instructional sequences. You get the immediate benefits of professionally written software for your application.

The resulting custom program is truly a separate Basic program. You can list it, you can modify it, you can actually see what makes it tick. You can even ask it to print out its own operating instruction manual so others can run it for you. Finally, you can really tap the speed and power of your computer the way you really want. You can create new programs for every use you have in Business, Science, Education, and Hobby areas. And you can start now.

The software is available immediately from the creators. It comes in two versions. If you want to generate separate Basic programs with all the data handling plus Calculations and Report Printing features, you want *Quikpro+Plus*. Specify to run on TRS80 Model I and Model III at only $149; to run on TRS80 Model II at $189.

If you do not need Calculation ability or Report Printing in the separate Basic programs you will create from this program generating software, then standard *Quikpro* will do the job for you. Standard *Quikpro* to run on TRS80 Model I or Model III is $89; to run on TRS80 Model II is $129. (Later on you can always trade up to the Plus Versions for only the cost difference between the two).

Both programs are available to run on many other computers besides TRS80. Details are available by calling or writing.

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turing your energizers and taking them to the top of the screen. The energizers are placed on gantry towers throughout the planet. If you destroy the first wave, another wave appears after you receive bonus points for remaining energizers. There is no end to the villains until you lose all your ships or all the energizers are captured.

The enemy comes in assorted degrees of difficulty. Disruptoids are the most common and the easiest to destroy; they score 150 points. Disruptoids hover around the energizers waiting for a chance to kidnap them. I think their favorite trick is to put an energizer between you and them. This means you run the chance of destroying the energizer yourself and saving them considerable risk. If a disruptoid makes it to the top of the screen he moves much faster and is more difficult to destroy.

The second type of alien is a drone; although they don't fire at you, their purpose is to plant aerial mines. If you hit a mine, your ship is destroyed. They score 250 points. The final enemy is a tracer dispersal unit, or TDU. They are harmless to your ship and score 1,000 points. After being touched, five tracers are released; each tracer is worth 150 points. These tracers follow you and each one packs a deadly force. With practice, you can score extra points by destroying a disruptoid carrying an energizer. Normally energizers fall back to the gantries, scoring 250 points if they are dropped from no further than halfway up the screen. (Any further and they are destroyed when they land.) By intercepting a falling energizer you score 500 points; placing it on an open gantry scores an additional 500 points.

One or two players may play. If you are one of the top 10 scores, you can enter it along with your name. The disk version permanently stores the information. Screen information includes score, ships, and bombs remaining, and current record high score. At the top of the screen is a long range scanner that covers the entire planet. It indicates the location of the aliens and if any energizers are being picked up. Sound is available through the cassette AUX plug. The game aborts by pressing shift and break. Pressing the S and shift keys freezes the display until the enter key continues the fight.

To score points, manipulate the controls as if they were an extension of your hand. It's imperative to eliminate the first wave without using any disruptor charges. You need them more during the later waves. By saving the tracer dispersal units (TDU) for last, you can eliminate the tracers with greater ease. Rapid fire is not advised; you usually end up destroying as many energizers as aliens. Once a disruptoid gets to the top of the screen, he will try to come from behind. By keeping him in front, you have a much better chance of destroying him.

The game instructions are clear and include loading instructions for all computers.

Eliminator is fast, challenging, and saves enough quarters in a month to pay for itself. Graphics and sound are superb, just as advertised. Eliminator is one of the first arcade games to come from Adventure International and certainly not the last.■

Search and Sort
Micro Pro Systems
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Models I and III
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$13.95 disk

by Joel Benjamin

Search and Sort is a set of machine-language modules that can easily be called from a Basic program. They perform several related tasks essential in any program handling data files.

Search and Sort provided the ability to search through sorted lists of strings for a specific string. If the target string is found, the program returns a value corresponding to the string's position. If it is not found, you have the option of inserting it in its proper place. You can also sort a string or numeric array in ascending or descending order.

A search of an ordered array of 1,000 strings takes about one second. Once the correct position is found, the insert takes less than a second. A random list of 1,000 strings, each about eight characters long, takes about three seconds. It sorts an array of 1,000 random integers in about three seconds and 1,000 single or double-precision numbers in four to six seconds.

The documentation briefly describes how routines are called from Basic through the USR function and then refers you to the sample Basic program that is provided on tape or disk. Demonstration programs are all too often omitted from utility packages where their inclusion could save hours of needless trial and error.

I do have a few reservations about Search and Sort's sample program. Since there is no listing of the program supplied, if you don't have a printer, you must decipher it from the screen. This can be a tedious chore because the code is not formatted to be easily read. For one thing, it does not utilize that powerful aid to both vision and understanding—*indentation*. This would have helped to easily distinguish the code that accesses machine-language subroutines from the code that generates the random numbers and strings. The author also didn't include blank remark lines, which would have helped to block off program modules.

Although the sample program demonstrates how to access the search and sort routines, I don't feel it should be used as a substitute for amply written documentation. It would have been helpful to have included a simple application or two.

Search and Sort is an excellent utility package which can be used very profitably by both advanced and, with a bit of struggling, beginning programmers. I recommend it.■

Mind Thrust
Hayden
50 Essex St.
Rochelle Park, NJ 07662
Model I Level II, 16K
$16.95

by Eric Maloney
***80 Micro* staff**

Here at the office, the first reaction to Mind Thrust was, "Too simple. What's the point?"

Well, a nice simple program sounded fine to me. I had just finished wrestling with a behemoth of a space epic which, between its convoluted playing procedures and its dismal documentation, had me spitting blood at self-indulgent programmers who write Chinese puzzles that a troop of drug-frenzied Tibetan lamas on roller skates would not be able to figure out. Why do so many game programs look like they were salvaged from Rube Goldberg's wastebasket? What's wrong with the modest elegance of traditional games like chess, checkers, Scrabble and 500 rummy?

So I was prepared to enjoy Mind Thrust. And I did—for about 15 minutes. Mind

Thrust is simple, all right. Unfortunately, it is also simplistic.

Mind Thrust reminds you vaguely of Othello. You are given a 6 by 8 grid on which you and the computer each place five pieces. Then, taking turns placing pieces, you each try to form a chain from end to end, or eliminate each other's pieces by attacking.

You can attack any piece touching one of yours. But the computer can defend some of its pieces. If you have a choice of five pieces to attack, the computer can defend three. If you attack a piece it chooses not to defend, it loses the piece. If the computer defends successfully, you lose your piece, all those adjacent to it and any left isolated. The computer, naturally, can also attack.

Hayden bills Mind Thrust as a game that "combines strategic skill and luck." Put the emphasis on luck.

First, the computer does not think strategically. Its opening moves are random. In some cases you can form a chain and win unchallenged. Also, the computer has no idea when to attack; it will plod along trying to form a chain when attack is its only hope of winning.

"...the computer... will plod along trying to form a chain when attack is its only hope of winning."

Second, when you attack, your choice of which piece to go after is strictly a matter of guesswork. The computer uses no strategy when it defends.

Finally, you cannot develop any logical plan of defense. The computer randomly decides which of your pieces it will attack; you must randomly decide which ones to protect.

The game is not a bad idea and could be fairly entertaining if the computer were programmed with some more smarts. But as it is now, Mind Thrust falls somewhere between being a game of chance and a game of strategy, providing the satisfactions of neither. It offers about one thrill every hour, if you can sit still that long. ■

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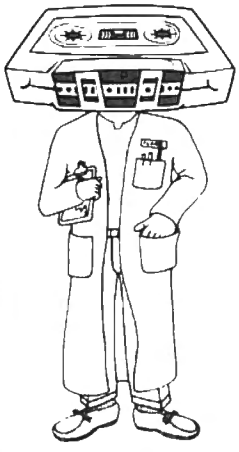

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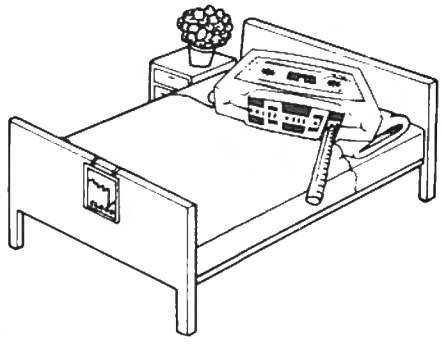

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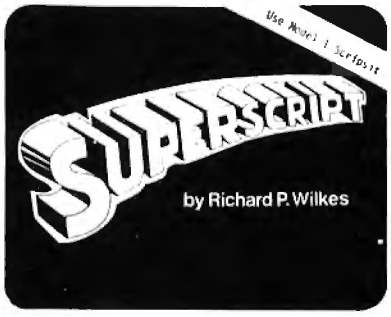

SuperScript

By Richard Wilkes

An enhancement program to Radio Shack's Scripsit, SuperScript turns a good word processing system into a great one! Depending on your printer's capabilities, you can superscript, subscript, underline, boldface, select 10/12 pitch and slash zeroes. Brackets, braces and carets can now be entered from the keyboard. You can get a Directory and Kill files within SuperScript without losing text. You can pause while printing and insert text into unjustified lines. Eleven drivers are included with SuperScript—one of which should work with almost any type of printer. However, not *all* features are available on all drivers . . . and not all features are possible on all printers. Serial drivers are provided which use the ETX/ACK protocol for 1200 baud communications. Special drivers are provided for the NEC 5510, Nec 5530, Daisy Wheel II, Lineprinter IV (Centronics 737), Diablo printer, and Epson MX80 (Graftrax owners can get underlining and italics). Custom serial and parallel drivers are included which can be modified to provide some or all features on most standard printers. Both Model I and Model III versions require Model I Scripsit. Model III owners use the Model III TRSDOS "CONVERT" utility. SuperScript is designed to work with TRSDOS. SuperScript may work to some extent with other systems—but not all features may be available. Model III version will run under LDOS. For more information, write Acorn for a Fact Sheet.

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By Tom Stibolt

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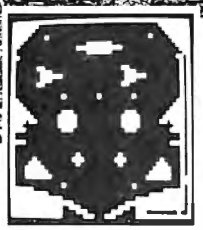

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By Brian Howarth

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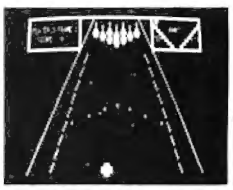

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So you want to make a million dollars by writing computer software? Well join the club. You'd better have a lot of patience. I've yet to meet the person who became wealthy by authoring software. Admittedly, money *is* to be made but hold on to your day job. And don't order the yacht or the Rolls Royce yet because no software publisher stuffs rolls of banknotes into a programmer's sweaty palms.

For one thing, the industry is still growing. The publisher who's going to get a million-seller doesn't exist yet. In fact, the people who've made the most money in the business are authors who've taken the time to market their own product. This is becoming harder and harder as the business becomes more sophisticated. Professional packaging, customer support and the hard sell all take time; and that's time you could use to write your next hot product. Many programmers realize this early on in the game and farm out some of their programs to software-hungry publishing houses.

Remember, these guys are new to the game too. Software publishers did not exist five years ago, so any publisher you care to name is, in a word, inexperienced. That inexperience manifests itself in a number of ways, most of them detrimental to both programmer and publisher, but more so to the programmer. If the publisher plays his cards right, you both stand to make money; if not he probably has you by the short and curlies.

You'll have that nice contract to look at. It will remind you that you're locked into your agreement until you're ninety-two years old. Many contracts proffered by publishers take unbelievable liberties with your rights and leave you totally at their mercy. Their mercy to make all the mistakes a growing industry makes; and with your toil and sweat. This points up another disturbing attitude amongst a number of publishers (and for some reason, this is worst amongst the larger houses) and that is the holier-than-thou syndrome.

They'll actively solicit your software (after all, what else are software houses going to sell?), then treat you like dirt. Picture this scenario: You churn out your latest piece of programming magic which, let's say, makes it ten times easier to load tape programs on the computer. You know full well how many tape-loading problems you've had to deal with and you are about to ease the miseries of thousands of computer owners that share that burden. You look around and what do you see? Waiting with a used car-salesman's smile—teeth glinting like an Ultrabrite ad—is the newest, slickest operation in the whole wide world. How can you possibly resist the sweet-talking and the promises? Besides, they're backed by capital and previous success in other fields.

"Many contracts. . . take unbelievable liberties with your rights."

You go for it. Your program is sucked with an obscene slurp into their newly-manufactured freshly-polished finely-honed machinery. You check your mailbox every hour for the next three weeks. Lo and behold, on the fifth week you receive a contract. They love the program so much they offer you an advance of $3000 against future royalties. You'll have earned it all back within three or four months and will be on a percentage after that. After scouring the contract and reluctantly reassigning various rights, you return it along with a program for the Color Computer which you're certain they're going to be equally enthralled with. Your future is assured and you make plans to be writing more software in anticipation of this growing demand from a software-hungry public.

Meanwhile, back at the publishers' place they've decided they like your latest offering too. This one doesn't have quite the market of your first product so you're offered a mere $1500. Amazing how these guys have such a firm handle on the market after such a short time in the business, but that's close on $5000 ready to be tipped into your bank account. Things are looking good. Maybe it's time to take a trip to the Bahamas and think about writing your next gem of software. After all, you don't want to slacken off in the face of success. So where's the check for $3000. Nobody buys airplane tickets with buttons so you give your new-found colleagues a call. Of course, at precisely the point when you're riding so high on your hopes and expectations is the point at which the house of cards will choose to collapse.

They've had second thoughts about the first program. They're not sure it's a stand-alone product. The publisher feels that if you could only wait for a similar piece of software to arrive (maybe six months, maybe a year, maybe never) that they'd have a fine package. Amazing again! These professionals are. . . well. . . so professional! They've been in the business six months and are making such inspired, enlightened judgments as if they'd been at it for twenty years. But what about the contract? Well, the contract wasn't really a contract at all until it was signed by both parties so it's a piece of paper showing your intent and nothing more.

Naturally, you're rather annoyed. You've lost a good three month's worth of marketing time for your program and have nothing to show for the time you've taken to play this new computer game. At least these guys get paid for it though. You're left holding a useless piece of returned

contract and decide to talk to the guy in charge. You refuse to be treated like this without at least squealing like a stuck pig. But those teeth are still glinting mercilessly down the telephone. This fellow is a real pro. After all, he passed the job interview with some high-powered executives which means he's going to have no problem with you.

So you put the phone down knowing how bad they feel about the miserable treatment they've meted out to you. At least they realize and regret what they did, but business is business and it's better in the long run if they make their mistakes early on. Anyway, there's still that Color Computer program and the $1500 advance on the way; there's hope yet. In the meantime, you forget the Bahamas and continue writing software in the freezing back room. Now that you understand these fellows better, you're in a much better position to supply what they "know" will sell.

Suddenly the Ace of Spades comes floating past your eyes, the Joker hard on his heels followed by your trump card—the Color Computer program. The house of cards finally collapsed in its entirety—they don't want your program. Not enough market. Sorry. Yes, we have treated you poorly, haven't we?

Talk about *caveat emptor*! This is dog eat dog and let the devil take the hindmost. If you think this anecdote is an exaggeration in order to make my point, let me tell you that I have close ties with the person it happened to. By now you probably have deduced it was sucker features here—me. Apart from an embellishment or two (just for effect, you understand), that's the way it happened.

Well, some of the lessons come easy, some come hard. I just had one of the hard ones, that's all. If nothing else, I'm prepared to try and learn from that mistake and share the experience publicly to warn other starry-eyed potential software authors. If you take the time to analyze the steps I took with that particular publisher, you can probably think of numerous safeguards I could have taken to be in a less vulnerable position.

I should also point out that not all publishers will dish out this kind of treatment. After all, many of them have been in this game for four years or more. Wow! A whole four years; excuse me if that doesn't impress me too much any more. Both authors and publishers are making some primordial mistakes and, as usual, it's the little guy who gets knocked about the most. So use some of the same savvy that made you a programmer in the first place. Let the seller beware.■

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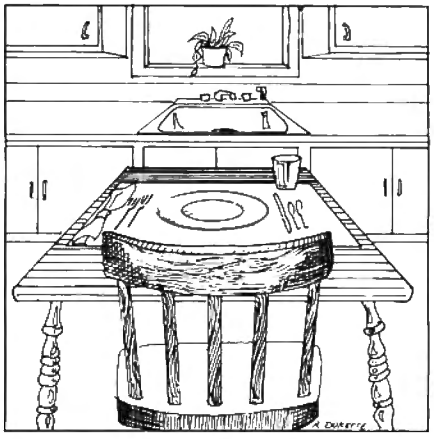
News From KITCHEN TABLE SOFTWARE, INC.

by David Busch

"New Jersey State Assembly Adventure and Haunted Delicatessen seem too specialized or obscure to be of much interest.



Question: What popular computer program requires risk of life, long hours hunting for elusive rewards and solving an obscure puzzle wrapped in an enigma?

Answer: If you said DROSSDOS 1.1, you were right! However, because this is *80 Micro*'s games issue, I've decided to look at Kitchen Table's latest game offerings, not its operating system.

The flood of programs copying Adventure has led me to conclude nearly any idiot can write an adventure game. Apparently the folks at KTI have made the same observation.

I strongly suspect the crew at the world-famous hardware-software vendor took one of their usual shortcuts and purchased an adventure generator from an outside source. My suspicions stem from KTI's introducing no less than 247 adventures in two weeks.

Some of these, like New Jersey State Assembly Adventure and Haunted Delicatessen, seem too specialized or obscure to be of much interest. Others, like Peanut Farmer and Mood Ring, are outdated for the 80s. A few KTI games, especially Small Engine Maintenance and Savage Bus Stop, appear very derivative of adventures already on the market.

I liked Mailman Adventure and spent several happy hours figuring out the correct route. As in most adventures, two-word, subject-verb commands are used, like TAKE MAIL, KILL DOG, and KISS HOUSEWIFE. I won't give any hints to spoil the fun, but when in the hardware store, do not type TAKE INVENTORY or you could be held up for three days counting carriage bolts!

My second favorite game was Programmer's Dungeon. Each player assumes the guise of a programmer. Among the roles are Software Sage, Assembly Language Wizard, Cobol Warrior, and Basic Dwarf.

Each character has powers and attributes determined at the start of the game. Assembly Language Wizard may use CALLs, wield mystical registers with aplomb, and battle the vicious ORG. The wizard is not mobile, however, because of his difficulty relocating. Most players will not understand this character and ignore him. The exception is the Machine Language Troll, who can only be addressed through the wizard or by use of the magic scepter, T-Bug.

On the other hand, the Basic Dwarf is clumsy but easily understood. His weapons include the For. . . Next loop (used to garrot enemies). By uttering GOSUB, he may send an opponent to the dreaded Subroutine, perhaps never to return.

Cobol Warrior is all business, while Fortran Elf carries his weapons in a plastic pocket protector in his breast pocket. The Lisp Fairy spends his time prancing about merrily.

In the game, each player is a crack programmer who must locate all the bugs in a piece of software before sending it to a magazine for publication. If one bug is missed, the computer writes a letter to the magazine's editor explaining the program's functions can be performed with a single NEWDOS80 command.

Programmer's Dungeon is quite realistic. In fact, the game itself is the program that must be debugged. I found it fascinating to be confronted with UNDEFINED LINE IN 11210 in the middle of the game.

It is possible to cheat at this game. I handily sidestepped all traps by adding a single line: 10 ON ERROR RUN.

One problem, however, is this is KTI's first 3D talking adventure. Personally, I found wearing the red and green 3D glasses annoying. With my Green Screen installed, I could see my CRT through the green lens, but the red one rendered the screen invisible.

Also disconcerting was the voice synthesis effect. I didn't find the voice messages helpful. Typical rejoinders included "You just tried to write to ROM, fool!" and "Congratulations! You are the first person to ever try and PEEK (47345½)." I scrapped the whole thing and substituted tapes by "The Clash," "The Stray Cats," and "The Undertones." The messages were no more abusive, but infinitely more entertaining.

Realism freaks will be glad to know KTI is applying its 3D-talking concept to checkers. The boring, flat checkerboard is rendered in full three-dimensional glory and brought to life with vivid sound effects. Crystal clear click-click-click noises are generated as checkers move. The computer intones "Your move," and takes on a gleeful note when it utters "Crown me!"

Several levels of play are provided. At the level recommended for children, the computer tips over the checkerboard when it sees it may lose. At the adolescent level, the same thing happens—only the computer pretends it was an accident. When the computer loses at the adult level, it pretends not to care and challenges the winner to a game of backgammon. And at the highest level—International Grand Checker Master—the computer looks ahead more than 40 moves to determine the best strategy, sometimes taking a half hour to determine it will be defeated and must tip over the checkerboard.

I pitted 3D Checkers against Sargon II. The confrontation proved a draw. But I judged 3D Checkers the winner, because I finished the game with more kings.

Kitchen Table has also introduced some interesting game utilities. Despace Invaders will search your disks and kill all Space Invaders variations it finds. The utility should be as popular as DeTrek and DeWumpus. A similar utility would be useful for biorhythm, diet and hangman.

The current mania for computer games

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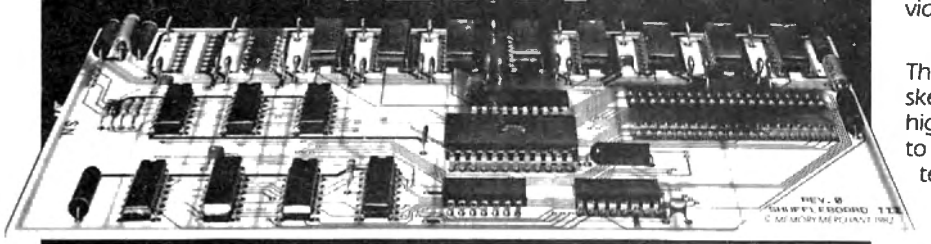

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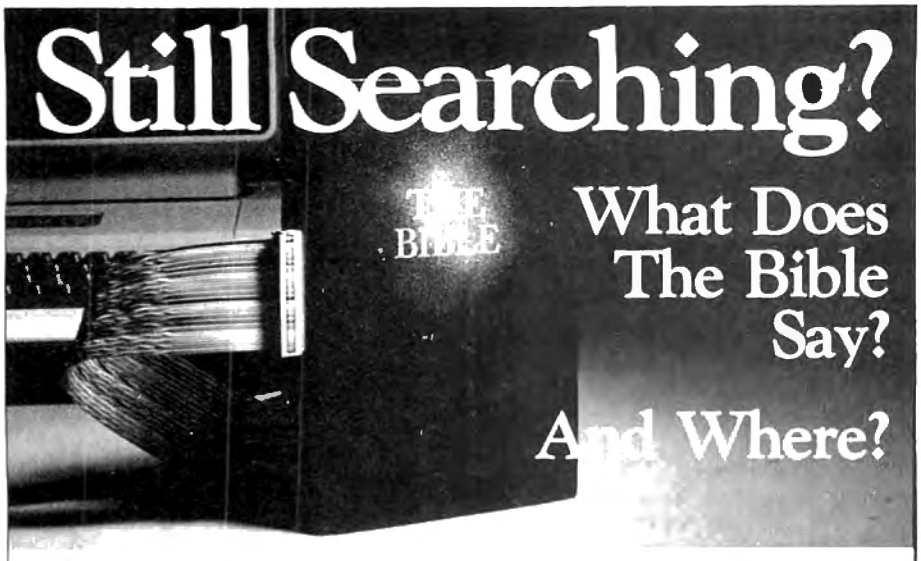

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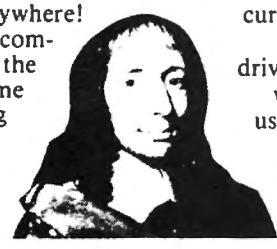

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(PASCAL 80 does not implement variant records, pointer and window variables, or functions and procedures used as parameters.)

↙255

KITCHEN TABLE

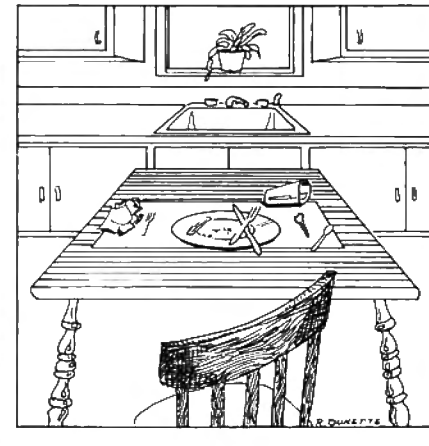
has touched a greedy chord in the KTI hierarchy and it has established a software acquisition department. Since even the most inept programmer could create something better than KTI's staff could produce, the doorway is wide open. Game submissions should meet the following guidelines:

- All games must not contain any original concepts. They should be based on existing arcade, computer, board or television games with proven popularity. Computer games must have an original twist—like renumbering or changing a few variable names—to protect KTI from copyright infringement suits.
- The programmer must be prepared to become rich. Kitchen Table marketing consultants point out there are more than 300,000 TRS-80 and TLS-8E owners in the United States. If only 50 percent of them purchase a KTI game at the list price of $99, then the programmer's 10 percent royalty amounts to $1.5 million! Since an average KTI game requires two weeks to write, debug, document and market, an industrious programmer could earn $3 million a month.

Eager programmers should know KTI starts paying royalties three years after a program is accepted. Programmers in need for immediate funds have submitted their programs to KTI's monthly magazine ZAP!, which pays on acceptance. They reason $60-$100 now is more valuable than $1.5 million two or three years from now.

- Games should be accompanied by a $1,000 evaluation fee, which will be applied to royalties if the author is alive when they come due.

Watch for the Kitchen Table Games line on the pegboard at your local computer dealer soon. If you know anyone who has bought one, please let the folks at KTI know. They're waiting for some brave soul to break the ice.■



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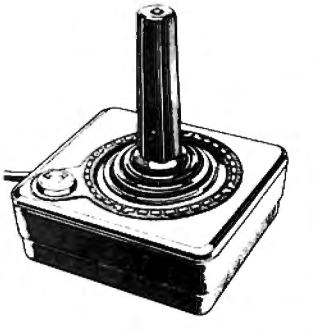

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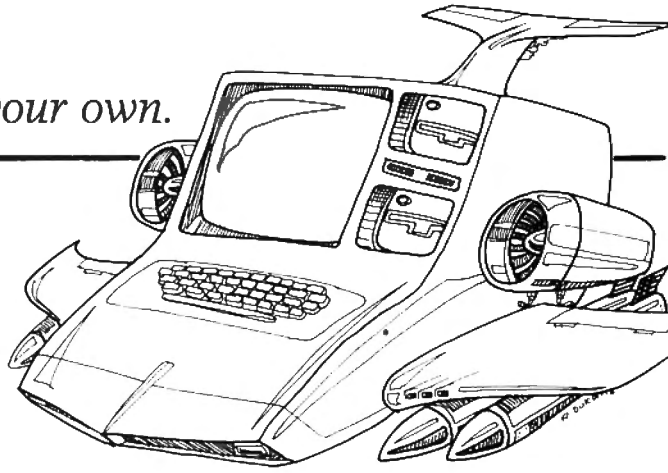

Assignment 46

Victor T. Albino
18501 194 N.E.
Woodinville, WA 98072

Last December a character by the name of Harry A. Flynn made his *80 Micro* debut in a program called Assignment 45. Commander Flynn shot over alien terrain in a jet sled, broke through force fields, fought laser wielding robots and circumvented a booby-trapped computer installation to rescue a lovely damsel in distress. Well, Harry is back. And in Assignment 46, he is better than ever.

But this time, in addition to the adventure, there is a detailed description of how the program works, including flowcharts of all the decision branching questions. In fact, this is a complete explanation of how to create your own adventures from storyline development to the final touches. This is a true anatomy of an adventure. If you really want to enjoy the program enter and play it before reading any further, because during the explanation of the program, all of its secrets will be revealed.

One hint before you start. If you have tried every possible choice at one of the decision points and still fail, it is not the program. You probably made an incorrect decision somewhere earlier. This adventure is like real life where we sometimes do not learn about our mistakes until later.

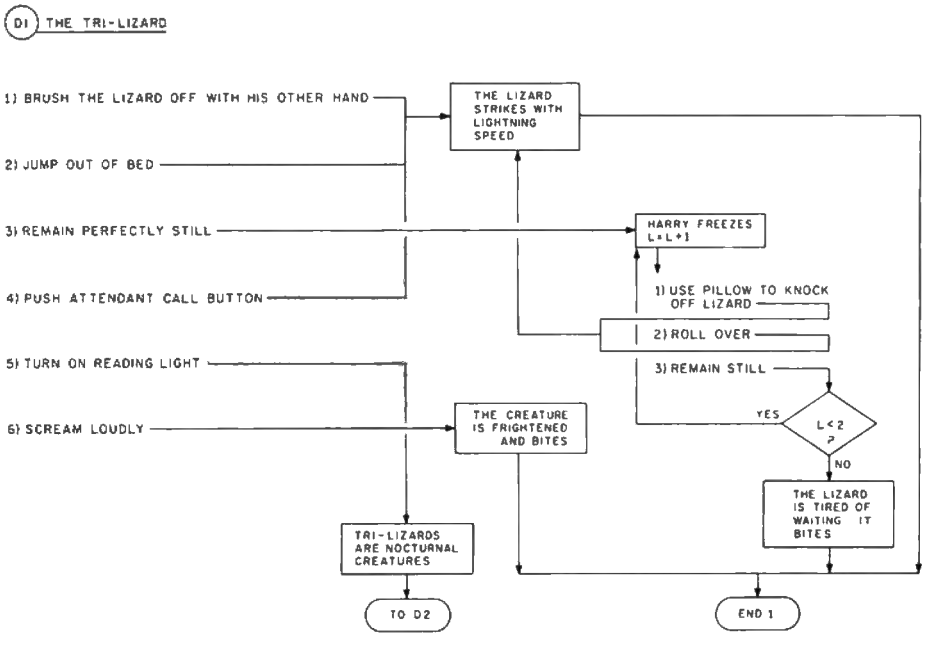

Fig. 1. D1—The Tri-Lizard

The Beginning

All stories originate with an idea, but how do you get a good idea for an adventure? One method is association. Begin with disconnected story elements and think of ways in which they might interact. The story element list can be divided into four main categories: people, places, life forms and things.

Most of these element parts never make

PEOPLE	LIFE FORMS	PLACES	THINGS
Commander Harry A. Flynn	Sandies	Space station oasis	Robot Giant
Sector Chief Chronos	Armadillian	Tomb world	Mako Jet Sled
Major Orr	Feminoids	Crystallia (crystal planet)	Laser ring
Honi Pott	Greenies	Stargates	Mini-nuke shirt button grenade
Dr. Non from K.R.U.E.L.	Slime Devils	Jungle Planet	Sedation lipstick
Storm Troopers	Tri-Lizards	Desert Planet	Gold
Col. Zigfried Syn		Luxury passenger cruiser	Diamonds
Leone Dracone		Gambling casino	Power crystals
		Ice Age Planet	Tube gun and darts
			Tri-corder wristwatch
			Homer dart

Table 1. Story Elements List

it into the story. When creating the list don't worry about possible associations. At this point you are only interested in brainstorming to gather ideas.

Since Assignment 46 followed Assignment 45, there were already a few characters I carried over into the new adventure. Certainly the hero, Commander Harry A.

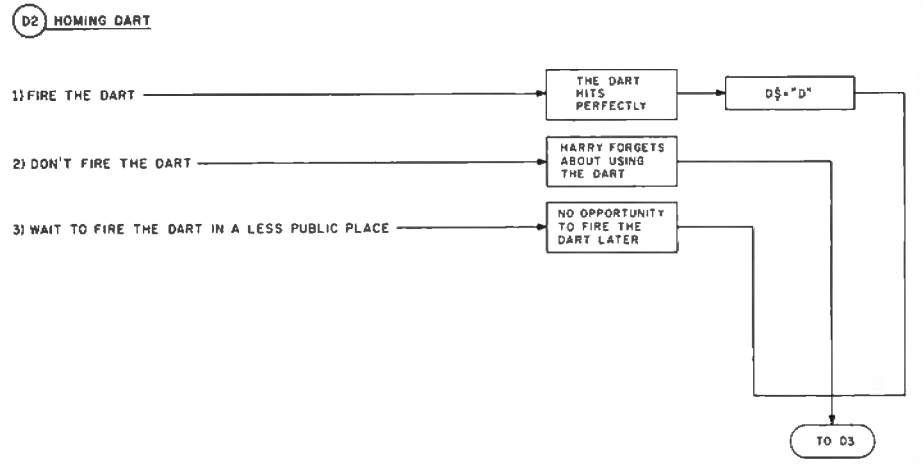

Fig. 2. D2—Homing Dart

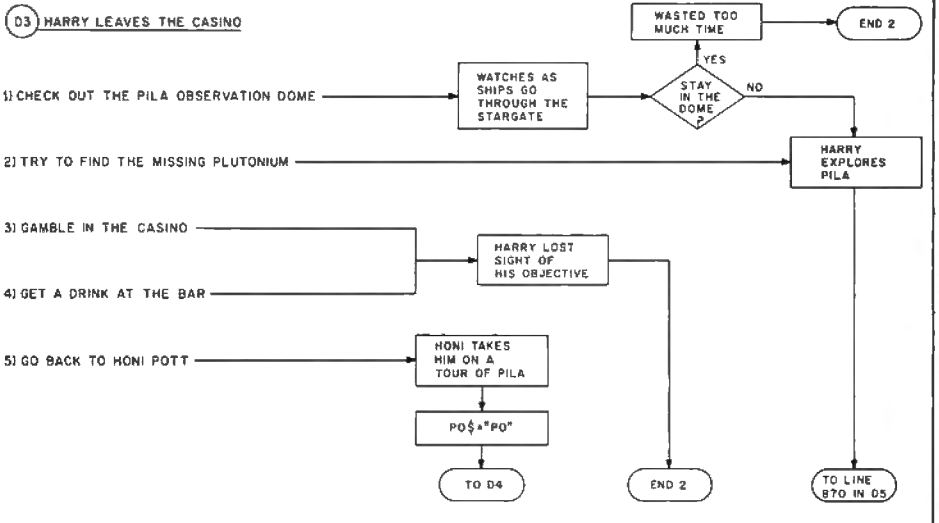

Fig. 3. D3—Harry leaves the casino

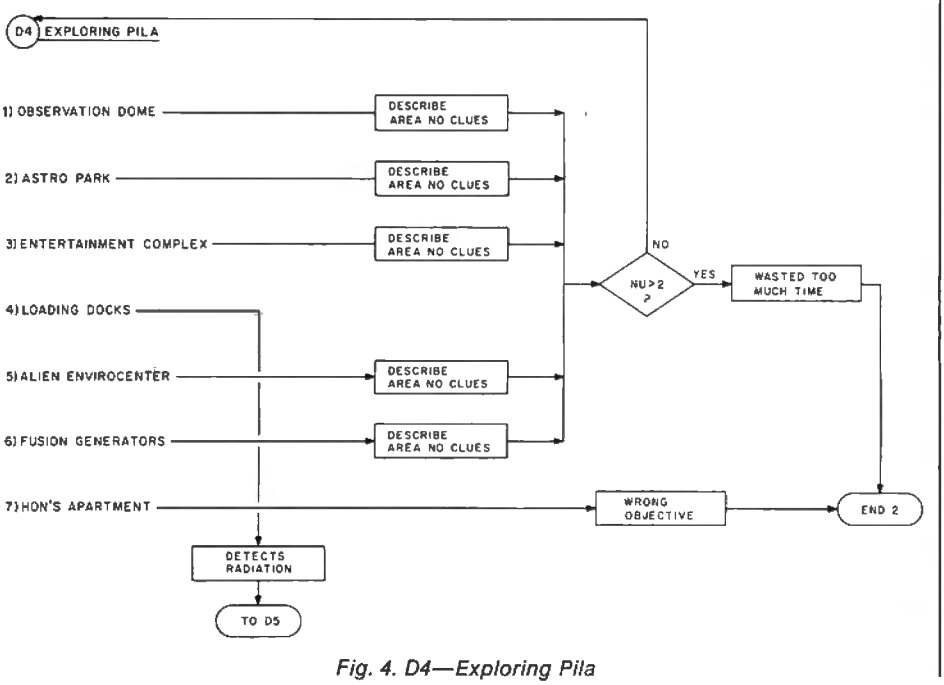

Fig. 4. D4—Exploring Pila

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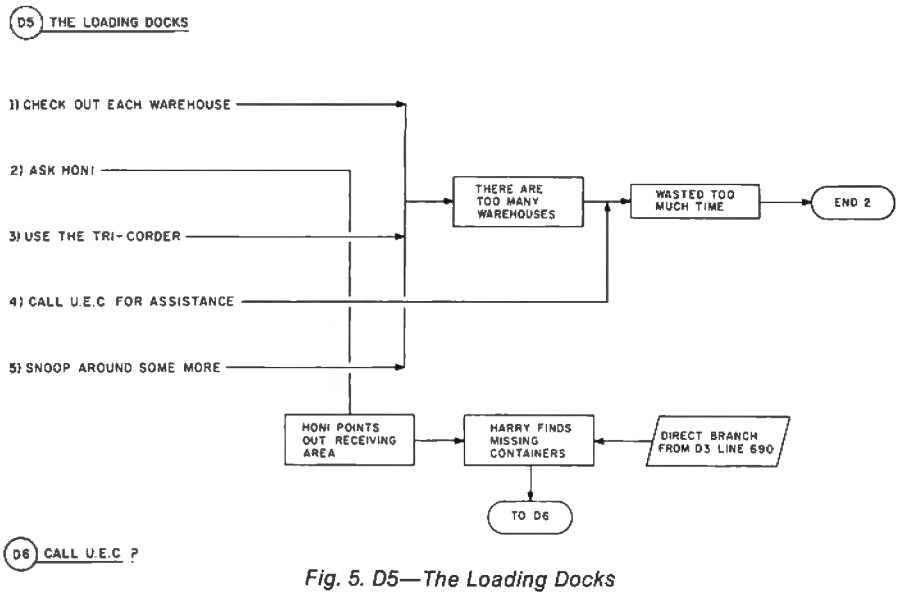

Fig. 5. D5—The Loading Docks

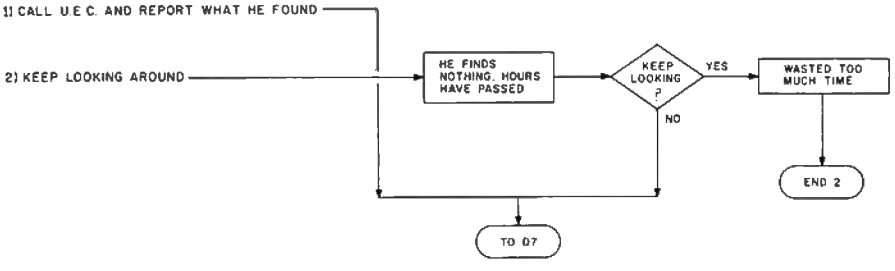

Fig. 6. D6—Call U.E.C.?

Flynn, and his director, Sector Chief Chronos, would be there. Others from the earlier adventure such as Major Orr and the infamous Dr. Non, while placed on the list, were not needed in the new story. Just two or three elements from each category were all that was necessary to create a basic story line. The important thing to remember is: Exciting stories contain exciting elements. Let your imagination go and come up with as many items as you can in each category.

Using the elements in your list, formulate a general plot from the thousands of possible combinations of people, places and things. The plot outline for Assignment 46 would show how Harry, working with Honi Pott, uses homer darts and laser rings to overcome an Armadillan bodyguard, a venomous tri-lizard and ultimately the super villain himself, Leo Dracone. All of this is accomplished in a setting of luxury passenger starcruisers, gambling casinos and space cities forming a ring around the only known stargate to Andromeda.

The Program Listing— One Step at a Time

This program can be broken down into 12 distinct segments: the introduction, ten major decision branching questions and finale. The introduction sets the stage and explains the mission. The finale, of course, finishes the adventure, but it can end in one of three different ways. The adventurer can

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die and consequently fail his mission, or he can live, but still fail, or he can succeed. The decision branching questions are limited to about 10 or 11 situations because that is about all one can fit into a 16K machine and still have enough memory left to accommodate the narration necessary to tie the adventure together.

Figures 1-10 flowchart each of the 10 main decision points in the program. Flowcharting is essential for a clear understanding of the results of each action an adven-

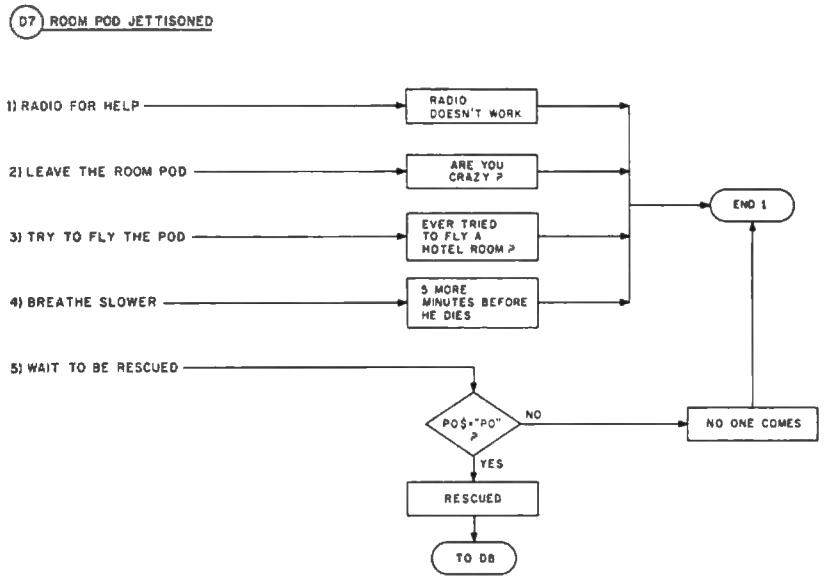

Fig. 7. D7—Room pod jettisoned

Program Listing

```
0 CLS
10 REM ** ASSIGNMENT 46
          BY VICTOR T. ALBINO  JAN. 1982
20 H=982:H$="HIT '/ ' KEY":GOTO50
30 IFINKEY$<>"/"THEN30ELSECLS:RETURN
40 FORT=1TO1500:NEXT:RETURN
50 PRINT@278,"ASSIGNMENT 46":GOSUB40
60 PRINT@463,"A HARRY FLYNN (TM) ADVENTURE":GOSUB40
65 PRINT@604,"BY":PRINT@725,"VICTOR T. ALBINO":GOSUB40:CLS
70 PRINT@342,"YEAR:  2154":GOSUB40
80 PRINT@460,"PLACE:  A SANDY BEACH ON MON KARLO
                      THE PLEASURE PLANET
90 GOSUB40
100 PRINT@726,"TIME:  3:20 PM":GOSUB40:GOSUB40:CLS
110 PRINT@320,"COMMANDER HARRY A. FLYNN, UNITED EARTH COMMAND (U
EC), LIES ON
THE SAND.  HE IS PENSIVE WHILE HE WATCHES THE REFLECTION OF THE
HOT SUN DANCE ON HIS RUBY LASER RING.

SUDDENLY, A SIGNAL BLARES OUT AS HIS COMMUNICATOR SWITCHES ON.
120 PRINT@H,H$;:GOSUB30
130 PRINT"HELLO HARRY.  THIS IS SECTOR CHIEF CHRONOS.
SORRY TO INTERRUPT YOUR VACATION, BUT WE JUST RECEIVED
INFORMATION THAT THE RING CITY OF PILA IS IN DANGER.
140 PRINT"THE CITY ENCIRCLES THE PILA STARGATE WHICH IS THE ONLY

WAY TO REACH THE GALAXY OF ANDROMEDA.  WE ARE ESPECIALLY
CONCERNED BECAUSED A PLUTONIUM FREIGHTER HEADED FOR PILA
DISAPPEARED YESTERDAY.  THERE'S ENOUGH MATERIAL ABOARD THAT
SHIP";
150 PRINT" TO VAPORIZE THE CITY AND DESTROY THE STARGATE.
SINCE YOU'RE ON VACATION, A VISIT TO THE FAMOUS PILA CASINO
SHOULD NOT RAISE SUSPICION.
155 PRINT:PRINT"YOUR MISSION IS TO PROTECT THE RING CITY AND THE
 PILA STARGATE.
PASSAGE HAS ALREADY BEEN BOOKED FOR YOU ABOARD THE LUXURY LINER
QUEEN ZIRA.
160 PRINT"     GOOD LUCK, COMMANDER.
170 PRINT@H,H$;:GOSUB30
175 CLEAR:P=448:W=150:W$="WHAT SHOULD HE DO?":H=982:H$="HIT '/ '
 KEY":E=906:E$="(ENTER THE NUMBER OF THE ACTION YOU SELECT)"
180 PRINT@64,"IT WAS LATE WHEN HARRY BOARDED THE GIANT LINER.
HE WENT TO HIS CABIN AND FELL ASLEEP.
190 PRINT:PRINT"ONLY HALF AWAKE, HARRY FELT THE COOLNESS OF THE
```

Program continues

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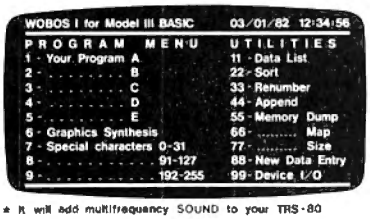

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Program continued

```
SLIME TRAIL AS
THE TRI-LIZARD WHICH HAD BEEN PLACED IN HIS BED BEGIN CRAWLING
UP HIS LEFT ARM.  QUICKLY, HARRY OPENED HIS EYES AND STARED AT
THE THREE HEADED, POISONOUS REPTILE.";
195 PRINT"  THE ANIMAL HISSED SOFTLY;
ITS THREE TOUNGES DARTING IN AND OUT AS IT SLITHERED UP TOWARDS
HARRY'S THROAT.

ONE BITE WOULD BE FATAL.
200 PRINT@H,H$;:GOSUB30
210 CLS:PRINT@W,W$:L=0
220 PRINT@320,"1)  BRUSH THE LIZARD OFF WITH HIS OTHER HAND
230 PRINT"2)  JUMP OUT OF BED
240 PRINT"3)  REMAIN PERFECTLY STILL
250 PRINT"4)  PUSH ATTENDANT CALL BUTTON
260 PRINT"5)  TURN ON THE READING LIGHT
270 PRINT"6)  SCREAM LOUDLY
280 PRINT@E,E$;:INPUTN
290 CLS:IFN<1ORN>6THEN280
300 ONNGOTO310,310,315,310,400,390
310 PRINT@460,"THE LIZARD STRIKES WITH LIGHTNING SPEED !":GOSUB4
0:GOTO5000
315 PRINT@86,"HARRY FREEZES"
320 PRINT@W,W$:PRINT@384,"1)  USE PILLOW TO KNOCK OFF LIZARD.":P
RINT"2)  ROLL OVER QUICKLY":PRINT"3)  REMAIN STILL"
330 PRINT@E,E$;:INPUTM
340 CLS:IFM<1ORM>3THEN330
350 ONMGOTO310,310,360
360 PRINT@470,"HARRY STILL DOESN'T MOVE":GOSUB40:L=L+1
370 CLS:IFL=1THEN320ELSE380
380 PRINT@P,"THE LIZARD IS TIRED OF WAITING... IT BITES":GOSUB40
:GOTO5000
390 PRINT@460,"THE CREATURE IS FRIGHTENED... AND BITES":GOSUB40:
GOTO5000
400 PRINT@P,"TRI-LIZARDS ARE NOCTURNAL CREATURES.  THE HIGH INTE
NSITY
READING LIGHT BLINDS THE ANIMAL.  HARRY PULLS OUT HIS LASER AND
BLASTS IT.
410 PRINT@H,H$;:GOSUB30
420 PRINT@256,"THE ZIRA ARRIVES AT PILA, AND HARRY HEADS FOR THE
 RING CITY
CASINO.  LEO DRACONE, THE CASINO OWNER, IS THERE WITH HIS
ARMADILLAN BODYGUARD.";
425 PRINT".. A LARGE, HUMANOID HULK WITH GRAY,
ARMOR-LIKE SKIN.
430 PRINT"SINCE DRACONE HAS REPORTEDLY BEEN LINKED TO K.R.U.E.L.

(KIDNAPPING, REVOLT, USURPATION, EXTORTION LEAGUE), HARRY
WONDERS WHETHER TO RISK SHOOTING A HOMER DART INTO THE HEEL OF
THE CASINO OWNER'S SHOE.  ";
440 PRINT"IF HE HITS IT, HE WILL BE ABLE TO
MONITOR DRACONE'S MOVEMENTS.  IF HE MISSES AND DRACONE FEELS
THE DART, THEY WILL BE ALERTED TO HIS PRESENCE.
450 PRINT@H,H$;:GOSUB30
460 PRINT@W,W$
470 PRINT@320,"1)  FIRE THE DART
2)  DON'T FIRE THE DART
3)  WAIT TO FIRE THE DART LATER IN A LESS PUBLIC PLACE
480 PRINT@E,E$;:INPUTN
490 CLS:IFN<1ORN>3THEN480
500 ONNGOTO510,520,530
510 PRINT@465,"THE DART HITS PERFECTLY.":D$="D":GOSUB40:GOTO540
520 PRINT@460,"HARRY FORGETS ABOUT USING THE DART.":GOSUB40:GOTO
540
530 PRINT@P,"UNFORTUNATELY, HARRY DOESN'T GET ANOTHER OPPORTUNIT
Y
TO FIRE THE DART.":PRINT@H,H$;:GOSUB30
540 CLS:PRINT@320,"HARRY FEELS A TAP ON HIS SHOULDER AND TURNS T
O SEE A BEAUTIFUL
BLOND WOMAN IN A RED PLASTO-MOLD JUMPSUIT.

SHE SMILES AND SAYS,  ' HELLO HANDSOME ! '
550 PRINT@H,H$;:GOSUB30
560 PRINT@P,"' WELL HELLO, '  HARRY ANSWERS,  ' AND WHAT'S YOUR
NAME? '":PRINT@H,H$;:GOSUB30
570 PRINT@P,"' I'M HONI POTT.  I WORK HERE.  YOU'RE NEW ON PILA,
 AREN'T YOU?
WOULD YOU LIKE ME TO SHOW YOU AROUND? '":PRINT@H,H$;:GOSUB30:CLS

580 PRINT@P,"MUCH TO HIS REGRET, HARRY FINDS HIMSELF SAYING,

         ' SORRY HONI, MAYBE SOME OTHER TIME. '

THEN HE LEAVES THE CASINO.":PRINT@H,H$;:GOSUB30
590 CLS:PRINT@W,W$
600 PRINT@320,"1)  CHECK OUT THE PILA OBSERVATION DOME
```

Program continues

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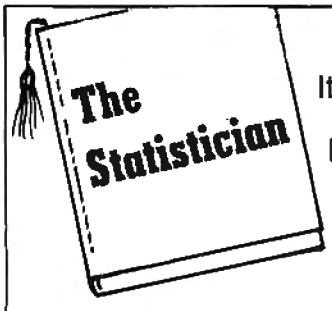

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Program continued

```
2)  TRY TO FIND THE MISSING PLUTONIUM
3)  GAMBLE IN THE CASINO
4)  GET A DRINK AT THE BAR
5)  GO BACK TO HONI POTT
610 PRINT@E,E$;:INPUTN
620 CLS:IFN<1ORN>5THEN610
630 ONNGOTO640,690,700,700,710
640 PRINT@128,"AT THE DOME HARRY WATCHES SHIPS GO THROUGH THE ST
ARGATE":

                PRINTW$:PRINT"1)  STAY IN THE DOME AND LOOK FOR
CLUES
2)  EXPLORE MORE OF THE CITY"
650 PRINT@E,E$;:INPUTN
660 CLS:IFN<1ORN>2THEN650
670 ONNGOTO680,690
680 CLS:PRINT@463,"HARRY HAS WASTED TOO MUCH TIME.":GOSUB40:GOTO
5010
690 PRINT@465,"HARRY EXPLORES PILA.":GOSUB40:CLS:GOTO870
700 CLS:PRINT@P,"SEEMS LIKE HARRY HAS GOTTEN CAUGHT UP IN THE  '
 FUN AND GOOD
TIMES '  SPIRIT OF THE RING CITY AND LOST SIGHT OF HIS MAIN
OBJECTIVE.":PRINT@H,H$;:GOSUB30:GOTO5010
710 PRINT@384,"HARRY DECIDES THAT HONI MIGHT BE HELPFUL.  SHE IS
 HAPPY TO SEE
HIM AND ASKS WHERE HE WOULD LIKE TO GO ON PILA.":PRINT@H,H$;:GOS
UB30:PO$="PO":NU=0
720 CLS:NU=NU+1:IFNU>2THEN760ELSEPRINT@W,"WHERE SHOULD HE GO?
1)  OBSERVATION DOME
2)  ASTRO PARK
3)  ENTERTAINMENT COMPLEX
4)  LOADING DOCKS
5)  ALIEN ENVIRO-CENTER
6)  FUSION GENERATORS
7)  HONI'S APARTMENT
730 PRINT@E,E$;:INPUTN
740 CLS:IFN<1ORN>7THEN730
750 ONNGOTO770,771,772,790,773,780,774
760 CLS:PRINT@398,"HE FINDS NOTHING ON HIS TOUR.":GOSUB40:GOTO68
0
770 PRINT@P,"HARRY WATCHES AS SEVERAL SHIPS APPROACH AND CAREFUL
LY PASS
THROUGH THE STARGATE, BUT HE SEES NO TRACE OF THE MISSING
FREIGHTER.":GOTO775
771 PRINT@P,"THE PARK IS BEAUTIFUL UNDER THE ARTIFICIAL SUN, BUT
 HARRY FINDS
NO CLUES.":GOTO775
772 PRINT@P,"HARRY REALLY ENJOYS THIS PLACE, BUT HE FINDS NOTHIN
G AND TIME
IS QUICKLY RUNNING OUT.":GOTO775
773 PRINT@P,"HARRY AND HONI PEER AT STRANGE ALIEN LIFE FORMS THR
OUGH THICK
GLASS WALLS, BUT THERE IS NO ABNORMAL RADIATION HERE OR
ANYTHING ELSE THAT WOULD INDICATE THE PRESENCE OF THE MISSING
PLUTONIUM.":GOTO775
774 PRINT@P,"ALAS, HARRY HAS EVIDENTLY DECIDED THAT HIS PERSONAL
 OBJECTIVES
COME BEFORE HIS MISSION... A UNWISE CHOICE UNDER THE PRESENT
CIRCUMSTANCES.":PRINT@H,H$;:GOSUB30:GOTO5010
775 PRINT@H,H$;:GOSUB30:GOTO720
780 PRINT@P,"HARRY'S WRISTBAND TRICORDER DETECTS RADIATION...
BUT IT'S ONLY FROM THE FUSION GENERATORS.":PRINT@H,H$;:GOSUB30:G
OTO720
790 PRINT@P,"HARRY'S WRISTBAND TRICORDER PICKS UP RADIATION, BUT
 THE DOCKS
ARE HUGE AND CAVERNOUS.":PRINT@H,H$;:GOSUB30
800 PRINT@W,W$;:PRINT@320,"1)  CHECK OUT EACH WAREHOUSE
2)  ASK HONI
3)  USE THE TRICORDER
4)  CALL U.E.C. FOR ASSISTANCE
5)  SNOOP AROUND SOME MORE
810 PRINT@E,E$;:INPUTN
820 CLS:IFN<1ORN>5THEN810
830 ONNGOTO840,850,840,680,840
840 PRINT@P,"THERE ARE TOO MANY WAREHOUSING PODS TO EXPLORE.":PR
INT@H,H$;:GOSUB30:GOTO680
850 PRINT@192,"SINCE THE FREIGHTER WAS REPORTED MISSING ONLY YES
TERDAY, HARRY
ASKS HONI WHERE THE CARGO IS FIRST RECEIVED.  SHE POINTS TO THE
MASTER INVENTORY CONTROL CENTER.  HARRY EXCUSES HIMSELF AND
LEAVES HER.
860 PRINT@H,H$;:GOSUB30
870 PRINT@320,"USING HIS TRICORDER, HARRY LOCATES THE MISSING PL
UTONIUM
CONTAINERS; BUT THEY ARE EMPTY.  ONLY RESIDUAL RADIATION REMAINS
BEHIND.
```

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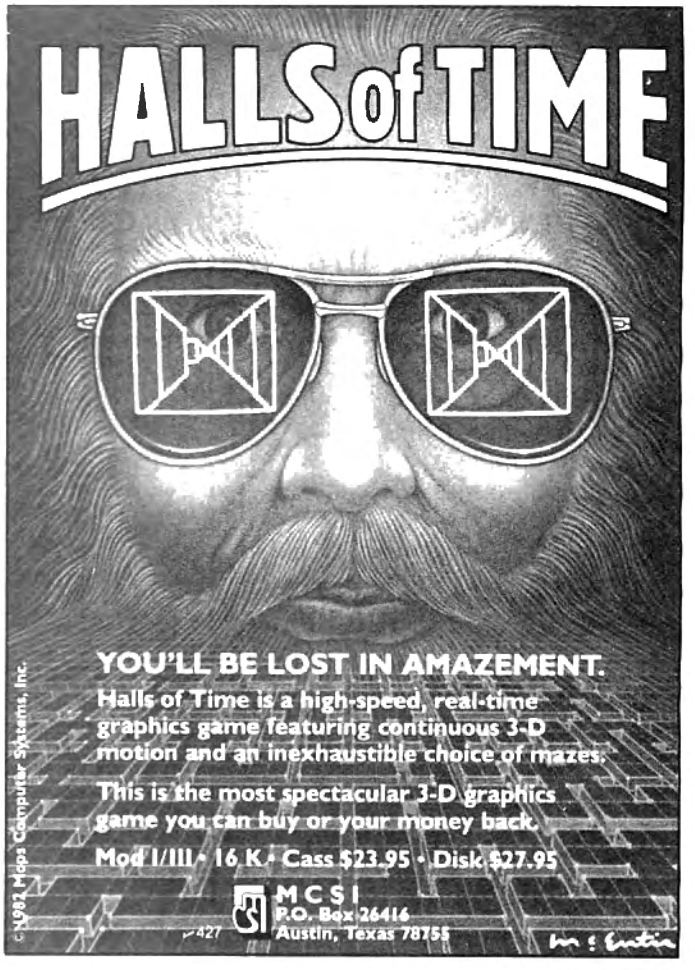

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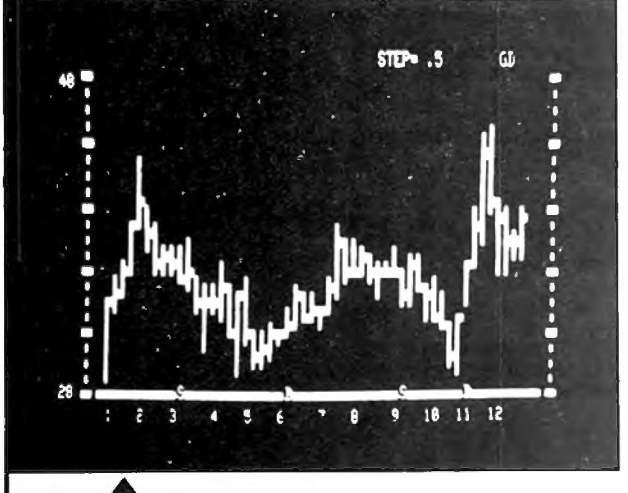

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Program continued

```
880 PRINT@H,H$;:GOSUB30
890 PRINT@W,W$
900 PRINT@320,"1)  CALL U.E.C. AND REPORT WHAT HE FOUND
2)  KEEP LOOKING AROUND
910 PRINT@E,E$;:INPUTN
920 CLS:IFN<1ORN>2THEN910
930 ONNGOTO960,940
940 PRINT@P,"HARRY FINDS NOTHING.  HOURS HAVE PASSED":
INPUT"SHOULD HE KEEP LOOKING (Y/N)";Q$
950 IFQ$="Y"THEN680:IFQ$<>"N"THENCLS:GOTO940
960 PRINT@320,"HARRY RUNS TO HIS HOTEL ROOM TO TELL U.E.C. THAT
THE
PLUTONIUM IS ON PILA.  BUT BEFORE HE CAN CALL, HIS ROOM IS
JETTISONED INTO SPACE, AND A VOICE COMES OVER A SPEAKER.
IT IS LEO DRACONE.
965 PRINT@H,H$;:GOSUB30
970 PRINT@P,"' HELLO COMMANDER FLYNN.  SORRY TO HAVE EVICTED YOU
 SO
FORCEFULLY FROM PILA, BUT YOU WERE BECOMING MEDDLESOME. '":PRINT
@H,H$;:GOSUB30
980 PRINT@P,"' JUST WHAT DO YOU PLAN TO DO AT PILA, ' QUESTIONED
 HARRY.":PRINT@H,H$;:GOSUB30
990 PRINT@192,"' QUITE SIMPLE COMMANDER.  WITH THE PILA STARGATE
 GONE, THE ONLYMEANS OF TRADE WITH ANDROMEDA WILL BE THROUGH A N
EW
GATE WHICH WE HAVE DISCOVERED.  K.R.U.E.L. WILL CONTROL ALL
INTER-GALAXY TRANSPORTATION.";
1000 PRINT"  IT WILL BE WORTH BILLIONS OF
GALACTIC CREDITS ANNUALLY.
I MUST LEAVE YOU NOW AND MAKE FINAL PREPARATIONS FOR THE
UNFORTUNATE CATASTROPHE WHICH IS ABOUT TO TAKE PLACE.
1005 PRINT:PRINT"I ESTIMATE YOU HAVE ABOUT 10 MINUTES OF AIR LEF
T IN YOUR ROOM.

GOOD BYE, COMMANDER. '
1010 PRINT@H,H$;:GOSUB30
1020 PRINT@W,W$
1030 PRINT@320,"1)  RADIO FOR HELP
2)  LEAVE THE ROOM POD
3)  TRY TO FLY THE POD
4)  BREATHE SLOWER
5)  WAIT TO BE RESCUED
1040 PRINT@E,E$;:INPUTN
1050 CLS:IFN<1ORN>5THEN1040
1060 ONNGOTO1070,1080,1090,1100,1110
1070 PRINT@P,"THE RADIO NO LONGER FUNCTIONS!":GOSUB40:GOTO5000
1080 PRINT@470,"ARE YOU  C R A Z Y !":GOSUB40:GOTO5000
1090 PRINT@P,"HAVE YOU EVER TRIED TO FLY A HOTEL ROOM?":GOSUB40:
GOTO5000
1100 PRINT@P,"THIS GIVES HIM 5 MORE MINUTES... BEFORE HE DIES.":
GOSUB40:GOTO5000
1110 IFPO$="PO"THEN1120ELSEPRINT@460,"HARRY HAS NO FRIENDS ON PI
LA TO RESCUE HIM.":PRINT@H,H$;:GOSUB30:GOTO5000
1120 PRINT@256,"IT'S A GOOD THING HARRY MADE FRIENDS WITH HONI.
 SHE WAS ON HER
WAY TO HIS ROOM WHEN IT WAS JETTISONED.  SHE PICKS HIM UP IN A
SERVICE SHUTTLE.
ONCE ABOARD THE SHIP, HARRY SPEEDS BACK TO PILA.
1130 PRINT"HE MUST STOP DRACONE FROM SETTING THE BOMBS AND MAKIN
G GOOD HIS
ESCAPE.":PRINT@H,H$;:GOSUB30
1140 IFD$="D"THEN1150ELSEPRINT@P,"BUT PILA IS A BIG PLACE WITH S
HIPS ARRIVING AND DEPARTING
CONTINUOUSLY.
HARRY CAN'T FIND DRACONE IN TIME.":PRINT@H,H$;:GOSUB30:GOTO5010
1150 PRINT@P,"LUCKILY, THE HOMER DART IN DRACONE'S SHOE IS STILL
 WORKING.
AS SOON AS HE DOCKS, HARRY SETS OUT AFTER HIM.":PRINT@H,H$;:GOSU
B30
1160 PRINT@P,"BUT OUT OF THE SHADOWS LEAPS THE ARMADILLAN.  HE G
RABS HARRY IN
A CRUSHING, VICE-LIKE GRIP!!!":PRINT@H,H$;:GOSUB30:AR=0
1170 CLS:AR=AR+1:IFAR>2THEN1215ELSEPRINT@W,W$
1180 PRINT@320,"1)  USE KARATE
2)  BITE HIM
3)  CRY FOR HELP
4)  BREAK FREE
5)  SOCK HIM
6)  STEP ON HIS FOOT
7)  TRY TO BRIBE HIM
8)  PRETEND TO FAINT
1190 PRINT@E,E$;:INPUTN
1200 CLS:IFN<1ORN>8THEN1190
1210 ONNGOTO1220,1220,1220,1220,1230,1220,1220,1220
1215 CLS:PRINT@396,"HARRY HAS RUN OUT OF CHANCES.
```

Program continues

turer might take. It also helps to conserve memory by making it easy to identify when different actions can branch to and use the same program routine.

With your outline and flowcharts in hand you should have a good idea of what is going to happen in the program including the introduction, decisions and finale. To see how all these parts fit together, let's go through Assignment 46's listing.

Line 20 sets the variables H = 982 and H$ = "Hit 'i' Key". Setting often used variables will save typing and conserve memory.

The subroutine in line 30 allows the adventurer to read the text on the screen at his own rate and then clear it for the next bit of narrative. Again, we save time and memory by calling on the same subroutine throughout the program.

Instead of setting up a delay loop each time we need one, the routine in line 40 is called up repeatedly. Lines 50-100 set the stage for the adventure and line 110 starts the main narrative portion of the program. By mentioning the laser ring here, a subtle clue is given as to what Commander Flynn will need later on. Lines 120-170 explain the mission.

Line 175 is important to understand. Flags are set at several places in the program. Program execution routes change depending on the value certain variables have been given during the operation of the program. If the adventurer selects option 1, then variable X might be given a value of five, whereas if option 2 is chosen, X may be set equal to 10. Later in the program, the action of the adventure will be different depending on what the value of X is at that point. In Level II Basic, when one goes from the command mode to the execute mode by typing Run, all numeric variables are set to zero and all string variables are set to null. But in this program, if the adventurer fails his mission and wants to start over, he does not have to type Run. All he has to do is type a Y when asked if he wants to try again. If yes, program operation will resume at line 175. All variables will carry over the values from the previous game to the new game. Obviously, a new game requires new variables and by starting line 175 with the Clear command, we are assured of beginning the new adventure with a clean slate.

Why not let the program end when the current game is over? You could require that Run be typed each time the adventure is played. I feel that going all the way back to line 175 is penalty enough without having the player sit through the program introduction over and over again. The rest of line 175 sets the variables to be used throughout the balance of the program. It is necessary to reset H and H$ since the Clear command would have reinitialized them also.

Lines 180-200 provide the connecting narrative to the first decision branching point called D1.

The flowchart for D1 (Fig. 1) explains the choices available to the adventurer and the results of each action as written in lines

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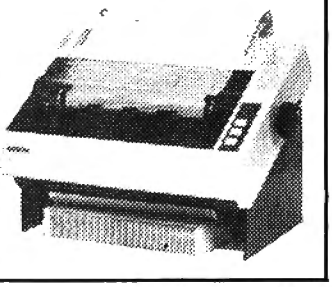

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Program continued

```
      HE DOESN'T GET PASSED THE POWERFUL ARMADILLAN.":PRINT@H,H
$;:GOSUB30:GOTO5000
1220 PRINT@P,"SUCH ACTION IS USELESS WHEN FIGHTING AN ARMADILLAN
.":PRINT@H,H$;:GOSUB30:GOTO1170
1230 PRINT@P,"HARRY JABS AT THE CREATURE'S JAW.  HIS LASER RING
FLASHES A
RUBY RED PULSE, AND THE ARMADILLAN FALLS TO THE FLOOR.":PRINT@H,
H$;:GOSUB30
1240 PRINT@256,"HARRY FINDS DRACONE IN A LARGE AIR LOCK WITH A D
OZEN GUARDS.
THEY ARE STUDYING A LARGE CHART SHOWING THE PILA AIR HANDLING
SYSTEM WITHIN WHICH DRACONE HAS HIDDEN THE BOMBS.":PRINT@H,H$;:G
OSUB30
1250 CLS:PRINT@W,W$
1260 PRINT@320,"1)  CALL FOR HELP
2)  BLAST THEM WITH HIS LASER
3)  EXAMINE THE AIR LOCK
4)  USE A MINI-NUKE SHIRT BUTTON GRENADE TO BLOW THEM OUT
1270 PRINT@E,E$;:INPUTN
1280 CLS:IFN<1ORN>4THEN1270
1290 ONNGOTO1300,1310,1330,1320
1300 PRINT@P,"IT'S TOO LATE FOR THAT.":GOSUB40:GOTO1250
1310 PRINT@P,"THERE'S TOO MANY OF THEM.  YOU LOSE.":PRINT@H,H$;:
GOSUB30:GOTO5000
1320 PRINT@P,"THE GRENADE IS TOO POWERFUL.  IT BLOWS OUT A SECTI
ON OF THE
CITY AND THEN SETS OFF DRACONE'S BOMBS.":PRINT@H,H$;:GOSUB30:GOT
O5000
1330 PRINT@P,"HARRY FINDS THE AIR LOCK CONTROLS, SHUTS THE INNER
 DOORS, AND
PUMPS OUT THE AIR UNTIL EVERYONE IN THE CHAMBER PASSES OUT.  HE
THEN STARTS TO CALL U.E.C. TO HAVE DRACONE AND HIS MEN PICKED UP
WHEN  **  B O O M !  ** . . ."
1335 PRINT@H,H$;:GOSUB30
1340 PRINT@P,"HARRY LOOKED THROUGH THE AIR LOCK WINDOW.  DRACONE
 HAD BEEN
WEARING AN ENVIRONMENTAL SUIT, AND HE BLASTED A HOLE IN THE
OUTSIDE WALL KILLING HIS GUARDS BUT GAINING HIS OWN FREEDOM.
HARRY WAS FURIOUS.":PRINT@H,H$;:GOSUB30
1350 PRINT@W,W$
1360 PRINT@320,"1)  GET AN ENVIRONMENTAL SUIT AND GO AFTER HIM
2)  GET A SHIP AND GO AFTER HIM
3)  SEE IF THE HOMER DART IS STILL TRANSMITTING
1370 PRINT@E,E$;:INPUTN
1380 CLS:IFN<1ORN>3THEN1370
1390 ONNGOTO1400,1405,1410
1400 PRINT@P,"TOO MUCH TIME IS LOST WHILE HARRY TRIES TO FIND A
SUIT.  DRACONEGETS AWAY.":PRINT@H,H$;:GOSUB30:GOTO5010
1405 PRINT@P,"HARRY WASTES TOO MUCH TIME TRYING TO GET A SHIP.
DRACONE GETS
AWAY.":PRINT@H,H$;:GOSUB30:GOTO5010
1410 PRINT@320,"hARRY PICKS UP THE SIGNAL.  IT LEADS TO THE EXEC
UTIVE SUITE
ABOVE THE CASINO.  LASER GUN IN HAND, HARRY KICKS OPEN THE DOOR
AND FINDS IN THE MIDDLE OF THE ROOM...":PRINT@H,H$;:GOSUB30
1420 PRINT@214,"DRACONE'S SHOES!
SUDDENLY THE LIGHTS GO OUT AS HARRY IS STRUCK FROM BEHIND.
DRACONE RUNS TO THE LAUNCH BAY AND CLIMBS INTO HIS PRIVATE
SHUTTLE.
1430 PRINT"HARRY STAGGERS TO HIS FEET AND RUNS DOWN THE CORRIDOR
 AFTER
HIM.  AS DRACONE'S SHIP LEAVES THE BAY, HARRY FIRES SEVERAL
QUICK BURSTS.  ONE TEARS INTO THE SHUTTLE'S STABILIZER UNIT.
1440 PRINT"THE SHIP BUCKS ONCE, THEN AGAIN.  PEOPLE IN THE
OBSERVATION DOME SCREAM AS THEY SEE THE SHIP ENTER THE STARGATE
AT THE WRONG ANGLE.  IN AN INSTANT, THE SHIP VANISHES, LOST
FOREVER SOMEWHERE IN THE FABRIC OF SPACE AND TIME."
1450 PRINT@H,H$;:GOSUB30
1460 PRINT@400,CHR$(23)"CONGRATULATIONS":PRINT@524,"MISSION ACCO
MPLISHED !":FORT=1TO3000:NEXT:END
5000 CLS:PRINT@470,"GOOD BYE HARRY !":PRINT@H,H$;:GOSUB30
5010 CLS:PRINT@260,CHR$(23)"THE MISSION IS A FAILURE.

PILA HAS BEEN BLOWN TO ATOMS,

          AND

THE STARGATE IS LOST FOREVER.
5020 PRINT@978,H$;:GOSUB30
5030 CLS:PRINT@468,"WANT TO TRY AGAIN (Y/N)";
5040 INPUTD$:CLS:IFD$="Y"THENGOTO175
5050 IFD$="N"THEN5070
5060 IFD$<>"Y"ANDD$<>"N"THENCLS:PRINT@464,"ANSWER ONLY WITH Y OR
 N.":GOTO5040
5070 PRINT@456,"NOW THE FORCES OF K.R.U.E.L. WILL TRIUMPH UNOPPO
SED !":PRINT:PRINT
```

210–410. Face to face with a venomous Trilizard, the player selects his response from a list of six possibilities. In this case, only one of the choices will allow the adventurer to escape with his life. If number three is selected, the player finds himself confronted with two new possible actions plus the option of remaining still again. The flag L is incremented each time the player elects to remain still. If the adventurer chooses to remain still too long, the lizard gets tired of waiting for him to make a move and bites him anyway.

In the end, however, there are only two ways out of the D1 confrontation: kill the lizard and go on to D2, or die and go to End 1. End 1 is that part of the finale that signals that the adventurer has died as well as failed his mission. In End 2 the player also fails his mission, but remains alive and has the chance to fight another day.

Lines 420–450 contain the connecting narrative setting the stage for D2.

Lines 460–530 and the flowchart (Fig. 2) for D2 is very simple. The player is given three choices: fire the dart, don't fire the dart or wait to fire the dart. All three choices allow the program to proceed on to D3 as if nothing important has happened. If the first choice is selected and the dart is fired, the variable D$ is set equal to "D". The player will not realize until much later that if he did not fire the dart, he made a crucial error.

At lines 540–580 Honi Pott, the beautiful blond in a red plasto-mold jumpsuit, is introduced. At first she appears to be a pleasant distraction. Later, Commander Flynn will discover that not only the mission, but his very life depend on her.

Lines 590–700 explain D3 (Fig. 3) which is especially important to the rest of the adventure. Our hero can dally too long in the observation dome, or get distracted by the attractions of the casino or bar. If these choices are selected, the results of the adventurer's action are soon apparent. This is not true for two other possible choices. If option 2 is selected, the program will appear to proceed normally, but later the adventurer will come to a tragic end. Only if option 5 is chosen will PO$ = "PO". Giving the variable this value allows Honi Pott to come to Harry's rescue later in D7.

In D4 (Fig. 4 and program lines 710–780), the adventurer is given two chances to pick the right location in which to find clues. Then variable NU in line 720 exceeds two and the program branches to line 760. The player has wasted too much time looking in the wrong locations and fails the mission. In one cse, the selection of a visit to Honi's apartment, option 7, it is fairly obvious the player has the wrong objective on his mind and, therefore, is not given a second chance to pick another location to visit.

The flowchart in Fig. 5 shows the options available to the player at lines 790–860. Notice, in the lower right hand corner, that if the wrong decision was made back in D3, the program will branch down to this point skipping both D4 and D5. This is one of those transparent mistakes the player

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makes but does not find out about until later. The error was exploring the city without having Honi Pott along.

Figure 6 (lines 890–950) graphically shows that in D6 the player may either report his findings to U.E.C. or keep looking around. But if he wastes too much time before reporting, he fails the mission.

In lines 960–1010 the villain explains his plot. Our unfortunate hero is in no condition to do anything about it unless he comes out of D7 alive.

It is obvious from looking at Fig. 7 and lines 1020–1120, that decision D7 can be a most frustrating experience for the adventurer. A player can select all of the available choices and still not escape from his jettisoned hotel room. Only if PO$ = "PO" will the adventurer be rescued. That will not happen unless Harry Flynn made friends

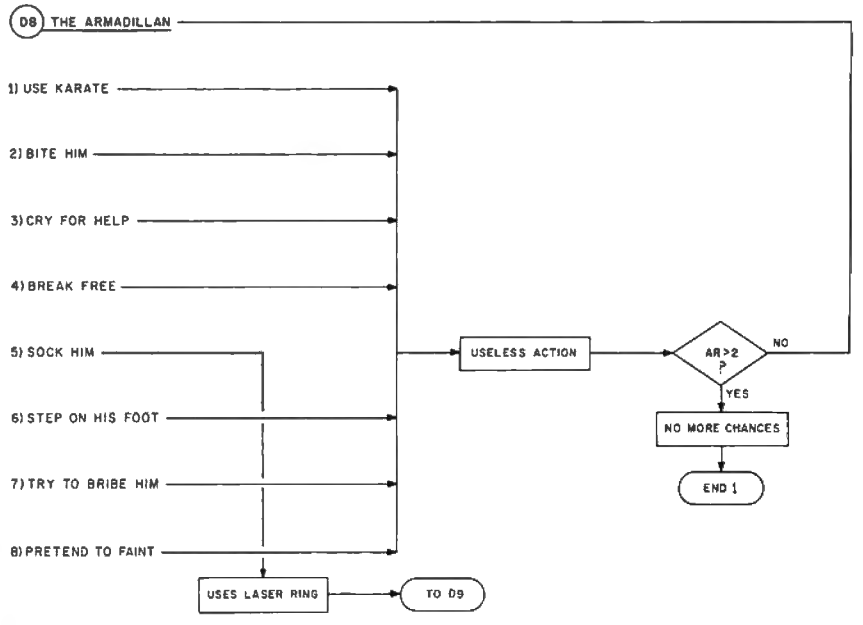

Fig. 8. D8—The Armadillan

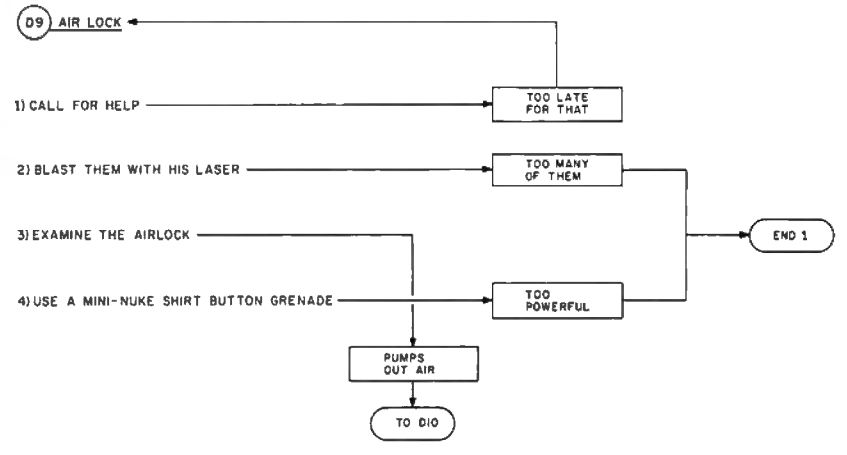

Fig. 9. D9—Air Lock

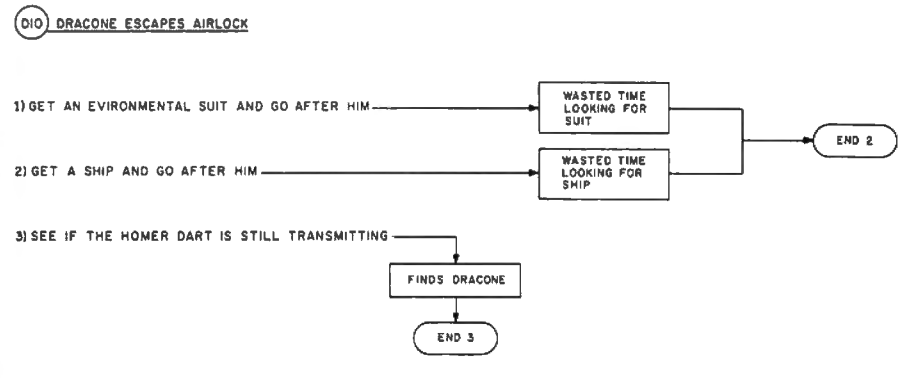

Fig. 10. D10—Dracone Escapes Airlock

with Honi Pott back in D3.

The adventurer may discover still another mistake he made earlier in the program at lines 1130–1150. If the homer dart was not fired when the opportunity was given, D$ will not equal "D" and the player will not be able to locate the villain in time to prevent the disaster.

Lines 1170–1230 and Fig. 8 again show the player with two chances to select the right action from a list of possibilities. The astute adventurer will remember Flynn's laser ring from the opening scene of the story.

In D9 the adventurer may call for help if he wants (lines 1250–1335). Although he is told he does not have time to get help, he is not penalized for seeking assistance. If, on the other hand, the adventurer is too bold and selects options 2 or 4, he perishes in a blaze of glory.

Lines 1350–1410 hold the last decision. D10 (Fig. 10) is relatively simple. At this point the narrative begins to take over as the excitement builds in the rush to the successful finale.

Lines 1420–1460 contain the narrative for ending three: the successful finish for "Mission Accomplished." Line 5000 is ending one: The adventurer dies. Line 5010–5020 is ending two: The adventurer lives, but he fails the mission.

Lines 5030–5070 give the adventurer an opportunity to try again. If he says yes, he goes to line 175. If he declines the opportunity, he is given a short scolding with the words "Now the forces of K.R.U.E.L. will triumph unopposed!"

A Word About Memory

It is easy to get carried away with fantastic illustrations when depicting the characters and surroundings in adventure games. The first time I wrote an adventure, I ran out of memory before I was three-quarters of the way through. So write colorfully, but conservatively.

As mentioned earlier, use subroutines wherever possible. Also note the absence of spaces. Your computer does not need spaces most of the time. They needlessly take up memory. Also, be careful about how many line numbers you use; each one takes up five bytes.

One last thing about memory usage—It changes. A program uses more memory as it is running: Additional memory is used during program operation by such things as setting a variable to a constant or allocating string space. Assignment 46 uses 68 more bytes of memory as it is being run. So leave yourself a little breathing room.

In Conclusion

I hope you enjoy this latest escapade of Harry Flynn and that this anatomy has been helpful to some budding adventurists. There is no substitute for experience, so start exploring the universe with your imagination and your computer. Then share your daring exploits with the rest of us. Good Luck! ■

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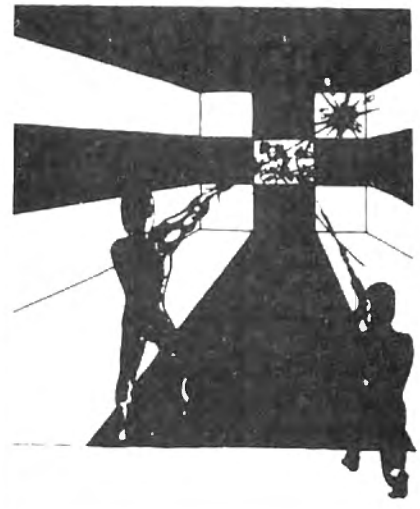

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The object of Spy Versus Spy is to be the last player on the field. Players are eliminated when one opponent scores a legal hit with a wet blast from a water pistol. Players are assigned adversaries to eliminate by the computer.

The games are played in a maze of colored marker boundaries. Each player is assigned a color and a starting position by the computer. A hit can only be made when a player's assignment is on the pursuer's color. Movement, determined by the roll of three computerized dice, is accomplished by one of two methods. Each player can receive a dice roll or everyone can move the amount of each roll.

In Rendezvous, players are divided into spy teams of two members each. Initially, team members are unknown to each other. After locating one another, they must set up a base of operation on their assigned color. The computer assigns the same mission to all teams: to collect the most maze markers from a list compiled by the computer.

Spy teams can set traps, perform enforced expropriations and cut off travel routes by capturing mission markers. If a team's base marker is captured they are eliminated from the game. Teams which have been cut off can build bridges and resume play. The game is over when only one team remains or all of the mission

Program Listing 1. The Games

```
                MEMORY REQUIRMENTS*
WORK SPACE REQUIRMENTS                      - APPROX. 1400 BYTES MAXIMUM
PROGRAM WITH REMARKS AND LPRINTS            - APPROX 16,100 BYTES
PROGRAM WITH NO LPRINTS BUT WITH REMARKS    - APPROX. 13,800 BYTES
PROGRAM WITH LPRINTS BUT NO REMARKS         - APPROX. 13,400 BYTES
PROGRAM WITH NEITHER REMARKS NOR LPRINTS    - APPROX. 11,500 BYTES

 * PROGRAM CONSISTS OF LISTING + WORK SPACE

10 REM                    SPY VERSES SPY
20 REM
30 REM            FROM THE WONDERFUL WACKY WORLD
40 REM                       OF
50 REM                   BARRY L ADAMS
60 REM                  109 VALLY PLACE
70 REM                GREENVILLE, NC 27834
80 REM
90 '
                          PROGRAM SETUP
100 '
110 CLS:CLEAR 700:DEFINT A-Z:RANDOM
120 GOSUB 2280
130 PRINT:INPUT"ENTER THE NUMBER OF PLAYERS";T:IF T>14 THEN 1840 ELSE PRINT:T1=T
/2
140 DIM A(T),AC(T),C(7),M(T*3),P(166),PN(T),SP(T),TM(14),TP(T),AC$(T),AN$(T),I$(
16),M$(T),N$(12),PN$(T),R$(T),S$(1),T$(2),TM$(T/2),TP$(T)
150 FOR X=1 TO 12:READ N$(X):NEXT
160 FOR X=1 TO 9:READ C$(X):NEXT
170 FOR X=1 TO 16:READ I$(X):NEXT
180 S$(1)=" ":S$(0)=" & "
190 T$(1)="TRAP":T$(2)="BRIDGE":T1$="RENDEZVOUS"
200 L1$=CHR$(27)+CHR$(14):L2$=STRING$(1,138)
210 CLS:PRINT@272,CHR$(23)"SPY VERSE SPY":PRINT
220 PRINT"PLEASE ENTER EACH PLAYER'S FIRST NAME":PRINT:PRINT"IN CASE OF SAME FIR
ST NAME":PRINT"ENTER FIRST LETTER OF THE LAST  NAME ALSO":PRINT
230 FOR X=1 TO T:PRINT@832,"ENTER PLAYER"CHR$(31)X"'S NAME";:INPUT PN$(X):PN(X)=
X:AN$(X)=N$(RND(12))+STR$(X):NEXT
240 '
                       MASTER PROGRAM MENU
250 '
260 GOSUB 2280:PRINT
270 PRINTTAB(4)"1  SPY CODE NUMBER ROSTER"
280 PRINTTAB(4)"2  PLAYER TURN SEQUENCE"
290 PRINTTAB(4)"3  SPY VERSES SPY"
300 PRINTTAB(4)"4  RENDEZVOUS"
310 GOSUB 2260:ON VAL(A$) GOTO 340,2400,380,1020
320 '
                     PLAYER CODE NUMBERS
330 '
340 CLS:PRINTTAB(16)"PLAYER CODE NUMBER ROSTER":FOR X=1 TO T:PRINT TAB(14)"NO."X
 TAB(34) PN$(X):NEXT X:GOSUB 2260:GOTO 260
350 '
************************************************************
360 '
                        SPY VERSE SPY
                         GAME  SETUP
370 '
************************************************************
380 GOSUB 2280:IF F=1 THEN 480
390 K=0:FOR X=1 TO T:A(X)=0:NEXT X
400 FOR X=1 TO 166:P(X)=0:NEXT
410 FOR X=1 TO T:PRINT@596,"WORKING"
420 AC$(X)=C$(RND(7))
430 A=RND(T):IF A<>X AND A(A)=0,M$(X)=PN$(A):A(A)=1:AC(X)=A:K=K+1 ELSE IF T-K=1
```

Listing 1 Continues

The Key Box

Model I or III
Basic Level II
32K RAM
Printer optional

markers have been captured. Then the team with the most markers is the winner.

TRS-80 In, Loonies Out

With the hot sun and all those water pistols it is better to leave the computer inside and keep the crazies and loonies out. The computer does play an integral part and it is necessary that the computer operator, who is the mission master, be able to see and easily converse with the players during play. At our home I move the computer to our screened-in back porch. Other possibilities include covered patios, tents and gazebos. Remember water is not your only enemy. The sun can be a problem as well, so choose a location that affords protection from both.

Setting Up

Both games can be played with up to fourteen players. You will need an equal number of water pistols. If water pistols don't appeal to you, try cans of whipped topping or shaving cream. Water balloons might seem a bit much, but on a muggy day they are just the thing.

Do not, of course, use anything that is harmful. Avoid dart guns regardless of how innocent they may appear, as well as anything else that shoots a projectile. Also, do not color the water with dyes or inks. While many colorings are safe to drink and eat, they may be dangerous in the eyes.

The field markers can be made from the black base of the two-liter plastic soft drink bottles. The bases can be removed by first removing the cap and then pinching the bottom of the thinner plastic. Grip the base and pull the two pieces apart. (In addition to game markers the bases also make excellent rooting pots for flowers.)

Ten marker colors are needed. The colors used are up to you. (I use blue, green, red, yellow, silver, white, light blue, light green, orange and black.) Household spray enamel works fine—the paint scratches but that is not a problem.

Three colors represent special purposes. In my color scheme orange colored markers are *turn* markers, light green markers represent *safe zones* and black markers are *bridges*.

With the exception of the special purpose markers, 21 markers of each color are required. Seven *turn* markers and nine *safe zone* markers are needed. The number you need for the other special purpose marker, the *bridge* marker, is not fixed. I recommend 10-20 of these. All markers, except the bridge markers, are given a number between 1 and 166. Assign the numbers randomly. (Be sure that no two markers receive the same number.) Write the numbers on the top with magic markers.

You might be wondering how to come up with 166 two-liter soft drink bottles. Buying them would be expensive, not to mention the strain on the kidneys.

I visited dumpsters at the apartment complexes. Of course there are drawbacks. My wife accompanied me only once. She

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↙See List of Advertisers on page 338

Listing 1 continued

```
THEN 390 ELSE 430
440 A=RND(166):IF P(A)=0,SP(X)=A:P(A)=1 ELSE 440
450 NEXT:F=1:K=0:GOSUB 2320
460 '
                        SPY VERSE SPY
                            MENU
470 '
480 GOSUB 2280:PRINT
490 PRINT"1.  INITIAL MISSION ORDERS"
500 PRINT"2.  MISSION UPDATES"
510 PRINT"3.  MISSION ASSIGNMENT SUMMARY
520 PRINT"4   MISSION RECORD SUMMARY"
530 PRINT"5.  MAIN MENU"
540 PRINT"6.  DICE"
550 PRINT"7.  HIT/SCORE TABLE"
560 GOSUB 2260:IF B<6 THEN ON B GOTO 570,700,880,950,260 ELSE ON B-5 GOSUB 1080,
1960:GOTO 480
570 CLS:PRINT@460,"TOP SECRET MESSAGES FOR SPY VERSE SPY"
580 GOSUB 2250:IF B=1 THEN 2510
590 '
                INITIAL MISSION MESSAGES
600 '
610 X=0:INPUT"ENTER AGENT'S CODE NUMBER";X:IF X>T PRINT"MISTAKE":PRINT:GOTO 610
ELSE IF X=0 THEN 480
620 CLS:PRINT@214,"SECRET MISSION":PRINT
630 PRINT"AGENT "PN$(X)
640 PRINT"CODE NUMBER"PN(X):PRINT"CODE NAME "AN$(X)
650 PRINT"YOU HAVE BEEN ASSIGNED COLOR  "AC$(X)
660 PRINT"YOUR STARTING POINT IS MARKER NUMBER"SP(X)
670 PRINT"YOUR INITIAL MISSION IS TO ELIMINATE  "M$(X):PRINT I$(RND(16)):PRINT:G
OSUB 2270:CLS:GOTO 610
680 '
                        MISSION UPDATE
690 '
700 X=0:CLS:INPUT"ENTER YOUR CODE NUMBER";X:PRINT:IF A(X)=0,PRINT"MISTAKEN INPUT
 "PN$(X)" HAS BEEN ELIMINATED":GOSUB 2270:GOTO 700
710 PRINT"AGENT ";AN$(X):PRINT"HAVE YOU COMPLETED YOUR MISSION AND ELIMINATED "M
$(X):PRINT"FROM THE GAME ?":PRINT" ( Y OR N )":GOSUB 2260
720 IF A$="N" CLS:PRINT@448,"WELL GET OUT THERE AND GET WITH IT AGENT ";AN$(X).
 YOU ARE WASTING TIME":GOSUB 2260:GOTO 480
730 PRINT:PRINT"AN EXCELLENT REPORT AGENT ";AN$(X)".":PRINT"YOUR NEXT MISSION I
S AS FOLLOWS:"
740 A(AC(X))=0:K=K+1
750 IF K+1=T,CLS:PRINT@448,PN$(X);" , "AN$(X):PRINT:PRINT"YOU ARE THE WINNER !":
GOSUB 2260:GOTO 480
760 AC$(X)=C$(RND(7))
770 R=RND(T):IF R<>X AND A(R)<>0,M$(X)=PN$(R) ELSE 760
780 GOSUB2250:IF B=1 THEN 2600
790 PRINT TAB(12)"TOP SECRET MESSAGE"
800 PRINT"AGENT "PN$(X)
810 PRINT"CODE NUMBER"PN(X):PRINT"CODE NAME "AN$(X)
820 PRINT"YOU HAVE BEEN REASSIGNED COLOR  "AC$(X)
830 PRINT"YOUR NEXT MISSION IS TO ELIMINATE  "M$(X):PRINT I$(RND(16)):GOSUB 2270
:CLS
840 FOR Z=1 TO T:IF Z<>X AND AC(Z)=AC(X),AC(Z)=X:M$(Z)=PN$(X)
850 NEXT:R$(X)=R$(X)+PN$(AC(X))+" , ":AC(X)=PN(R):GOTO 480
860 '
                    ASSIGNMENT SUMMARY
870 '
880 GOSUB 2240:IF B=1 THEN 2950
890 CLS:PRINTTAB(21)"ASSIGNMENT SUMMARY":PRINT
900 PRINT"PLAYER       STARTING PT.       COLOR              ASSIGNMENT"
910 FOR X=1 TO T:IF A(X)<>0,PRINTPN$(X)TAB(15)SP(X)TAB(30)AC$(X)TAB(50)M$(X)
920 NEXT:GOSUB 2260:GOTO 480
930 '
                        MISSION RECORD
940 '
950 CLS:PRINTTAB(18)"GAME ASSIGNMENT RECORD"
960 GOSUB 2250:IF B=1 THEN 3000
970 CLS:Z=0:PRINTTAB(18)"GAME ASSIGNMENT RECORD":PRINT:PRINT"PLAYER"TAB(50)"RECO
RD":FOR X=1 TO T:PRINT PN$(X)TAB(22)R$(X):Z=Z+1:IF Z=10,Z=0
980 NEXT X:GOSUB 2260:GOTO 480
990 '
**********************************************************************
1000 '
                         RENDEZVOUS
                         GAME SETUP
1010 '
**********************************************************************
1020 Z=0:IF K=1 THEN 1210 ELSE CLS:PRINT@468,CHR$(23);
1030 FOR X=1 TO T:A(X)=0:NEXT X
1040 FOR X=1 TO T1
1050 C=RND(7):IF C(C)=1 THEN 1050 ELSE C(C)=1
1060 FOR K=1 TO 0 STEP -1
1070 A=RND(T):IF A(A)=0,A(A)=1 ELSE 1070
1080 TM$(X)=PN$(A)+S$(K)+TM$(X):TM=(X*2)-K:TM(A)=X:PRINT MID$(T1$,TM,1);
1090 AC$(A)=C$(C):AC(X)=C
1100 FOR Y=1 TO T:SP(Y)=RND(166):Z=0
1110 Z=Z+1:IF Z=Y THEN 1120 ELSE IF SP(Y)=SP(Z),Y=Y-1 ELSE IF Z=T THEN 1120 ELSE
 1110
1120 NEXT Y,K,X:PRINT@468,T1$
1130 K=1
1140 M1=T1*3
1150 FOR X=1 TO M1:M(X)=RND(166):C(X/3)=-1:P(X)=0:Z=0
1160 Z=Z+1:IF Z=X THEN 1170 ELSE IF M(X)=M(Z),X=X-1 ELSE 1160
1170 NEXT X
1180 GOSUB 2320
1190 '
                         RENDEZVOUS
                            MENU
1200 '
1210 CLS:PRINTCHR$(23)TAB(10)"RENDEZVOUS":PRINT:PRINT
1220 PRINTTAB(2)"1  MISSION MARKER ASSIGNMENTS"
1230 PRINTTAB(2)"2  PLAYER ASSIGNMENTS"
1240 PRINTTAB(2)"3  SPY TEAM ASSIGNMENTS"
```

Listing 1 continues

didn't like watching her frumpy husband digging in heaps of garbage. Other drawbacks include cats and insects—still it's better than drinking over 332 liters of soft drinks. I collected all I needed in just two weekends.

Arrange the markers a uniform distance apart. Distances of two to four feet work best. The play field's pattern is illustrated in Fig. 1. Other patterns will work, possibly even better. The play field should provide a number of different routes. A dead end with a single *turn* marker located at the terminus would certainly cause a stir. Evenly distribute the color groups around the field. The number of special purpose markers is up to you, but the game appears to be more enjoyable when the total number of *turn* and *safe zone* markers make up no more than about 10 percent of the total number of markers.

To lay out the field use a string with premeasured markings. Using the string two people can set up the field fairly quickly.

The Program

The program includes a printer option allowing players to have a printout of their missions. This is particularly important in Rendezvous where a large number of specific field markers must be collected by the spy teams. If a printer is not available players can record pertinent information by hand.

Although the Key Box indicates you need 32K RAM, there are ways around this limitation. The program was written with a luxurious number of REM statements to aid understanding and debugging. The Remark statements can be deleted without disturbing program continuity. None of the GOTO and GOSUB statements reference a REM statement. You can also easily delete the print option. All LPRINT subroutines have been lumped into one big block. The branching statements, within the main program loop, are contained in isolated lines which can be easily removed. Table 1 lists the program lines to delete if you have no printer. Now the program requires approximately 14K of memory. With the printer and REM statements removed the program requires only about 12K. With the printer option intact and only the REM statements removed the program requires approximately 13K of memory.

Program Listing 2 generates a printout of the field pattern used in Fig. 2. The program is capable of printing the play field by marker color or number. While it is a standalone program it can easily be appended to the game program with slight modifications. Because the first line number begins at 4000, just include the program and add branching statements to the game menus.

The field of play pattern generator is also useful as a map for use during the game. If you do not have a printer photocopy Fig. 1.

The game program is divided into six blocks. The first block consists of the general purpose operations: defining, di-

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The Color Computer is an incredibly powerful and versatile computer, but for text editing it has some major drawbacks. The small 32 character by 16 line screen format shows you too little of the text and, combined with its lack of lower case letters, bears little resemblance to the way text really looks on the page. Reverse video in place of lower case just adds confusion.

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. . . one of the best programs for the Color Computer I have seen . . .
— Color Computer News, Jan. 1982

You can copy, move or delete any size block of text, search repeatedly for any pattern of characters, then instantly delete it or replace it with another. Telewriter gives you a tab key, tells you how much space you have left in memory, and warns you when the buffer is full.

FORMAT FEATURES

When it comes time to print out the finished manuscript, Telewriter lets you specify: left, right, top, and bottom margins; line spacing and lines per page. These parameters can be set before printing or they can be dynamically modified during printing with simple format codes in the text.

. . . truly a state of the art word processor . . . outstanding in every respect.
— The RAINBOW, Jan. 1982

Telewriter will automatically number pages (if you want) and automatically center lines. It can chain print any number of text files from cassette or disk without user intervention. You can tell it to start a new page anywhere in the text, pause at the bottom of the page, and set the Baud rate to any value (so you can run your printer at top speed).

You can print all or any part of the text buffer, abort the printing at any point, and there is a "Typewriter" feature which allows you to type straight to your printer. Because Telewriter lets you output numeric control codes directly (either from the menu or during printing), it works with **any** printer. There's even a special driver for the Epson MX-80 that lets you simply select any of its 12 fonts and do underlining with a single underline character.

CASSETTE AND DISK I/O

Because Telewriter makes using cassette almost painless, you can still have a powerful word processor without the major additional cost of a disk. The advanced cassette handler will search in the forward direction till it finds the first valid file, so there's no need to keep retyping a load command when you are lost in your tape. The Verify command checks your cassette saves to make sure they're good. You can save all or any part of the text buffer to disk or cassette and you can append pre-existing files from either medium to what you have in the buffer already.

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```
G  G  LG T  LB                LG Y  Y  Y  Y  Y  Y  T  W  W  W  W  B
G     S     S                 G     LG       B     G                B
G     S     Y  LB LB LB LB LB G     R        B     G                G
G     S     Y                 G     R        B     G  B  B  B  LG G
R     S     Y  B  B  B  B  B  W     R        B     G                W
R     S     G                 W     R        B     G  Y  Y  Y  Y  Y
R     S     B                 W     T        B     G                S
W  Y  Y  G  LG LB LB LB LB LB LB LG S  S  S  R  R  R  R  R  R  T  S
W        G                 R                                     LG
T        G                 R                                     Y
B        G                 R  W  W  W  W  W  T  LB LB S  S  S  S  S  R
B        R                 R                                     LB
B        R                 R                                     LB
B  LB LB LB LB LG T  S  S  S  S  Y  Y  Y  Y  W  W  W  W  W  W  LG LB
```

KEY

B - BLUE
G - GREEN
LB - LIGHT BLUE
LG - LIGHT GREEN (SAFE ZONE MARKER)
R - RED
S - SILVER
W - WHITE
O - ORANGE (TURN MARKER)

THE BLACK MARKERS ARE BRIDGE MARKERS

Fig. 1. The Playing Field

Listing 1 continued

```
1250 PRINTTAB(2)"4  TRAPS & BRIDGES"
1260 PRINTTAB(2)"5  SPRING TRAP"
1270 PRINTTAB(2)"6  MAIN MENU"
1280 PRINTTAB(2)"7  DICE"
1290 PRINTTAB(2)"8  HIT/SCORE TABLE"
1300 GOSUB 2260:IF B<7 THEN ON B GOTO 1330,1410,1540,1640,1640,260 ELSE ON B-6 G
OSUB 1880,1960:GOTO 1210
1310 '
                MISSION MARKER ASSIGNMENTS
1320 '
1330 CLS:PRINT@470,"MISSION MARKERS"
1340 GOSUB2250:IF B=1 THEN 2670
1350 CLS:PRINT TAB(18)T1$;" MISSION MARKER
"TAB(24)"ASSIGNMENTS"
1360 PRINT
1370 FOR X=1 TO M1:PRINT, X"."TAB(40)M(X):NEXT X
1380 GOSUB 2260:GOTO 1210
1390 '
                  RENDEZVOUS ASSIGNMENTS
1400 '
1410 CLS:PRINTTAB(20)"RENDEZVOUS ASSIGNMENTS":PRINT
1420 GOSUB 2250:IF B=1 THEN 2730
1430 X=0:INPUT"ENTER AGENT'S CODE NUMBER";X:IF X>T PRINT"MISTAKE":PRINT:GOTO 143
0 ELSE IF X=0 THEN 1210 ELSE CLS
1440 PRINT TAB(12)"TOP SECRET MESSAGE"
1450 PRINT"AGENT  "AN$(X)"  ( "PN$(X)" )"
1460 PRINT"YOU HAVE BEEN ASSIGNED THE CONTACT COLOR - "AC$(X)
1470 PRINT"YOU ARE ASSIGNDED TO SPY TEAM";TM(X)
1480 PRINT"YOUR STARTING POINT IS MARKER NUMBER "SP(X)
1490 PRINT"FOLLOWING IS A LIST OF THE MARKERS THAT MUST BE COLLECTED.TO WINYOU A
ND YOUR CONTACT MUST COLLECT THE MOST MARKERS . ";
1500 PRINT"REMEMBER - YOU MUST FIRST MAKE CONTACT, DESIGNATE YOUR HOME MARKER AN
D     ESTABLISH YOUR TRAP BEFORE YOU CAN BEGIN YOUR MISSION":PRINT"GOOD LUCK !"
1510 FOR Y=1 TO M1:PRINT M(Y),:NEXT Y:GOSUB 2260:CLS:GOTO 1430
1520 '
                    SPY TEAM ROSTER
1530 '
1540 CLS:PRINTTAB(20)"SPY TEAM ROSTER":PRINT
1550 GOSUB 2250:IF B=1 THEN 2870
1560 CLS:PRINTTAB(20)"SPY TEAM ROSTER":PRINT
1570 PRINT"TEAM NO."TAB(17)"MEMBERS"TAB(45)"COLOR GROUP"
1580 FOR X=1 TO T1
1590 PRINTX","TAB(17)TM$(X)TAB(45)C$(AC(X))
1600 NEXT X
1610 GOSUB 2270:GOTO 1210
1620 '
                      TRAPS & BRIDGES
1630 '
```

Listing 1 continues

mensioning and initializing most of the variables. The number of players and their names are entered here. This section also includes the program's master menu. It provides access to the two games, player identification codes and gives the order of players' moves.

The primary menus of both games include a return to the master menu option.

The second and third blocks contain the two games, Spy Versus Spy and Rendezvous, respectively. The fourth block contains miscellaneous operations: dice rolls, hit probability routine and a sort utility used to determine the order of player turns. The fifth block is the printer option and the sixth contains all data statements. Each of the six blocks, as well as all of the subroutines, are introduced by an identifying REM statement, making it easy to follow the flow of the program.

The listing contains 30 integer variables which include nine arrays. In addition, there are 16 string variables, of which 11 are arrays. That is where all the memory went. Arrays are neat and easy to use, but they do eat up memory.

Computer Command Center

The computer's role is that of controller and records keeper. It assigns the missions with updates as changes occur and maintains a complete record. It also rolls the dice, keeps track of how many times someone rolled triples and tells everyone who goes first.

The game menu commands are self-explanatory. In Spy Versus Spy, the game menu consists of seven commands. The initial Mission command should only be used at the beginning of the game. The Mission Update command is used during play. In each of these cases the information is specific to a particular player and should not be seen by the other players. There is also a hit/probability option used to determine whether a legal squirt from a water pistol is a hit or a miss. The remaining two menu commands access the record keeping utilities; current player assignments; and a record of the game's progress so far. The assignment summary should be used by the mission master to keep tabs on the game. The game record is most useful after the game is over.

The game menu for Rendezvous consists of eight commands. These are the general purpose commands: dice rolls, return to the main menu and hit/probability. In addition, the command Player Assignments performs essentially the same function as the Initial Mission command in Spy Versus Spy. The command Spy Team Assignments should only be used by the mission master. The Mission Marker command calls the list of field markers which must be collected during the current game. The two remaining commands deal with traps and bridges and are explained in the rules.

Spy Versus Spy Rules

- Each spy is assigned the name of another spy by the computer. His mission is to

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LEAVE WORD "AS IS":	HIT <ENTER> KEY
DISPLAY WORD IN CONTEXT:	?
DISPLAY DICTIONARY:	@
ADD WORD TO DICTIONARY:	+
EXIT:	!

WORD: (Your error)
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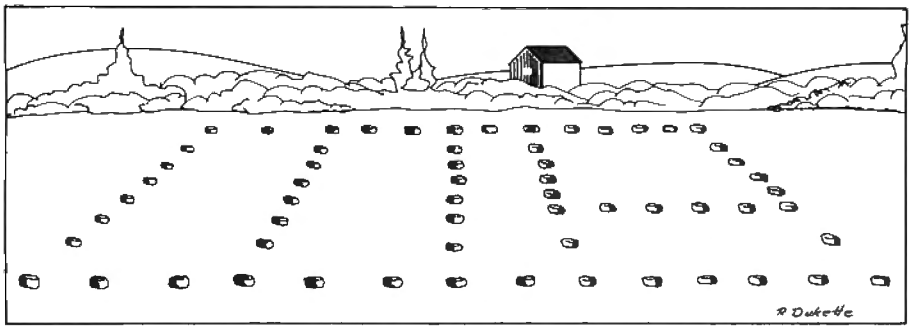

Listing 1 continued

```
1640 CLS:IF B=4 PRINTTAB(20)"TRAPS & BRIDGES" ELSE PRINT@470,"TRAP !!!!!! ?"
1650 GOSUB 1760:IF B=5 GOSUB 1790:GOTO 1740
1660 IF C(Z)=-1 GOSUB 1790:GOSUB 1770:IF TP=0 THEN 1660 ELSE C(Z)=0:GOTO 1800
1670 IF C(Z)=0 INPUT"DO YOU WISH TO BUILD A TRAP (1) OR A BRIDGE (2)";C(Z)
1680 IF C(Z)=1 AND P(Z)>0 PRINT"TEAM"Z"ALREADY HAS A TRAP AT MARKER"P(Z):C(Z)=0:
GOTO 1800
1690 GOSUB 1930:A(Z)=A(Z)+D1+D2+D3
1700 IF A(Z)=>25+(C(Z)-1)*10 THEN ON C(Z) GOTO 1720,1730
1710 PRINT T$(C(Z))" CONSTRUCTION IN PROGRESS":PRINT"THE TEAM NOW HAS A CREDIT O
F"A(Z):GOTO 1800
1720 GOSUB 1790:GOSUB 1770:IF TP=0 THEN 1720 ELSE 1800
1730 PRINT"BRIDGE COMPLETED BY TEAM"Z:A(Z)=0:C(Z)=0:GOTO 1800
1740 IF P(Z)=TP THEN P(Z)=0:PRINT:PRINT TAB(24)"TRAP SPRUNG !!!":GOTO 1800
1750 PRINT:PRINT"SORRY ! TEAM"Z"'S TRAP IS MARKER"P(Z):GOTO 1800
1760 PRINT:INPUT"ENTER SPY TEAM NUMBER";Z:RETURN
1770 PRINT"TRAP MARKER"TP;:FOR Y=1 TO T1:IF P(Y)=TP PRINT"NOT ";:TP=0
1780 NEXT Y:PRINT"CONFIRMED FOR TEAM"Z:P(Z)=TP:A(Z)=0:RETURN
1790 INPUT"ENTER THE NUMBER OF THE MARKER";TP:RETURN
1800 GOSUB 2270:GOTO 1210
1810 '
**********************************************************************
1820 '
                        MISCELLANEOUS
1830 '
**********************************************************************
1840 CLS:PRINT@448,"THE TOTAL NUMBER OF PLAYERS EXCEEDS THE PLAYING FIELD CAPABI
LITY":PRINTTAB(12)"THE TOTAL MUST BE REDUCED BY"T-14" SORRY"
1850 GOSUB 2270:GOTO 1210
1860 '
                           DICE
1870 '
1880 CLS:D4=0:PRINTCHR$(23)TAB(12)"DICE":PRINT
1890 GOSUB 1930
1900 PRINTTAB(6)"THE DIE VALUES ARE":PRINTTAB(8)D1"   "D2"   "D3:PRINT:PRINTTAB(
8)"A TOTAL OF "D1+D2+D3:IF D1=D2 AND D2=D3,D4=1:PRINT"YOU HAVE ROLLED TRIPLES RO
LL    AGAIN AFTER PLAYER HAS MOVED":PRINT
1910 GOSUB 2260
1920 IF D4=1 THEN 1880 ELSE RETURN
1930 FOR X=1 TO RND(T*T):D1=RND(7)-1:D2=RND(7)-1:D3=RND(7)-1:NEXT:RETURN
1940 '
                  SCORE PROBABILITY TABLE
1950 '
1960 CLS:PRINT@460,CHR$(23)"SCORE PROBABILITY TABLE":PRINT
1970 PRINTTAB(2)"(1)  SCORE PROBABILITY"
1980 PRINTTAB(2)"(2)  SCORE PROBABILITY TABLE"
1990 GOSUB 2260
2000 CLS:PRINTTAB(20)"SCORE PROBABILITY TABLE":PRINT
2010 PRINTTAB(10)"RANGE"TAB(35)"PROBABILITY OF SCORING A HIT"
2020 PRINTTAB(12)"1"TAB(45)"100 %  ( 1 - 10)"
2030 PRINT"GREATER THAN 1 BUT LESS THAN 6"TAB(46)"70 %  ( 1 - 7 )"
2040 PRINT"GREATER THAN 5 BUT LESS THAN 8"TAB(46)"50 %  ( 1 - 5 )"
2050 PRINT"GREATER THAN 7 BUT LESS THAN 11"TAB(46)"30 %  ( 1 - 3 )"
2060 PRINT"GREATER THAN 10 BUT LESS THAN 16"TAB(46)"20 %  ( 1 - 2 )"
2070 PRINT"GREATER THAN 15"TAB(46)"10 %  ( 1 - 1 )"
2080 IF B=2 GOSUB 2270:RETURN
2090 '
                      PROBABILITY
2100 '
2110 PRINT
2120 INPUT"ENTER THE SHORTEST COUNTABLE RANGE";R
2130 X=RND(10)
2140 PRINT@904,"THE COMPUTER HAS DETERMINED A RANDOM FACTOR OF":PRINTTAB(24)X" F
OR YOU";
2150 IF R=1 THEN 2220
2160 IF R<=5 AND X<=7 THEN 2220
2170 IF R>5 AND R<=7 AND X<=5 THEN 2220
2180 IF R>7 AND R<=10 AND X<=3 THEN 2220
2190 IF R>10 AND R=<15 AND X<=2 THEN 2220
2200 IF R>15 AND X=1 THEN 2220
2210 FOR Y=1 TO 10:PRINT@790,"SORRY, IT'S A MISS !":FOR X=1 TO 50:NEXTX:GOTO 223
0
2220 FOR Y=1 TO 10:PRINT@790," IT'S A HIT !":FOR X=1 TO 50:NEXT X
2230 PRINT@790,CHR$(30);:FOR X=1 TO 50:NEXT X,Y:RETURN
2240 PRINT:PRINT "HARD COPY (1) OR CRT READOUT (2)":GOTO 2260
2250 PRINT:PRINT TAB(14)"HARD COPY (1) OR CRT READOUT (2)"
2260 A$=INKEY$:IF A$="" THEN 2260 ELSE B=VAL(A$):RETURN
2270 PRINTTAB(18)"PRESS ENTER TO CONTINUE":GOTO 2260
2280 CLS:PRINT@398,CHR$(23)"SPY VERSES SPY"
2290 RETURN
2300 '
                  PLAYER TURN SEQUENCE SORT
2310 '
2320 FOR X=1 TO T
2330 TP(X)=SP(X):TP$(X)=PN$(X)
```

Listing 1 continues

eliminate his opponent by scoring a hit with a water pistol. The computer randomly assigns each player an initial starting point and a home color. Duplication may occur only in the case of color.

- Play begins with each player taking position by the marker with the number assigned.
- The player with the lowest number assignment goes first, the second lowest number next and so on. The computer will declare the order of player turns.
- The dice are rolled and the player moves the *total* number of markers indicated. A player may not reverse direction unless he makes a legal turn (and doubles back) or encounters an orange turn marker. If a player's roll carries him past a turn marker it is the player's option to turn or not to turn. However, if a player completes his turn on a turn marker he must turn on his next move. In games involving a large number of players you can avoid long delays by allowing all players to move at once to the same roll of the dice.
- The light green markers are safe zone markers. A player cannot be attacked while on a safe zone marker.
- Players eliminate other players by scoring a hit using the water pistol (a good squirt anywhere below the head will do). A legal hit eliminates a player from the game. Legal hits are those hits which are made when the target spy is on the attacking spy's color. The attacking spy does *not* have to be on his own color.
- Legal hits made from an adjacent marker always result in the elimination of the target spy. Hits made from a range other than adjacent must be referred to the score probability table. The range used to enter the probability table is equal to the shortest countable distance (continuous markers) between two spies. There may be cases where the straight line distance between the players may be much shorter than the countable distance. The maximum range is dictated by the water pistol, wind and, of course, player's aim. Regardless of position the attacker must first hit the target spy with a wet blast from his water pistol before the attack is considered a hit.
- When a player successfully eliminates another spy from the game he is issued a new assignment and a new color. Because of this feature it is possible for one player to have more than one pursuer. When a player's assigned spy is eliminated by another player the attacker spy now becomes the second pursuer's assignment. If there are more than two players remaining in the game the attacker spy is assigned a new target spy by the computer (all reassignments are made by the computer). When there are only two players remaining in the game they are each other's target.
- The computer simulates rolling three six-sided dice (zero to five digits). The values of the dice are summed. The totals can range from zero to 15. A player must move the total amount indicated by the dice. If the values of all three dice are

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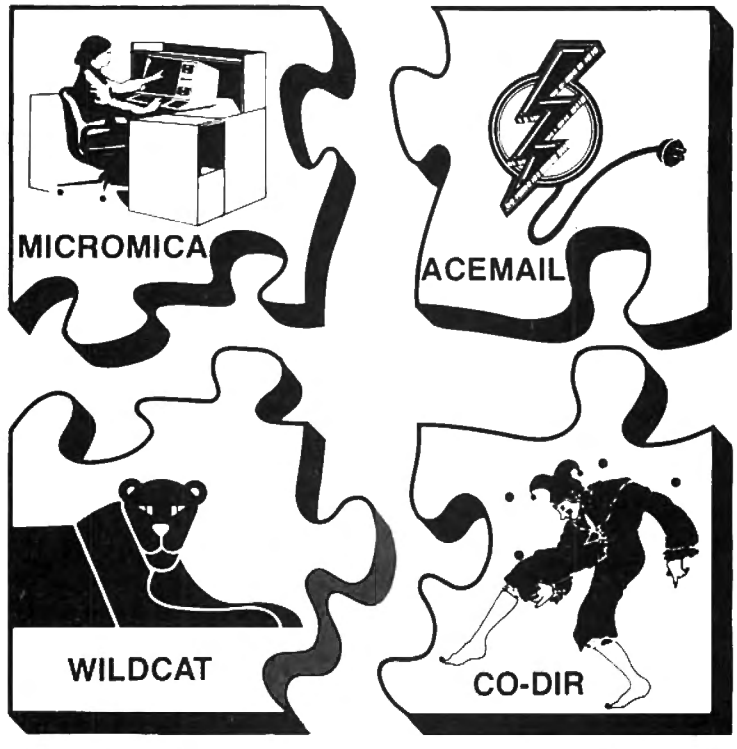

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Listing 1 continued

```
2340 NEXT X
2350 FOR I=1 TO T-1
2360 FOR J=I+1 TO T
2370 IF TP(I)<=TP(J) THEN 2390 ELSE PS=TP(I):TP(I)=TP(J)
2380 TP(J)=PS:P$=TP$(I):TP$(I)=TP$(J):TP$(J)=P$
2390 NEXT J,I:RETURN
2400 CLS:PRINT@470,"PLAYER TURN SEQUENCE":PRINT
2410 GOSUB 2250:IF B=1 THEN 3040
2420 CLS:PRINTTAB(20)"PLAYER TURN SEQUENCE":PRINT
2430 PRINT"TURN #","PLAYER",,"MARKER #"
2440 FOR X=1 TO T
2450 PRINTX,",TP$(X),,TP(X)
2460 NEXT X
2470 GOSUB 2260:GOTO 260
2480 '
                ****************************
                *       PRINTER BLOCK      *
                ****************************
2490 '
                        SPY VERSE SPY ROSTER
2500 '
2510 CLS:PRINT@460,"TOP SECRET MESSAGES FOR SPY VERSE SPY":FOR X=1 TO T:LPRINT L
1$TAB(12)"TOP SECRET MESSAGE"L2$
2520 LPRINT"AGENT "PN$(X)
2530 LPRINT"CODE NUMBER"PN(X):LPRINT"CODE NAME "AN$(X)
2540 LPRINT"YOU HAVE BEEN ASSIGNED COLOR  "AC$(X)
2550 LPRINT"YOUR STARTING POINT IS MARKER NUMBER"SP(X)
2560 LPRINT"YOUR INITIAL MISSION IS TO ELIMINATE  "M$(X):LPRINT I$(RND(16))STRIN
G$(5,138)
2570 NEXT:I=1:GOTO 480
2580 '
                    SPY VERSE SPY UPDATE
2590 '
2600 LPRINT L1$TAB(12)"TOP SECRET MESSAGE"L2$
2610 LPRINT"AGENT "PN$(X)
2620 LPRINT"CODE NUMBER"PN(X):LPRINT"CODE NAME "AN$(X)
2630 LPRINT"YOU HAVE BEEN REASSIGNED COLOR  "AC$(X)
2640 LPRINT"YOUR NEXT MISSION IS TO ELIMINATE  "M$(X):LPRINT I$(RND(16))STRING$(
5,138):GOTO 840
2650 '
          RENDEZVOUS MISSION MARKER ASSIGNMENTS
2660 '
2670 LPRINT L1$TAB(8)"RENDEZVOUS MISSION MARKER
"L1$TAB(14)"ASSIGNMENTS"
2680 LPRINT STRING$(3,138)
2690 FOR X=1 TO M1:LPRINT TAB(38)M(X):NEXT X
2700 GOTO 1210
```

Listing 1 continues

equal (a triple) the player receives another roll that turn.

- Players may only wage attacks against other players after they have moved the full distance required by the dice roll. If a player rolls die values of two, four, and four, he must move a total of 10 markers. He may only wage an attack after he has reached the tenth marker. If he is not going to attempt an attack he indicates *pass* and the turn passes to the next player. He may only wage an attack if the target spy is on the attacker's assigned color. In the case of a triple the full total of all dice rolls must be expended before an attack can be made.
- Players cannot move past other players. If a player finds his route completely blocked he must pass his turn to the next player. Players may not occupy the same marker at any time.

Rendezvous Rules

- As in Spy Versus Spy, each player is assigned a color and a starting position marker number. The order of player turns is also the same. The turn order changes somewhat as the game progresses and spy teams form. Teams that have formed roll the dice at the same time and combine their rolls for a single total. Since there are seven colors there can be a total of seven spy teams. Each team member is assigned the same base color.
- Each player's first objective is to find his teammates and form a spy team. A Spy

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Team is formed when the two players who have been assigned the same color occupy a marker of that color at the same time. The marker at which the team members successfully contact each other is now their spy team's base of operations. A black marker should be placed beneath the field marker to designate it as the base of operations, making it easily distinguishable from other markers. The basic strategy for locating team members is simple—each player should attempt to stay on or near markers of his assigned color. By doing so players can quickly get an idea of who has what color.

● As soon as a spy team has been formed the players no longer operate as individuals, but as a team. The newly formed

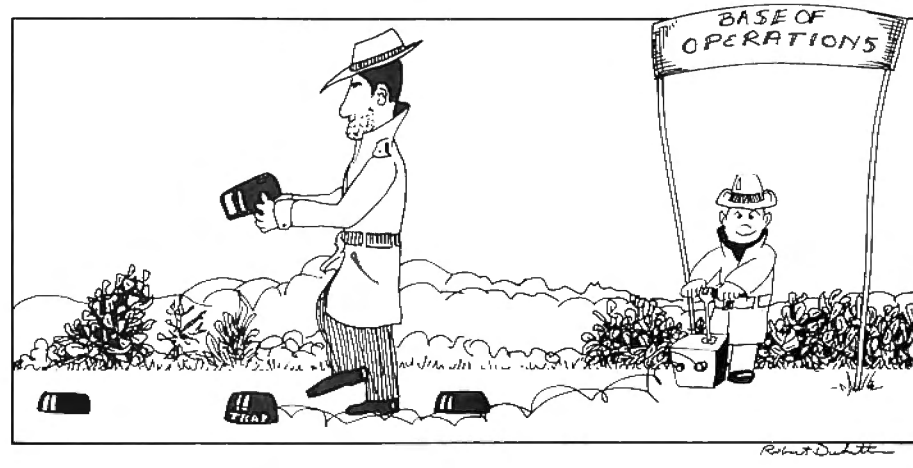
"Each player should attempt to stay on or near markers of his assigned color."

team may not move on the next turn of the team member who was stationary at the time the contact was made. Instead of moving the team may designate the location of the team's *trap* to the mission master (see rule 4). From that point on, the turn of the team member on whose turn contact was originally made becomes the turn of the spy team. Both players receive dice rolls, which are summed. The players may split the total between them in any manner. One member may move the distance equal to the total while the second member moves none, or they could divide the total equally. The full distance indicated by the sum of dice rolls of both players must always be taken, except as noted in the fifth rule.

● Each team may secretly designate to the mission master one marker of their assigned color group as a trap. Any opposing team member who passes over a properly designated trap can loose any markers he has with him at the time. It is the option of the team operating the trap whether to spring their trap. They can let a player pass and say nothing. But if they want to snare his markers they can by declaring "trap!" The trap must then be verified. The team must announce the number of the marker for confirmation by the mission master. If the trap is confirmed by using the Spring Trap command the trapped player must turn over all his markers to the trapping team. If the trap is not confirmed the players continue without change.

● After having sprung a trap a team can lay a new trap or reestablish an old one by not moving any of the distance indicated by the sum of the dice rolls. Instead, the team

```
2710 '
                RENDEZVOUS ASSIGNMENTS
2720 '
2730 FOR X=1 TO T
2740 LPRINT L1$TAB(12)"TOP SECRET MESSAGE"L2$
2750 LPRINT"AGENT  "AN$(X)"  ( "PN$(X)" )"
2760 LPRINT" "
2770 LPRINT"  YOU HAVE BEEN ASSIGNED THE CONTACT COLOR - "AC$(X)
2780 LPRINT"YOU ARE ASSIGNDED TO SPY TEAM";TM(X)
2790 LPRINT"YOUR STARTING POINT IS MARKER NUMBER "SP(X)
2800 LPRINT"THE FOLLOWING IS A LIST OF THE MISSION MARKERS THAT ARE TO BE COLLEC
TED":LPRINT"IN ORDER TO WIN YOU AND YOUR CONTACT MUST COLLECT THE MOST MARKERS .
"
2810 LPRINT"REMEMBER - YOU MUST FIRST MAKE CONTACT, DESIGNATE YOUR HOME MARKER A
ND ESTABLISHYOUR TRAP BEFORE YOU CAN BEGIN YOUR MISSION."L2$
2820 LPRINTTAB(30)"- GOOD LUCK -"L2$L2$
2830 FOR Y=1 TO M1 STEP 3:LPRINT,M(Y),M(Y+1),M(Y+2):NEXT Y:LPRINTSTRING$(4,138)
2840 NEXT X:GOTO 1210
2850 '
                RENDEZVOUS TEAM ASSIGMENTS
2860 '
2870 LPRINT L1$TAB(16)"SPY TEAM ROSTER"L2$
2880 LPRINT TAB(18)"TEAM NO."TAB(35)"MEMBERS"TAB(55)"COLOR GROUP"
2890 FOR X=1 TO T1
2900 LPRINT TAB(20)X".",TM$(X);TAB(57)C$(AC(X))
2910 NEXT X
2920 GOTO 1210
2930 '
                    ASSIGMENT SUMMARY
2940 '
2950 LPRINTTAB(32)"CURRENT ASSIGNMENTS"STRING$(2,138):LPRINTTAB(6)"PLAYER      S
TARTING PT.        COLOR              ASSIGNMENT"
2960 FOR X=1 TO T:IF A(X)<>0,LPRINTTAB(6)PN$(X)TAB(21)SP(X)TAB(36)AC$(X)TAB(56)M
$(X)
2970 NEXT:GOTO 480
2980 '
                    ASSIGNMENT RECORD
2990 '
3000 LPRINTTAB(32)"GAME ASSIGNMENT RECORD":LPRINT" ":LPRINT"PLAYER
                    RECORD":FOR X=1 TO T:LPRINT PN$(X)TAB(22)R$(X):NEXT
3010 GOTO 480
3020 '
                PLAYER TURN SEQUENCE
3030 '
3040 PRINTTAB(26)"HARDCOPY"
3050 LPRINTTAB(26)"PLAYER TURN SEQUENCE"L2$LZ$
3060 LPRINT"TURN #","PLAYER",,"MARKER #"
3070 FOR X=1 TO T
3080 LPRINTX".",TP$(X),,TP(X)
3090 NEXT X
3100 GOTO 260
3110 '
              ******************************
              *       DATA    BLOCK        *
              ******************************
3120 '
3130 DATA KING RAT,NUMBER,MR BIG,SLY,SNEAK NUMBER,CONTACT,CODE,SECRET AGENT,DOUB
LE AGENT,SUPER SNEAK,SNEAKY,00
3140 DATA DARK BLUE,LIGHT BLUE,YELLOW,RED,SILVER,DARK GREEN,WHITE,LIGHT GREEN,OR
ANGE
3150 DATA ONE OF THOSE DESPICABLE CHARACTERS WHO ACTUALLY CLEAN THEIR FINGER NAI
LS,A SUPER VILLIAN FOR THE OTHER SIDE ( OTHER SIDE OF WHAT WE DON'T KNOW )
3160 DATA  A KGB AGENT ( KRAZY GOOF BALL ),TERRORIST ( ESPECIALLY AT THE CARD GA
ME OLD MAID ),A REAL BAD EGG - DOESN'T KNOW THAT RELIEF IS SPELLED  R O L A I D
S,ONE WHO IS KNOWN TO ACTUALLY ENJOY DRINKING CASTOR OIL
3170 DATA A VERY DEADLY CHARACTER ( DEADLY BORING THAT IS ),ONE WHO IS SUSPECTED
 OF HAVING RING AROUND THE COLLAR,A KNOWN CONTACT FOR THE OTHER SIDE - WANTED TO
 BE A DRISTAN BUT THEY WOULDN'T HAVE ANY PART OF IT
3180 DATA SUSPECTED HERETIC - THOUGHT TO PERFER THE PUBLIC BROADCASTING NETWORK
TO THE BIG THREE
3190 DATA DOSEN'T LIKE HOT DOGS  APPLE PIE OR CHEVERDLET,THINKS APPLE PIE IS OUR
 NATIONAL PIE ( ANY FOOL KNOWS THAT IT IS PIZZA ),ONE WHO IS ALWAYS COMPLAINING
ABOUT SOME SILLY TUB OF MARGERINE WHICH INSISTS IT'S BUTTER
3200 DATA ONE OF THOSE DEGENERATES WHO READS THE INSTRUCTIONS BEFORE ASSEMBLING
ANYTHING,IS ONE OF THOSE DEGENERATES WHO CAN REFOLD A ROAD MAP PROPERLY THE FIRS
T TRY
3210 DATA ONE OF THOSE SUBVERSIVES WHO LIKE MAYONNAISE ON THEIR HAMBURGERS,ONE O
F THOSE SUBVERSIVES WHO ALWAYS PEELS AWAY THE CRUST FROM SANDWICH BREAD
```



```
AGENT RENE'
CODE NUMBER 1
CODE NAME 00 1
YOU HAVE BEEN ASSIGNED COLOR  DARK GREEN
YOUR STARTING POINT IS MARKER NUMBER 162
YOUR INITIAL MISSION IS TO ELIMINATE  ANN L.
DOSEN'T LIKE HOT DOGS  APPLE PIE OR CHEVEROLET
```

Fig. 2. Sample Assignment

```
4000 REM                    FIELD OF PLAY
4010 REM
4020 REM                SUPPLIMENTAL PROGRAM TO
4030 REM                    SPY VERSE SPY
4040 REM
4050 CLS:CLEAR 50
4060 DIM MN$(14),MC$(14),CI$(8),CN$(8)
4070 FOR X=1 TO 14:READ MN$(X):NEXT
4080 FOR X=1 TO 14:READ MC$(X):NEXT
4090 FOR X=1 TO 8:READ CN$(X):NEXT
4100 FOR X=1 TO 8:READ CI$(X):NEXT
4110 L1$=CHR$(27)+CHR$(14):L2$=STRING$(1,138)
4120 L3$=CHR$(27)+CHR$(20)
4130 CLS:PRINT@463,CHR$(23)"SPY VERSE SPY":PRINT:PRINTTAB(8)"FIELD OF PLAY"
4140 PRINT:PRINT"ENTER (1) FOR NUMERICAL MAP":PRINT"ENTER (2) FOR LETTER MAP"
4150 GOSUB 4350:IF B=0 OR B>2 THEN 4150
4160 LPRINT L3$ L1$TAB(28)"SPY VERSES SPY"
4170 LPRINT L3$ L1$ TAB(28)"FIELD OF PLAY"
4180 IF B=2 THEN 4280
4190 '
                      NUMBER LAY OUT
                     OF FIELD OF PLAY
4200 '
4210 LPRINT L3$ L1$TAB(28)"NUMBER LAY OUT"L2$ L2$ L2$
4220 FOR X=1 TO 14
4230 LPRINT L3$ TAB(20) MN$(X)
4240 NEXT X
4250 GOTO 4130
4260 '
                      LETTER LAY OUT
                     OF FIELD OF PLAY
4270 '
4280 LPRINT L3$ L1$TAB(28)"LETTER LAY OUT"L2$ L2$ L2$
4290 FOR X=1 TO 14
4300 LPRINT L3$ TAB(30) MC$(X)
4310 NEXT X
4320 LPRINT STRING$(2,138) TAB(60)" KEY":FOR X=1 TO 8:LPRINT TAB(55)CI$(X)" -  "
CN$(X):NEXT
4330 LPRINT L2$ TAB(50) "THE BLACK MARKERS ARE BRIDGE MARKERS"
4340 GOTO 4130
4350 A$=INKEY$:IF A$="" THEN 4350 ELSE B=VAL(A$):RETURN
4360 '
4370 '
4380 DATA 85  86  88  101 100                       118 119 120 127 128 129 145 14
4 146 147 148 149 150
4390 DATA 84      87      99                        117     121         130     16
6             151
4400 DATA 83      89      98  102 103 104 105 106 107    122         131     14
3             152
4410 DATA 82      90      97                        108     123         132     14
2 161 162 163 164 153
4420 DATA 81      91      96  114 113 112 111 110 109    124         133     14
1             154
4430 DATA 80      92      95                        115     125         134     14
0 160 159 158 157 155
4440 DATA 79      93      94                        116     126         135     13
9             156
4450 DATA 7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
  25  26  27  28  29
4460 DATA 6           78                  48
            30
4470 DATA 5           77                  47
            31
4480 DATA 4           76                  46  45  44  43  42  41  40  39  38  37
  36  35  34  33  32
4490 DATA 3           75                  66
            49
4500 DATA 2           74                  65
            50
4510 DATA 1   73  72  71  70  69  68  67  64  63  62  61  60  59  58  57  56  55
  54  53  52  165 51
4520 DATA G  G  LG T  LB                LG Y  Y  Y  Y  Y  T  W  W  W  W  B
4530 DATA G     S     S                 G     LG       B     G              B
4540 DATA G     S     Y  LB LB LB LB LB  G     R        B     G              G
4550 DATA G     S     Y                 G     R        B     G  B  B  B  LG G
4560 DATA R     S     Y  B  B  B  B  B  W     R        B     G              W
4570 DATA R     S     G                 W     R        B     G  Y  Y  Y  Y  Y
4580 DATA R     S     B                 W     T        B     G              S
4590 DATA W  Y  Y  G  LG LB LB LB LB LB LB LG S  S  S  R  R  R  R  R  R  T  S
4600 DATA W       G              R                                          LG
4610 DATA T       G              R                                          Y
4620 DATA B       G              R  W  W  W  W  W  T  LB LB S  S  S  S  S  R
4630 DATA B       R              R                                          LB
4640 DATA B       R              R                                          LB
4650 DATA B  LB LB LB LB LB LG T  S  S  S  S  Y  Y  Y  Y  W  W  W  W  W  W  LG LB
4660 DATA BLUE,GREEN,LIGHT BLUE,LIGHT GREEN ( SAFE ZONE MARKER ),RED,SILVER,WHIT
E,ORANGE (TURN MARKER)
4670 DATA B,G,LB,LG,R,S,W,O
```

Program Listing 2. Field of Play

can build a credit of 25 units with the mission master. Upon securing a credit of 25 units the trap is secretly indicated to the mission master in the same manner. Any amount in excess of 25 is lost by the team. Movement may resume the *next* turn. Only one trap can exist per team at any one time. Building credits toward establishing a new trap does not have to be done on consecutive turns. A team may elect to build credit on one turn, move the next several turns and finish acquiring credits later. Credits *may not* be built while the team still has an operable trap.

- The base of operations marker is the point where acquired mission markers are stored. Unless a team member occupies the marker, an opposing team can take the base marker by landing on it. If a team's marker is taken the team has one chance to get it back—if either or both members are on the team's color somewhere in the maze and if the team can score a hit with their water pistol. If both members are on the color, both may shoot but only one hit is counted. The shorter range is used to enter the score probability table. If the attempt to defend is successful, the intruding team returns the base marker and continues with their turn. The attempt to defend must be made while the intruder is on the defender's color and during the current turn. If the attempt fails the defending team is eliminated from the game and all their markers are turned over to the team that pulled off the caper.

"Enforced expropriation is a polite way of saying ambush."

- The mission markers are designated by the computer at the start of the game. Teams acquire the markers by terminating their turn on them. Once the marker has been removed it cannot be replaced that game. The removal of a marker blocks that route of the play field. Players may not pass over an open position. A team can erect a bridge (indicated by a black marker) over an opening by building 35 credits with the mission master. Unlike the procedures involving traps, once bridge building has begun it must continue in consecutive turns until there are enough credits to complete its construction. The team cannot move while building the bridge. Only one team member need land on a mission marker to claim it.
- Enforced expropriation is a polite way of saying ambush. It is a way one team can collect mission markers from another team. The ambush is accomplished by both members of the ambushing team. The player being ambushed has to be on the ambushing team's color. Both ambushers must be able to hit the target. The attack is then treated by the score probability table like all other

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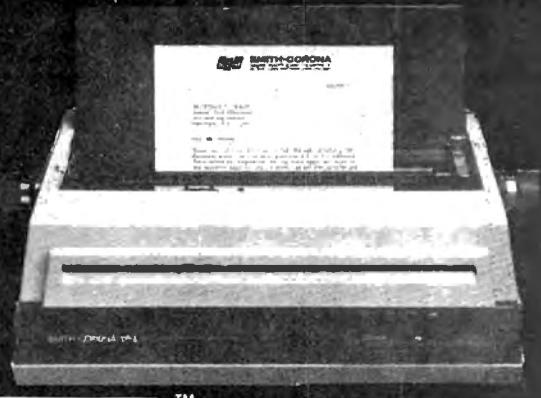

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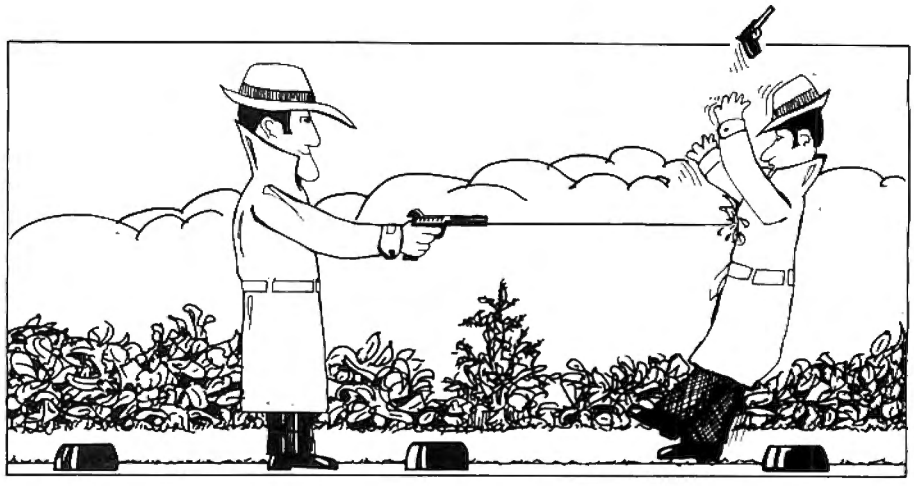
hits. If it is successful, any markers carried by the ambushed player are turned over to the ambushers. The attack is made while the unsuspecting player is moving to complete his turn. The attackers announce "ambush!" and carry out their attack.

● When all designated mission markers have been collected by the teams the game is over. The mission markers count as one point each. Base of operations markers count five each. The team with the highest point total wins. Remember: To claim a mission marker, the team must be able to make it back to their base of operations with the marker. It is not as easy as it may seem.

● As in Spy Versus Spy, players may not move past other players—teammates included. Players can only occupy the same marker during the forming of the spy team. If one team member's route is blocked the second member must move the distance necessary so that the total distance moved by both players is equal to the combined dice roll. In the event that both team members are blocked, both team members must move as far as possible and forfeit the next turn.

That's about it. So gather up an armful of water pistols or whipped cream, don your 007 garb and have at it! ■

Formerly an Eagle Scout and Vietnam vet (ARTY 1969-1970), Barry Adams is an environmental chemist for NC's water pollution control agency.



Line Number	Program Section
200	Program setup
580	Spy Versus Spy menu
780	Spy Versus Spy mission update
880	Spy Versus Spy assignment summary
980	Spy Versus Spy mission record
1340	Rendezvous mission marker assignments
1420	Rendezvous assignments
1550	Rendezvous spy team roster
2410	Player turn sequence
2480-3100	LPRINT Block

Table 1. LPRINT option line numbers

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The Colorful Computer—Part I

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This is the first of three articles illustrating the great versatility of the Color Computer's graphics functions. In "A Better Basic" (*80 Micro*, June/July 1982) I described the Extended Basic instruction set for the Color Computer.

In this article I will describe several graphics commands in more detail and present short (mostly less than 500 bytes) programs to stimulate others from the readers of *80 Micro*. These are a mixture of original programs and Model I programs (from *80 Micro*) rewritten for the Color Computer.

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Because of the advertised nature of the Color Computer and because I stress its graphics capabilities, do not be misled into thinking it is a toy useful only for playing games. With a disk system it is the equal of a Model I or III, although not the same. The Color Computer has many features they lack, and lacks some features available in the others.

Possibilities are endless for the use of computer-generated patterns in designing fabrics, clothing, wallpaper and book covers. You could use a camera and in the course of an evening record a dozen colorful designs from a single program. You might even develop hundreds of colorful patterns by program alterations. There are limitations in the number of colors available, but the potential is still overwhelming.

In this first article I will illustrate the Line function as one way to create beautiful patterns in color. Other graphic functions such as Color, Set, PSET and PMODE will also be included. If you are unfamiliar with the Color Computer you will find the speed of execution of some of these instructions startling.

Color Computer Set

In VLR a screen position is composed of four pixels (not six as in the Model I) for a total of 2,048 coordinates. The format for SET is:

SET (X, Y, C)

where X and Y are coordinates and C is a number from zero to eight designating the desired color. X may vary from zero to 63 and Y from zero to 31. The colors are black (zero), green (one), yellow (two), blue (three), red (four), buff (five), cyan (six), magenta (seven), and orange (eight). Because the pixels are so large, only rather crude graphics can be drawn.

One example of Set is in Program Listing 1 (Chevron). Note that Set is very similar to Level II graphics except for the color designation and the resolution. The CLS0 in line 10 clears the screen to a black background instead of a green one. (The screen can be cleared to any of the nine colors noted

```
10 REM LISTING 1  CHEVRON
20 CLS0:Y=0:K=0
30 R=RND(8):S=RND(8):IFR = S THEN30
40 FORX=0TO40STEP20
50 FORI=X TO X+10
60 SET(I,Y+K,R):Y=Y+1
70 NEXTI:Y=K
80 NEXTX
90 FORX=10TO50STEP20
100 FORI=X TO X+10
110 IFY+10+K>31THEN190
120 SET(I,Y+10+K,S):Y=Y-1
130 NEXTI
140 Y=K
150 NEXTX
160 K=K+1:IFK>10THEN190
170 Y=K
180 GOTO30
190 GOTO190
200 REM MEM = 272
```

Program Listing 1. Chevron

```
10 REM LISTING 2  PATTERNS
20 CLS0:A=10:B=7:S=0:DIMA(7),B(7)
30 T=RND(73)+162:FORJ=0TO7:A(J)=J:B(J)=J:NEXT
40 FORJ=0TO7:R=RND(8)-1:W=A(J):A(J)=A(R):A(R)=W:NEXT
50 FORJ=0TO7:R=RND(8)-1:W=B(J):B(J)=B(R):B(R)=W:NEXT
60 FORJ=0TO7:FORK=0TO7:R=A(J):W=B(K):C=R+W+T:X=A+R:Y=B+W:GOSUB16
0
70 Y=B-W:GOSUB160:Y=B-W:GOSUB160:X=A-R:GOSUB160:Y=B+W:GOSUB160
80 X=A+W:Y=B+R:GOSUB160:Y=B-R:GOSUB160:X=A-W:GOSUB160:Y=B+R:GOSU
B160
90 NEXTK,J
100 CLS0:N=128:M=64:FORJ=1TORND(20)+10:R=RND(17)*2:W=RND(M)
110 T=S:IFRND(0)>.8THENT=T+2
120 A$=CHR$(N+W)+CHR$(N+W):PRINT@S,A$;
130 FORK=T TO S+509 STEP R
140 PRINT@K,A$;:NEXT:NEXT
150 GOTO30
160 A$=STRING$(3,C)
170 PRINT@S+32*Y+3*X,A$;:RETURN
180 PRINT@S+32*Y+3*X+2,CHR$(C);:RETURN
190 REM MEM = 573
```

Program Listing 2. Patterns

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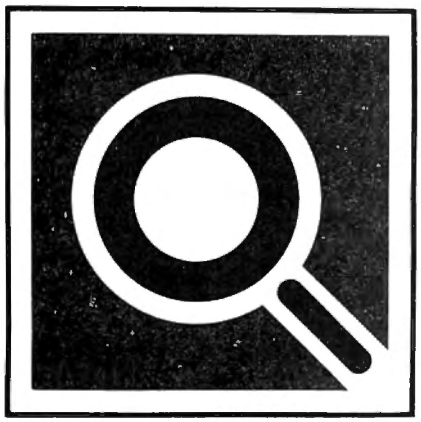
DAISYWHEEL II



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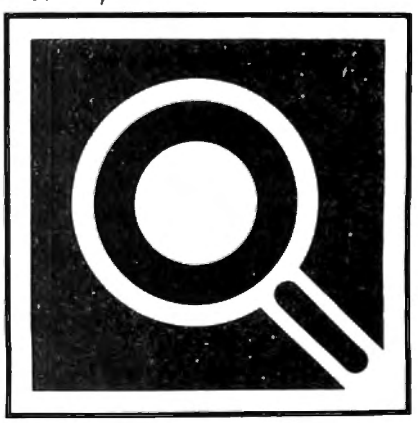

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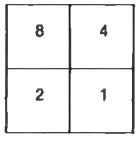
above by CLS C, where C is a number from zero to eight.)

You cannot set pixels within a block or position to different colors. The last pixel set takes precedence and resets all others to the last color specified. In other words, if Y equals 10 and X1 equals 10 and X2 equals 10 and you wish to Set X1 to blue and X2 to orange, when X2 is Set orange X1 will be reset to orange.

When CHR$ is used or if graphics characters are POKEd to the screen, the all-pixels-off numbers are 128, 144, 160, 176, 192, 208, 224 and 240. Fifteen different characters are available with eight colors for each and eight black blocks of four pixels each. CHR$(255), for example, is all pixels on—orange.

If in Set graphics we represent a block as four pixels, they should be numbered as shown:



To calculate the appropriate number for the desired character (for example, ▛ in green), we proceed as follows: 128 plus 8 plus 4 plus 1, or 141. CHR$(141) will light the three green pixels eight, four and one. POKEing a location with 141 accomplishes the same end. The base number for green is 128. For each subsequent color add 16, or use the black blocks as the base numbers instead of 128. Listing 2 (Patterns) is an example of the use of strings and CHR$ to produce rapid, colorful patterns. Listing 3 (Poke) is a similar program using POKEs.

Listing 4 (Strings) stores the screen contents in strings for later retrieval or for storage on disk or tape. VARPTR is not the same pointer in Color Basic as it is in Level II and Disk Basic. VARPTR returns a number which points to a five-byte description of a string (see Table 1).

```
10 REM LISTING 3 POKE
20 CLS0
30 B=128:SC=1024:A=145
40 D=RND(8):E=RND(8)+7
50 FORI= D TO E STEP2
60 K=SC+(I-1)*32:L=SC+I*32
70 F=RND(30):G=RND(15)+15
80 FORJ= F TO GSTEP2
90 POKEK+J,A:POKEK+J+1,B
100 POKEL+J,B:POKEL+J+1,A
110 NEXTJ,I
120 A=B:B=RND(127)+128:GOTO40
130 REM RAM RANDOM POKE3
140 CLS0
150 C=RND(128)+128:IFC/16=INT(C/16)THEN150
160 FORA=155TO1STEP-1:FORB=1024TO1535STEPA:POKEB,C:NEXTB:CLS0:NE
XTA:RUN
170 REM MEM = 340
```

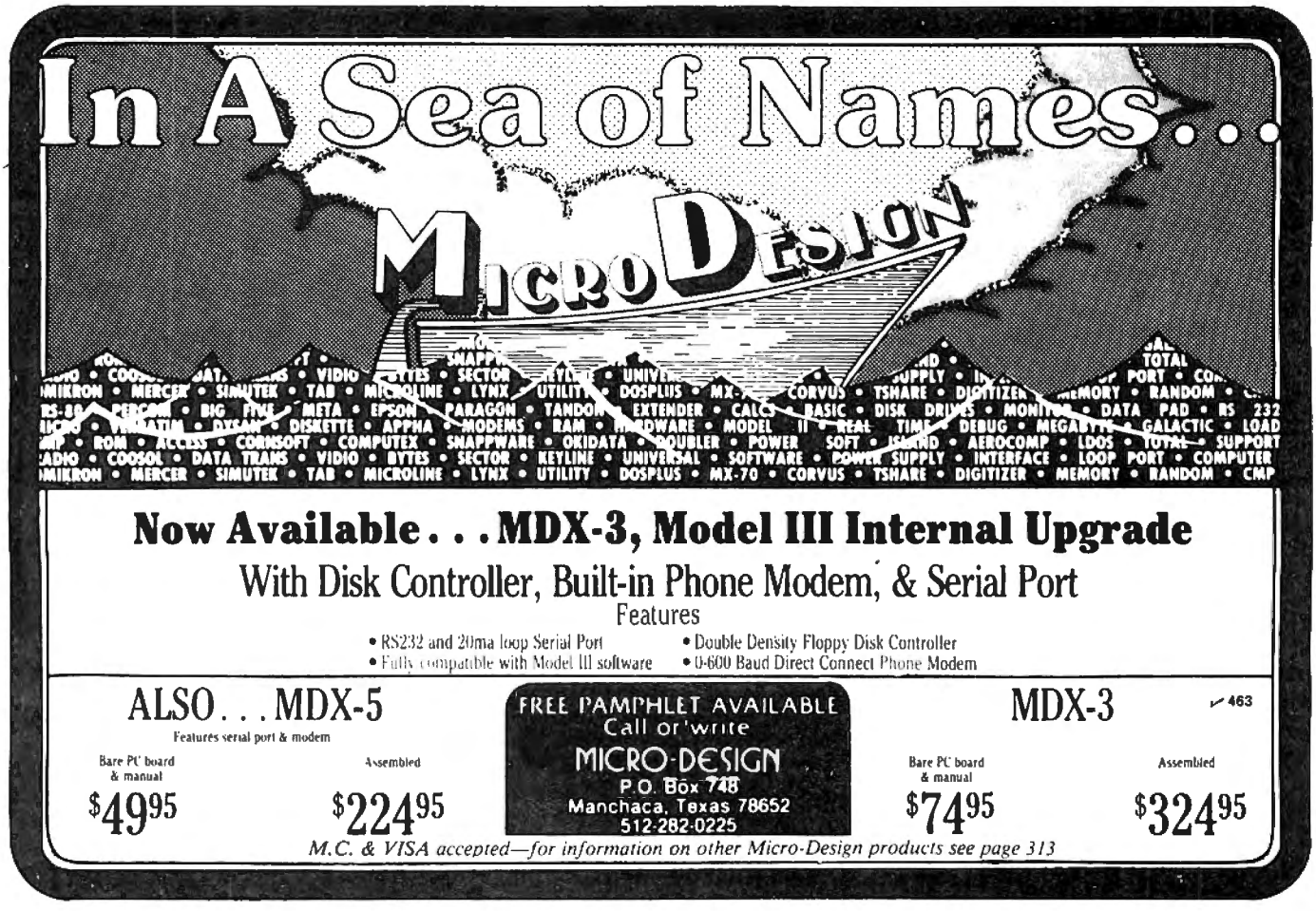
Program Listing 3. Poke

Line 50 POKEs the string length (32) into the first byte to which VARPTR(T$) points. (There are 32 locations for each screen line.) Line 70 POKEs the left screen location into VARPTR locations three and four of T$. This method is faster than reading a whole line and concatenating the characters, as is usually done. The contents of T$ thus reside in the memory locations on the screen (pointed to by VARPTR).

The string manipulation in line 80 is necessary so T$ and T$(J) do not continue to point to the screen at the end of the program or after a screen change. Otherwise, they would contain the screen contents at that location no matter what is on the screen. As a result, the string array would contain garbage when you next tried to use it.

Line 80 forces Basic to rearrange the string area so the strings are transferred to a different location in high memory. This method permits storage of the screen fairly rapidly. Try taking out line 80 and see what happens to your string arrays.

Additional commands may be added af-



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```
10 REM LISTING 4 STRINGS
20 CLS0:CLEAR600
30 DIMT$(15)
40 FORI=0TO14:FORJ=0TO31:PRINTCHR$(128+RND(127));:NEXTJ,I
50 T$="":V=VARPTR(T$):POKEV,32
60 FORJ=0TO15
70 S=1024+32*J:H=INT(S/256):L=S-256*H
80 POKEV+2,H:POKEV+3,L
90 T$(J)=LEFT$(T$,31):T$(J)=T$(J)+RIGHT$(T$,1)
100 NEXT
110 FORI=1TO1000:NEXT
120 CLS0
130 FORI=0TO1000:NEXT
140 FORI=0TO14:PRINTT$(I);:NEXT
150 GOTO150
160 REM MEM = 290
```

Program Listing 4. Strings

Byte No.	Description
1	String length
2	Not available to the user
3	Address of first character
4	Address of first character
5	Not available to the user

Table 1

ter line 80 to use T$(J) in any fashion you wish. I have included a few lines as an illustration. You may, of course, save any part of the screen in a suitable string array with proper identification of the screen locations. Once strings have been built up by concatenation or by using this method, filling the screen with graphics becomes extremely fast. In this case, the screen can be cleared and reproduced in .23 second, including the time Basic requires to manipulate Timer. The actual execution time is probably less than .2 second.

Line

Next let us examine the Line command in some detail. Its execution is extremely fast; a line is drawn in the blink of an eye compared to Level II's laggardly pace. The format for Line is:

LINE (X1, Y1) – (X2, Y2), PSET, BF

where X1, Y1 and X2, Y2 are the coordinates of any two points on the screen (B and F are optional). The coordinates may vary between X1 equals zero to X1 equals 255 and Y1 equals zero to Y1 equals 191, depending upon the resolution you require.

Preset will reset a line to the background color—erase it. VLR graphics displays 2048 pixels. VHR graphics will produce 49,152 pixels, while Model I and Model III provide only 6144 pixels. You may also use a resolution of 24,576 or 12,288 pixels. The largest number of pixels can tax the resolution of a standard television set (and that of the human eye). As resolution increases, a straight line looks less and less like a staircase.

In addition to drawing lines, Line will also draw squares or rectangles and fill them with a solid color. If the X1, Y1 and X2, Y2 coordinates are the opposite corners of a square or rectangle, Line draws a complete box when the B option is selected. Listing 5 (Boxes) is a simple illustration which can easily be written in one line, since Color Basic allows up to 255 characters per program line. By adding an F to the B, you may fill the area with a solid color. Unless specified otherwise by Color, the foreground color will be used.

Listing 6 (Lines) illustrates the use of MR graphics. In PMODE1, 12,288 pixels are available—one-fourth as many as in HR graphics. Screen 1,0 selects the first four colors mentioned above by the use of the

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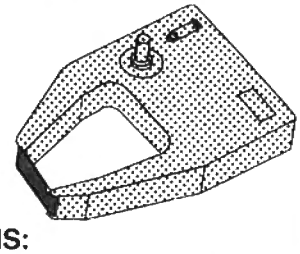

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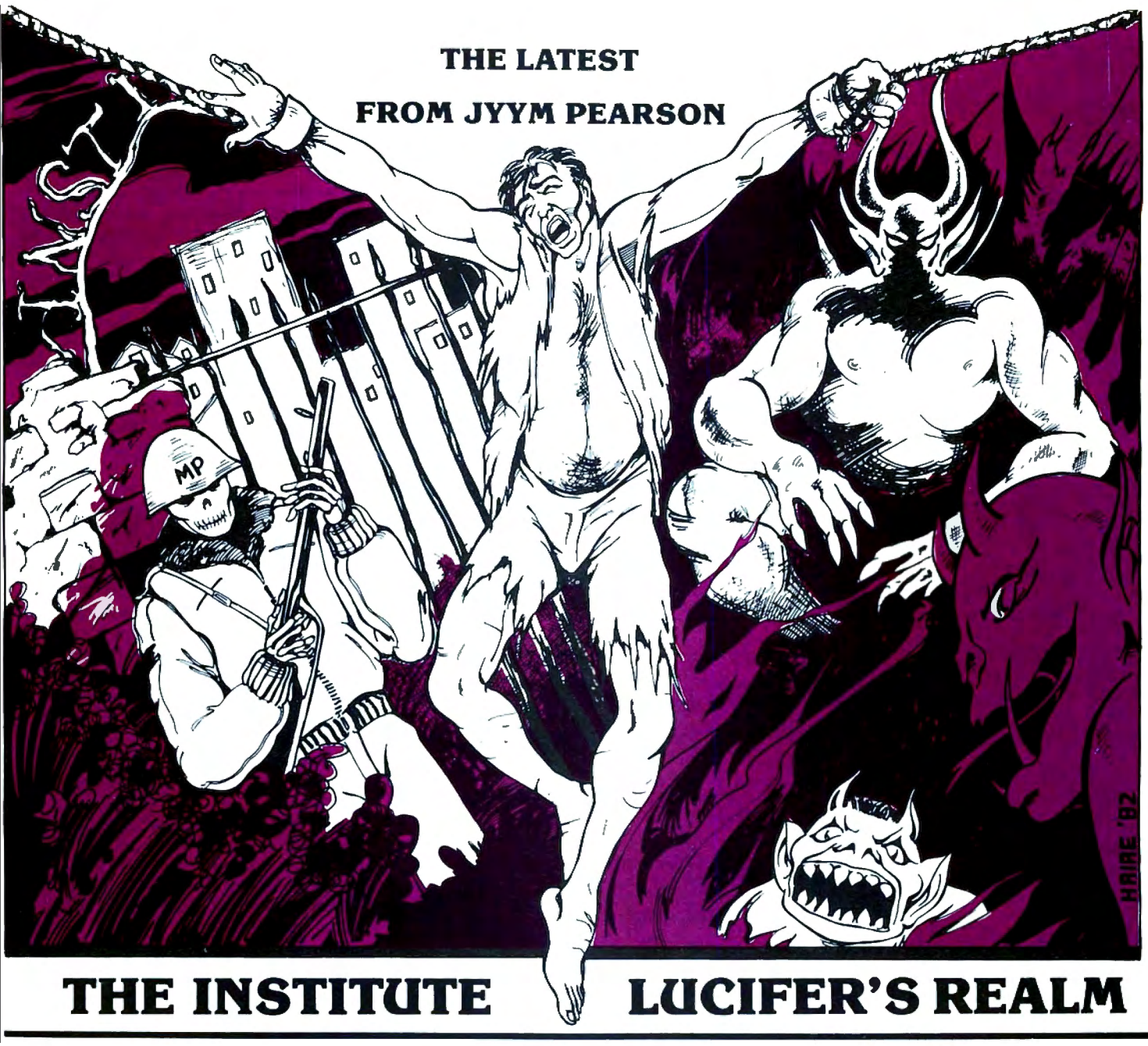

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```
10 REM LISTING 5 BOXES
20 FORK1=0TO1
30 PCLS:FORK=1TO4
40 PMODEK,1
50 SCREEN1,K1
60 R=0
70 FORI=1TO35
80 LINE(250-R,180-R)-(225-R,150-R),PSET,B
90 R=R+4
100 NEXT
110 FORL=1TO1500:NEXT
120 NEXTK
130 NEXTK1
140 GOTO140
150 REM MEM = 170
```

Program Listing 5. Boxes

```
10 REM LISTING 6 LINES
20 PMODE4,1
30 PCLS
40 SCREEN1,1
50 X=RND(255):Y=RND(191)
60 LINE-(X,Y),PSET
70 FORX=1TO200:NEXT
80 GOTO50
90 REM MEM = 98
```

Program Listing 6. Lines

```
10 REM LISTING 7 WEAVING
20 PMODE1,1:PCLS:SCREEN1,1
30 I=0:J=0
40 PSET(I,J,7)
50 PSET(255-I,191-J,8)
60 I=I+1:IFI>255THENI=RND(50)
70 J=J+1:IFJ>191THENJ=0
80 GOTO40
90 REM MEM = 130
```

Program Listing 7a. Weaving

```
10 REM LISTING 7 WEAVING
20 PMODE3,1:PCLS:SCREEN1,P
30 Y=10
40 R=RND(4):S=RND(4):IFR= S THEN40
50 PCLSR:COLORS,0
60 FORX=0TO220STEP20
70 LINE(X,Y-10)-(X+10,Y+10),PSET
80 LINE(X+10,Y+10)-(X+20,Y-10),PSET
90 K=RND(4):IFK=R THEN90
100 COLORK,0
110 NEXT
120 LINE(240,Y-10)-(250,Y+10),PSET
130 Y=Y+10:IFY>184THEN150
140 GOTO60
150 FORI=1TO2000:NEXT:IFP=1THENP=0ELSEP=1
160 GOTO20
170 REM MEM = 289
```

Program Listing 7b. Weaving

```
10 REM LISTING 8 PLAID
20 P=0
30 FORN=1TO10
40 PMODE1,1:PCLS:SCREEN1,P
50 K=0:L=30
60 FORI=0TO220STEP30
70 R=RND(3)+5
80 COLORR,5
90 LINE(250-I,K)-(220-I,L),PSET
100 LINE(I,K)-(I+30,L),PSET
110 LINE(248-I,K)-(218-I,L),PSET
120 LINE(I+2,K)-(I+32,L),PSET
130 R=RND(3)+5:COLORR,5
140 LINE(244-I,K)-(214-I,L),PSET
150 LINE(I+6,K)-(I+36,L),PSET
160 R=RND(3)+5:COLORR,5
170 LINE(240-I,K)-(210-I,L),PSET
180 LINE(I+10,K)-(I+40,L),PSET
190 R=RND(3)+5:COLORR,5
200 IF206-I<0THEN230
210 LINE(234-I,K)-(206-I,L),PSET
220 LINE(I+16,K)-(I+46,L),PSET
230 NEXT
240 K=K+30:IFK>160THEN270
250 L=K+30
260 GOTO60
270 IFP=0THEN P=1ELSEP=0
280 FORZ=1TO2000:NEXT
290 NEXTN
300 GOTO300
310 REM MEM = 529
```

Program Listing 8. Plaid

zero. A one instead of a zero would select the second four colors. Screen 0 instead of Screen 1 would select VLR graphics. (Screen 0 is normally not used because the default is always Screen 0.) PCLS clears the screen and erases any graphics from memory. You may use PCLS C in a fashion similar to CLS C.

Pages

When you use P in Screen 1 or PMODE R, Basic assumes you are going to use a high resolution mode. (R refers to the mode and P to the page number.) There are five PMODES, zero through four. PMODE 0 and PMODE 1 have the same resolution but provide two and four colors, respectively (128 by 96 pixels each). PMODE 2 and PMODE 3 are of higher resolution, and also provide two and four colors (128 by 192 pixels each). PMODE 4 is the highest resolution (256 by 192 pixels) but provides only two colors: a black background with a white or buff foreground, or a black background with a green foreground. Buff actually turns out to be a rainbow of colors enhanced by "color-fringing" in most tv sets.

PMODE 0 requires one page of memory; PMODEs 1 and 2 require two pages and PMODEs 3 and 4 require four pages. Each page of memory uses 1.5K bytes of RAM. The default when the computer is turned on is four pages. You can change the number of pages available by using PCLEAR and a number from one to eight, since eight pages are possible with a 16K memory. Since all programs in this article require little memory, we merely accept the default. The second number in PMODE is the starting page used by Basic to store the graphics. Additional pages may be cleared and used to store graphics for animation purposes.

Back to Lines. Notice that you are able to manipulate Color, PMODE and Screen arithmetically much as you can the Set function. In the Line instruction the PSET is mandatory.

Listings 7 and 8 (Weaving and Plaid) are two examples of the Line instruction in PMODEs 2 and 3 with four colors. The displays can be very beautiful.

Listing 9 (Four Node), in the highest resolution mode (PMODE 4), illustrates one of the many ways mathematical functions may be used to create designs. The program is based on one which first appeared in *80 Micro*.

Paint

Listings 10, 11 and 12 (Color, Color 2, Color 3) are all variations on a theme. In two, the Paint command is used. Paint has the format:

PAINT (X,Y), C1, C2

Paint is used to fill large areas of the screen with a solid color. X and Y refer to coordinates anywhere within the area to be colored, and C1 designates the color. C2 tells Basic the bordering line at which to stop coloring. The bordering lines can be formed using Line, Circle, Draw or PSET.

Listings 14, 15 and 16 are variations of one program illustrating the use of PSET. Experiment yourself to make them more interesting. The format is identical to Set, except for the added P which is mandatory in high resolution. Because of the many pixels on the screen, PSET can be extremely slow in execution. Whenever possible, use a command such as Line to set more than a few pixels.

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Print check stubs?	No	No	Yes	Yes with limited information
Print check register statement?	Yes	Yes	Yes	Yes
Print bank statement reconciliation?	Yes	Yes	Yes	Yes
Print income and expense subtotals?	Expense only	No	Yes	No
Print individual account statements?	Yes	No	Yes	Yes
Print check register notes?	No	No	Yes	No
Print account distribution statement?	No	No	Yes	No
Payee Address file (for automatic printing of address on checks)?	No	Yes	Yes	No
Number of payees	N/A	75	40 Mod I 75 Mod III	N/A
Number of lines in payee address	N/A	3	4	N/A
TRANSACTION ENTRY				
Check "In Pay of" file (for automatic printing of what check is for on checks)?	No	Payee only	Yes	No
Number of payees/payors in file	N/A	75	40 Mod I 75 Mod III	N/A
Distribute transactions over multiple accounts	Difficult	Difficult	Easy	Easy
Flag tax-deductible items in any account?	Yes	No	Yes	Yes
User-friendliness	Good	Excellent	Excellent	Fair
Protection against user error	Good	Excellent	Excellent	Fair
Allow entry of manually-written checks?	Yes	Yes	Yes	Yes
Ease of finding checkbook balance	Easy	Difficult	Easy	Easy
MISCELLANEOUS				
Supplied with DOS?	No	TRSDOS	TDOS	Mod I TDOS Mod III No
System	Mod I and Mod III	Mod III only	Mod I and Mod III	Separate Mod I or Mod III
Accept lower-case commands?	No	No	Yes	No
Accept lower-case text?	No	Yes	Yes	Yes
Self-prompting?	Yes	Mostly	Yes	Mostly
Swapping of program diskettes required?	Yes	No	Mod I Yes Mod III No	No
VISICALC(tm)-compatible data?	No	No	Yes	No
Documentation quality	Fair	Excellent	Excellent	Fair
CAPACITIES				
Maximum amount per transaction	99999.99	99999.99	99999.99	Not listed in manufacturer's documentation
Maximum balance	99999.99	99999.99	99999.99	Not listed in manufacturer's documentation
Limit on deposits per day?	No	Yes — 1	No	No
Number of income accounts	1	1	Up to 223 total income and expense	Not listed in manufacturer's documentation
Number of expense accounts	Up to 99	Up to 30	Up to 223 total income and expense	Not listed in manufacturer's documentation
Limits on transactions	Mod I 100/mo Mod III 250/mo	2500/yr	Unlimited	Mod I 300/mo Mod III 2400/mo
Number of bank accounts	Unlimited - no interaction	9 - with interaction	Unlimited no interaction	Unlimited - no interaction

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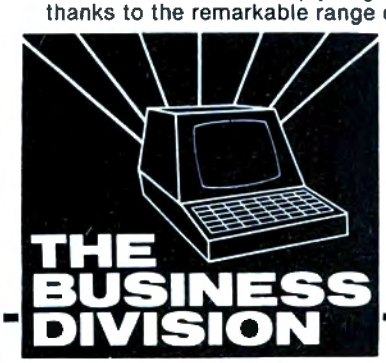

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```
10 REM LISTING 9 FOUR NODE
20 PMODE4,1:PCLS:SCREEN1,1
30 PI=3.14159:P1=2*PI:P3=PI/60:P2=PI/2
40 FORT=0TO P1 STEPP3
50 R=COS(2*T)*95
60 X1=COS(T)*R+127:Y1=SIN(T)*R+95
70 A=T+P2
80 R2=COS(2*A)*95
90 X2=COS(A)*R2+127:Y2=SIN(A)*R2+95
100 LINE(X1,Y1)-(X2,Y2),PSET
110 NEXT
120 GOTO120
130 REM MEM = 238
```

Program Listing 9. Four Node

```
10 REM LISTING 10 COLORS
20 FORL=1TO2
30 PMODE1,1:PCLS:SCREEN1,P
40 FORI=0TO250
50 LINE(I,0)-(128,96),PSET
60 NEXT
70 COLOR7,5
80 FORI=0TO191
90 LINE(255,I)-(128,96),PSET
100 NEXT
110 COLOR6,5
120 FORI=255TO0STEP-1
130 LINE(I,191)-(128,96),PSET
140 NEXT
150 COLOR7,5
160 FORI=191TO0STEP-1:LINE(0,I)-(128,96),PSET:NEXT
170 FORJ=1TO1000:NEXTJ
180 P=1:NEXT
190 GOTO190
200 REM MEM = 282
```

Program Listing 10. Colors

```
10 REM LISTING 11 COLORS 2
20 FORL=1TO2
30 PMODE1,1:PCLS:SCREEN1,P
40 LINE(0,0)-(255,191),PSET
50 LINE(255,0)-(0,191),PSET
60 PAINT(125,90),6,8
70 PAINT(125,100),7,8
80 PAINT(20,80),8,8
90 PAINT(160,110),8,8
100 FORI=1TO1500:NEXT
110 P=1
120 NEXTL
130 GOTO130
140 REM MEM = 199
```

Program Listing 11. Colors 2

```
10 REM LISTING 12 COLORS3
20 FORM=1TO10
30 GOSUB210
40 FORL=1TO2:PMODE1,1:PCLS:SCREEN1,P
50 FORI=0TO255STEP127
60 LINE(I,0)-(255-I,191),PSET
70 NEXT
80 J=50:R=1
90 FORK=1TO3
100 FORI=75TO200STEP75
110 Z=A(R)
120 PAINT(I,J),Z,8
130 R=R+1
140 NEXT
150 J=J+50
160 NEXTK
170 FORI=1TO1500:NEXTI
180 IFP=1THENP=0ELSEP=1
190 NEXTM
200 GOTO200
210 FORI=1TO6:A(I)=RND(3)+1:NEXT
220 IFA(1)=A(2)ORA(3)=A(1)ORA(2)=A(4)THEN210
230 IFA(3)=A(5)ORA(4)=A(6)THEN210
240 IFA(5)=A(6)THEN210
250 RETURN
260 REM MEM = 377
```

Program Listing 12. Colors 3

```
10 REM LISTING 13 TAPESTRY
20 PMODE1,1:PCLS:SCREEN1,0
30 K=0
40 FORI= K TO200STEP55
50 COLORRND(3)+5,5
60 LINE(I,0)-(I+55,191),PSET
70 NEXT
80 K=K+10:IFK>200THEN100
90 GOTO40
100 K=255
110 FORI= K TO55STEP-55
120 COLORRND(3)+5,5
130 LINE(I,0)-(I-55,191),PSET
140 NEXT
150 K=K-10:IFK<55THEN170
160 GOTO110
170 FORI=0TO55STEP5
180 COLORRND(3)+5,5
190 LINE(I,0)-(I,191),PSET
200 NEXT
210 FORI=200TO255STEP5
220 COLORRND(3)+5,5
230 LINE(I,0)-(I,191),PSET
240 NEXT
250 GOTO250
260 REM MEM = 358
```

Program Listing 13. Tapestry

```
10 REM LISTING 14 PSET
20 PMODE1,1:PCLS:SCREEN1,1
30 J=0:FORI=0TO255
40 PSET(I,J,7):PSET(255-I,J,7):PSET(I,191-J,7):PSET(255-I,191-J,
7)
50 PSET(I,J+1,7):PSET(255-I,J+1,7):PSET(I,190-J,7):PSET(255-I,19
0-J,7)
60 PSET(I,J+2,7):PSET(255-I,J+2,7):PSET(I,189-J,7):PSET(255-I,18
9-J,7)
70 J=J+4
80 IFJ>189THENJ=0
90 NEXT
100 COLOR7,5

110 LINE(0,96)-(255,96),PSET
120 LINE(0,48)-(255,48),PSET
130 LINE(0,145)-(255,145),PSET
140 GOTO140
150 REM MEM = 342
```

Program Listing 14. PSET

```
10 REM LISTING 15 PSET 2
20 PMODE3,1:PCLS:SCREEN1,0
30 FORI=0TO254
40 J=J+1
50 IFJ>191THENJ=0
60 PSET(I,J,4):PSET(255-I,J,3)
70 PSET(I,191-J,2):PSET(255-I,191-J,4)
80 PSET(I+1,191-J,3):PSET(255-I+1,191-J,2)
90 NEXT
100 GOTO30
110 REM MEM = 180
```

Program Listing 15. PSET 2

```
10 REM LISTING 16 PSET 3
20 PMODE1,1:PCLS:SCREEN1,0
30 Q=RND(3)+1:FORI=0TO255
40 J=J+1
50 IFJ>191THENJ=0
60 PSET(I,J,Q):PSET(255-I,J,3)
70 PSET(I,191-J,2):PSET(255-I,191-J,Q)
80 PSET(I+4,J,2):PSET(I,J+2,4)
90 NEXT
100 GOTO30
110 REM MEM = 177
```

Program Listing 16. PSET 3

I offer Listings 17, 18, 19 and 20 (Star 6, Star 7, Eye and Shrimp) without further comment except to note that Listings 19 and 20 are based on programs which previously appeared in *80 Micro*. I will discuss Circle and Draw in subsequent articles.

Try changing the Mode, Color and Screen in all these programs for different color effects. The Color Computer is a very powerful toy! ■

Franklyn Miller is employed by the U.S.I. Chemical Company. He enjoys programming, electronics and photography.

```
10 REM LISTING 17 STAR 6
20 PMODE1,1:PCLS:SCREEN1,1
30 COLOR7,5
40 LINE(128,0)-(0,191),PSET
50 LINE(129,0)-(255,191),PSET
60 COLOR8,5
70 LINE(0,50)-(255,50),PSET
80 COLOR6,5
90 LINE(0,53)-(253,189),PSET
100 LINE(255,53)-(2,189),PSET
110 GOTO110
120 REM MEM = 184
```

Program Listing 17. Star 6

```
5 REM LISTING 18 STAR 7
10 PMODE1,1:PCLS:SCREEN1,1
20 COLOR8,5
30 LINE(128,0)-(0,191),PSET
40 LINE(129,0)-(255,191),PSET
50 LINE(0,50)-(255,50),PSET
60 LINE(0,53)-(253,189),PSET
70 LINE(255,53)-(2,189),PSET
80 PAINT(128,96),7,8
90 PAINT(50,60),8,8
100 PAINT(200,60),8,8
110 PAINT(128,30),6,8
120 PAINT(50,160),6,8
130 PAINT(220,160),6,8
140 GOTO140
150 REM MEM = 274
```

Program Listing 18. Star 7

```
10 REM LISTING 19 EYE
20 CLS:INPUT"NUMBER OF POINTS";N:DIMA(N),B(N)
30 PI=3.14159:M=2*PI-.001:M1=2*PI/N
40 PMODE3,1:PCLS:SCREEN1,1
50 FORQ=0TO250STEP9
60 X1=0:Y1=Q:X2=Q:Y2=191
70 LINE(X1,Y1)-(X2,Y2),PSET
80 X1=Q:Y1=0:X2=250:Y2=Q
90 LINE(X1,Y1)-(X2,Y2),PSET
100 NEXT
110 LINE(255,0)-(255,191),PSET
120 Z=0
130 FORT=0TO M STEPM1:Z=Z+1
140 A(Z)=COS(T)*75+110:B(Z)=SIN(T)*65+95
150 NEXT:FORS=1TON-1:FORD=S+1TON
160 X1=A(S):Y1=B(S):X2=A(D):Y2=B(D)
170 LINE(X1,Y1)-(X2,Y2),PSET
180 NEXTD,S
190 GOTO190
200 REM MEM = 419
```

Program Listing 19. Eye

```
10 REM LISTING 20 SHRIMP
20 PMODE4,1:PCLS:SCREEN1,0
30 PI=3.14159:P1=2*PI:P2=PI/30:P3=2*PI/3
40 FORT=0TO P1 STEPP2
50 R=T*15
60 X1=COS(T)*R+127:Y1=SIN(T)*R+101
70 A=T+P3
80 X2=COS(A)*R+127:Y2=SIN(A)*R+101
90 LINE(X1,Y1)-(X2,Y2),PSET
100 B=T+2*P3
110 X1=COS(B)*R+127:Y2=SIN(B)*R+101
120 LINE(X1,Y1)-(X2,Y2),PSET
130 X1=COS(T)*R+127:Y2=SIN(T)*R+101
140 LINE(X1,Y1)-(X2,Y2),PSET
150 NEXT
160 GOTO160
170 REM MEM = 343
```

Program Listing 20. Shrimp

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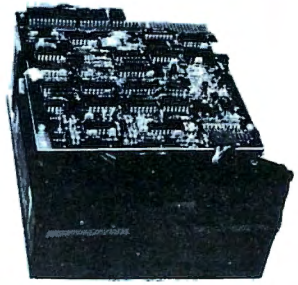

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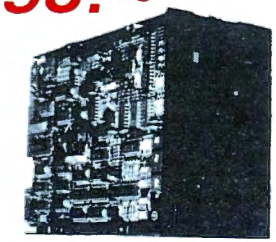

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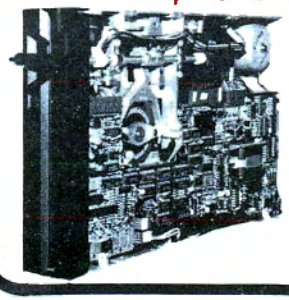

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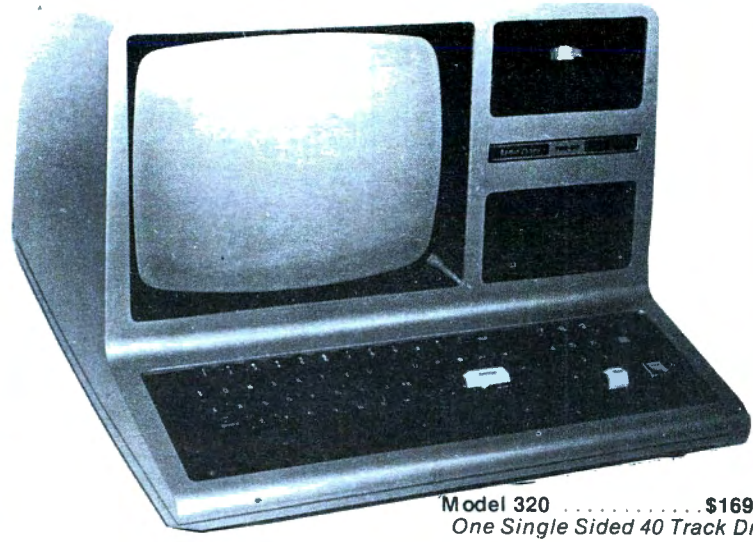

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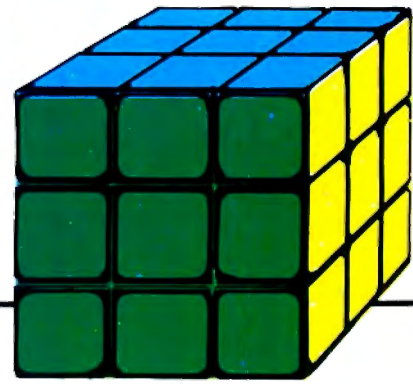

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When Cube-80 is run, it asks for the color orientation of your cube. Not all cubes have the same colors or color orientations. The color orientation describes the geometric relationship of the colored sides on a particular cube. Each side's center square establishes the color for that side. A cube might be completely scrambled, but the six center squares never change positions with respect to each other.

Once you have picked a side to be the top, use Fig. 1 to determine the orientation of the remaining sides. Cube-80 solves the top first. If your cube has one side completed, use that side as the top. Answer the prompts for each side with the color of the center square.

Once the color orientation for the cube is entered, the computer internally assigns constants. This process takes a few seconds. The next prompts ask for one of the three options available from Cube-80. The three options are input, move and solve.

Input

Here you are able to tell the computer the present position of your scrambled cube. In the Input mode the computer asks you to enter Stop or a color for a specific square. Each square is numbered (Fig. 2). Carefully enter the first letter of the color for the specific square. If you make a mistake type Stop and the computer will return you to the option mode.

Once all 54 squares are entered, the computer checks for the correct number and location of colors. If white and orange are on opposite sides of a cube, the scrambled cube can never show white next to orange. The computer will detect this mistake. If you do have a mistake, the computer will tell you and go back to the option mode.

Move

To scramble a cube on your computer, type Move while in option mode. The computer will ask you for Stop or a move. All moves are numbered (Fig. 3). After scrambling the cube, type

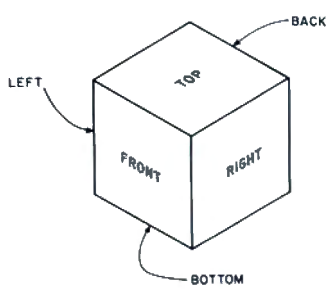

Fig. 1. The six sides of the cube and their names

1	2	3										
4	5	6										
7	8	9										
10	11	12	19	20	21	28	29	30	37	38	39	
13	14	15	22	23	24	31	32	33	40	41	42	
16	17	18	25	26	27	34	35	36	43	44	45	
									46	47	48	
									49	50	51	
									52	53	54	

Fig. 2. Unfolded cube with each square numbered

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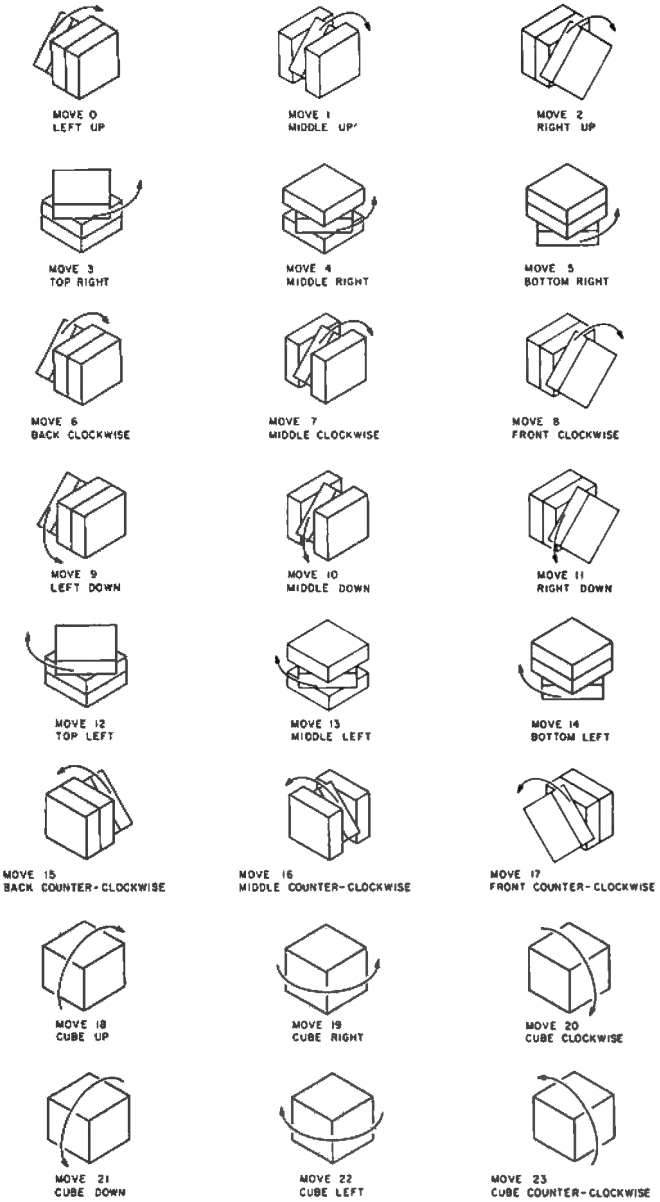

Fig. 3. Numbered move options

Stop to return to the option mode.

Solve

This option will, of course, solve a scrambled cube. Once Solve is entered the computer asks for a time delay, which I will explain later.

When the computer finds a set of moves for a specific arrangement, it will stop and wait for you to hit a key. During this waiting period, the computer flip-flops the cassette output bit. If you have a small audio amplifier, connect it to the large gray plug. The noise you will hear is a signal meaning the computer has found a set of moves. You can take a break while the computer works on your cube.

Implementing the Fix

A solution can be just one move or up to 20 moves. The computer can display the moves very quickly, but will ask you to enter a time delay between moves to give you time to turn the cube. The delay ranges from zero to almost five seconds depending on what number you enter. Begin with a seven, but you may eventually become fast enough to use a one or a zero.

When the computer finds a set of moves, position the cube *exactly* as shown on the screen. The front of the cube is always facing you, even though the color of the front may not be

> *". . . the six center squares never change positions . . ."*

what you first entered during the color orientation of the cube. Use Fig. 3 to help you match the displayed words with the actual move. Be careful with the middle moves because the cube has three middles. One middle can be rotated up or down; another can be rotated right or left; and the last can be rotated clockwise or counter-clockwise.

The computer can solve Rubik's Cube in 15-30 minutes. If you make a mistake during any part of the solution, you will have to start all over and input the cube from the point where you made the mistake. As the computer comes closer to completing the cube, the time necessary to locate a set of moves may increase. If the computer seems to repeat the same set of moves, have faith and keep going.

The program may be slow compared to Assembly language game programs, but it is faster than not working the cube at all. ■

Winefred Washington is an engineering co-op student at University of Tennessee.

Program Listing

```
10 REM                    ************************
20 REM                    **       CUBE-80      **
30 REM                    ** BY W. WASHINGTON   **
40 REM                    **         2/1/82     **
50 REM                    ************************
100 CLEAR 1500:DIM C(55),CC(55),B(28),BB(28),A$(24),S(55),M$(24)

110 CLS:PRINT@13,"** THE COLOR ORIENTATION OF CUBE **":PRINT:PRI
NT"ENTER THE CENTER SQUARE'S COLOR ON THE ..."
120 PRINT:INPUT"TOP";K$(1):INPUT"FRONT";K$(2):INPUT"RIGHT";K$(3)
:INPUT"BACK";K$(4):INPUT"LEFT";K$(5):INPUT"BOTTOM";K$(6):PRINT"C
OMPUTING...":FORX=1TO6:K(X)=ASC(LEFT$(K$(X),1)):NEXT:GOSUB160  :
GOSUB170  :GOSUB340
130 PRINT@576,STRING$(60,32):PRINT@576,"ENTER AN OPTION (INPUT,
MOVE, SOLVE)";:INPUTZ$:PRINT@576,STRING$(45,32):IF LEFT$(Z$,3)="
INP" THEN GOSUB360  :GOTO130
140 IF LEFT$(Z$,3)="SOL" THEN INPUT"ENTER DELAY BETWEEN MOVES FR
OM 0 TO 10";DD:GOSUB470  :GOTO130
150 IF LEFT$(Z$,3)="MOV" THEN GOSUB340  :GOSUB350  :GOTO130  ELS
E GOTO130
160 FOR X=1 TO 9:C(X)=1:C(X+9)=2:C(X+18)=4:C(X+27)=8:C(X+36)=16:
C(X+45)=32:NEXT:GOSUB420  :GOSUB440  :RETURN
170 FOR Y=0 TO 8
180 READ Z:IF Z<>0 THEN A$(Y)=A$(Y)+CHR$(Z+137):A$(Y+9)=CHR$(Z+1
37)+A$(Y+9):GOTO180  ELSE NEXT
190 A$(18)=A$(0)+A$(1)+A$(2):A$(19)=A$(3)+A$(4)+A$(5):A$(20)=A$(
6)+A$(7)+A$(8):A$(21)=A$(9)+A$(10)+A$(11):A$(22)=A$(12)+A$(13)+A
$(14):A$(23)=A$(15)+A$(16)+A$(17)
200 FOR Y=0 TO 23:READ M$(Y):NEXT:RETURN
210 FOR X=1 TO LEN(A$(Y))-1 STEP2:CC(ASC(MID$(A$(Y),X+1,1))-137)
=C(ASC(MID$(A$(Y),X,1))-137):NEXT
220 FOR X=2 TO LEN(A$(Y)) STEP2:C(ASC(MID$(A$(Y),X,1))-137)=CC(A
SC(MID$(A$(Y),X,1))-137):NEXT:GOSUB 420  :GOSUB 440  :RETURN
230 DATA 1,36,4,33,7,30,10,1,13,4,16,7,48,10,47,13,46,16,36,48,3
3,47,30,46,37,43,38,40,39,37,42,38,45,39,44,42,43,45,40,44,0
240 DATA 2,35,5,32,8,29,11,2,14,5,17,8,51,11,50,14,49,17,35,51,3
2,50,29,49,0
250 DATA 3,34,6,31,9,28,12,3,15,6,18,9,54,12,53,15,52,18,34,54,3
1,53,28,52,21,27,20,24,19,21,22,20,25,19,26,22,27,25,24,26,0
260 DATA 10,19,11,20,12,21,19,28,20,29,21,30,28,37,29,38,30,39,3
7,10,38,11,39,12,7,9,8,6,9,3,6,2,3,1,2,4,1,7,4,8,0
270 DATA 13,22,14,23,15,24,22,31,23,32,24,33,31,40,32,41,33,42,4
0,13,41,14,42,15,0
280 DATA 16,25,17,26,18,27,25,34,26,35,27,36,34,43,35,44,36,45,4
3,16,44,17,45,18,48,54,51,53,54,52,53,49,52,46,49,47,46,48,47,51
,0
290 DATA 1,21,2,24,3,27,21,52,24,49,27,46,52,43,49,40,46,37,43,1
,40,2,37,3,30,28,29,31,28,34,31,35,34,36,35,33,36,30,33,29,0
300 DATA 4,20,5,23,6,26,20,53,23,50,26,47,53,44,50,41,47,38,44,4
,41,5,38,6,0
310 DATA 7,19,8,22,9,25,10,12,11,15,12,18,15,17,18,16,17,13,16,1
0,13,11,19,54,22,51,25,48,54,45,51,42,48,39,45,7,42,8,39,9,0
320 DATA "LEFT UP","MIDDLE UP","RIGHT UP","TOP RIGHT","MIDDLE RI
GHT","BOTTOM RIGHT","BACK CLOCKWISE","MIDDLE CLOCKWISE","FRONT C
LOCKWISE","LEFT DOWN","MIDDLE DOWN","RIGHT DOWN","TOP LEFT","MID
DLE LEFT","BOTTOM LEFT","BACK COUNTER-CLOCKWISE"
330 DATA "MIDDLE COUNTER-CLOCKWISE","FRONT COUNTER-CLOCKWISE","C
UBE UP","CUBE RIGHT","CUBE CLOCKWISE","CUBE DOWN","CUBE LEFT","C
UBE COUNTER-CLOCKWISE"
340 CLS:PRINT@25,"** CUBE-80 **";YY=Y:FOR Z=0 TO 45 STEP 9:FOR X
=0 TO 6 STEP 3:FOR Y=1 TO 3:POKE 15699+4*Z/9+64*X/3+Y,K(LOG(C(X+
Y+Z))/LOG(2)+1):NEXTY,X,Z:PRINT@532,"TOP ";"FRT ";"RHT ";"BCK ";
"LFT ";"BTM":Y=YY:RETURN
350 PRINT@576,"ENTER A MOVE FROM 0 TO 23 OR 'STOP'";:INPUTY$:IF
Y$="STOP" THEN RETURN ELSE Y=VAL(Y$):GOSUB210  :GOSUB340  :GOTO3
50
360 PRINT@576,STRING$(50,32):FOR Z=0 TO 45 STEP 9:FOR X=0 TO 6 S
```

Program continues

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Program continued

```
TEP 3:FOR Y=1TO3:PRINT@576,"ENTER 'STOP' OR FIRST LETTER OF COLO
R FOR SQUARE";X+Y+Z;:INPUTC$:IFLEFT$(C$,2)="ST"ORLEN(C$)>1THENRE
TURNELSEFORM=1 TO 6:IF C$=K$(W) THEN C(X+Y+Z)=2[(W-1) ELSE NEXTW

370 POKE 15699+4*Z/9+64*X/3+Y,K(LOG(C(X+Y+Z))/LOG(2)+1):NEXTY,X,
Z:PRINT@532,"TOP ";"FRT ";"RHT ";"BCK ";"LFT ";"BTM"
380 INPUT"IS CUBE CORRECT";Z$:IF LEFT$(Z$,1)="Y" THEN GOTO390
ELSE IF LEFT$(Z$,1)<>"N" THEN 380   ELSE 360
390 FORH=0 TO 5:H(H)=0:NEXT:FOR X=1 TO 54:H(LOG(C(X))/LOG(2))=H(
LOG(C(X))/LOG(2)+1:NEXT:FORH=0 TO 5:IF H(H)<>9 THEN 410   ELSE
NEXTH
400 GOSUB440  :FOR X=1 TO 27:FOR Y=1 TO 27:IF B(Y)<>BB(X) THEN N
EXTY:GOTO410   ELSE NEXTX:RETURN
410 CLS:PRINT"MISTAKE IN COLOR ARRANGEMENT":RETURN
420 B(10)=C(32)+C(41):B(11)=C(32):B(12)=C(23)+C(32):B(13)=C(41):
B(14)=0:B(15)=C(23):B(16)=C(14)+C(41):B(17)=C(14):B(18)=C(14)+C(
23):B(1)=C(5)+B(10):B(2)=C(5)+B(11):B(3)=C(5)+B(12):B(4)=C(5)+B(
13):B(5)=C(5):B(6)=C(5)+B(15):B(7)=C(5)+B(16):B(8)=C(5)+B(17)
430 B(9)=C(5)+B(18):B(19)=C(50)+B(10):B(20)=C(50)+B(11):B(21)=C(
50)+B(12):B(22)=C(50)+B(13):B(23)=C(50):B(24)=C(50)+B(15):B(25)=
C(50)+B(16):B(26)=C(50)+B(17):B(27)=C(50)+B(18):RETURN
440 BB(1)=C(1)+C(38)+C(37):BB(2)=C(2)+C(29):BB(3)=C(3)+C(21)+C(2
8):BB(4)=C(4)+C(38):BB(5)=C(5):BB(6)=C(6)+C(20):BB(7)=C(7)+C(10)
+C(39):BB(8)=C(8)+C(11):BB(9)=C(9)+C(12)+C(19):BB(10)=C(33)+C(40
):BB(11)=C(32):BB(12)=C(24)+C(31):BB(13)=C(41)
450 BB(14)=0:BB(15)=C(23):BB(16)=C(13)+C(42):BB(17)=C(14):BB(18)
=C(15)+C(22):BB(19)=C(36)+C(43)+C(46):BB(20)=C(35)+C(49):BB(21)=
C(27)+C(34)+C(52):BB(22)=C(44)+C(47):BB(23)=C(50):BB(24)=C(26)+C
(53):BB(25)=C(16)+C(45)+C(48)
460 BB(26)=C(17)+C(51):BB(27)=C(18)+C(25)+C(54):RETURN
470 U=C(5):IF C(1)+C(2)+C(3)+C(4)+C(5)+C(6)+C(7)+C(8)+C(9)=9*C(5
)ANDB(1)=BB(1)ANDB(2)=BB(2)ANDB(3)=BB(3)ANDB(4)=BB(4)ANDB(6)=BB(
6)ANDB(7)=BB(7)THEN 870
480 IF C(1)+C(3)+C(5)+C(7)+C(9)=5*C(5)ANDB(1)=BB(1)ANDB(3)=BB(3)
ANDB(7)=BB(7)THEN 670
490 K$="":IF B(9)<>BB(9)ORC(5)<>C(9)THEN500   ELSE Y=22:GOSUB210
  :GOTO490
500 IF B(9)=BB(19) THEN K$="0505":GOTO580
510 IF B(9)=BB(9) THEN 580
520 IF B(9)=BB(21) THEN K$="14":GOTO580
530 IF B(9)=BB(27) THEN 580
540 IF B(9)=BB(25) THEN K$="05":GOTO580
550 IF B(9)=BB(1) THEN K$="150506":GOTO 580
560 IF B(9)=BB(3) THEN K$="020511":GOTO 580
570 IF B(9)=BB(7) THEN K$="090508"
580 GOSUB 590  :GOTO 480
590 IF K$="" THEN 600   ELSE GOSUB 2100
600 IF B(9)=BB(9)ANDC(5)=C(12)THEN K$="110502141105O2":GOTO 660

610 IF B(9)=BB(9)ANDC(5)=C(19)THEN K$="081417050814l7":GOTO 660

620 IF B(9)=BB(27)ANDC(5)=C(18)THEN K$="080517":GOTO 660
630 IF B(9)=BB(27)ANDC(5)=C(54)THEN K$="110502080505l7":GOTO 660

640 IF B(9)=BB(27)ANDC(5)=C(25)THEN K$="111402":GOTO 660
650 Y=22:GOSUB210  :RETURN
660 GOSUB 2100 :RETURN
670 IF B(2)=BB(2)ANDB(4)=BB(4)ANDB(8)=BB(8)ANDB(6)=BB(6)ANDC(2)=
C(5)ANDC(4)=C(5)ANDC(6)=C(5)ANDC(8)=C(5) THEN 470
680 IF B(8)=BB(8)ANDC(5)=C(8) THEN K$="22":GOSUB2100 :GOTO680
690 IF B(8)=BB(22) THEN K$="05":GOTO 760
700 IF B(8)=BB(20) THEN K$="0505":GOTO 760
710 IF B(8)=BB(24) THEN K$="14":GOTO 760
720 IF B(8)=BB(4) THEN K$="191005011422O5":GOTO 760
730 IF B(8)=BB(2) THEN K$="22221005011422220505":GOTO 760
740 IF B(8)=BB(6) THEN K$="221005011419l4":GOTO 760
750 GOSUB 770  :GOTO 670
760 GOSUB 2100 :GOSUB 770  :GOTO 670
770 IF B(8)=BB(8)ANDC(5)=C(11)THEN K$="1005050108041713":GOTO860

780 IF B(8)=BB(12) THEN K$="171313080404":GOTO 860
790 IF B(8)=BB(10) THEN K$="080404171313":GOTO 860
800 IF B(8)=BB(16)ANDC(5)=C(42) THEN K$="13170408": GOTO 860
810 IF B(8)=BB(18)ANDC(5)=C(22) THEN K$="04081317":GOTO 860
820 IF B(8)=BB(16)ANDC(5)=C(13) THEN K$="130804041713":GOTO 860

830 IF B(8)=BB(18)ANDC(5)=C(15) THEN K$="041713130804":GOTO 860

840 IF B(8)=BB(26)ANDC(5)=C(51) THEN K$="10050501":GOTO 860
850 IF B(8)=BB(26)ANDC(5)=C(17) THEN K$="08041703":GOTO 860
860 GOSUB 2100 :RETURN
870 IF C(46)+C(47)+C(48)+C(49)+C(50)+C(51)+C(52)+C(53)+C(54)=9*C
(50)ANDB(19)=BB(19)ANDB(20)=BB(20)ANDB(21)=BB(21)ANDB(22)=BB(22)
ANDB(23)=BB(23)ANDB(24)=BB(24)ANDB(25)=BB(25) THEN 1170
880 IF C(46)+C(48)+C(50)+C(52)+C(54)=5*C(50)ANDB(19)=BB(19)ANDB(
21)=BB(21)ANDB(25)=BB(25) THEN 1170
890 IF C(50)=C(46)AND(C(50)=C(52)ORC(50)=C(48))THEN 960
900 IF C(50)=C(54)AND(C(50)=C(48)ORC(50)=C(52)) THEN 960
910 IF C(50)=C(46) THEN K$="22":GOTO950
920 IF C(50)=C(48) THEN K$="2222":GOTO950
930 IF C(50)=C(54) THEN K$="19":GOTO950
940 K$="110502050814l7":GOSUB 2100 :GOTO 890
950 GOSUB 2100 :K$="110502050814l7":GOSUB2100 :GOTO 890
960 IF B(21)=BB(21)ANDB(19)=BB(19)ANDB(25)=BB(25)ANDB(27)=BB(27)
 THEN K$="18":GOSUB2100 :GOTO1100
970 IF B(21)=BB(21)ANDB(19)=BB(19)THEN K$="182323":GOSUB2100 :GO
OTO 1050
980 IF B(21)=BB(21)ANDB(27)=BB(27) THEN K$="1823":GOSUB2100 :GOT
O1050
990 IF B(21)=BB(21) THEN 1010
1000 K$="14":GOSUB 2100 :GOTO 960
1010 K$="1818":GOSUB2100
1020 K$="120203801211O309":GOSUB2100
1030 IF B(1)=BB(1)ANDB(3)=BB(3)ANDB(7)=BB(7) THEN K$="21":GOSUB2
100 :GOTO1100
1040 IF B(3)=BB(3)ORB(7)=BB(7) THEN K$="21":GOSUB2100 :GOTO1050
 ELSE GOTO1020
1050 IF B(7)=BB(7)ANDB(9)=BB(9) THEN 1090
1060 IF B(25)=BB(25)ANDB(7)=BB(7) THEN K$="20":GOSUB2100 :GOTO10
90
1070 IF B(9)=BB(9)ANDB(27)=BB(27) THEN K$="23":GOSUB 2100 :GOTO
1090
1080 IF B(25)=BB(25)ANDB(27)=BB(27) THEN K$="2323":GOSUB2100 :GO
TO1090

1090 K$="121703171711171702171217031717111717021717051717141795l
714":GOSUB 2100 :GOTO 1100
1100 FOR B=10 TO 18:IF C(B)=C(14) THEN NEXT:GOTO1170  ELSE GOTO1
120
1110 IF C(10)+C(12)+C(14)+C(16)+C(18)=5*C(14)ANDB(7)=BB(7)ANDB(9
)=BB(9)ANDB(25)=BB(25) THEN 1170
1120 IF C(14)=C(10)ANDC(14)=C(12)ANDB(7)=BB(7)ANDB(9)=BB(9) THEN
 K$="2323":GOSUB2100 :GOTO1160
1130 IF C(14)=C(16)ANDC(14)=C(10)ANDB(25)=BB(25)ANDB(7)=BB(7) TH
EN K$="23":GOSUB2100 :GOTO1160
1140 IF C(14)=C(12)ANDC(14)=C(18)ANDB(9)=BB(9)ANDB(27)=BB(27) TH
EN K$="20":GOSUB2100 :GOTO1160
1150 IF C(14)=C(12)ANDB(9)=BB(9) THEN K$="20":GOSUB2100 :GOTO111
0
1160 K$="021515110315151200031515120215151117":GOSUB2100 :GOTO11
10
1170 FOR T=1 TO 4:IF B(2)=BB(2)ANDB(4)=BB(4)ANDB(6)=BB(6)ANDB(8)
=BB(8)ANDB(10)=BB(10)ANDB(12)=BB(12)ANDB(16)=BB(16)ANDB(18)=BB(1
8)ANDB(20)=BB(20)ANDB(22)=BB(22)ANDB(24)=BB(24) THEN 1180  ELSE
1190
1180 FOR V=0 TO 5:FOR W=1+9*V TO 9+9*V:IF C(W)=C(9*V+5) THEN NEX
T W,V:CLS:PRINT"THE CUBE IS COMPLETED":RETURN
1190 IF C(32)=U THEN K$="19":GOSUB2100  ELSE IF C(14)=U THEN K$=
"22":GOSUB2100  ELSE IF C(23)=U THEN K$="1919":GOSUB2100  ELSE I
F C(5)=U THEN K$="23":GOSUB2100  ELSE IF C(50)=U THEN K$="20":GO
SUB2100
1200 ON T GOSUB1220 ,1420 ,1560 ,1640
1210 NEXTT:GOTO1170
1220 FORL=1 TO 3
1230 IF (B(8)=BB(26)ORB(26)=BB(8)ORB(2)=BB(20)ORB(20)=BB(2))AND(
B(8)<>BB(8)ANDB(26)<>BB(26)ANDB(20)<>BB(20)ANDB(2)<>BB(2)) THEN
GOSUB1800 :RETURN
1240 IF (B(8)=BB(26)ORB(26)=BB(8)ORB(24)=BB(6)ORB(6)=BB(24))AND(
B(8)<>BB(8)ANDB(26)<>BB(26)ANDB(24)<>BB(24)ANDB(6)<>BB(6)) THEN
GOSUB1810 :RETURN
1250 IF (B(8)=BB(2)ORB(2)=BB(26)ORB(26)=BB(8))AND(B(8)<>BB(8)AND
B(2)<>BB(2)ANDB(26)<>BB(26)) THEN GOSUB1820 :RETURN
1260 IF (B(2)=BB(8)ORB(26)=BB(2)ORB(8)=BB(26))AND(B(2)<>BB(2)AND
B(26)<>BB(26)ANDB(8)<>BB(8)) THEN GOSUB1830 :RETURN
1270 IF (B(2)=BB(24)ORB(24)=BB(8)ORB(8)=BB(2))AND(B(2)<>BB(2)AND
B(24)<>BB(24)ANDB(8)<>BB(8)) THEN GOSUB1840 :RETURN
1280 IF (B(24)=BB(2)ORB(8)=BB(24)ORB(2)=BB(8))AND(B(24)<>BB(24)A
NDB(8)<>BB(8)ANDB(2)<>BB(2)) THEN GOSUB1850 :RETURN
1290 IF (B(8)=BB(2)ORB(2)=BB(12)ORB(12)=BB(8))AND(B(8)<>BB(8)AND
B(2)<>BB(2)ANDB(12)<>BB(12)) THEN GOSUB1860 :RETURN
1300 IF (B(2)=BB(8)ORB(12)=BB(2)ORB(8)=BB(12))AND(B(2)<>BB(2)AND
B(12)<>BB(12)ANDB(8)<>BB(8)) THEN GOSUB1870 :RETURN
1310 IF (B(2)=BB(8)ORB(18)=BB(2)ORB(8)=BB(18))AND(B(2)<>BB(2)AND
B(18)<>BB(18)ANDB(8)<>BB(8)) THEN GOSUB1880 :RETURN
1320 IF (B(8)=BB(2)ORB(2)=BB(18)ORB(18)=BB(8))AND(B(8)<>BB(8)AND
B(2)<>BB(2)ANDB(18)<>BB(18)) THEN GOSUB1890 :RETURN
1330 IF (B(2)=BB(26)ORB(26)=BB(18)ORB(18)=BB(2))AND(B(2)<>BB(2)A
NDB(26)<>BB(26)ANDB(18)<>BB(18)) THEN GOSUB1920 :RETURN
1340 IF (B(26)=BB(2)ORB(18)=BB(26)ORB(2)=BB(18))AND(B(26)<>BB(26
)ANDB(2)<>BB(2)ANDB(18)<>BB(18)) THEN GOSUB1930 :RETURN
1350 IF (B(2)=BB(6)ORB(6)=BB(8)ORB(8)=BB(2))AND(B(2)<>BB(2)ANDB(
6)<>BB(6)ANDB(8)<>BB(8)) THEN GOSUB2030 :RETURN
1360 IF (B(6)=BB(2)ORB(8)=BB(6)ORB(2)=BB(8))AND(B(6)<>BB(6)ANDB(
2)<>BB(2)ANDB(8)<>BB(8)) THEN GOSUB2020 :RETURN
1370 IF B(6)=BB(6)ANDB(8)=BB(8)ANDC(5)<>C(8)ANDC(5)<>C(6) THEN G
OSUB2040 :RETURN
1380 IF B(2)=BB(2)ANDB(8)=BB(8)ANDC(5)<>C(2)ANDC(5)<>C(8) THEN G
OSUB2050 :RETURN
1390 IF B(8)=BB(8)ANDB(24)=BB(24)ANDC(5)<>C(8)ANDC(23)<>C(26) TH
EN GOSUB2060 :RETURN
1400 IF B(26)=BB(26)ANDB(6)=BB(6)ANDC(14)<>C(17)ANDC(5)<>C(6) TH
EN GOSUB2070 :RETURN
1410 K$="18":GOSUB2100 :NEXT:RETURN
1420 K$="22":GOSUB2100 :FOR L=1 TO 3
1430 IF (B(8)=BB(26)ORB(26)=BB(8)ORB(6)=BB(24)ORB(24)=BB(6))AND(
B(8)<>BB(8)ANDB(26)<>BB(26)ANDB(6)<>BB(6)ANDB(24)<>BB(24)) THEN
GOSUB1810 :RETURN
1440 IF (B(4)=BB(18)ORB(18)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(18)<>BB(18)ANDB(8)<>BB(8)) THEN GOSUB1960 :RETURN
1450 IF (B(18)=BB(4)ORB(8)=BB(18)ORB(4)=BB(8))AND(B(18)<>BB(18)A
NDB(4)<>BB(4)ANDB(8)<>BB(8)) THEN GOSUB1970 :RETURN
1460 IF (B(4)=BB(26)ORB(26)=BB(18)ORB(18)=BB(4))AND(B(4)<>BB(4)A
NDB(26)<>BB(26)ANDB(18)<>BB(18)) THEN GOSUB1980 :RETURN
1470 IF (B(26)=BB(4)ORB(18)=BB(26)ORB(4)=BB(18))AND(B(26)<>BB(26
)ANDB(4)<>BB(4)ANDB(18)<>BB(18)) THEN GOSUB1990 :RETURN
1480 IF (B(4)=BB(16)ORB(16)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(16)<>BB(16)ANDB(8)<>BB(8)) THEN GOSUB2000 :RETURN
1490 IF (B(16)=BB(4)ORB(8)=BB(16)ORB(4)=BB(8))AND(B(16)<>BB(16)A
NDB(4)<>BB(4)ANDB(8)<>BB(8)) THEN GOSUB2010 :RETURN
1500 IF B(6)=BB(6)ANDB(8)=BB(8)ANDC(5)<>C(8)ANDC(5)<>C(6) THEN G
OSUB2040 :RETURN
1510 IF B(4)=BB(4)ANDB(6)=BB(6)ANDB(22)=BB(22)ANDB(18)=BB(18)AND
C(5)<>C(4)ANDC(5)<>C(6)ANDC(41)<>C(44)ANDC(14)<>C(15) THEN GOSUB
2080 :RETURN
1520 IF B(6)=BB(6)ANDB(22)=BB(22)ANDC(5)<>C(6)ANDC(41)<>C(44) TH
EN GOSUB2090 :RETURN
1530 IF B(8)=BB(8)ANDB(24)=BB(24)ANDC(5)<>C(8)ANDC(23)<>C(26) TH
EN GOSUB2060 :RETURN
1540 IF B(6)=BB(6)ANDB(26)=BB(26)ANDC(5)<>C(6)ANDC(14)<>C(17) TH
EN GOSUB2070 :RETURN
1550 K$="20":GOSUB2100 :NEXT:RETURN
1560 K$="2222":GOSUB2100 :FOR L=1 TO 3
1570 IF (B(2)=BB(26)ORB(26)=BB(16)ORB(16)=BB(2))AND(B(2)<>BB(2)A
NDB(26)<>BB(26)ANDB(16)<>BB(16)) THEN GOSUB1900 :RETURN
1580 IF (B(26)=BB(2)ORB(16)=BB(26)ORB(2)=BB(16))AND(B(26)<>BB(26
)ANDB(2)<>BB(2)ANDB(16)<>BB(16)) THEN GOSUB1910 :RETURN
1590 IF (B(4)=BB(10)ORB(10)=BB(8)ORB(8)=BB(4))AND(B(8)<>BB(8)AND
B(10)<>BB(10)ANDB(4)<>BB(4)) THEN GOSUB1940 :RETURN
1600 IF (B(10)=BB(4)ORB(8)=BB(10)ORB(4)=BB(8))AND(B(10)<>BB(10)A
NDB(8)<>BB(8)ANDB(4)<>BB(4)) THEN GOSUB1950 :RETURN
1610 IF (B(4)=BB(16)ORB(16)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(16)<>BB(16)ANDB(8)<>BB(8)) THEN GOSUB2010 :RETURN
1620 IF (B(16)=BB(4)ORB(8)=BB(16)ORB(4)=BB(8))AND(B(16)<>BB(16)A
NDB(8)<>BB(8)ANDB(4)<>BB(4)) THEN GOSUB2020 :RETURN
1630 K$="18":GOSUB2100 :NEXT:RETURN
1640 K$="23":GOSUB2100 :FOR L=1 TO 3
1650 IF (B(8)=BB(2)ORB(2)=BB(12)ORB(12)=BB(8))AND(B(8)<>BB(8)AND
B(2)<>BB(2)ANDB(12)<>BB(12)) THEN GOSUB1860 :RETURN
1660 IF (B(2)=BB(8)ORB(12)=BB(2)ORB(8)=BB(12))AND(B(2)<>BB(2)AND
B(8)<>BB(8)ANDB(12)<>BB(12)) THEN GOSUB1870 :RETURN
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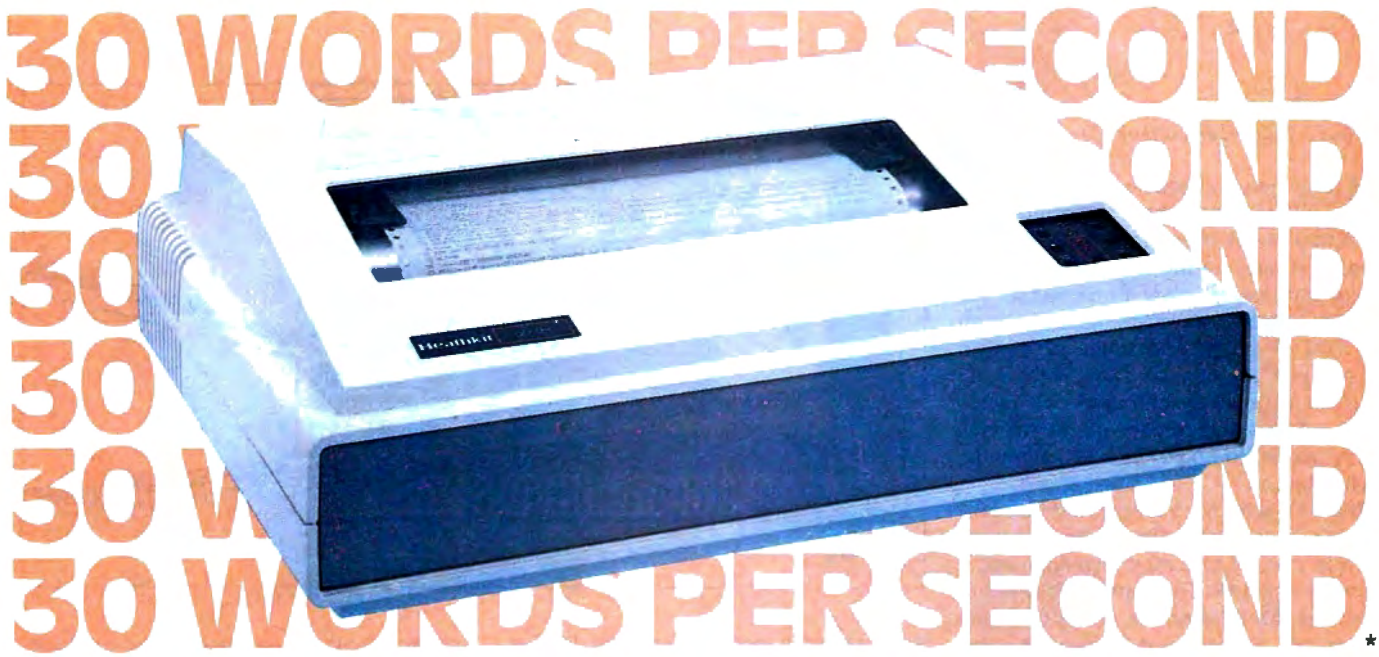

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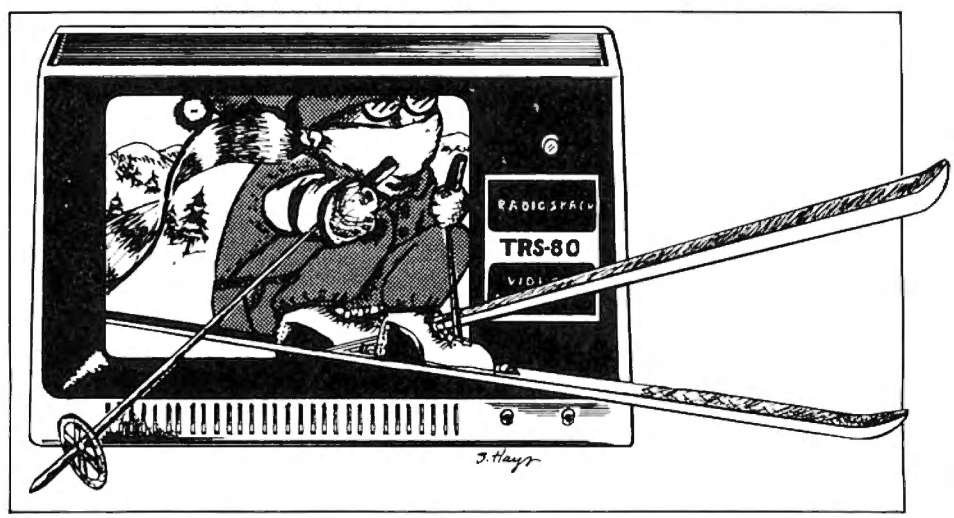

No klingons, space-meanies or snargwerdlers; in fact there's nothing extraterrestrial about this game. Your feet are planted firmly on the ground, your skis waxed and you're about to plunge at 100 mph through 200 awkwardly placed flags on the side of a cliff. I promise no broken bones; just an ego or two. This is all the fault of Kerry Leichtman—our games issue editor—who forced me (at the risk of my career) to come up with something for this issue.

This has been lying around unplayed for over three years and I'd forgotten how much fun it is. It won't take much typing in and it will even run in 4K. There are three levels of difficulty; the third one is pretty challenging. In fact, I have a sneaky feeling some bends at level three are impossible to negotiate. You'll always have an excuse why you didn't get a perfect score. Or you can try again. You might be sorry.

You're always offered the option of attempting the course again. This way you will either become addicted or quickly leave the computer with your eyes crossed. One of the strange things that happens, after attempting a slope or two, is you are suddenly inflicted with the illusion that you're traveling backwards. This doesn't make it any easier to steer a true course—but who wants it to be too easy? You're on your own. Break a leg. No, that's not right. Enjoy it.

Here's a breakdown of the program. Line 130 sets the course length at 200 flags; change this value to either increase or decrease the length. Line 150 sets up the simple string graphics—a pair of skis and two flags. Line 160 sets the degree of difficulty according to your current state of recklessness.

The value input to variable ZD, at this point, determines how severely the course direction changes. A value of one gives you a fairly gentle course, whereas a value of three will give you motion sickness.

If you're feeling sneaky, change the ZD>3 at the end of line 160 to ZD>4. This will give you (better yet an unsuspecting friend) a course that is physically impossible to negotiate, providing a new slant to the game (if you'll excuse the pun). It's kind of like trying to ski down Mount Everest from the top: there's no way you'll get to the bottom alive, but whoever does it and dies the least amount of times is the winner. You'll be sorry.

Lines 170–200 plot the course into the integer array ZC. The degree of difficulty changes both the severity of the curves and the length of each new direction. Once the course is plotted, lines 210–230 throw you headlong into possible destruction.

Lines 250 and 260 scan the keyboard using the PEEK function for the left or right arrows for steering. The INKEY$ function would have been the more correct statement to use at this point, but it slows the program intolerably.

Line 270 displays your latest score at the top of the screen. As the display is constantly scrolling, it's necessary to show this score as each new flag comes into view. Your score equals the number of flags you've knocked down. In other words, a perfect score is zero.

Line 270 also does a numerical check to see that your skis are within the flags. If so, it returns to the main code at lines 220 and 230. If not, it drops down to line 280 where

your offending move is flashed to cause you maximum pain and embarrassment. Your skis are then automatically planted centrally between the two flags and you're sent on your way to continue the course.

Walking the course is not permitted, nor is taking the chairlift down. On some courses, it may be a disadvantage to be relocated in the middle of two flags in which case, tough luck! You'll have to be more careful. Blame it all on Kerry Leichtman. Then he'll be sorry.■

```
100 CLS:PRINT@22,"TRS-80 Slalom Run"
110 PRINT@86,"By Jake Commander"
120 PRINT:PRINT@210,"To go LEFT, press left arrow":PRINT@273,"To
 go right, press right arrow":PRINT@336,"Otherwise skis go strai
ght ahead."
130 DEFINTL-Z:L=200:DIMZC(L+7)
140 YD=RND(3)-2:IFYD=0THEN140
150 DEFSTRA-F:A=CHR$(170)+CHR$(170):B=CHR$(171):C=CHR$(151)
160 PRINT@512,;:INPUT"Degree of difficulty (1,2 OR 3)";ZD:IFZD<0
ORZD>3THEN160
170 Y=0:Z=1:CLS:PRINT@22,"Plotting new course"
180 Y1=RND(ZD*2+1)-3:YD=-YD
190 X=RND(6/(ABS(Y1)+1))+RND(2):IFX+1=Z1THEN190ELSEFORZ1=1TOX:Y=
Y+Y1*YD:IFABS(Y)>25YD=-YD:Y=Y+Y1*YD
200 ZC(Z)=Y:Z=Z+1:IFZ<L+1NEXT:GOTO180
210 CLS:U=0:X=0
220 FORZ=1TOL:PRINT@985+ZC(Z),B:GOSUB250:PRINT@996+ZC(Z),C:GOSUB
250:NEXT
230 FORZ=ZTOZ+6:PRINT@1023,:GOSUB250:PRINT@1023,:GOSUB250:NEXT
240 PRINT@192,"Same course";:INPUTD:D=LEFT$(D,1):IFD="E"THENENDE
LSEIFD="Y"ORD="y"THEN210ELSE160
250 IF(PEEK(14400)AND32)=32X=X-1
260 IF(PEEK(14400)AND64)=64X=X+1
270 PRINT@60,U;:PRINT@30+X,A;:IFZ<8THENRETURNELSEIFABS(ZC(Z-7)-X
)<5RETURN
280 FORZZ=1TO7:PRINT@30+X,"**";:PRINT@30+X,A;:NEXT:X=ZC(Z-7):U=U
+1:RETURN
```

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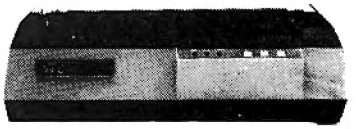

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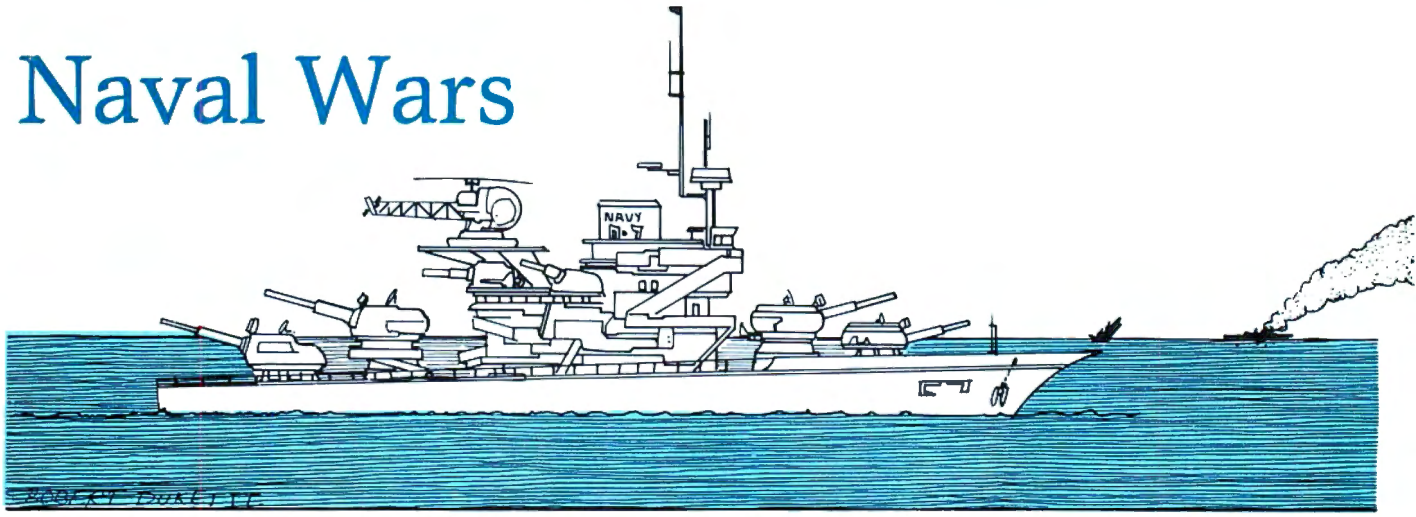
This one is so good you need two computers.

Naval Wars



Arthur J. Byrnes
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To play Naval Wars you need a 16K Model I or III and a friend (or enemy) with a 16K Model I or III. The computers do not have to be the same, but if you use a Model I with a Model III, set the Model III for 500 baud tape.

In Naval Wars both computers run the same program simultaneously.

The program does not use any machine-language subroutines. It is fun to play and even more fun watching the two machines talk to each other.

10–95	Graphics variable assignment
100–150	Introduction display
160–170	Battle area mapping
180–350	Ship placement
370–380	Sets timing between computers
400–430	Fires at other computer
435–450	Receives hit or miss data
500–530	Receives fire from other computer
540–550	Determines location of incoming fire
560–570	Determines hit or miss
600–680	Determines which ship was hit
690–700	Determines if ship has been sunk
800–830	Determines location of input
900–930	Determines if ship is too close to border

Table 1. Program Breakdown

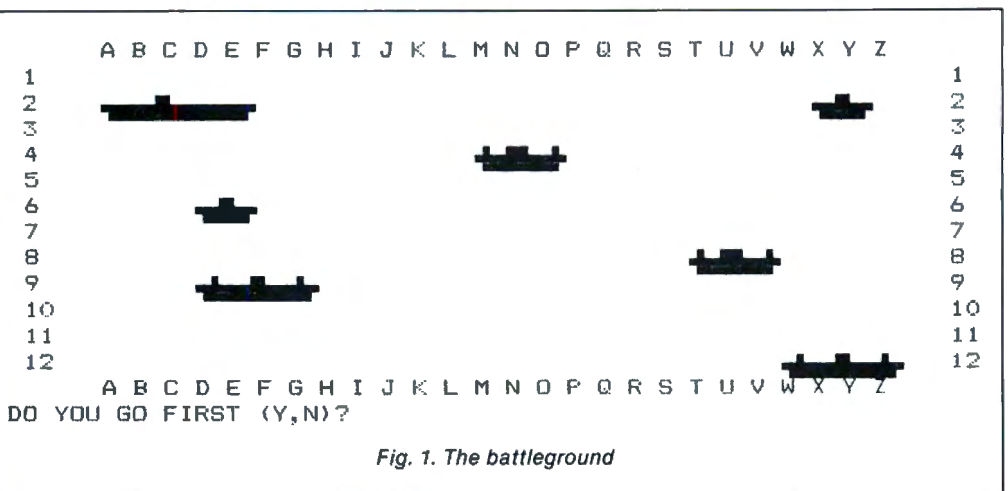

Fig. 1. The battleground

Connecting the Micros

Put the two TRS-80s back to back. Set up the cassette recorders as normal. (It is best to turn off or unplug your disk drives and use Level II Basic.) Load the program into both computers. Then remove the black plug from your recorder and the black plug from your partner's recorder; plug in yours where his was and his where yours was. Make sure not to remove the gray plugs. Open the cassette door and push in the tab at the left rear. Hold it in while pushing down the record and play buttons. If the record button will not go down you're not holding the tab in far enough.

Now recheck your connections. Everything should be normal except that your black plug is plugged into your friend's recorder and his black plug is plugged into your recorder and both recorders are in the record mode.

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with automatic level controls we are able to buffer the computers' inputs and outputs. Table 1 breaks the program down for you.

To Play

Type Run and press Enter on both computers. The first display will show the different ships and how many you get. The next display shows the battle area and asks you to place your ships (Fig. 1). As you enter the coordinates, the computer displays the ship in its location. Coordinates must be entered letter first, then the number with no spaces in between. Once the ships are in place, the computer will ask you if you go first. Make sure you enter different letters (Y or N), since this statement sets up the timing between the computers. There is no advantage to going first. If you do both type the same letter, press Reset on both computers and rerun the program.

The strategy is to destroy your opponent's ships before he destroys yours. Some ships can take more hits than others.

If the computers lock-up press Reset, check the recorder connections and volume levels and rerun the program. ■

Arthur Byrnes is employed by Racal Decca Marine Inc.

Program Listing

```
10 REM BATTLESHIP
20 REM ARTHUR J. BYRNES
8/19/81
P.O.BOX 478
HOLLY HILL FLA. 32017
30 CLS:PRINT"WELCOME TO THE GAME OF BATTLESHIP.
35 CLEAR150
40 Q$=STRING$(60," ")
75 B$=CHR$(172)+CHR$(189)+CHR$(188)+CHR$(190)+CHR$(189)+CHR$(188
)+CHR$(190)+CHR$(156)
85 D$=CHR$(172)+CHR$(190)+CHR$(189)+CHR$(156)
90 A$=CHR$(172)+CHR$(188)+CHR$(188)+CHR$(190)+CHR$(189)+CHR$(188
)+CHR$(188)+CHR$(188)+CHR$(188)+CHR$(156)
95 C$=CHR$(174)+CHR$(188)+CHR$(191)+CHR$(189)+CHR$(188)+CHR$(157
)
100 PRINT@128,"THESE ARE YOUR SHIPS AND QUANTITY (N) ."
110 PRINT@256,A$,"AIRCRAFT CARRIER   (1)"
120 PRINT@384,B$,"BATTLE SHIP        (2)"
130 PRINT@512,C$,"DESTROYER          (2)"
140 PRINT@640,D$,"P.T. BOAT          (2)"
150 PRINT@832,:INPUT"PRESS ENTER TO CONTINUE";
155 CLS
160 FORX=64TO768 STEP64:Y=Y+1:PRINT@X,Y;:PRINT@X+60,Y;:NEXTX
165 Y=64
170 FORX=6TO56 STEP2:Y=Y+1:PRINT@X,CHR$(Y);:PRINT@X+832,CHR$(Y);
:NEXT
180 PRINT@832,:INPUT"WHERE WOULD YOU LIKE YOUR AIRCRAFT CARRIER"
;I$
181 Z$=LEFT$(I$,1)
182 IFZ$="W" OR Z$="X" OR Z$="Y" OR Z$="Z" GOSUB900:GOTO180
190 GOSUB800
195 G=L
200 PRINT@L,A$;
210 PRINT@832,:INPUT"WHERE WOULD YOU LIKE YOUR FIRST BATTLESHIP"
;I$
220 GOSUB800
222 Z$=LEFT$(I$,1)
223 IFZ$="X" OR Z$="Y" OR Z$="Z" GOSUB900:GOTO210
225 H=L
230 PRINT@L,B$;
240 PRINT@832,:INPUT"WHERE WOULD YOU LIKE YOUR NEXT BATTLESHIP
";I$
241 Z$=LEFT$(I$,1)
242 IFZ$="X" OR Z$="Y" OR Z$="Z" GOSUB900:GOTO240
245 GOSUB800
247 J=L
250 PRINT@L,B$;
260 FORX=1TO2
265 PRINT@896,Q$;
270 PRINT@896,"WHERE WOULD YOU LIKE DESTROYER #";X;:INPUTI$
275 Z$=LEFT$(I$,1)
276 IFZ$="Z" OR Z$="Y" GOSUB900:GOTO270
280 GOSUB800
282 K(X)=L
285 PRINT@L,C$;
290 NEXT
```

Program continues

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Program continued

```
300 FORX=1TO2
310 PRINT@896,Q$;
320 PRINT@896,"WHERE WOULD YOU LIKE P.T. BOAT #";X;:INPUTI$
330 GOSUB800
335 M(X)=L
340 PRINT@L,D$;
350 NEXT
360 PRINT@896,Q$;
370 PRINT@896,;:INPUT"DO YOU GO FIRST (Y,N)";N$
380 IF LEFT$(N$,1)="N" GOTO500
400 REM FIRE SUB
410 PRINT@896,Q$;
420 PRINT@896,;:INPUT"YOUR TURN TO FIRE , ENTER POSITION";I$
430 PRINT#-1,I$
435 FORX=1TO25:NEXT
440 INPUT#-1,L,W$
450 PRINT@L+1,W$;
500 REM RECEIVE FIRE SUB
510 PRINT@896,Q$;
520 PRINT@896,"I N C O M I N G  F I R E
530 INPUT#-1,I$
540 GOSUB800
550 PRINT@L,"*";
560 GOSUB600
565 IFLEN(W$)>1 PRINT@L,W$;
570 PRINT#-1,L,W$
580 GOTO400
600 REM SCORE SUB
605 FORB=0TO10 STEP2
610 IFL=G+B PRINT@896,Q$;:PRINT@896,"HIT ON AIRCRAFT CARRIER":W$
="H":B=10:V(1)=V(1)+1:GOTO690
615 NEXTB
617 FORB=0TO8 STEP2
620 IFL=H+B PRINT@896,Q$;:PRINT@896,"HIT ON BATTLESHIP #1":W$="h
":V(2)=V(2)+1:GOTO690
630 IFL=J+B PRINT@896,Q$;:PRINT@896,"HIT ON BATTLESHIP #2":W$="h
":V(3)=V(3)+1:GOTO690
635 NEXTB
637 FORB=0TO6STEP2
640 IFL=K(1)+B PRINT@896,Q$;:PRINT@896,"HIT ON DESTROYER #1":W$=
"H":V(4)=V(4)+1:GOTO690
650 IFL=K(2)+B PRINT@896,Q$;:PRINT@896,"HIT ON DESTROYER #2":W$=
"H":V(5)=V(5)+1:GOTO690
655 NEXTB
657 FORB=0TO4STEP2
660 IFL=M(1)+B PRINT@896,Q$;:PRINT@896,"HIT ON P.T.BOAT #1":W$="
H":V(6)=V(6)+1:GOTO690
670 IFL=M(2)+B PRINT@896,Q$;:PRINT@896,"HIT ON P.T.BOAT #2";W$="
H":V(7)=V(7)+1:GOTO690
675 NEXTB
680 PRINT@896,Q$;:PRINT@896,"MISS":W$="M":RETURN
690 IFV(1)=5 THENW$="S U N K    ":L=G:G=0:V(1)=0:RETURN
691 IFV(2)=4 THENW$="S U N K ":L=H:H=0:V(2)=0:RETURN
692 IFV(3)=4 THENW$="S U N K ":L=I:I=0:V(3)=0:RETURN
693 IFV(4)=3 THENW$="SOUTU N K":L=K(1):K(1)=0:RETURN
694 IFV(5)=3 THENW$="S U N K":L=K(1):K(1)=0:RETURN
695 IFV(6)=2 THENW$="SUNK":L=M(1):M(1)=0:RETURN
696 IFV(7)=2 THENW$="SUNK":L=M(2):M(2)=0:RETURN
697 RETURN
800 REM LOC SUB
805 V=VAL(MID$(I$,2))
810 N=(ASC(I$)-62)*2
820 L=(V*64)+N
830 RETURN
900 REM CLOSE SUB
910 PRINT@896,Q$:PRINT@896,"SORRY , THAT WOULD PUT PART OF THE S
HIP ON LAND.  TRY AGAIN"
920 FORQ=0TO1000:NEXTQ
925 PRINT@896,Q$
930 RETURN
```

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Inside Leo Christopherson.

The Graphics King

by Steven Frann
80 Micro staff

Do you believe that dreams tell the future? In the case of Leo Christopherson, it's true. Leo teaches computers and math in the seventh and eighth grades. He pioneered fast animated graphics with his Android Nim program in 1978. Since then he has authored other successful graphics oriented game programs including Dancing Demon in which the demon, a graphics character, dances to the music and step patterns you program in, and Voyage of the Valkyrie, a blend of arcade and adventure games.

Leo was born in Spokane, Washington in June 1937. He tells about a dream he had when he was in grade school in the late 1940s: "When I went to sixth or seventh grade class sometimes it seemed I was a teacher and sometimes I was a student. When students went to school they would sit down in a little isolated booth. In front of them would be a keyboard and in front of that would be some way of presenting material to them. The teacher would have some kind of control console up front and would make sure each student was doing what he was supposed to be doing.

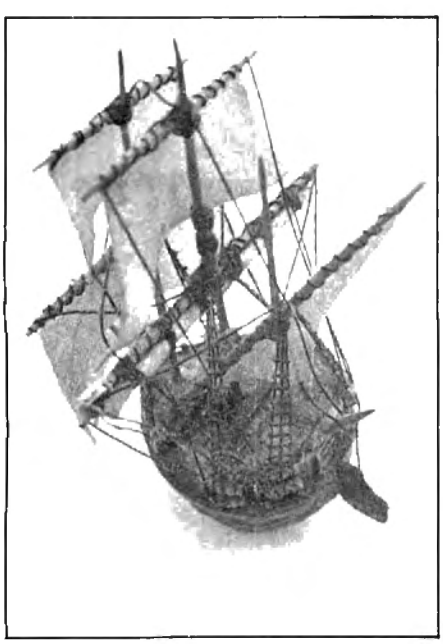

Photo 1. The surviving walnut shell boat

"That is a lot like a computer system. I didn't know what a computer was. It was vague in my mind what the student would be looking at because we didn't have tv back then in Spokane. I would see pictures of radar-like screens."

Is it just coincidence that Leo is now a teacher in a school district near his home in Tacoma, WA, and that he uses computers in some of his courses? What turned Leo's dream into reality?

Explosions

Leo grew up in Spokane, WA. He and his friends used to buy ingredients for gunpowder from a local drug store. "We tried to make the best kind of gunpowder we could figure out how to make. We spiked it up with powered magnesium and some other things.

"Sometimes I would spend three or four days putting together ships out of walnut shells and toothpicks and glue. I laid a planking across the ship and put a bunch of BBs in its bottom so it would float upright. Then I put a mast and rigging and sails on it. We'd dig some holes out in the back yard and flood them to make lakes. Then we put little gunpowder charges on the boats and push them in the water. And then we blew them up. It was fun to watch. But building the ships took a lot of time. I still have one of those boats left. I finally got old enough to respect all the work it took to build one of these things and I just couldn't blow that one up" (see Photo 1).

From these early experiments with gunpowder Leo caught the science bug. He studied physics at Washington State University for three years, dropped it, and eventually received a bachelor's degree in math. He became unhappy with what he had been told about the job prospects in the industry. He didn't want to sit around doing crossword puzzles while waiting for a superior to give him a problem to solve. So he decided to study languages. The problem with that was he didn't want to become a translator.

Leo left school for a year and returned to Spokane. After talking with an old friend he decided to become a teacher. "Teachers were in demand back then. The first job offer I got was in the school district here near Tacoma. I've stayed here ever since. It turned out to be a good place for a person who likes to involve himself in all sorts of things, but who is not an expert in any one of them."

Building Blocks

Just as Leo's experiments with blowing up walnut shell ships led him to study science and eventually become a teacher, other childhood experiences have come through in his computer games.

"When I was 8 or 10 years old my uncle gave me a set of stone blocks for a birthday present. The blocks were of various sizes and there were a limited number of each one. In order to put them all together you had to do quite a bit of planning. That was one of the best gifts I ever got. I really loved it. I worked and worked and worked on it. The kind of thinking involved there is important in programming."

Leo grew up with a lot of music around him. His parents had a radio/phonograph and a collection of 78s. He played them often. "It set something in my mind in terms of finding patterns in musical structure. When I was 10 they gave me an accordion.

"The accordion is a neat instrument for finding patterns in music. It took me quite a while to figure the thing out. They never gave me lessons. The whole left-hand bass section of the accordion is laid out in an interesting structure that is related to the chord structure by which music is generally patterned."

Of all his programs, Dancing Demon most embodies the spirit of these two childhood events. "Dancing Demon is an educational program. I wrote it to illustrate the same idea of the stone blocks where you have to fit one group of certain size things together with another group. In the case of Demon you have to put down the musical measures that have so many beats per mea-

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sure and you have to program the dance steps on top of that."

Cartoon Graphics

Leo's games are graphics oriented. This also has a root in Leo's childhood. "I liked to draw. I started getting Walt Disney comic books and I just loved the cartooning in them. I started trying to duplicate that. I drew cartoons and pictures all through grade school and junior high. The first thing I wanted to be was a cartoonist. I think that still shows up in my programs now. That's why they are so graphics oriented and why some people have called them cartoon graphics."

Leo bought a Level I TRS-80 computer when they first came out. When Level II became available in the Tacoma area he started the Android Nim program. In this program, the old game of nim is played using animated androids as the playing pieces. "I really wanted to try graphics. It started as an animation of little characters that would draw a gun and shoot.

"Reviewers have called my early games, Android Nim, Snake Eggs, and Beewary, trivial. Beewary is a simple arcade type game. The player controls a bee and must fly it around carefully, trying to sting a spider before the spider jumps and gets the bee. These games are mostly experiments in graphics and other techniques. There is an entertainment factor involved in them. From the response I've received it seems people like to get the programs and take them apart to study the techniques used.

"Demon was the first game that wasn't really trivial. It requires you to think about what you're doing. The results depend on how well you understand the game. With something like Dancing Demon the more you put into it the better the results you get."

A Recipe for Games

Leo's Voyage of the Valkyrie is selling well through Advanced Operating Systems. In Valkyrie the player is a Space Viking with the job of capturing an alien controlled island. He must develop a map and find the island's castles. Arcade action is involved in capturing each castle. Wagner's music is used throughout the program.

"Valkyrie represents a step further in terms of programming something that is more a game than a graphics showpiece. The graphics in fact may be slightly less involved than in my other games."

If it's not the graphics, then what makes Voyage of the Valkyrie so special? "The books that are the most exciting to read for me are the ones that have a lot of action, then are slowly paced for a while to fill in the details and then have more action and so on. In computer programming the action part is an arcade type game and the slow part is a section where you have to figure out what you are going to do next."

Valkyrie combines both these elements. "You have the arcade action with the birds. You have to think about what you are going to do next as you explore the island and try to find where the castles are. Once you know all that, you still have to watch fuel levels and calculate how far away the castles are so you know you can get there and back. You have to figure out where you can make a refueling base so you can successfully knock off the last few castles. I think this balance between action and planning makes a good formula for a game and I intend to use this approach in a number of games I'm developing."

Leo is also doing some programming on the Color Computer. "It is a beautiful machine. The 6809 chip in there is fantastic. I hope to program some cartoon type, color, high-resolution graphics games for the Color Computer soon." Judging by his previous efforts we really have something to look forward to. Who says dreams can't come true?■

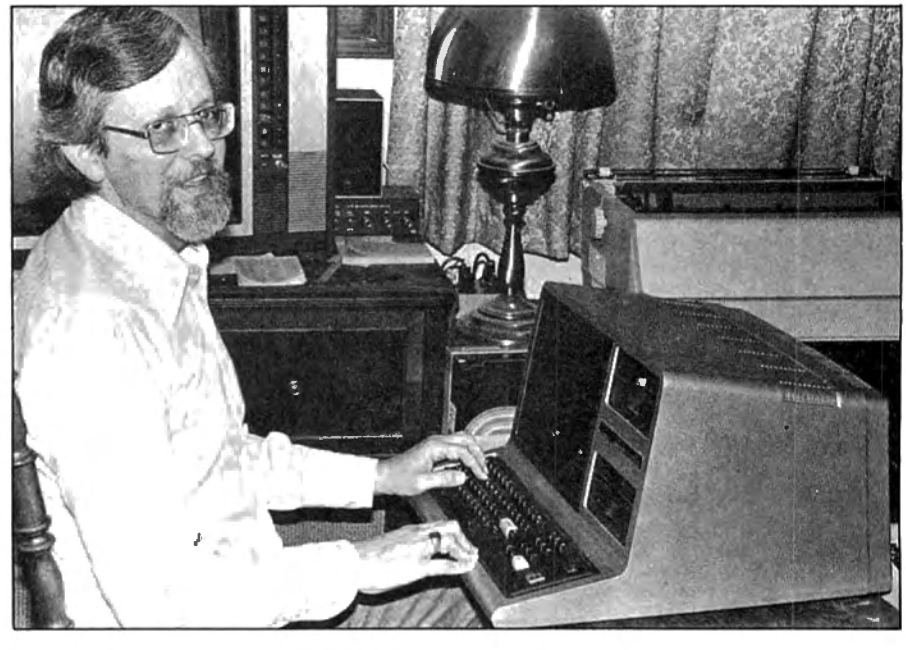

Photo 2. Leo Christopherson

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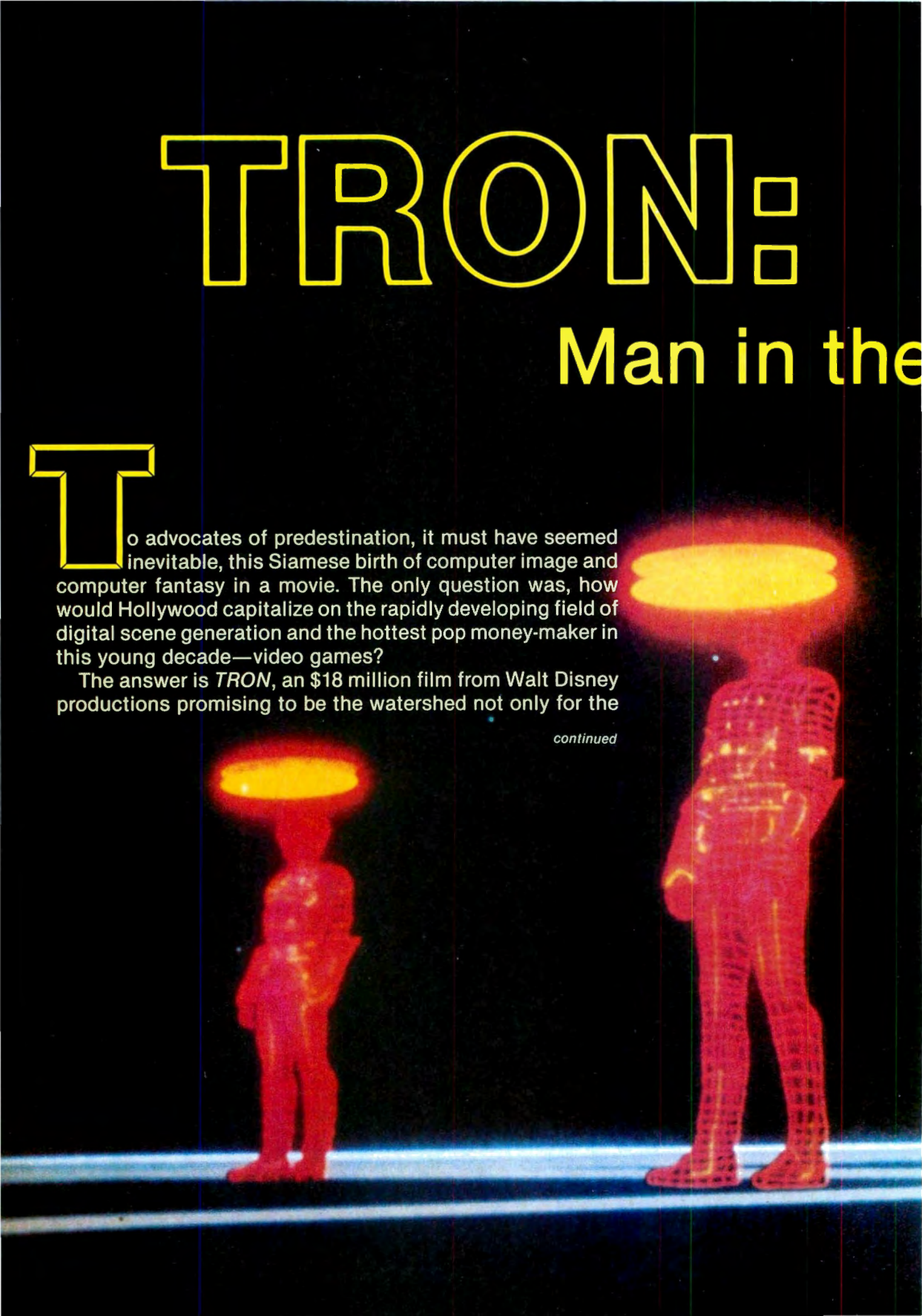
Man in the

To advocates of predestination, it must have seemed inevitable, this Siamese birth of computer image and computer fantasy in a movie. The only question was, how would Hollywood capitalize on the rapidly developing field of digital scene generation and the hottest pop money-maker in this young decade—video games?

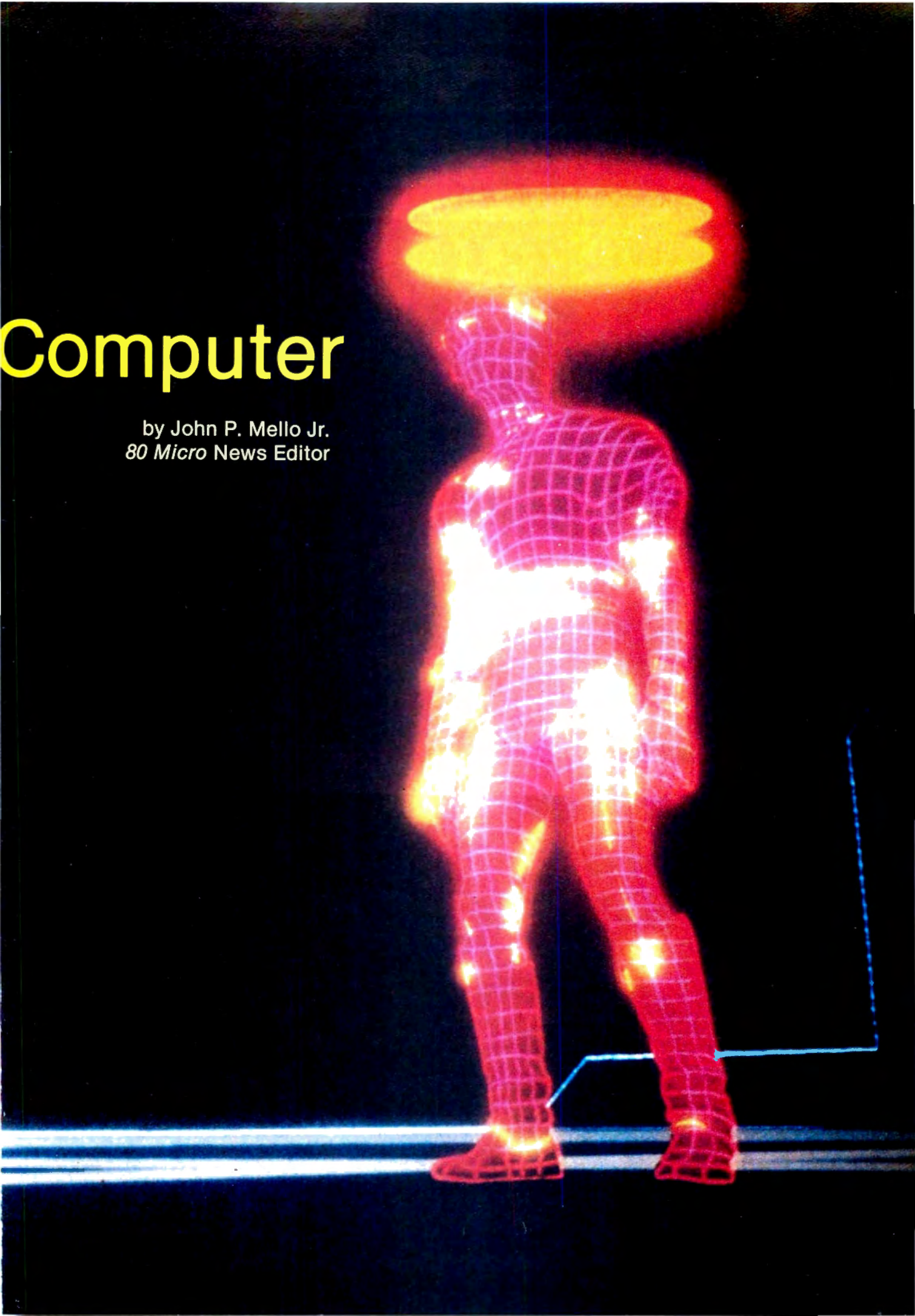
The answer is *TRON*, an $18 million film from Walt Disney productions promising to be the watershed not only for the

continued



Computer

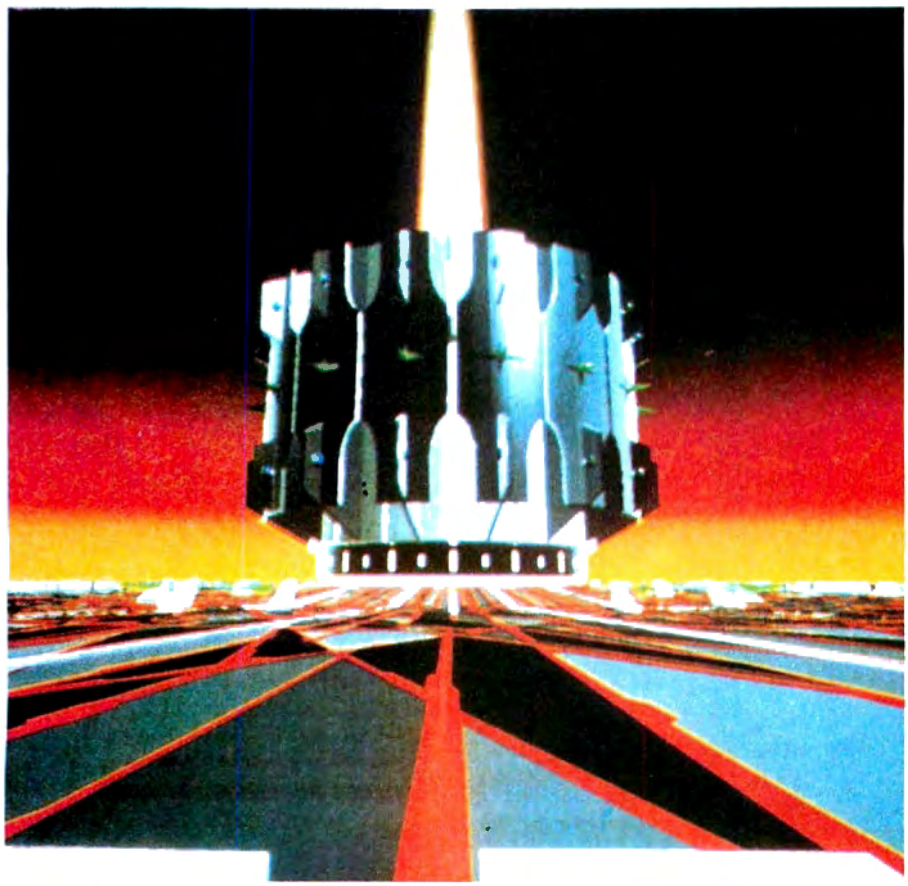
by John P. Mello Jr.
80 Micro News Editor



video game mania infecting the nation, but for computer-generated movie making. According to one science magazine, the film may be to the 80s what *2001: A Space Odyssey* was to the 60s and *Star Wars* was to the 70s.

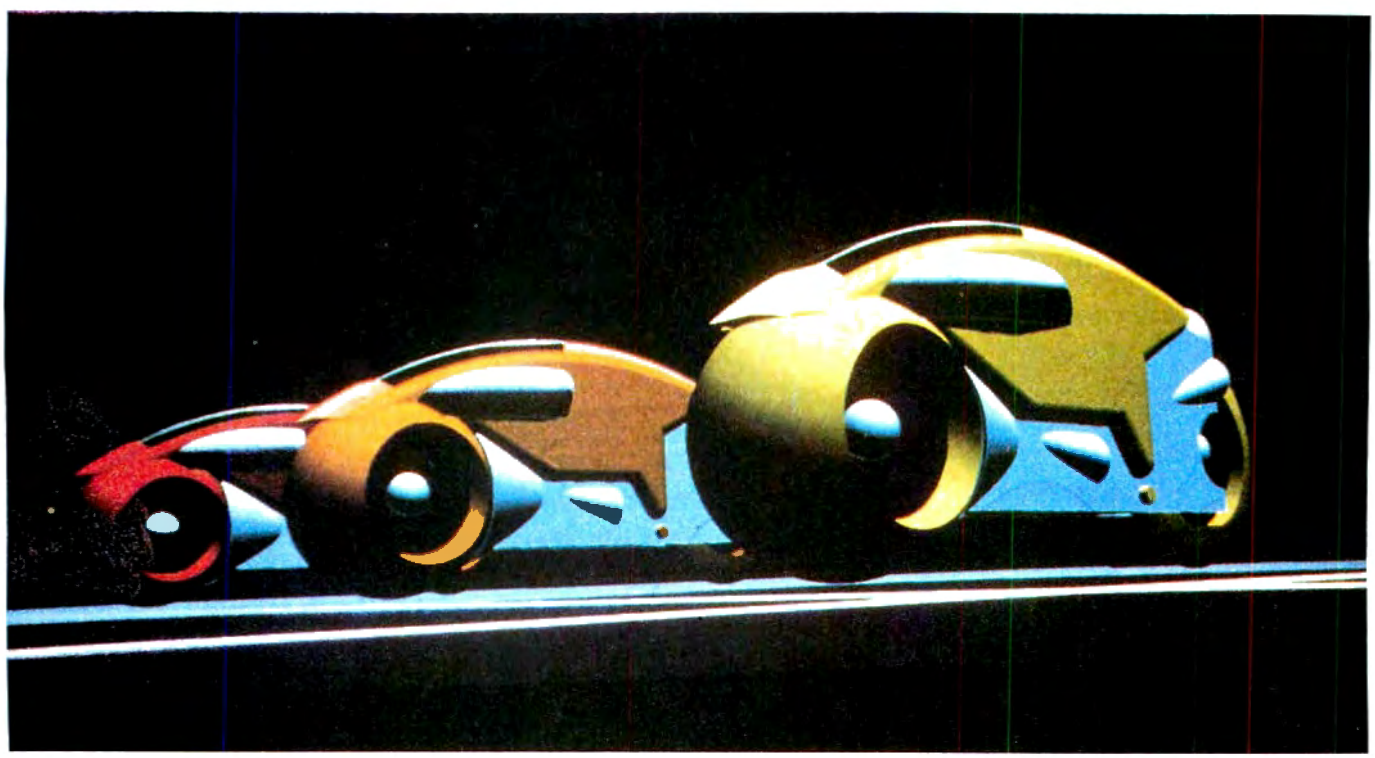
Film-makers have used computers for years, but what sets off *TRON* from its predecessors is its blend of live action with computer-generated imagery. Computer imagery has been used as an "effect" in movies like *Star Wars, Looker* and *West World*, but in *TRON*, computer generated landscapes, buildings, and vehicles provide settings for live-action characters.

Makers of *TRON* are also setting it off from what is currently considered "computer animation." Said Larry Elin, one of the computer animators of the film: "People are calling 'motion control'—where you use a computer to control the activity of a real camera photographing a real object—computer animation. I don't think it is. If you start out with a picture, what is the computer creating? It isn't doing anything. It may be manipulating another image being fed in, but it isn't really generating anything."



A WORLD TO WOW THE EYE.

In *TRON*, Flynn—a wizard at programming video games—begins to suspect Dillinger—an executive of a communications conglomerate—of manipulating the cartel's computer system to pirate programs from other systems. When Flynn tries to break into the conglomerate's system, he's blasted into the computer, where he discovers a futuristic fantasy world (left) and teams up with the king of video warriors, Tron. Together the pair attempt to overthrow Dillinger's program which is threatening the real and electronic worlds. Combat in the electronic world is conducted on the game grid where warriors race into a fray on video motorcycles (lower left), light cycles (lower right), and in tanks (right). Photos from *TRON* © 1982 Walt Disney Productions.



In *TRON*, a sort of silicon *Fantastic Voyage*, "the computer is generating the picture based on mathematical descriptions of what's in it," said Elin, head of animation at the Mathematic Applications Group Inc. of Elmwood, NY, the single largest contributor of computer imagery to the movie.

A Fortran program inside MAGI's computers, Elin explained, contains descriptions of shapes that are simple—spheres, cones, cylinders, boxes, ellipsoids—and some not so simple—the "terrain surface," which shapes hills and valleys, and the "general surface," which can be almost anything. He said: "We use these simple shapes as blocks to construct more complex things. You can build practically anything combining simple shapes."

After rendering an object in three views on graph paper, an animator begins punching code into the computer.

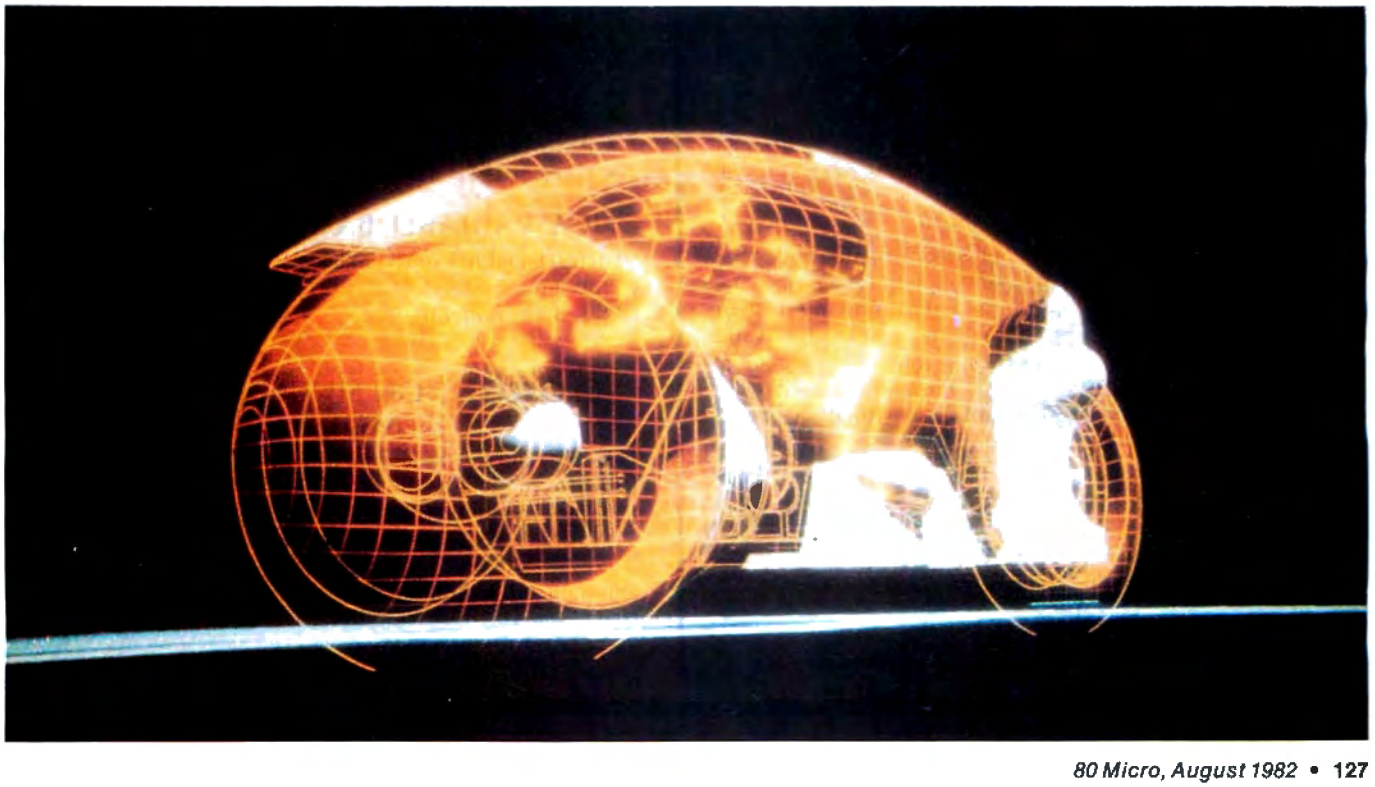
"Suppose we want a tank," Elin noted. "We tell the computer: Here's a tank. It consists of the following: a sphere located at x,y,z coordinates and radius x. All other parts of the tank will have equally simple input parameters."

However, more than just an object's parameters are loaded into the machine because in digital image generation, real cinematic life is simulated—including camera and light sources. When an animator uses "director's language" to call up a scene on a specialized machine called a Chromatic 7900, it appears on the CRT as a three-dimensional object seen at a specified camera angle and focal length, with a light source at point x.

The initial images are line drawings—called "pencil sets"—shown at low resolution, 300 lines per screen. These are scrutinized for errors.

"The most common error at this point," Elin said, "is a typo. We just type in the wrong number and all of a sudden we've got a cylinder that's four miles long instead of a couple of inches."

Even at this simple stage, things can get complicated. The MAGI animator said: "In some scenes, we might have 500 lines of director's language when things are *being*



moved around, when we have 14 tanks and three light cycles and all kinds of things happening."

When the pencil sets are finalized, the animators can go a step further and colorize the frames. Each pixel on the Chromatic's CRT is assigned a color and intensity. Elin observed, "It's no different from the way they light the billboard in Times Square, except the billboard has maybe 8,000 lights and one of our monitors has over 2 million pixels."

For every frame of film, a pixel is assigned several values. When those values for the 2 million pixels are multiplied by 24—the number of frames in one second of film—nearly 100 million bits of information are needed for screen time that would be missed in the blink of an eye.

Once MAGI felt a scene jibed with the film's storyboards—frame-by-frame drawings of a scene—they transmitted it at 1200 baud via transcontinental modem hookup to Chromatics at Disney's studios in Burbank, CA. Elin said it took about an hour to transmit 100 frames, a little over four seconds of film. "When we filled their Chromatics," he said, "they could press a button and the animation would start." According to Disney, the transmission arrangement cut two-and-a-half to five days from the creation of each scene.

After Burbank viewed the scene, instructions to modify it would be sent to MAGI. "They'd make creative decisions," Elin said. "Usually they're based on what happens before this scene starts and after it ends. They want to develop a continuity."

He explained that the final product is displayed on a high resolution—1200 lines per screen—CRT: "We output the frames one at a time in color on a high resolution cathode ray tube. That output is photographed on a movie camera that is locked into position and staring down at the CRT."

"This is the first time anyone has done anything this large," he observed. *TRON* runs 105 minutes, 20 minutes of it computer-generated.

Elin's firm, whose computers have been making pictures since 1965, is the oldest of a handful of companies dealing in computer-generated animation. The head of MAGI's computer graphics division said of the companies: "Everyone's system was developed on their own. There is little technology that is shared. It's not like the automobile industry where one car is the same as another. In this industry, our work is easily identifiable as our work and other people's work is easily identifiable as theirs."

But *TRON* isn't a benchmark movie only because of its innovative special effects. It also is the first major film to use video games as its leitmotif.

TRON is set in two worlds: the real world, where a vast computer system in a communications conglomerate is controlled by a single program, and the electronic world, where electric-and-light beings want to overthrow the program controlling their lives.

In the real world, a computer genius, Flynn (played by Jeff Bridges), tries to break into the computer system of the conglomerate ENCOM. Flynn suspects an ENCOM executive, Dillinger (played by David Warner), is a softbuc who's pirated some of the video-game wizard's programs. When Flynn attempts his break-in, he's blasted into another dimension, inside the computer, where programs are the alter egos of the programmers that created them. Flynn teams up with Tron, the mightiest of the electronic warriors, to battle the minions of the master program on a monumental video game grid, where arcade amusements become life and death realities.

"I realized this was a new life form," writer-director Steven Lisberger told *Rolling Stone*, "that these little characters were running around doing unexpected things. I was also intrigued by the concept that there's this other reality quietly forming around us—the world of computers."

Lisberger, who with producer Donald Kushner conceived of *TRON* in 1978, added in a statement released by Disney: "We had played all the video games and when we investigated computer art, we realized that by combining the concepts of electronic games and computer imaging, we could bring something to life that hadn't been there before."

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The Boston Museum of Fine Arts school graduate added: "Everyone's looking for new fantasies in the movies. Outer space has been done to death. They've gone inside the body and under the sea. We've created a world in *TRON* by taking video games and just blowing them out to the point where they're reality. Video games were the basis for the fantasy; computer imagery was the means to create it."

"I'm fascinated with the idea of artificial graphics interacting with real people in a time mode," the Cunningham, PA, native told *Omni* magazine. "I've always been interested in video and computer games and I feel it's significant that the computer people and the video people are forming a bridge between the two camps. *TRON* is giving us a chance to create our own mythology, our own archetypal characters for the Computer Age."

He added: "Kids are going to learn how to relate to computers as users—not being subservient to them. But there are no myths about how people should relate to these new techniques. It's virgin territory. We can make up stories and tales and create those archetypes now with some help from Carl Jung. One of the characters in the electronic world, Ram, says, 'It gives me a great feeling helping people plan for their future needs.' That's how I feel about *TRON*. I want people to come out of it inspired, to think of technology as something that belongs to them. I'm very optimistic and benevolent toward technology."

Asked by *Omni* if the awesome special effects in *TRON* would make the film more gloss than substance, Lisberger, 31, replied: "There's a big temptation to wow them with special effects, but what we tried to do was create a balance between the machine aspects and the human aspects. We have to do that in film and in society and science, too. For me, the actor is the ultimate special effect. People get motivated by a story, not special effects. This isn't just a light show. We give reasons for why it looks like it does. To tell the story, we needed to do certain special effects. To tell another story, other effects might be more apropos. It's a matter of finding the technology to tell a story rather than forcing a technology to tell a story it's not right for. The medium is secondary, really. What's most important is understanding emotions and feelings."

More than the plot of *TRON* is tied to the $5 billion video game industry. Arcade giant Bally Manufacturing of Chicago has created a *TRON* video game and installed it in its 240 Aladdin's Castles across the country and in theaters showing the Disney film. And Mattel will have a *TRON* for its Intellivision while a hand-held version of the game will be marketed by Tomy.

Even if *TRON* doesn't become a screen classic, it will influence how movies are made in the future, according to its head of computer special effects. Richard Taylor told *Omni*: "Here we are walking on the moon and we're still making movies using 1920s technology. It's absurd. But *TRON* is going to change that."

"We have a unique opportunity on this film," he went on to say. "It's like nothing anybody's done before with a new technology. The industry badly needs new tools." He added *TRON* will probably lead to digital film printing, which is cheaper than existing methods.

"The computer is like a magic hat," he said, "with an incredible number of magic tricks inside."

He added: "Even though the computer creates an image on a two-dimensional plane, it creates it in three-dimensional space and with perfect perspective, never a mistake in shape, and absolutely accurate. When you put that on the screen, there's something that innately connects to a human being subconsciously that tells him that it is perfect. Computer simulation can do all the things you can't do in reality. There are no physical limitations, no limits to point of view." ■

Lisberger: "Everyone's looking for new fantasies in the movies."

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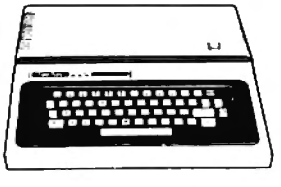

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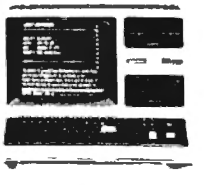

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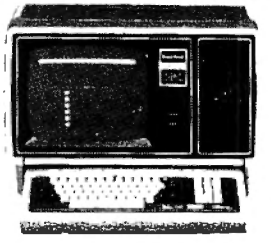

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1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	**: 0 MIN. 2 SEC.**
BASIC Execution speed MOD 1, LEVEL II	**: 7 MIN. 34 SEC.**
ZBASIC Execution speed MOD 1, LEVEL II	**:0 MIN. 18 SEC.**
BASIC Program size (WITHOUT VARIABLES)	**: 895 BYTES**
ZBASIC Program size (WITHOUT VARIABLES)	**: 2733 BYTES**

(Remember that the ZBASIC program includes an 1879 byte sub-routine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '========== ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST========
20 CLS:CLEAR100:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1TO127STEP2 :FOR J=47TO1STEP-3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J) :XX=ABS(INT(RND(I*J)-AA)+7) :RESET(I,J)
60 XX=PEEK(I+J) :POKE15360+I+J,J :OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J) :BA$=LEFT$(AB$,2) :AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)) :XX=INSTR(1,BA$,"9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2) :MID$(BA$,1,1)=Z :IF XX THEN 100 ELSE CLS
100 IF LEN(BA$)>3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++";
110 IFPOS(0)>62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$:IF A$="Y" OR A$="y" AND I>120 THEN PRINT"TRUE.."
130 RESTORE :READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT :PRINT"*";:NEXTI:CLS:PRINT@512,ST$,"STOP TIME ";TIME$
150 STOP'========== END OF MAIN TEST LOOP ==================
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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Kalah is an age old game of strategy for two players. This Assembly language program plays Kalah frustratingly well. By developing an intelligent Kalah program I now have a tough and tireless opponent. I hope this Kalah will inspire others to develop intelligent two-opponent games.

My first priority was to see how a rudimentary form of artificial intelligence could be realized within the confines of 16K. This influenced my choice of game. The game needs to be a head-to-head battle of wits between the computer and me. There should be no element of chance and no element of time. There should be no simple winning strategy, such as in tic-tac-toe, and yet the game has to have enough order to give a human player a sense of strategy. Furthermore, each player must have a finite, relatively small number of legal options for each move, so the program can examine each of them in detail. Lastly, the game must unavoidably end; the program cannot get stuck in an endless loop.

Any game with these relatively unrestrictive characteristics is a candidate for the same programming approach used in Kalah. I chose the game of Kalah, but games like Reversi (Othello), three-dimensional tic-tac-toe and many of the games described in Sackson's excellent *A Gamut of Games* (Castle Games, New York) or Gardner's Mathematical Games column of *Scientific American* are susceptible to this approach. However, an application of this method to a game as complex as checkers or chess is likely to be a very difficult task.

The Key Box

Model I
4K to run
16K to assemble

Rules of Kalah

Kalah is a two-player game played on a wooden board with hollowed-out pits, arranged as shown in Fig. 1. The game begins with an equal number of counters in each of the circular bins. The oval pits, called kalahs, begin empty. The standard game begins with six counters in each bin; I wrote the program to accommodate an initial number of counters ranging from three to nine.

The object of the game is for each player to accumulate as many counters in his kalah as possible. A move consists of a player choosing one of his bins, removing all of the counters from it, and distributing these counters in a counter-clockwise sequence, dropping one counter into each bin or kalah encountered. If the last counter falls into the player's own kalah, he gets a free move (see Figs. 2 and 3). The number of consecutive free moves is not restricted. If the counting-out process reaches the opponent's kalah, the opponent's kalah is skipped over and the next counter is added to the player's own bin 6.

A capture is made if the last counter is deposited in one of the player's own empty bins: this last counter and all of the counters in the opponent's bin opposite it are added to the player's own kalah. This terminates his move. If the opponent's opposite bin is empty, no capture is made and the last counter remains alone in the appropriate bin. Figures 4 and 5 illustrate the boards before and after player 2 makes a capture by moving from bin 1. A player with 13 counters in any of his bins can always make a capture because the last counter will fall into the same bin he started from.

The game ends when all of the bins on one player's side are empty (regardless of whose move it is). The player with counters remaining in his bins adds them to those in his kalah. The winner is the player with the greater number of counters in his kalah after this final maneuver.

In abstract terms, the board's configuration is limited by the number of counters in each of the twelve bins and two kalahs. Moves are described by a number in the range one to six to specify the selected bin. This simplicity greatly facilitates programming the game.

Choosing a Strategy

I attempted to design the program's strategy based, in a general way, on how I play Kalah. If one is confronted with a position where a single move will end the game immediately with a win, it is no problem to find the move and execute it. But this circumstance happens only rarely. It is also rare to be in a position where the game can be analyzed completely to the end. Knowing this, the human player can determine how advantageous a given position of the

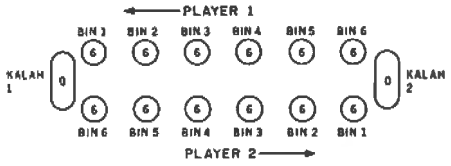

Fig. 1. Ready to play Kalah.

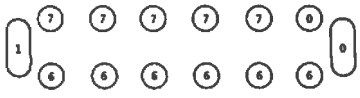

Fig. 2. Move originated from player 1's bin 6. The last counter fell into player 1's own kalah giving him a free move.

Fig. 3. Player 1's next move originated from bin 2 and finished in player 2's bin 2.

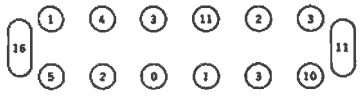

Fig. 4. Player 2 is about to capture by moving from bin 1.

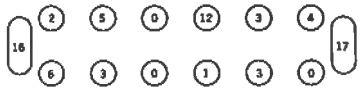

Fig. 5. Capture completed.

board is and choose his move to result in the best position according to this standard. Let us call this standard the *evaluation function*. The evaluation function is a way of translating a given position of the board into a number which expresses the relative advantage of player 1. Expressed in terms of the evaluation function, player 1's goal is to maximize the evaluation function and player 2's goal is to minimize it. At the end of the game, player 1 wins if the evaluation function is positive and player 2 wins if it is negative.

Intuitively, one major determinant of the evaluation function should be the number of counters in each kalah. Towards the end of the game, the total number of counters in each player's bins becomes significant, since these bins are combined with the kalah at the end of the game for total points. A combination of these two quantities, with the second quantity weighted by how close the end of the game is, forms a good evaluation function. I chose the evaluation function by playing various candidates against each other.

A second strategy ingredient interacts with the evaluation function: the depth to which future moves are analyzed. Assume the program is player 1 and is, then, attempting to maximize the evaluation function. The simplest way to pursue this goal is to calculate the evaluation function for each position and choose the move which gives the maximum value. (For the moment, the complication of free moves is neglected.) This *depth-of-one* strategy will certainly notice moves with immediate advantages, such as an opportunity to capture, but unless the evaluation function is extremely clever, this strategy will show little foresight. For example, it will probably not defend itself against captures set up by the opponent.

The next layer of complexity fixes this problem. To evaluate a potential move, player 1 assumes that player 2 will reply by using the depth-of-one strategy from player 2's point of view; that is, player 2 will attempt to minimize the evaluation function. Player 1 will choose a move giving him the maximum evaluation function after player 2 replies with a move to minimize it. This can be called the *depth-of-two* strategy or the minimax rule.

It does not take much imagination to extend this process to arbitrary depths. The *depth-of-n* strategy for player 1 consists of choosing the move which maximizes the evaluation function *n* moves in the future, assuming player 2 will respond with a *depth-of-(n – 1)* strategy. If player 1 uses a *depth-of-3* strategy, he may be able to select a move that will set himself up to make a capture no matter what player 2's reply is to his original move. If player 1 uses a *depth-of-four* strategy, he will be capable of selecting a move to avoid getting trapped as was player 2 in the previous example.

If the end of the game is reached within the depth analyzed, the depth-of-n strategy will play a perfect game. However, the amount of calculations necessary for the depth-of-n strategy increases exponentially with n. The rapidity of this increase is determined by the branching number, the number of possible moves a player has in a typical game position. In the case of Kalah, the branching number is six (again neglecting the complication of free turns). A practical limit for the depth of analysis is approximately four for machine-language programs or two for Basic programs making the minimax rule and its extensions only usable for reasonably short-range planning, and the evaluation function must try to take account of the global situation.

If (as is usually the case) the depth of examination is not sufficient to see a game through to the end, the present kind of strategy need not select the ideal move—disaster may lurk just over the horizon. This may be exploited by the opponent, perhaps not even intentionally. It is possible that a depth-of-two strategy may beat a depth-of-four strategy. One cannot assume that increasing the level of analysis makes a superior strategy. Odd-depth strategies can be characterized as offensive and even-depth strategies as defensive. Knowing this may be as important as the level of analysis. These quirks do not arise in Kalah, but I mention them to caution those who may attempt to apply this general method to other games.

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To sum up: choice of an evaluation function and a depth of analysis determines a strategy; analysis of the game may suggest a rudimentary evaluation function; and comparison of two evaluation functions and choice of a depth of analysis must be done experimentally by playing prospective strategies against each other.

Programming Strategy vs Strategy

I used Program Listing 1 to test one strategy against another. This program assumes player 1 uses a predetermined evaluation function A and that player 2 uses a second evaluation function B; both evaluation functions are an integral part of the source code and must be specified before assembly. The depth of analysis used by each player can be modified at run time. The generated strategies are pitted against each other for up to 255 games. The program keeps track of the total number of games and counters won by each player.

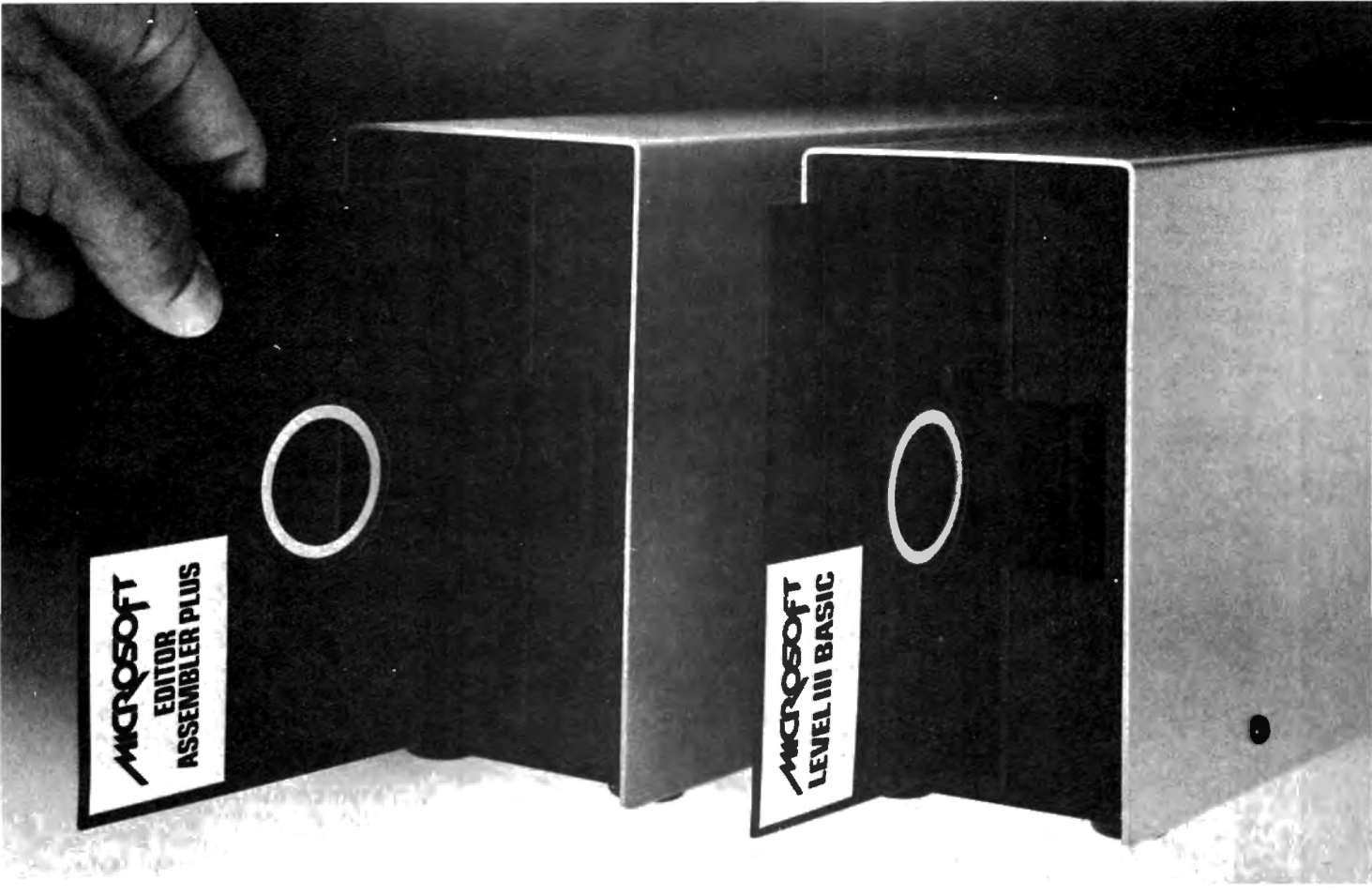
The opening dialog begins at Start. It asks for depth of analysis to be used by each internal "player;" these are stored in location IQ for player 1 and in location IQ+1 for player 2. The number of counters to be placed in each bin is kept in INICTR. The number of games to be played is kept in NGAMES.

The program's strategy will always yield an unambiguous choice, except in the rare instance of two potential moves leading to the same extreme value of the evaluation function. Playing one strategy against an-

Program Listing 1

```
                00000 ;AUTO-KALAH VERSION 3 ... J. D. VICTOR
42E9            00001         ORG     42E9H
42E9 ED7BA040   00002 START   LD      SP,(40A0H)
42ED CDC901     00003         CALL    1C9H
42F0 21A346     00004         LD      HL,MS1
42F3 CDA728     00005         CALL    28A7H
42F6 219D46     00006         LD      HL,SCORE
42F9 010006     00007         LD      BC,600H
42FC CD2F46     00008         CALL    MVBCHL
42FF 21CB46     00009         LD      HL,MS4A
4302 CD6846     00010         CALL    GTINT
4305 7B         00011         LD      A,E
4306 329846     00012         LD      (IQ),A
4309 21D146     00013         LD      HL,MS4B
430C CD6846     00014         CALL    GTINT
430F 7B         00015         LD      A,E
4310 329946     00016         LD      (IQ+1),A
4313 21D746     00017         LD      HL,MS5
4316 CD6846     00018         CALL    GTINT
4319 7B         00019         LD      A,E
431A 329C46     00020         LD      (INICTR),A
431D 21BB46     00021         LD      HL,MS3
4320 CD6846     00022         CALL    GTINT
4323 7B         00023         LD      A,E
4324 329A46     00024         LD      (NGAMES),A
4327 AF         00025         XOR     A
4328 329B46     00026         LD      (NGAME),A
                00027 ;SET UP STARTING POSITION
432B 3A9B46     00028 GAME    LD      A,(NGAME)
432E CB47       00029         BIT     0,A
4330 204D       00030         JR      NZ,GA1
4332 CB4F       00031         BIT     1,A
4334 2038       00032         JR      NZ,GA2
4336 3A9C46     00033         LD      A,(INICTR)
4339 4F         00034         LD      C,A
433A 0606       00035         LD      B,6
433C 217246     00036         LD      HL,STPOS
433F AF         00037         XOR     A
4340 77         00038         LD      (HL),A
4341 23         00039         INC     HL
4342 CD2F46     00040         CALL    MVBCHL
4345 77         00041         LD      (HL),A
4346 23         00042         INC     HL
4347 CD2F46     00043         CALL    MVBCHL
434A 010206     00044         LD      BC,602H
434D 117246     00045         LD      DE,STPOS
4350 C5         00046 GA4     PUSH    BC
4351 D5         00047         PUSH    DE
4352 210600     00048         LD      HL,6
4355 CD5B46     00049         CALL    RNDM
4358 D1         00050         POP     DE
4359 19         00051         ADD     HL,DE
435A C1         00052         POP     BC
435B CB40       00053         BIT     0,B
435D 2002       00054         JR      NZ,GA5
435F 34         00055         INC     (HL)
4360 34         00056         INC     (HL)
4361 35         00057 GA5     DEC     (HL)
4362 10EC       00058         DJNZ    GA4
4364 0D         00059         DEC     C
4365 2818       00060         JR      Z,GA1
4367 0606       00061         LD      B,6
4369 117946     00062         LD      DE,STPOS+7
436C 18E2       00063         JR      GA4
436E 217346     00064 GA2     LD      HL,STPOS+1
4371 117A46     00065         LD      DE,STPOS+8
4374 0606       00066         LD      B,6
4376 1A         00067 GA3     LD      A,(DE)
4377 4E         00068         LD      C,(HL)
4378 77         00069         LD      (HL),A
4379 79         00070         LD      A,C
437A 12         00071         LD      (DE),A
437B 23         00072         INC     HL
437C 13         00073         INC     DE
437D 10F7       00074         DJNZ    GA3
437F 217246     00075 GA1     LD      HL,STPOS
4382 112847     00076         LD      DE,BOARDS+1
4385 010E00     00077         LD      BC,0EH
4388 EDB0       00078         LDIR
438A 3A9B46     00079         LD      A,(NGAME)
438D E601       00080         AND     1
438F 3D         00081         DEC     A
4390 322747     00082         LD      (BOARDS),A
                00083 ;START PLAYING
4393 3E0D       00084         LD      A,0DH
4395 CD3A03     00085         CALL    033AH
4398 DD212847   00086 POSIT   LD      IX,BOARDS+1
439C CD2C45     00087         CALL    GAMOVR
439F CA4645     00088         JP      Z,ENDGAM
43A2 DD212847   00089         LD      IX,BOARDS+1
43A6 DD7EFF     00090         LD      A,(IX+0FFH)
43A9 219846     00091         LD      HL,IQ
43AC B7         00092         OR      A
43AD 2801       00093         JR      Z,TR1
43AF 23         00094         INC     HL
43B0 46         00095 TR1     LD      B,(HL)
43B1 CDD443     00096         CALL    BSTMOV
43B4 69         00097         LD      L,C
43B5 2D         00098         DEC     L
43B6 7D         00099         LD      A,L
43B7 C631       00100         ADD     A,'1'
43B9 CD3A03     00101         CALL    33AH
43BC DD212847   00102         LD      IX,BOARDS+1
43C0 DD66FF     00103         LD      H,(IX+0FFH)
43C3 CD9A44     00104         CALL    KALMOV
43C6 FE02       00105         CP      2
43C8 28CE       00106         JR      Z,POSIT
43CA 3A2747     00107         LD      A,(BOARDS)
43CD 2F         00108         CPL
43CE 322747     00109         LD      (BOARDS),A
43D1 C39843     00110         JP      POSIT
                00111 ;ENTRY: IX->ACTIVE BOARD,A=TURN,B=IQ
                00112 ;EXIT: C=BIN #(1-6),HL=EVAL
43D4 F5         00113 BSTMOV  PUSH    AF
43D5 0E00       00114         LD      C,0
43D7 CD2C45     00115         CALL    GAMOVR
43DA 2002       00116         JR      NZ,BS0
43DC F1         00117         POP     AF
43DD C9         00118         RET
43DE C5         00119 BS0     PUSH    BC
43DF D5         00120         PUSH    DE
43E0 E5         00121         PUSH    HL
43E1 DDE5       00122         PUSH    IX
43E3 FDE5       00123         PUSH    IY
43E5 210000     00124         LD      HL,0
43E8 39         00125         ADD     HL,SP
43E9 E5         00126         PUSH    HL
43EA FDE1       00127         POP     IY
43EC 3E06       00128         LD      A,6
43EE FD6E02     00129 BS1     LD      L,(IY+2)
43F1 FD6603     00130         LD      H,(IY+3)
43F4 2B         00131         DEC     HL
43F5 5D         00132         LD      E,L
43F6 54         00133         LD      D,H
43F7 010F00     00134         LD      BC,0FH
43FA 09         00135         ADD     HL,BC
43FB EB         00136         EX      DE,HL
43FC EDB0       00137         LDIR
43FE 23         00138         INC     HL
43FF E5         00139         PUSH    HL
4400 DDE1       00140         POP     IX
4402 6F         00141         LD      L,A
4403 2D         00142         DEC     L
4404 DD66FF     00143         LD      H,(IX+0FFH)
4407 08         00144         EX      AF,AF'
4408 CD9A44     00145         CALL    KALMOV
440B FD4609     00146         LD      B,(IY+9)
440E CB4F       00147         BIT     1,A
4410 2810       00148         JR      Z,BS3
4412 0F         00149         RRCA
4413 301C       00150         JR      NC,BS2
4415 08         00151 BS4     EX      AF,AF'
4416 3D         00152         DEC     A
4417 20D5       00153         JR      NZ,BS1
4419 FDE1       00154         POP     IY
441B DDE1       00155         POP     IX
441D E1         00156         POP     HL
```

Listing 1 continues



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```
441E E1        00157          POP     HL
441F C1        00158          POP     BC
4420 F1        00159          POP     AF
4421 C9        00160          RET
4422 05        00161 BS3      DEC     B
4423 2005      00162          JR      NZ,BS5
4425 CD5E44    00163          CALL    EVAL
4428 180C      00164          JR      BS6
442A DD7EFF    00165 BS5      LD      A,(IX+0FFH)
442D 2F        00166          CPL
442E DD77FF    00167          LD      (IX+0FFH),A
4431 08        00168 BS2      EX      AF,AF'
4432 CDD443    00169          CALL    BSTMOV
4435 08        00170          EX      AF,AF'
4436 FD7E08    00171 BS6      LD      A,(IY+8)
4439 B7        00172          OR      A
443A 2815      00173          JR      Z,UPDATE
443C FD5E06    00174          LD      E,(IY+6)
443F FD5607    00175          LD      D,(IY+7)
4442 B7        00176          OR      A
4443 ED52      00177          SBC     HL,DE
4445 28CE      00178          JR      Z,BS4
4447 DD7EF0    00179          LD      A,(IX+0F0H)
444A 3801      00180          JR      C,BS7
444C 2F        00181          CPL
444D 0F        00182 BS7      RRCA
444E 30C5      00183          JR      NC,BS4
4450 19        00184          ADD     HL,DE
4451 08        00185 UPDATE   EX      AF,AF'
4452 FD7708    00186          LD      (IY+8),A
4455 08        00187          EX      AF,AF'
4456 FD7506    00188          LD      (IY+6),L
4459 FD7407    00189          LD      (IY+7),H
445C 18B7      00190          JR      BS4
               00191 ;ENTRY: IX->ACTIVE BOARD; EXIT: HL=EVAL
445E D9        00192 EVAL     EXX
445F AF        00193          XOR     A
4460 67        00194          LD      H,A
4461 57        00195          LD      D,A
4462 47        00196          LD      B,A
4463 DD6E00    00197          LD      L,(IX+0)
4466 DD5E07    00198          LD      E,(IX+7)
4469 ED52      00199          SBC     HL,DE
446B CD2C45    00200          CALL    GAMOVR
446E 2022      00201          JR      NZ,EV1
4470 DDE5      00202          PUSH    IX
4472 0606      00203          LD      B,6
4474 DD23      00204 EV2      INC     IX
4476 DD5E00    00205          LD      E,(IX+0)
4479 19        00206          ADD     HL,DE
447A DD5E07    00207          LD      E,(IX+7)
447D B7        00208          OR      A
447E ED52      00209          SBC     HL,DE
4480 10F2      00210          DJNZ    EV2
4482 DDE1      00211          POP     IX
4484 3A2747    00212          LD      A,(BOARDS)      ;FOR DIFFERENT
4487 B7        00213          OR      A               ;STRATEGIES
4488 2808      00214          JR      Z,EV1           ;INCLUDE THESE
448A 7C        00215          LD      A,H
448B B5        00216          OR      L
448C 2804      00217          JR      Z,EV1
448E 7C        00218          LD      A,H
448F EE40      00219          XOR     40H
4491 67        00220          LD      H,A
4492 E5        00221 EV1      PUSH    HL
4493 D9        00222          EXX
4494 E1        00223          POP     HL
4495 7C        00224          LD      A,H
4496 EE80      00225          XOR     80H
4498 67        00226          LD      H,A
4499 C9        00227          RET
               00228 ;ENTRY: IX->ACTIVE BOARD,L=BIN #(0-5),H=TURN(0,-1)
               00229 ;EXIT: A=-1 FOR EMPTY BIN,1 FOR CAPTURE,2 FOR FREE MOVE
449A C5        00230 KALMOV   PUSH    BC
449B D5        00231          PUSH    DE
449C DDE5      00232          PUSH    IX
449E 010700    00233          LD      BC,7
44A1 50        00234          LD      D,B
44A2 5D        00235          LD      E,L
44A3 1C        00236          INC     E
44A4 7C        00237          LD      A,H
44A5 B7        00238          OR      A
44A6 2803      00239          JR      Z,KM0
44A8 79        00240          LD      A,C
44A9 83        00241          ADD     A,E
44AA 5F        00242          LD      E,A
44AB DD19      00243 KM0      ADD     IX,DE
44AD DD7E00    00244          LD      A,(IX+0)
44B0 B7        00245          OR      A
44B1 2006      00246          JR      NZ,KM1
44B3 3D        00247          DEC     A
44B4 DDE1      00248 KM2      POP     IX
44B6 D1        00249 KM3      POP     DE
44B7 C1        00250          POP     BC
44B8 C9        00251          RET
44B9 DD360000  00252 KM1      LD      (IX+0),0
44BD 57        00253          LD      D,A
44BE DD2B      00254 KL       DEC     IX
```

Listing 1 continues

other will reproduce the same game, over and over, unless specific preventive measures are taken. To form a realistic sense of the relative merits of two strategies, I chose to pit them against each other using a variety of random starting positions. This is done by the next section of the code.

The 14 locations, beginning at STPOS, represent the contents of player 1's kalah, player 1's bins, player 2's kalah and player 2's bins (in that order) at the start of the game. The kalahs are initialized to zero and the bins to INICTR. Before the game is played, single counters are added to two bins of each player at random, and single counters are subtracted from two (not necessarily distinct) bins at random. This provides a wide variety of starting positions with the same total number of counters on each player's side, all close to the standard starting position. However, this process may by chance give one player a more advantageous starting position in the games sampled. This is corrected by exchanging starting positions after the game is played. Possible random variations are further balanced by allowing each player the opportunity to have the first move for each starting configuration. After four games based on a single random STPOS, a new random configuration is chosen.

The locations, beginning with Boards, hold the current state of the board at any given time during the evolution of the game. The format consists of 15 locations, with the initial byte indicating whose turn it is (zero for player 1; minus one for player 2), and the 14 subsequent locations holding the contents of the kalahs and bins, formatted as in STPOS. Just before the game begins, the contents of STPOS are transferred to the 14 locations beginning at Boards + 1, and Boards is loaded with the appropriate byte. Boards is the last location of the program. This is crucial, because an indefinite number of blocks of 15 bytes following the initial block will be used to hold the configuration of the board during analysis of the tree of hypothetical moves.

The loop beginning at POSIT is the playing of the game itself. First the routine GAMOVR is executed. This determines if the end of the game has been reached. If so, control passes to ENDGAM to determine the winner, tally the cumulative number of games and counters won by each player and begin the next game if the total number of games requested have not yet been played. Assuming the end of the game has not been reached, preparations are made to calculate the next move according to the strategy appropriate for the player whose turn it is: register IX is loaded with Boards + 1 (pointing to kalah 1 of the current board), register A indicates the player whose turn it is and register B contains the requested depth of analysis.

BSTMOV is the routine for calculating the best move for a given evaluation function and depth of analysis. Most importantly this subroutine is recursive—it can be called by itself. This is ideally suited for strategies looking many moves ahead.

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DISK Text space	N/A	6.5K	22.5K	N/A	0.5K	16.5K
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Video Window		YES			NO	
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Listing 1 continued

```
44C0 1D       00255          DEC     E
44C1 2012     00256          JR      NZ,NK1
44C3 79       00257          LD      A,C
44C4 87       00258          ADD     A,A
44C5 5F       00259          LD      E,A
44C6 DD09     00260          ADD     IX,BC
44C8 DD09     00261          ADD     IX,BC
44CA 14       00262          INC     D
44CB 7C       00263          LD      A,H
44CC B7       00264          OR      A
44CD 2013     00265          JR      NZ,DIDT
44CF 15       00266          DEC     D
44D0 DD34F2   00267          INC     (IX+0F2H)
44D3 180D     00268          JR      DIDT
44D5 7B       00269 NK1      LD      A,E
44D6 91       00270          SUB     C
44D7 2006     00271          JR      NZ,NK2
44D9 14       00272          INC     D
44DA 7C       00273          LD      A,H
44DB B7       00274          OR      A
44DC 2804     00275          JR      Z,DIDT
44DE 15       00276          DEC     D
44DF DD3400   00277 NK2      INC     (IX+0)
44E2 15       00278 DIDT     DEC     D
44E3 20D9     00279          JR      NZ,KL
44E5 7B       00280          LD      A,E
44E6 91       00281          SUB     C
44E7 2004     00282          JR      NZ,NEK2
44E9 3E02     00283 FT       LD      A,2
44EB 18C7     00284          JR      KM2
44ED 91       00285 NEK2     SUB     C
44EE 28F9     00286          JR      Z,FT
44F0 81       00287          ADD     A,C
44F1 AC       00288          XOR     H
44F2 17       00289          RLA
44F3 3803     00290          JR      C,OWNSID
44F5 AF       00291 KM4      XOR     A
44F6 18BC     00292          JR      KM2
44F8 DD7E00   00293 OWNSID   LD      A,(IX+0)
44FB 3D       00294          DEC     A
44FC 20F7     00295          JR      NZ,KM4
44FE FDE3     00296          EX      (SP),IY
4500 FDE5     00297          PUSH    IY
4502 79       00298          LD      A,C
4503 87       00299          ADD     A,A
4504 93       00300          SUB     E
4505 5F       00301          LD      E,A
4506 FD19     00302          ADD     IY,DE
4508 D1       00303          POP     DE
4509 D5       00304          PUSH    DE
450A FD7E00   00305          LD      A,(IY+0)
450D B7       00306          OR      A
450E 2816     00307          JR      Z,NOCAP
4510 DD360000 00308          LD      (IX+0),0
4514 FD360000 00309          LD      (IY+0),0
4518 3C       00310          INC     A
4519 F5       00311          PUSH    AF
451A 7C       00312          LD      A,H
451B B7       00313          OR      A
451C EB       00314          EX      DE,HL
451D 2801     00315          JR      Z,CAP1
451F 09       00316          ADD     HL,BC
4520 F1       00317 CAP1     POP     AF
4521 86       00318          ADD     A,(HL)
4522 EB       00319          EX      DE,HL
4523 12       00320          LD      (DE),A
4524 3E01     00321          LD      A,1
4526 DDE1     00322 NOCAP    POP     IX
4528 FDE1     00323          POP     IY
452A 188A     00324          JR      KM3
              00325 ;ENTRY: IX->ACTIVE BOARD; EXIT: Z=1 FOR END OF GAME
452C C5       00326 GAMOVR   PUSH    BC
452D E5       00327          PUSH    HL
452E 01FF06   00328          LD      BC,06FFH
4531 DDE5     00329          PUSH    IX
4533 E1       00330          POP     HL
4534 AF       00331 GV1      XOR     A
4535 23       00332 GV2      INC     HL
4536 86       00333          ADD     A,(HL)
4537 10FC     00334          DJNZ    GV2
4539 2003     00335          JR      NZ,GV3
453B E1       00336 GV4      POP     HL
453C C1       00337          POP     BC
453D C9       00338          RET
453E 23       00339 GV3      INC     HL
453F 0606     00340          LD      B,6
4541 0C       00341          INC     C
4542 20F7     00342          JR      NZ,GV4
4544 18EE     00343          JR      GV1
4546 CDC901   00344 ENDGAM   CALL    01C9H
4549 212847   00345          LD      HL,BOARDS+1
454C CD0B46   00346          CALL    EGAD
454F 57       00347          LD      D,A
4550 CD0B46   00348          CALL    EGAD
4553 5F       00349          LD      E,A
4554 D5       00350          PUSH    DE
4555 BA       00351          CP      D
4556 21FF46   00352          LD      HL,MS8
```

Listing 1 continues

Player 1's move is calculated by maximizing the evaluation function n moves ahead assuming player 2's move minimizes the evaluation function by using a depth-of-(n-1) strategy. Then the depth-of-n routine needs to call a depth-of-(n-1) routine from its opponent's point of view, the depth-of-(n-1) routine needs to call a depth-of-(n-2) routine, and so on. The descending chain stops at a depth-of-1 strategy when the evaluation function, resulting from a hypothetical series of n turns and replies, must be calculated.

The inputs to BSTMOV are as set up by POSIT: IX points to kalah 1, A indicates whose turn it is and B indicates the depth of analysis. IX-1 points to a location indicating whose turn it is. On return, register C contains the selected move (indicated by a number in the range one to six) and HL contains the evaluation function of the deepest hypothetical move resulting from this chosen line of play. If the game is over, register C contains a zero.

The initial step in BSTMOV determines if the game is over. GAMOVR is called with IX pointing to kalah 1; on return the flag Z is set if the game is over. In this case BSTMOV is exited with register C loaded with zero and HL unchanged. The initial call from POSIT to BSTMOV only takes place if the game is not over; this endgame case only occurs in recursive calls to BSTMOV.

If the game is not over, all registers are saved on the stack and IY is loaded with the stack pointer. This way the saved values are accessible by indexing with respect to IY. In addition to saving the registers so recursive calls to BSTMOV will not destroy data, the current board position (or on recursive calls, the board position after some hypothetical moves) must be preserved. This is done by copying the 15 bytes holding the turn indicator and the board configuration into the next available 15 bytes after Boards, and incrementing IX by 15 so it points to the new kalah 1. This area is used to try out the six possible moves. The moves are enumerated by register A, which is initially loaded with six and is decremented on each pass until all possible moves are tried.

The first step in testing a hypothetical move is to calculate its effect on the board. This is done by the subroutine KALMOV. On entry to KALMOV, register L contains the number of the bin to be moved (in the range zero to five), register H indicates whose turn it is and IX points to the current kalah 1. On return, the register IX is unchanged but the contents of the kalahs and bins are appropriately modified. Register A is loaded with zero unless a special condition holds: A contains minus one if the requested move calls for distributing an empty bin, A contains one of the requested move leads to a capture and A contains two if the requested move leads to a free move.

On return from KALMOV, three courses of action are possible depending on these special conditions. If the requested move was illegal (the indicated bin was empty), the next highest numbered bin is tried. If the move is legal but does not result in a free

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Scot Adam's Adventure #4 #5 #6	39 95	31 00	n/a	
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```
4559 2815      00353          JR      Z,EG1
455B 218046    00354          LD      HL,PLY1
455E 019D46    00355          LD      BC,SCORE
4561 3804      00356          JR      C,EG2
4563 218C46    00357          LD      HL,PLY2
4566 03        00358          INC     BC
4567 0A        00359 EG2      LD      A,(BC)
4568 3C        00360          INC     A
4569 02        00361          LD      (BC),A
456A CDA728    00362          CALL    28A7H
456D 21F846    00363          LD      HL,MS7
4570 CDA728    00364 EG1      CALL    28A7H
4573 D1        00365          POP     DE
4574 D5        00366          PUSH    DE
4575 5A        00367          LD      E,D
4576 1600      00368          LD      D,0
4578 2A9F46    00369          LD      HL,(SCORE+2)
457B 19        00370          ADD     HL,DE
457C 229F46    00371          LD      (SCORE+2),HL
457F D1        00372          POP     DE
4580 D5        00373          PUSH    DE
4581 1600      00374          LD      D,0
4583 2AA146    00375          LD      HL,(SCORE+4)
4586 19        00376          ADD     HL,DE
4587 22A146    00377          LD      (SCORE+4),HL
458A 114B3C    00378 EG3      LD      DE,3C4BH
458D 217F46    00379          LD      HL,PLY1-1
4590 CD3646    00380          CALL    MVND
4593 115B3C    00381          LD      DE,3C5BH
4596 218B46    00382          LD      HL,PLY2-1
4599 CD3646    00383          CALL    MVND
459C 21803C    00384          LD      HL,3C80H
459F 222040    00385          LD      (4020H),HL
45A2 210647    00386          LD      HL,MS9
45A5 CDA728    00387          CALL    28A7H
45A8 DD219D46  00388          LD      IX,SCORE
45AC DD6E00    00389          LD      L,(IX+0)
45AF CD4B46    00390          CALL    WSINT
45B2 CDFC45    00391          CALL    SP11
45B5 DD6E01    00392          LD      L,(IX+1)
45B8 CD4B46    00393          CALL    WSINT
45BB CD0646    00394          CALL    CLRL
45BE 211147    00395          LD      HL,MS10
45C1 CDA728    00396          CALL    28A7H
45C4 D1        00397          POP     DE
45C5 6A        00398          LD      L,D
45C6 D5        00399          PUSH    DE
45C7 CD4B46    00400          CALL    WSINT
45CA CDFC45    00401          CALL    SP11
45CD D1        00402          POP     DE
45CE 6B        00403          LD      L,E
45CF CD4B46    00404          CALL    WSINT
45D2 CD0646    00405          CALL    CLRL
45D5 211C47    00406          LD      HL,MS12
45D8 CDA728    00407          CALL    28A7H
45DB 2A9F46    00408          LD      HL,(SCORE+2)
45DE CD4D46    00409          CALL    WINT
45E1 CDFC45    00410          CALL    SP11
45E4 2AA146    00411          LD      HL,(SCORE+4)
45E7 CD4D46    00412          CALL    WINT
45EA 3A9B46    00413          LD      A,(NGAME)
45ED 3C        00414          INC     A
45EE 329B46    00415          LD      (NGAME),A
45F1 47        00416          LD      B,A
45F2 3A9A46    00417          LD      A,(NGAMES)
45F5 B8        00418          CP      B
45F6 C22B43    00419          JP      NZ,GAME
45F9 C37341    00420          JP      4173H
45FC 060B      00421 SP11     LD      B,0BH
45FE 3E20      00422 SP11L    LD      A,20H
4600 CD3A03    00423          CALL    33AH
4603 10F9      00424          DJNZ    SP11L
4605 C9        00425          RET
4606 3E0D      00426 CLRL     LD      A,0DH
4608 C33A03    00427          JP      33AH
460B AF        00428 EGAD     XOR     A
460C 0607      00429          LD      B,7
460E 86        00430 EG0      ADD     A,(HL)
460F 23        00431          INC     HL
4610 10FC      00432          DJNZ    EG0
4612 C9        00433          RET
4613 E5        00434 WNU      PUSH    HL
4614 D5        00435          PUSH    DE
4615 C5        00436          PUSH    BC
4616 CD9A0A    00437          CALL    0A9AH
4619 010002    00438          LD      BC,200H
461C C5        00439          PUSH    BC
461D 3E80      00440          LD      A,80H
461F CDBE0F    00441          CALL    0FBEH
4622 FDE5      00442          PUSH    IY
4624 D1        00443          POP     DE
4625 C1        00444          POP     BC
4626 48        00445          LD      C,B
4627 0600      00446          LD      B,0
4629 EDB0      00447          LDIR
462B C1        00448          POP     BC
462C D1        00449          POP     DE
462D E1        00450          POP     HL
```

Listing 1 continues

turn, the evaluation function is calculated for the resulting line of play. If the depth of analysis on entry to BSTMOV was one, the line of play has terminated with this move and the evaluation function may be calculated immediately from the board configuration pointed to by IX. This is done by the subroutine EVAL, which returns the value of the evaluation function in HL. However, if the depth of analysis is two or greater, the recursion must be invoked. The byte at IX–1, indicating whose turn it is, is complemented, and the depth of analysis contained in register B is decremented. BSTMOV is called, which ultimately returns the value of the evaluation function after the deepest hypothetical move in HL. The remainder of the process is independent of whether the recursion was invoked or not.

The third possibility is a free move resulting from the move tried by KALMOV. This case can be easily handled by calling BSTMOV recursively, but without decrementing the depth of analysis and without changing the indicator of whose turn it is. The result of this maneuver is that the depth of analysis parameter will apply to the number of *turns*, not the number of moves. Although this prolongs calculation time, it provides a fuller analysis and guarantees the opponent's moves will be inspected even if there are a multitude of possible free moves.

After the evaluation function for a particular trial move is calculated (either directly or by recursion), it is compared with the evaluation functions of previously tried moves. The extreme value (either maximum or minimum, depending on whose turn it is) and the bin number are saved on the stack to be loaded into registers HL and C, respectively, when BSTMOV is exited. When the six possible lines of play are investigated, the registers are restored and BSTMOV is exited. The exit may transfer control back to BSTMOV itself, but ultimately the highest level exit back to POSIT will be encountered.

The remainder of the program is relatively straightforward. EVAL, KALMOV and GAMOVR are subroutines that perform calculations on the board pointed to by IX. In this program, which plays one strategy against another, there has to be a provision for using two different evaluation functions, depending on whose turn it is. This is done by allowing EVAL to refer to the byte at the location Boards, which indicates who is moving. This provision will not be in the next program. It will use the best evaluation function found to play against an external opponent. The final few instructions in EVAL add 2^{15} to the calculated evaluation function (in HL); this way it is easier to compare two unsigned numbers than two signed numbers, an operation which must be done frequently in BSTMOV. The particular evaluation functions used in Listing 1 are the evaluation functions F_A for player 1 and F_D for player 2 (Table 1).

The routine ENDGAM is entered when the game is over. It tallies the total number of games and counters won by each player

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Listing 1 continued

```
462E C9         00451           RET
462F C5         00452 MVBCHL    PUSH    BC
4630 71         00453 MVB1      LD      (HL),C
4631 23         00454           INC     HL
4632 10FC       00455           DJNZ    MVB1
4634 C1         00456           POP     BC
4635 C9         00457           RET
4636 CD3E46     00458 MVND      CALL    MVN
4639 3E20       00459           LD      A,20H
463B 1B         00460           DEC     DE
463C 12         00461           LD      (DE),A
463D C9         00462           RET
463E 060B       00463 MVN       LD      B,0BH
4640 23         00464 MV1       INC     HL
4641 7E         00465           LD      A,(HL)
4642 12         00466 MV2       LD      (DE),A
4643 13         00467           INC     DE
4644 B7         00468           OR      A
4645 C8         00469           RET     Z
4646 10F8       00470           DJNZ    MV1
4648 AF         00471           XOR     A
4649 18F7       00472           JR      MV2
464B 2600       00473 WSINT     LD      H,0
464D CD9A0A     00474 WINT      CALL    0A9AH
4650 010005     00475           LD      BC,500H
4653 3E80       00476           LD      A,80H
4655 CDBE0F     00477           CALL    0FBEH
4658 C3A728     00478           JP      28A7H
465B CD9A0A     00479 RNDM      CALL    0A9AH
465E CDC914     00480           CALL    14C9H
4661 CD370B     00481           CALL    0B37H
4664 2A2141     00482           LD      HL,(4121H)
4667 C9         00483           RET
4668 CDA728     00484 GTINT     CALL    28A7H
466B CDB31B     00485           CALL    1BB3H
466E D7         00486           RST     10H
466F C35A1E     00487           JP      1E5AH
000E            00488 STPOS     DEFS    0EH
4680 41         00489 PLY1      DEFM    'ALGORITHM 1'
468B 00         00490           DEFB    0
468C 41         00491 PLY2      DEFM    'ALGORITHM 2'
4697 00         00492           DEFB    0
4698 0000       00493 IQ        DEFW    0
469A 00         00494 NGAMES    DEFB    0
469B 00         00495 NGAME     DEFB    0
469C 00         00496 INICTR    DEFB    0
0006            00497 SCORE     DEFS    6
46A3 53         00498 MS1       DEFM    'SELF-PLAYING K A L A H'
46B9 0C00       00499           DEFW    0CH
46BB 4E         00500 MS3       DEFM    'NUMBER OF GAMES'
46CA 00         00501           DEFB    0
46CB 49         00502 MS4A      DEFM    'IQ(1)'
46D0 00         00503           DEFB    0
46D1 49         00504 MS4B      DEFM    'IQ(2)'
46D6 00         00505           DEFB    0
46D7 48         00506 MS5       DEFM    'HOW MANY COUNTERS TO START (3-9)'
46F7 00         00507           DEFB    0
46F8 20         00508 MS7       DEFM    ' WINS.'
46FE 00         00509           DEFB    0
46FF 41         00510 MS8       DEFM    'A TIE.'
4705 00         00511           DEFB    0
4706 47         00512 MS9       DEFM    'GAMES      '
4710 00         00513           DEFB    0
4711 43         00514 MS10      DEFM    'COUNTERS   '
471B 00         00515           DEFB    0
471C 43         00516 MS12      DEFM    'CUMULATIVE'
4726 00         00517           DEFB    0
4727            00518 BOARDS    DEFL    $
42E9            00519           END     START
```

EVALUATION FUNCTION	VALUE GAME NOT OVER	VALUE GAME OVER
F_A	$K_1 - K_2$	$K_1 - K_2 + S_1 - S_2$
F_B	$K_1 - K_2 + S_1 - S_2$	$K_1 - K_2 + S_1 - S_2$
F_C	$K_1 - K_2 + \frac{(K_1 + K_2)(S_1 - S_2)}{12N}$	$K_1 - K_2 + S_1 - S_2$
F_D	$K_1 - K_2$	$K_1 - K_2 + S_1 - S_2 + 2^{14}$, PLAYER 1 WINS 0, TIE $K_1 - K_2 + S_1 - S_2 - 2^{14}$, PLAYER 2 WINS

Table 1. Several potentially useful evaluation functions. The contents of the two kalahs are indicated by K_1 and K_2. The total contents of the circular bins belonging to each player are indicated by S_1 and S_2 and the number of counters initially placed in each bin is N.

in Score and displays this data on the screen. The program ends with several utility routines that make use of Basic ROM for input/output, binary to decimal conversion and random number generation, followed by data storage and ASCII messages.

Some Evaluation Functions

My first choice for the evaluation function was simply the difference between the number of counters in player 1's kalah (K_1) and the number of counters in player 2's kalah (K_2). If the position being evaluated is an end-of-game position, the number of counters remaining in each player's circular bins, B_1 and B_2, are added to the appropriate kalahs before this difference is calculated. This is the evaluation function F_A (Table 1). F_A is always positive at the end of a game

N=3

IQ_1 \ IQ_2	1	2	3
2	.70, .61		
3	.90, .61	.73, .59	
4	.83, .62	.85, .63	.53, .51

N=6

IQ_1 \ IQ_2	1	2	3
2	.68, .61		
3	.60, .58	.70, .56	
4	.80, .60	75, .58	.65, 53

N=9

IQ_1 \ IQ_2	1	2	3
2	.85, .60		
3	.95, .60	.88, .58	
4	.90, .61	.80, .58	.90, .55

Table 2. The superiority of strategies using greater depths of analysis with evaluation function F_A. Each pair of entries in the table indicates the fraction of games and the fraction of total counters won by the strategy using the higher depth of analysis (IQ_1) in a series of 20 games (a tie game is considered as half a game won by each player). The number of initial counters is indicated by N. In all cases, the strategy with the greater depth-of-analysis won most of the games and most of the counters against an opponent using the same evaluation function but a lower depth of analysis (IQ_2).

won by player 1. It is always negative if player 2 wins. This is intuitively necessary if a minimax strategy for F_A is to make sense. F_A also has the practical advantage of needing very little calculation to compute it.

Before comparing F_A with other evaluation functions, I wanted to confirm that an F_A constructed minimax strategy made sense. I tested strategies with different depths of analyses against each other. I ran playoffs between strategies using depths of analyses one to four and with three, six, or nine counters in each bin initially. For a series of 20 games, the strategy with the deeper depth of analysis always won more games, and more counters, than its opponent (Table 2). Potential quirks, such as offensive strategy being superior to a defensive one, is not true for this class of Kalah strategies.

The evaluation function F_A only takes into account the number of counters in the circular bins when the game is over. By ignoring these counters before the end of the game, a strategy using F_A will not tend to accumulate counters on its side during the body of the game, and may be at a disadvantage relative to a strategy that does plan for the end of the game bin accumulation. This was the motivation for the evaluation function F_B, which sums all the counters on each side whether or not the game is over.

The evaluation functions F_A and F_B were compared using Listing 1 with EVAL suitably modified. Again, I compared the strategies generated by these evaluation functions for several values of the initial number of counters in each bin, to see if the relative merits of the evaluation functions depended on the length of the game (and on the

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	DEPTH OF ANALYSIS			
N	1	2	3	4
3	.69, .62	.76, .65	.90, .67	.63, .57
6	.85, .66	.65, .57	.73, .61	.68, .55
9	.85, .66	.68, .60	.90, .63	.75, .57

Table 3. The fraction of games and counters won in a series of 40 games by a strategy using evaluation function F_A against a strategy using evaluation function F_B, for three, six and nine initial counters and four depths of analyses. In all cases, the strategy using F_A won more games and more counters than its opponent.

	DEPTH OF ANALYSIS			
N	1	2	3	4
3	.54, .49	.48, .47	.64, .53	.53, .51
6	.64, .55	.41, .48	.61, .52	.61, .52
9	.70, .58	.53, .51	.71, .53	.53, .51

Table 4. The fraction of games and counters won in a series of 40 games by a strategy using evaluation function F_A against a strategy using evaluation function F_C, for three, six and nine initial counters and four depths of analyses. In all but two cases, the F_A strategy won more games, and in all but three cases, more counters than its opponent.

proportion of midgame to endgame). I also compared the evaluation functions for different depths of analyses to see if this factor interacted. Table 3 shows the results from a series of 40 games, with three, six and nine initial counters in each bin and depth of analysis one to four. In all cases, strategies using evaluation function F_A won more games and more counters than did strategies using evaluation function F_B.

Perhaps the problem with evaluation function F_B is it gives equal importance to the counters in the bins and the kalahs. Counters in the bins are only potential credits, becoming definite when the game ends. At the beginning of the game, counters in the bins are not nearly as likely to remain on a player's side as they are toward the end of the game. It might be preferable to calculate the evaluation function by weighting the counters in the bins according to an estimate of how near the end of the game is. One possibility for making this estimate is the fraction of counters already in the kalahs. Evaluation function F_C uses this fraction for counters in the bins until the end of

Program Listing 2

```
                00000 ;KALAH VERSION 3 ... J. D. VICTOR
42E9            00001         ORG     42E9H
0006            00002 MAXIQ   EQU     6
42E9 ED7BA040   00003 START   LD      SP,(40A0H)
42ED CDC901     00004 DIALOG  CALL    1C9H
42F0 21CC47     00005         LD      HL,SCORE
42F3 010006     00006         LD      BC,600H
42F6 CD6047     00007         CALL    MVBCHL
42F9 21D247     00008         LD      HL,MS1
42FC CDA747     00009         CALL    GTINT
42FF 7B         00010         LD      A,E
4300 FE02       00011         CP      2
4302 30E9       00012         JR      NC,DIALOG
4304 21F447     00013         LD      HL,MS2-1
4307 32B147     00014         LD      (MODE),A
430A B7         00015         OR      A
430B CC6747     00016         CALL    Z,GPN
430E 11B247     00017         LD      DE,PLY1
4311 CD7D47     00018         CALL    MVN
4314 3E01       00019         LD      A,1
4316 CD6747     00020         CALL    GPN
4319 11BE47     00021         LD      DE,PLY2
431C CD7D47     00022         CALL    MVN
431F 3AB147     00023         LD      A,(MODE)
4322 B7         00024         OR      A
4323 280E       00025         JR      Z,GAME
4325 210548     00026 DI1     LD      HL,MS4
4328 CDA747     00027         CALL    GTINT
432B 7B         00028         LD      A,E
432C FE07       00029         CP      MAXIQ+1
432E 30F5       00030         JR      NC,DI1
4330 32CA47     00031         LD      (IQ),A
4333 CDC901     00032 GAME    CALL    1C9H
4336 211A48     00033         LD      HL,MS5
4339 CDA747     00034         CALL    GTINT
433C 7B         00035         LD      A,E
433D FE0A       00036         CP      0AH
433F 30F2       00037         JR      NC,GAME
4341 FE03       00038         CP      3
4343 38EE       00039         JR      C,GAME
4345 32CB47     00040         LD      (INICTR),A
                00041 ;WHO GOES FIRST
4348 210200     00042         LD      HL,2
434B CD9A47     00043         CALL    RNDM
434E 7D         00044         LD      A,L
434F 3D         00045         DEC     A
4350 3D         00046         DEC     A
4351 32A848     00047         LD      (BOARDS),A
                00048 ;SET UP BOARD
4354 3ACB47     00049         LD      A,(INICTR)
4357 4F         00050         LD      C,A
4358 0606       00051         LD      B,6
435A 21A948     00052         LD      HL,BOARDS+1
435D AF         00053         XOR     A
```

Listing 2 continues

N	DEPTH OF ANALYSIS 1	2	3	4
3	.50, .50	.51, .50	.50, .49	.51, .50
6	.51, .50	.51, .50	.50, 50	.53, .50
9	50, .50	50, 50	.50, .49	.50, 50

Table 5. The fraction of games and counters won in a series of 40 games by a strategy using evaluation function F_D against a strategy using evaluation function F_A, for three, six and nine initial counters and four depths of analyses. The strategy using F_D always won at least half of the games and won more than half of the games in five cases.

the game is reached, when the bin counters reach full importance. Strategies using this evaluation function generally ignore the bins early in the game and concentrate on building them up as the end of the game approaches. But, when evaluation function F_C is tested against F_A (Table 4), the more complicated evaluation function of F_C does not give a significant advantage over the more simple-minded evaluation function F_A. In fact, for most conditions, the strategy of ignoring the circular bins until the end of the game is better than the strategy of gradually paying more and more attention to them as the game progresses. The idea of building up the bins as the game progresses is a good one, but to make it pay off, it is necessary to find a more sophisticated measurement of how close the end of the game is. I leave it to the reader to find such a measure.

Although the evaluation function F_A is substantially better than F_B and somewhat better than F_C, it can be improved upon. Imagine a situation where a player has a move which will end the game with a sure win, and a second move which will result in a larger difference between the two kalahs but will not end the game, and therefore not necessarily win. A strategy using evaluation function F_A with depth-of-1 analysis will choose the second move, which may not lead to victory and may ultimately lead to fewer counters won. Evaluation function F_D fixes this loophole by modifying the evaluation function F_A in the event the position being evaluated is an endgame position: it gives a large bonus (2^{14}) to the certain victor. Strategies using this evaluation function have a slight edge over those using F_A (Table 5). This slight advantage in games won may, however, be at the expense of a few less counters won. Because strategies using F_D did win a few more games than those using F_A in head-to-head competition and F_D is only minimally more complex to compute, I selected it for incorporation into my Kalah playing program.

Playing Against the Computer

Transforming the computer versus computer program into a computer versus human one involves a more extensive input and output (Program Listing 2).

The program first asks whether two humans will be playing against each other or one against the computer. It then asks for

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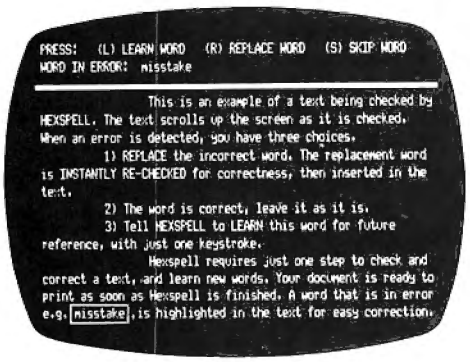

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435E 77        00054          LD      (HL),A
435F 23        00055          INC     HL
4360 CD6047    00056          CALL    MVBCHL
4363 77        00057          LD      (HL),A
4364 23        00058          INC     HL
4365 CD6047    00059          CALL    MVBCHL
4368 CDC901    00060 DRAWBD   CALL    1C9H
436B 21028C    00061          LD      HL,8C02H
436E 110400    00062          LD      DE,4
4371 FD21C53C  00063          LD      IY,3CC5H
4375 43        00064 DB3      LD      B,E
4376 FD23      00065 DB0      INC     IY
4378 FD74FC    00066          LD      (IY+0FCH),H
437B FD7434    00067          LD      (IY+34H),H
437E 10F6      00068          DJNZ    DB0
4380 0E06      00069          LD      C,6
4382 FD3600AA  00070 DB2      LD      (IY+0),0AAH
4386 FD360595  00071          LD      (IY+5),95H
438A FD36C0A0  00072          LD      (IY+0C0H),0A0H
438E FD36C590  00073          LD      (IY+0C5H),90H
4392 FD364082  00074          LD      (IY+40H),82H
4396 FD364581  00075          LD      (IY+45H),81H
439A 43        00076          LD      B,E
439B FD23      00077 DB1      INC     IY
439D FD74C0    00078          LD      (IY+0C0H),H
43A0 FD7440    00079          LD      (IY+40H),H
43A3 10F6      00080          DJNZ    DB1
43A5 FD19      00081          ADD     IY,DE
43A7 0D        00082          DEC     C
43A8 20D8      00083          JR      NZ,DB2
43AA FD21C53D  00084          LD      IY,3DC5H
43AE 2D        00085          DEC     L
43AF 20C4      00086          JR      NZ,DB3
43B1 FD21C13C  00087          LD      IY,3CC1H
43B5 114000    00088          LD      DE,40H
43B8 2E02      00089          LD      L,2
43BA FD3600A0  00090 DB5      LD      (IY+0),0A0H
43BE FD360590  00091          LD      (IY+5),90H
43C2 0603      00092          LD      B,3
43C4 FD19      00093 DB4      ADD     IY,DE
43C6 FD3600AA  00094          LD      (IY+0),0AAH
43CA FD360595  00095          LD      (IY+5),95H
43CE 10F4      00096          DJNZ    DB4
43D0 FD364082  00097          LD      (IY+40H),82H
43D4 FD364581  00098          LD      (IY+45H),81H
43D8 FD21F93C  00099          LD      IY,3CF9H
43DC 2D        00100          DEC     L
43DD 20DB      00101          JR      NZ,DB5
43DF 21693C    00102          LD      HL,3C69H
43E2 060E      00103          LD      B,0EH
43E4 0E3C      00104          LD      C,'<'
43E6 CD6047    00105          CALL    MVBCHL
43E9 21493E    00106          LD      HL,3E49H
43EC 0E3E      00107          LD      C,'>'
43EE CD6047    00108          CALL    MVBCHL
43F1 21B147    00109          LD      HL,PLY1-1
43F4 114A3C    00110          LD      DE,3C4AH
43F7 CD7547    00111          CALL    MVND
43FA 21BD47    00112          LD      HL,PLY2-1
43FD 116A3E    00113          LD      DE,3E6AH
4400 CD7547    00114          CALL    MVND
4403 010206    00115 POSIT    LD      BC,602H
4406 DD21A948  00116          LD      IX,BOARDS+1
440A FD21433D  00117          LD      IY,3D43H
440E 2600      00118          LD      H,0
4410 DD6E00    00119          LD      L,(IX+0)
4413 CD4447    00120          CALL    WNU
4416 FD217B3D  00121          LD      IY,3D7BH
441A DD6E07    00122          LD      L,(IX+7)
441D CD4447    00123          CALL    WNU
4420 FD21CB3C  00124          LD      IY,3CCBH
4424 110800    00125          LD      DE,8
4427 DD23      00126 PS1      INC     IX
4429 DD6E00    00127          LD      L,(IX+0)
442C CD4447    00128          CALL    WNU
442F FD19      00129          ADD     IY,DE
4431 10F4      00130          DJNZ    PS1
4433 7A        00131          LD      A,D
4434 B7        00132          OR      A
4435 200D      00133          JR      NZ,NXTMOV
4437 FD21F33D  00134          LD      IY,3DF3H
443B 0606      00135          LD      B,6
443D DD23      00136          INC     IX
443F 11F8FF    00137          LD      DE,-8
4442 18E3      00138          JR      PS1
4444 3AA848    00139 NXTMOV   LD      A,(BOARDS)
4447 2F        00140          CPL
4448 32A848    00141          LD      (BOARDS),A
444B CD3E47    00142          CALL    DELAY
444E DD21A948  00143          LD      IX,BOARDS+1
4452 CD4E46    00144          CALL    GAMOVR
4455 CA6846    00145          JP      Z,ENDGAM
4458 21C03E    00146 ASKMOV   LD      HL,3EC0H
445B 222040    00147          LD      (4020H),HL
445E 012040    00148          LD      BC,4020H
4461 CD6047    00149          CALL    MVBCHL
4464 21B247    00150          LD      HL,PLY1
4467 3AA848    00151          LD      A,(BOARDS)
```

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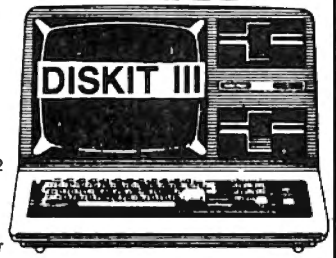

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```
446A B7       00152          OR      A
446B 2803     00153          JR      Z,AM1
446D 21BE47   00154          LD      HL,PLY2
4470 CDA728   00155 AM1      CALL    28A7H
4473 213B48   00156          LD      HL,MS6
4476 3AB147   00157          LD      A,(MODE)
4479 B7       00158          OR      A
447A 2819     00159          JR      Z,AM2
447C 3AA848   00160          LD      A,(BOARDS)
447F B7       00161          OR      A
4480 2013     00162          JR      NZ,AM2
              00163 ;CALCULATE TRS-80'S MOVE
4482 CDA728   00164          CALL    28A7H
4485 3E3D     00165          LD      A,'='
4487 CD3A03   00166          CALL    33AH
448A CDD944   00167          CALL    TRS80M
448D 7D       00168          LD      A,L
448E C631     00169          ADD     A,'1'
4490 CD3A03   00170          CALL    33AH
4493 1814     00171          JR      GOTMV
4495 CDA747   00172 AM2      CALL    GTINT
4498 6B       00173          LD      L,E
4499 2D       00174          DEC     L
449A 3805     00175          JR      C,AM3
449C 7D       00176          LD      A,L
449D FE06     00177          CP      6
449F 3808     00178          JR      C,GOTMV
44A1 218748   00179 AM3      LD      HL,ILGL
44A4 CD3447   00180          CALL    SPESHL
44A7 18AF     00181          JR      ASKMOV
44A9 DD21A948 00182 GOTMV    LD      IX,BOARDS+1
44AD DD66FF   00183          LD      H,(IX+0FFH)
44B0 CDBC45   00184          CALL    KALMOV
44B3 B7       00185          OR      A
44B4 281D     00186          JR      Z,GM1
44B6 3D       00187          DEC     A
44B7 2008     00188          JR      NZ,GM2
44B9 219448   00189          LD      HL,CAPT
44BC CD3447   00190          CALL    SPESHL
44BF 1812     00191          JR      GM1
44C1 3D       00192 GM2      DEC     A
44C2 20DD     00193          JR      NZ,AM3
44C4 219D48   00194          LD      HL,FTRN
44C7 CD3447   00195          CALL    SPESHL
44CA 3AA848   00196          LD      A,(BOARDS)
44CD 2F       00197          CPL
44CE 32A848   00198          LD      (BOARDS),A
44D1 1800     00199          JR      GM1
44D3 CD3E47   00200 GM1      CALL    DELAY
44D6 C30344   00201          JP      POSIT
44D9 DD21A948 00202 TRS80M   LD      IX,BOARDS+1
44DD 3ACA47   00203          LD      A,(IQ)
44E0 B7       00204          OR      A
44E1 2807     00205          JR      Z,DUMB
44E3 47       00206          LD      B,A
44E4 CDFC44   00207          CALL    BSTMOV
44E7 69       00208          LD      L,C
44E8 2D       00209          DEC     L
44E9 C9       00210          RET
44EA 210600   00211 DUMB     LD      HL,6
44ED CD9A47   00212          CALL    RNDM
44F0 2D       00213          DEC     L
44F1 4D       00214          LD      C,L
44F2 11AA48   00215          LD      DE,BOARDS+2
44F5 19       00216          ADD     HL,DE
44F6 7E       00217          LD      A,(HL)
44F7 B7       00218          OR      A
44F8 28F0     00219          JR      Z,DUMB
44FA 69       00220          LD      L,C
44FB C9       00221          RET
              00222 ;ENTRY: IX->ACTIVE BOARD,A=TURN,B=IQ
              00223 ;EXIT: C=BIN $(1-6),HL=EVAL
44FC F5       00224 BSTMOV   PUSH    AF
44FD 0E00     00225          LD      C,0
44FF CD4E46   00226          CALL    GAMOVR
4502 2002     00227          JR      NZ,BS0
4504 F1       00228          POP     AF
4505 C9       00229          RET
4506 C5       00230 BS0      PUSH    BC
4507 D5       00231          PUSH    DE
4508 E5       00232          PUSH    HL
4509 DDE5     00233          PUSH    IX
450B FDE5     00234          PUSH    IY
450D 210000   00235          LD      HL,0
4510 39       00236          ADD     HL,SP
4511 E5       00237          PUSH    HL
4512 FDE1     00238          POP     IY
4514 3E06     00239          LD      A,6
4516 FD6E02   00240 BS1      LD      L,(IY+2)
4519 FD6603   00241          LD      H,(IY+3)
451C 2B       00242          DEC     HL
451D 5D       00243          LD      E,L
451E 54       00244          LD      D,H
451F 010F00   00245          LD      BC,0FH
4522 09       00246          ADD     HL,BC
4523 EB       00247          EX      DE,HL
4524 EDB0     00248          LDIR
4526 23       00249          INC     HL
4527 E5       00250          PUSH    HL
```

Listing 2 continues

the name(s) of the human player(s). If the computer is an opponent, the program asks for a specification of the depth of analysis, in the range zero to six. (Warning: Do not use levels five or six unless you are willing to wait an hour or more for the computer to move!) Specifying a depth-of-zero strategy makes the program choose its moves at random. The last request is for the number of counters to fill each bin with at the start of the game. The program then randomly chooses a player to go first and starts the game.

The routine DRAWBD, executed before each move, draws a picture of the kalahs and the bins on the monitor and indicates how many counters are in each pit. The program then either calculates its move, or asks for the human's move. It checks the human's move making sure it is correctly specified as a bin number in the range one to six and that the indicated bin is not empty. Before the move is executed, the computer displays an appropriate message if a free turn or a capture will be generated. At the end of the game, the score is tallied and the program asks if additional play is desired.

Suggested Modifications

Although the program plays a respectable game with depth-of-four analysis, it is not beyond improvements. There are a few ways to shorten computer response time. For instance, when a chosen line of play will lead to a free move for the program, it could use the previous calculations without having to work out the free move from scratch. A second, independent method, more general because it applies equally well to games with no free moves, is a kind of pruning of the tree of hypothetical moves. Imagine a depth-of-two strategy is being calculated by player 1. Player 1 will choose the move for which player 2's best response will lead to the maximum evaluation function. Thus, if for a particular trial move for player 1, there exists a reply for player 2 which results in an evaluation function less than those previously encountered, this move for player 1 can be rejected without having to consider the remaining possible replies to it. This method of pruning the tree of hypothetical moves could be embodied into BSTMOV at a depth-of-two, so higher depth-of-analysis strategies, which call the depth-of-two strategy, will be able to make use of this savings.

These enhancements will make the program run faster but not any smarter. The real challenge of writing a sophisticated game playing program is to develop a way to determine which lines of play are fruitful and analyze those in greater detail, rather than lines of play that are silly. This level of sophistication is not a necessity in Kalah. Each player has only a relatively small number of moves, but it would be hard to do without in a game such as Go or chess. Good luck! ■

Jonathan Victor is a neurology resident at New York Hospital.

Listing 2 continued

```
4528 DDE1      00251          POP     IX
452A 6F        00252          LD      L,A
452B 2D        00253          DEC     L
452C DD66FF    00254          LD      H,(IX+0FFH)
452F 08        00255          EX      AF,AF'
4530 CDBC45    00256          CALL    KALMOV
4533 FD4609    00257          LD      B,(IY+9)
4536 CB4F      00258          BIT     1,A
4538 2810      00259          JR      Z,BS3
453A 0F        00260          RRCA
453B 301C      00261          JR      NC,BS2
453D 08        00262 BS4      EX      AF,AF'
453E 3D        00263          DEC     A
453F 20D5      00264          JR      NZ,BS1
4541 FDE1      00265          POP     IY
4543 DDE1      00266          POP     IX
4545 E1        00267          POP     HL
4546 E1        00268          POP     HL
4547 C1        00269          POP     BC
4548 F1        00270          POP     AF
4549 C9        00271          RET
454A 05        00272 BS3      DEC     B
454B 2005      00273          JR      NZ,BS5
454D CD8645    00274          CALL    EVAL
4550 180C      00275          JR      BS6
4552 DD7EFF    00276 BS5      LD      A,(IX+0FFH)
4555 2F        00277          CPL
4556 DD77FF    00278          LD      (IX+0FFH),A
4559 08        00279 BS2      EX      AF,AF'
455A CDFC44    00280          CALL    BSTMOV
455D 08        00281          EX      AF,AF'
455E FD7E08    00282 BS6      LD      A,(IY+8)
4561 B7        00283          OR      A
4562 2815      00284          JR      Z,UPDATE
4564 FD5E06    00285          LD      E,(IY+6)
4567 FD5607    00286          LD      D,(IY+7)
456A B7        00287          OR      A
456B ED52      00288          SBC     HL,DE
456D 28CE      00289          JR      Z,BS4
456F DD7EF0    00290          LD      A,(IX+0F0H)
4572 3801      00291          JR      C,BS7
4574 2F        00292          CPL
4575 0F        00293 BS7      RRCA
4576 30C5      00294          JR      NC,BS4
4578 19        00295          ADD     HL,DE
4579 08        00296 UPDATE   EX      AF,AF'
457A FD7708    00297          LD      (IY+8),A
457D 08        00298          EX      AF,AF'
457E FD7506    00299          LD      (IY+6),L
4581 FD7407    00300          LD      (IY+7),H
4584 18B7      00301          JR      BS4
4586 D9        00302 EVAL     EXX
4587 AF        00303          XOR     A
4588 67        00304          LD      H,A
4589 57        00305          LD      D,A
458A 47        00306          LD      B,A
458B DD6E00    00307          LD      L,(IX+0)
458E DD5E07    00308          LD      E,(IX+7)
4591 ED52      00309          SBC     HL,DE
4593 CD4E46    00310          CALL    GAMOVR
4596 201C      00311          JR      NZ,EV1
4598 DDE5      00312          PUSH    IX
459A 0606      00313          LD      B,6
459C DD23      00314 EV2      INC     IX
459E DD5E00    00315          LD      E,(IX+0)
45A1 19        00316          ADD     HL,DE
45A2 DD5E07    00317          LD      E,(IX+7)
45A5 B7        00318          OR      A
45A6 ED52      00319          SBC     HL,DE
45A8 10F2      00320          DJNZ    EV2
45AA DDE1      00321          POP     IX
45AC 7C        00322          LD      A,H
45AD B5        00323          OR      L
45AE 2804      00324          JR      Z,EV1
45B0 7C        00325          LD      A,H
45B1 EE40      00326          XOR     40H
45B3 67        00327          LD      H,A
45B4 E5        00328 EV1      PUSH    HL
45B5 D9        00329          EXX
45B6 E1        00330          POP     HL
45B7 7C        00331          LD      A,H
45B8 EE80      00332          XOR     80H
45BA 67        00333          LD      H,A
45BB C9        00334          RET
               00335 ;ENTRY: IX->ACTIVE BOARD,L=BIN #(0-5),H=TURN(0,-1)
               00336 ;EXIT: A=-1 FOR EMPTY BIN,1 FOR CAPTURE,2 FOR FREE MOVE
45BC C5        00337 KALMOV   PUSH    BC
45BD D5        00338          PUSH    DE
45BE DDE5      00339          PUSH    IX
45C0 010700    00340          LD      BC,7
45C3 50        00341          LD      D,B
45C4 5D        00342          LD      E,L
45C5 1C        00343          INC     E
45C6 7C        00344          LD      A,H
45C7 B7        00345          OR      A
45C8 2803      00346          JR      Z,KM0
45CA 79        00347          LD      A,C
45CB 83        00348          ADD     A,E
45CC 5F        00349          LD      E,A
```

Listing 2 continues

Listing 2 continued

```
45CD DD19       00350 KM0      ADD     IX,DE
45CF DD7E00     00351          LD      A,(IX+0)
45D2 B7         00352          OR      A
45D3 2006       00353          JR      NZ,KM1
45D5 3D         00354          DEC     A
45D6 DDE1       00355 KM2      POP     IX
45D8 D1         00356 KM3      POP     DE
45D9 C1         00357          POP     BC
45DA C9         00358          RET
45DB DD360000   00359 KM1      LD      (IX+0),0
45DF 57         00360          LD      D,A
45E0 DD2B       00361 KL       DEC     IX
45E2 1D         00362          DEC     E
45E3 2012       00363          JR      NZ,NK1
45E5 79         00364          LD      A,C
45E6 87         00365          ADD     A,A
45E7 5F         00366          LD      E,A
45E8 DD09       00367          ADD     IX,BC
45EA DD09       00368          ADD     IX,BC
45EC 14         00369          INC     D
45ED 7C         00370          LD      A,H
45EE B7         00371          OR      A
45EF 2013       00372          JR      NZ,DIDT
45F1 15         00373          DEC     D
45F2 DD34F2     00374          INC     (IX+0F2H)
45F5 180D       00375          JR      DIDT
45F7 7B         00376 NK1      LD      A,E
45F8 91         00377          SUB     C
45F9 2006       00378          JR      NZ,NK2
45FB 14         00379          INC     D
45FC 7C         00380          LD      A,H
45FD B7         00381          OR      A
45FE 2804       00382          JR      Z,DIDT
4600 15         00383          DEC     D
4601 DD3400     00384 NK2      INC     (IX+0)
4604 15         00385 DIDT     DEC     D
4605 20D9       00386          JR      NZ,KL
4607 7B         00387          LD      A,E
4608 91         00388          SUB     C
4609 2004       00389          JR      NZ,NEK2
460B 3E02       00390 FT       LD      A,2
460D 18C7       00391          JR      KM2
460F 91         00392 NEK2     SUB     C
4610 28F9       00393          JR      Z,FT
4612 81         00394          ADD     A,C
4613 AC         00395          XOR     H
4614 17         00396          RLA
4615 3803       00397          JR      C,OWNSID
4617 AF         00398 KM4      XOR     A
4618 18BC       00399          JR      KM2
461A DD7E00     00400 OWNSID   LD      A,(IX+0)
461D 3D         00401          DEC     A
461E 20F7       00402          JR      NZ,KM4
4620 FDE3       00403          EX      (SP),IY
4622 FDE5       00404          PUSH    IY
4624 79         00405          LD      A,C
4625 87         00406          ADD     A,A
4626 93         00407          SUB     E
4627 5F         00408          LD      E,A
4628 FD19       00409          ADD     IY,DE
462A D1         00410          POP     DE
462B D5         00411          PUSH    DE
462C FD7E00     00412          LD      A,(IY+0)
462F B7         00413          OR      A
4630 2816       00414          JR      Z,NOCAP
4632 DD360000   00415          LD      (IX+0),0
4636 FD360000   00416          LD      (IY+0),0
463A 3C         00417          INC     A
463B F5         00418          PUSH    AF
463C 7C         00419          LD      A,H
463D B7         00420          OR      A
463E EB         00421          EX      DE,HL
463F 2801       00422          JR      Z,CAP1
4641 09         00423          ADD     HL,BC
4642 F1         00424 CAP1     POP     AF
4643 86         00425          ADD     A,(HL)
4644 EB         00426          EX      DE,HL
4645 12         00427          LD      (DE),A
4646 3E01       00428          LD      A,1
4648 DDE1       00429 NOCAP    POP     IX
464A FDE1       00430          POP     IY
464C 188A       00431          JR      KM3
464E C5         00432 GAMOVR   PUSH    BC
464F E5         00433          PUSH    HL
4650 01FF06     00434          LD      BC,06FFH
4653 DDE5       00435          PUSH    IX
4655 E1         00436          POP     HL
4656 AF         00437 GV1      XOR     A
4657 23         00438 GV2      INC     HL
4658 86         00439          ADD     A,(HL)
4659 10FC       00440          DJNZ    GV2
465B 2003       00441          JR      NZ,GV3
465D E1         00442 GV4      POP     HL
465E C1         00443          POP     BC
465F C9         00444          RET
4660 23         00445 GV3      INC     HL
4661 0606       00446          LD      B,6
4663 0C         00447          INC     C
4664 20F7       00448          JR      NZ,GV4
4666 18EE       00449          JR      GV1
4668 CDC901     00450 ENDGAM   CALL    01C9H
466B 21A948     00451          LD      HL,BOARDS+1
466E CD2C47     00452          CALL    EGAD
4671 57         00453          LD      D,A
4672 CD2C47     00454          CALL    EGAD
4675 5F         00455          LD      E,A
4676 D5         00456          PUSH    DE
4677 BA         00457          CP      D
4678 214A48     00458          LD      HL,MS8
467B 2815       00459          JR      Z,EG1
467D 21B247     00460          LD      HL,PLY1
4680 01CC47     00461          LD      BC,SCORE
4683 3804       00462          JR      C,EG2
4685 21BE47     00463          LD      HL,PLY2
4688 03         00464          INC     BC
4689 0A         00465 EG2      LD      A,(BC)
468A 3C         00466          INC     A
468B 02         00467          LD      (BC),A
468C CDA728     00468          CALL    28A7H
468F 214348     00469          LD      HL,MS7
4692 CDA728     00470 EG1      CALL    28A7H
4695 D1         00471          POP     DE
4696 D5         00472          PUSH    DE
4697 5A         00473          LD      E,D
4698 1600       00474          LD      D,0
469A 2ACE47     00475          LD      HL,(SCORE+2)
469D 19         00476          ADD     HL,DE
469E 22CE47     00477          LD      (SCORE+2),HL
46A1 D1         00478          POP     DE
46A2 D5         00479          PUSH    DE
46A3 1600       00480          LD      D,0
46A5 2AD047     00481          LD      HL,(SCORE+4)
46A8 19         00482          ADD     HL,DE
46A9 22D047     00483          LD      (SCORE+4),HL
46AC 114B3C     00484 EG3      LD      DE,3C4BH
46AF 21B147     00485          LD      HL,PLY1-1
46B2 CD7547     00486          CALL    MVND
46B5 115B3C     00487          LD      DE,3C5BH
46B8 21BD47     00488          LD      HL,PLY2-1
46BB CD7547     00489          CALL    MVND
46BE 21803C     00490          LD      HL,3C80H
46C1 222040     00491          LD      (4020H),HL
46C4 215148     00492          LD      HL,MS9
46C7 CDA728     00493          CALL    28A7H
46CA DD21CC47   00494          LD      IX,SCORE
46CE DD6E00     00495          LD      L,(IX+0)
46D1 CD8A47     00496          CALL    WSINT
46D4 CD1D47     00497          CALL    SP11
46D7 DD6E01     00498          LD      L,(IX+1)
46DA CD8A47     00499          CALL    WSINT
46DD CD2747     00500          CALL    CLRL
46E0 215C48     00501          LD      HL,MS10
46E3 CDA728     00502          CALL    28A7H
46E6 D1         00503          POP     DE
46E7 6A         00504          LD      L,D
46E8 D5         00505          PUSH    DE
46E9 CD8A47     00506          CALL    WSINT
46EC CD1D47     00507          CALL    SP11
46EF D1         00508          POP     DE
46F0 6B         00509          LD      L,E
46F1 CD8A47     00510          CALL    WSINT
46F4 CD2747     00511          CALL    CLRL
46F7 216748     00512          LD      HL,MS12
46FA CDA728     00513          CALL    28A7H
46FD 2ACE47     00514          LD      HL,(SCORE+2)
4700 CD8C47     00515          CALL    WINT
4703 CD1D47     00516          CALL    SP11
4706 2AD047     00517          LD      HL,(SCORE+4)
4709 CD8C47     00518          CALL    WINT
470C CD2747     00519          CALL    CLRL
470F 217248     00520          LD      HL,MS11
4712 CDA747     00521          CALL    GTINT
4715 7B         00522          LD      A,E
4716 B7         00523          OR      A
4717 C23343     00524          JP      NZ,GAME
471A C37341     00525          JP      4173H
471D 060B       00526 SP11     LD      B,0BH
471F 3E20       00527 SP11L    LD      A,20H
4721 CD3A03     00528          CALL    33AH
4724 10F9       00529          DJNZ    SP11L
4726 C9         00530          RET
4727 3E0D       00531 CLRL     LD      A,0DH
4729 C33A03     00532          JP      33AH
472C AF         00533 EGAD     XOR     A
472D 0607       00534          LD      B,7
472F 86         00535 EG0      ADD     A,(HL)
4730 23         00536          INC     HL
4731 10FC       00537          DJNZ    EG0
4733 C9         00538          RET
4734 01E03E     00539 SPESHL   LD      BC,3EE0H
4737 ED432040   00540          LD      (4020H),BC
473B CDA728     00541          CALL    28A7H
473E 010000     00542 DELAY    LD      BC,0
4741 C36000     00543          JP      60H
4744 E5         00544 WNU      PUSH    HL
4745 D5         00545          PUSH    DE
4746 C5         00546          PUSH    BC
```

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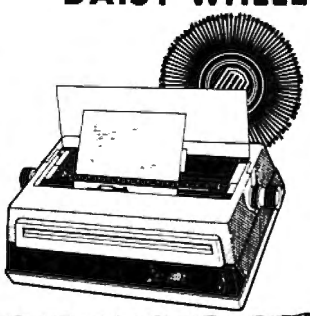

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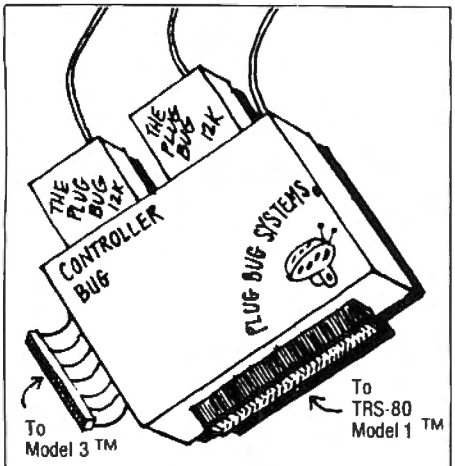

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```
4747 CD9A0A   00547          CALL    0A9AH
474A 010002   00548          LD      BC,200H
474D C5       00549          PUSH    BC
474E 3E80     00550          LD      A,80H
4750 CDBE0F   00551          CALL    0FBEH
4753 FDE5     00552          PUSH    IY
4755 D1       00553          POP     DE
4756 C1       00554          POP     BC
4757 48       00555          LD      C,B
4758 0600     00556          LD      B,0
475A EDB0     00557          LDIR
475C C1       00558          POP     BC
475D D1       00559          POP     DE
475E E1       00560          POP     HL
475F C9       00561          RET
4760 C5       00562 MVBCHL   PUSH    BC
4761 71       00563 MVB1     LD      (HL),C
4762 23       00564          INC     HL
4763 10FC     00565          DJNZ    MVB1
4765 C1       00566          POP     BC
4766 C9       00567          RET
4767 C631     00568 GPN      ADD     A,'1'
4769 320348   00569          LD      (MS3+7),A
476C 21FC47   00570          LD      HL,MS3
476F CDA728   00571          CALL    28A7H
4772 C3B31B   00572          JP      1BB3H
4775 CD7D47   00573 MVND     CALL    MVN
4778 3E20     00574          LD      A,20H
477A 1B       00575          DEC     DE
477B 12       00576          LD      (DE),A
477C C9       00577          RET
477D 060B     00578 MVN      LD      B,0BH
477F 23       00579 MV1      INC     HL
4780 7E       00580          LD      A,(HL)
4781 12       00581 MV2      LD      (DE),A
4782 13       00582          INC     DE
4783 B7       00583          OR      A
4784 C8       00584          RET     Z
4785 10F8     00585          DJNZ    MV1
4787 AF       00586          XOR     A
4788 18F7     00587          JR      MV2
478A 2600     00588 WSINT    LD      H,0
478C CD9A0A   00589 WINT     CALL    0A9AH
478F 010005   00590          LD      BC,500H
4792 3E80     00591          LD      A,80H
4794 CDBE0F   00592          CALL    0FBEH
4797 C3A728   00593          JP      28A7H
479A CD9A0A   00594 RNDM     CALL    0A9AH
479D CDC914   00595          CALL    14C9H
47A0 CD370B   00596          CALL    0B37H
47A3 2A2141   00597          LD      HL,(4121H)
47A6 C9       00598          RET
47A7 CDA728   00599 GTINT    CALL    28A7H
47AA CDB31B   00600          CALL    1BB3H
47AD D7       00601          RST     10H
47AE C35A1E   00602          JP      1E5AH
47B1 00       00603 MODE     DEFB    0
000C          00604 PLY1     DEFS    0CH
000C          00605 PLY2     DEFS    0CH
47CA 00       00606 IQ       DEFB    0
47CB 00       00607 INICTR   DEFB    0
0006          00608 SCORE    DEFS    6
47D2 4B       00609 MS1      DEFM    'K A L A H'
47DB 0C0C     00610          DEFW    0C0CH
47DD 41       00611          DEFM    'AM I PLAYER 1 (1=Y,0=N)'
47F4 00       00612          DEFB    0
47F5 54       00613 MS2      DEFM    'TRS-80'
47FB 00       00614          DEFB    0
47FC 50       00615 MS3      DEFM    'PLAYER X'
4804 00       00616          DEFB    0
4805 48       00617 MS4      DEFM    'HOW SMART AM I (0-'
4817 36       00618          DEFB    '0'+MAXIQ
4818 29       00619          DEFB    ')'
4819 00       00620          DEFB    0
481A 48       00621 MS5      DEFM    'HOW MANY COUNTERS TO START (3-9)'
483A 00       00622          DEFB    0
483B 27       00623 MS6      DEFB    '''
483C 53       00624          DEFM    'S MOVE'
4842 00       00625          DEFB    0
4843 20       00626 MS7      DEFM    ' WINS.'
4849 00       00627          DEFB    0
484A 41       00628 MS8      DEFM    'A TIE.'
4850 00       00629          DEFB    0
4851 47       00630 MS9      DEFM    'GAMES      '
485B 00       00631          DEFB    0
485C 43       00632 MS10     DEFM    'COUNTERS   '
4866 00       00633          DEFB    0
4867 43       00634 MS12     DEFM    'CUMULATIVE'
4871 00       00635          DEFB    0
4872 50       00636 MS11     DEFM    'PLAY AGAIN (1=Y,0=N)'
4886 00       00637          DEFB    0
4887 49       00638 ILGL     DEFM    'ILLEGAL MOVE'
4893 00       00639          DEFB    0
4894 43       00640 CAPT     DEFM    'CAPTURE!'
489C 00       00641          DEFB    0
489D 46       00642 FTRN     DEFM    'FREE TURN!'
48A7 00       00643          DEFB    0
48A8          00644 BOARDS   DEFL    $
42E9          00645          END     START
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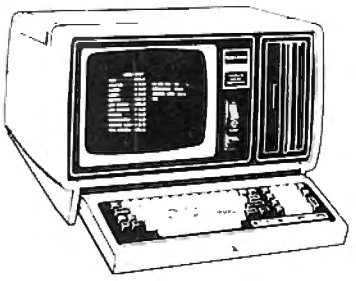

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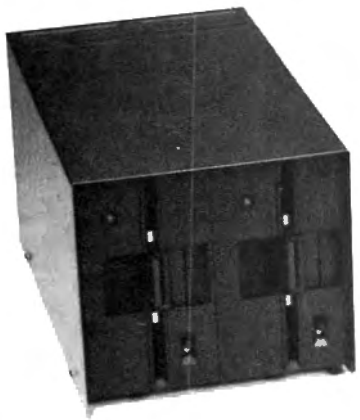

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Many of us have played a game on a small triangular piece of wood with ten drilled holes and nine pegs. To play the game you capture tees by jumping adjacent tees to unoccupied positions along a straight line. You can remove all but one tee this way. The game ends when only one tee remains. This simple board game inspired the program for Triangle Marker.

Before writing the program, I analyzed the game board to determine what moves are possible, how moves are entered and shown and what makes a win.

Another version of the board game uses 15 rather than 10 tees. To make the game more challenging I used 15 tees numbering the board positions consecutively. This numbering system is important in later program logic.

Next I compiled a list of possible moves on the board (see Fig. 1). For example, marker one can move to positions four or six, while marker four can move to positions one, six, 11, or 13. The player enters single numbers to move. The first two digits represent the position moved from and the last two digits represent the position moved to. A move from 13 to 15 is coded 1315. A move from 11 to four is coded 1104, but a move from four to 11 is coded 411. The computer requires no leading zero.

The first 36 data numbers in line 770 of Program Listing 1 are the codes of 36 possible moves on the game board. Line 200 reads and stores possible moves in M(1) through M(36). The program breaks the possible move codes so the first two digits stored in F(I) code the position moved from and the last two digits stored in T(I) code the position moved to.

The computer reads in the data while the user reads playing instructions.

Entering and Showing Moves

Line 200 reads the 15 "print at" positions for the markers on the screen and stores them in P(1) through P(15). Lines 240 -270 provide the playing board graphics. Line 290 puts a 1 in L(1), a 2 in L(2), a 3 in L(3), . . . , and a 15 in L(15). These variable locations determine board position vacancies. For example, when you remove marker 13 from the game board, L(13) will be set to zero. Board positions whose L( ) value is zero are vacant while those whose L( ) value is nonzero are occupied. In line 210, M$ is the graphics design for the individual marker and B$ removes the marker graphics from the video screen.

The user inputs moves with INKEY$ but some positions on the screen are coded by a single-

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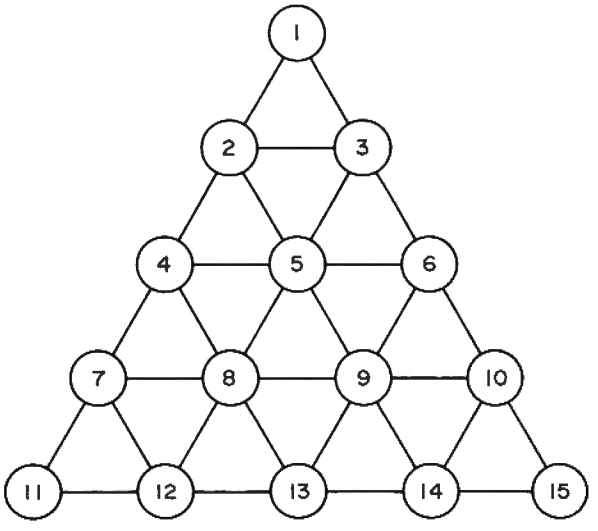

Fig. 1. Triangle Marker

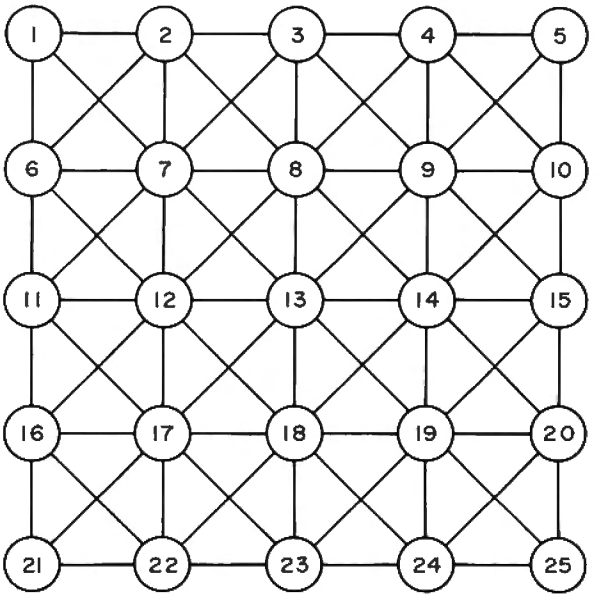

Fig. 2. Square Marker

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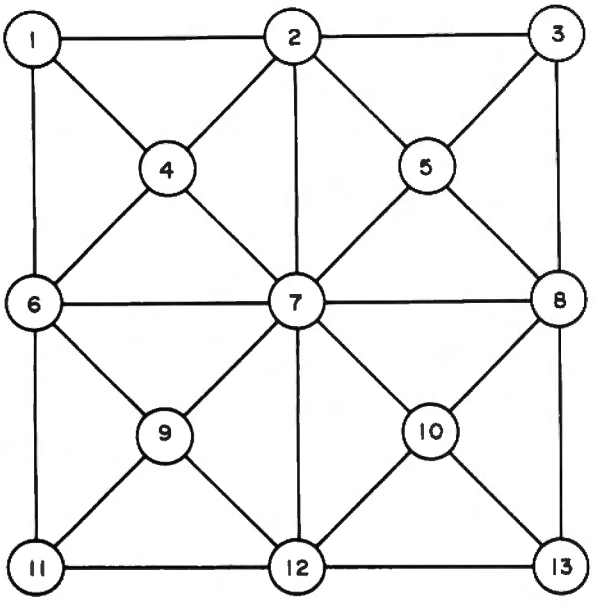

Fig. 3a. Lucky 13 Marker

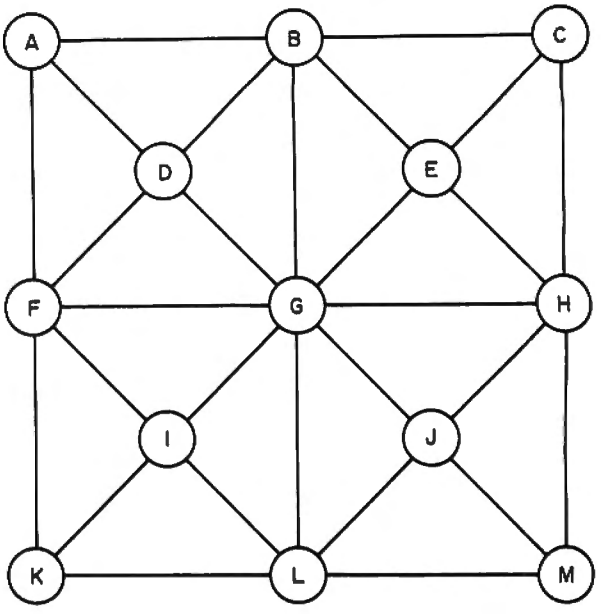

Fig. 3b. Lucky 13 Marker

digit number and some are coded by a two-digit number. I changed the code numbers for the positions from one through 15 to 10 through 24. The program subtracts nine from the number input so the program logic previously developed can still be used.

To begin the game, the routine in lines 290–340 permits the user to leave any of the 15 board positions vacant. F$ is the first digit of the input, S$ is the second digit of the input, and PP is the full position number in the original numbering system of one through 15.

Lines 360–430 code and enter the move from and the move to two-digit numbers input using INKEY$. Lines 450–540 determine if the user's move is possible and which marker is removed by the given jump.

Using the numbering system for the positions shown in Fig. 1, if the user jumps from two to nine, the five marker is removed. If the user jumps from 12 to five, the eight marker is removed. In both cases, if the position moved from is added to the position moved to, the sum divided by two, and the INT function taken of the quotient, the result is the number of the captured marker. This works no matter where the move is on the game board. Consequently, line 510 determines the marker you remove.

When a move is entered and checked, the subroutine in lines 570–630 positions the markers on the video screen. With C as a counter, the routine in lines 570–600 is used twice when two markers are removed, the position marker moved from and the position marker jumped.

Lines 650–700 check for remaining possible moves. When additional moves are possible, the program passes to line 360 where the user may enter additional moves. Lines 710–730 count the number of remaining markers. If no more moves are possible and more than one marker remains on the game board, line 750 provides a "No Possible Move" message; if only one marker remains on the game board, line 760 provides a "You Are A Winner" message. In both cases, the program passes to line 240 to begin a new game.

Square

Triangle fanned my curiosity about such games.

I analyzed a square game board to determine what moves are possible, how moves are entered and shown and when the game is won.

I numbered the game board positions consecutively; again, this particular numbering system proved worthwhile in the program logic. (See Fig. 2.)

I compiled a list of the possible moves. The coding for the moves in the Triangle Marker Game worked well, so I used the same procedure in Square Marker. The first two digits of a number represent the position moved from and the last two digits represent the position moved to.

There are 96 possible moves on the square game board; their respective codes are in the 96 data numbers in lines 760–780 of Program Listing 2. Line 200 reads

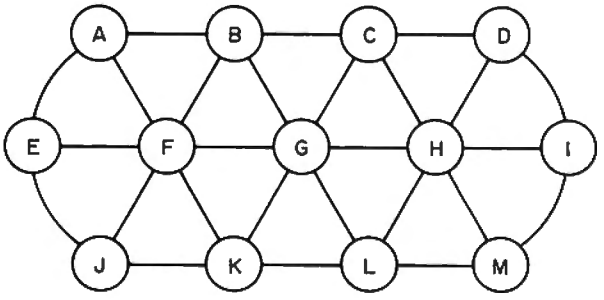

Fig. 5. Star Marker

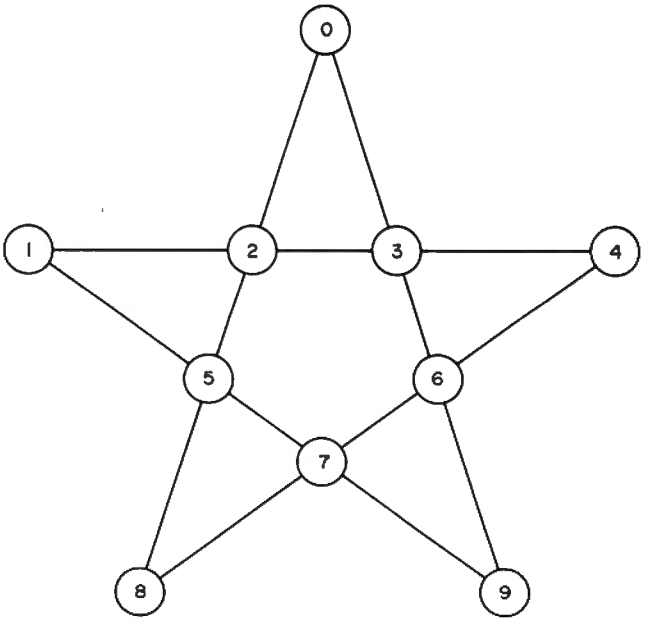

Fig. 4. 'Round the End Marker

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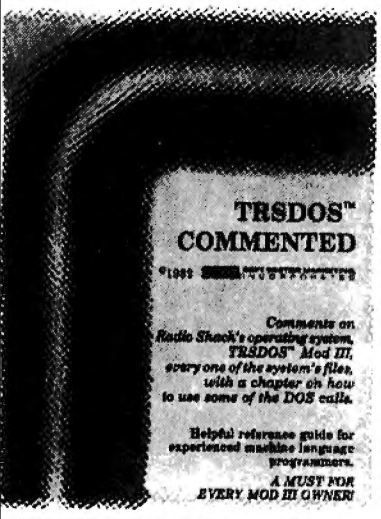

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the codes for the possible moves and stores them in M(1) through M(96). The program breaks the possible move codes and stores the first two digits in F(I) as the position moved from and the last two digits in T(I) as the position moved to.

Winning

Lines 560–610 check for additional possible moves. The program passes to line 320 where the user may enter additional moves. Lines 630–650 count the number of markers remaining on the board. If more than one marker remains and no more moves are possible, line 660 provides a "No Possible Move" message. If only one marker remains on the game board, line 690 provides a "You Are A Winner" message. In both cases the program passes to line 720 for another game.

Lucky 13

Fig. 3a shows the position of the 13 markers in this game. There are 32 possible moves; the first 32 data numbers in line 800 of Program Listing 3 give their respective codes. Instead of referring to the marker positions on the video by the coding in Fig. 3a, the positions are labeled as in Fig. 3b and INKEY$ is used for input.

The ASC function in lines 350, 420, and 460 of Listing 3 converts the alphabetic coding of Fig. 3b to the numerical coding of Fig. 3a for the program logic. As in the other games, the marker to be jumped can be determined by adding the position moved from to the position moved to and dividing the result by two.

'Round the End

Fig. 4 shows the thirteen markers used in this game. The codes of the 38 possible moves are in line 110 of Program Listing 4. The marker positions are similar to Fig. 4 and INKEY$ is used for input. The ASC function in lines 350, 390, and 410 converts alphabetic coding to the numerical coding the program logic requires.

Deciding which marker to jump is more complicated; checking for remaining moves involves more possibilities.

The computer reads in the data while the user reads playing instructions.

Entering and Showing Moves

Line 200 reads the 25 "print at" positions for the markers on the video screen and stores them in P(1) through P(25). Lines 240–260 provide the playing board graphics on the video screen. Line 270 puts a 1 in L(1), a 2 in L(2), a 3 in L(3), . . . , and a 25 in L(25), providing a method to determine board position vacancies. Positions whose L( ) value is zero are vacant, while positions whose L( ) value is non-zero are occupied. In line 200, M$ is the graphics design for the individual marker and B$ is the blanking needed to remove the marker graphics from the video screen.

Having used the INKEY$ function for user input in Triangle Marker, I decided to use the input function on Square Marker.

To begin, the routine in lines 290–300 permits the player to leave any of the 25 positions vacant. Line 320 provides input for individual moves. Lines 350–440 determine if the player's move is possible and which marker is captured by the given jump.

Using the numbering system for the positions shown in Fig. 2, if the user jumps from 17 to nine, the 13 marker must be removed. If the user jumps from six to 16, the 11 marker must be removed. In both cases, if the position moved from is added to the position moved to and the sum then divided by two, the result is the number of the captured marker. This particular process works no matter where the move is on the game board. Line 420 determines the marker to be removed.

When a move is entered and checked, the subroutine in lines 480–540 positions the markers on the video screen. With C as a counter, the routine in lines 480–510 is used twice when two markers are captured.

Star Marker

Fig. 5 shows the 10 markers in this game. There are 20 possible moves; their respective codes are in the first 20 data numbers in line 220 of Program Listing 5. The graphics for Star Marker in lines 220–310 are extensive. While determining which marker to capture is relatively simple,

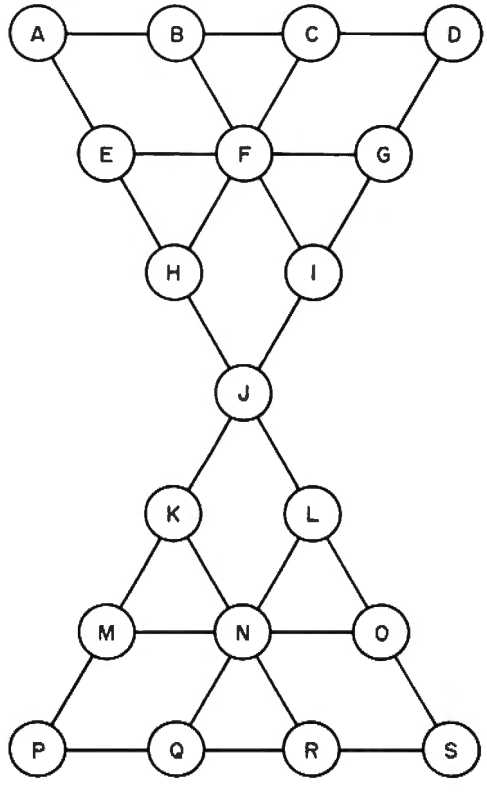

Fig. 6. Double Triangle Marker

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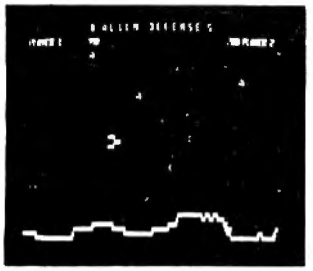

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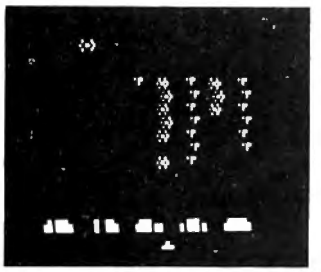

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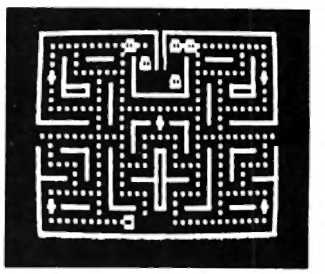

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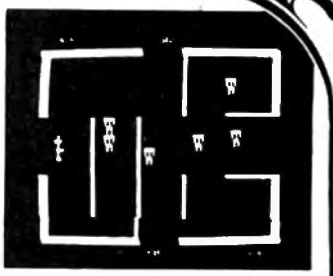

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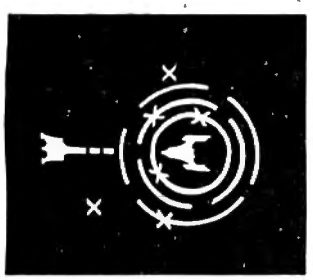

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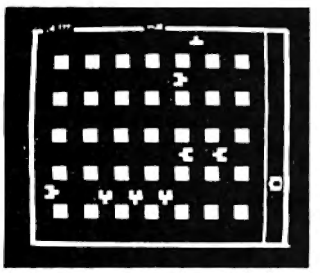

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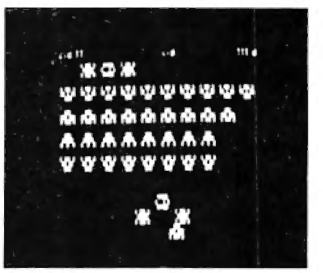

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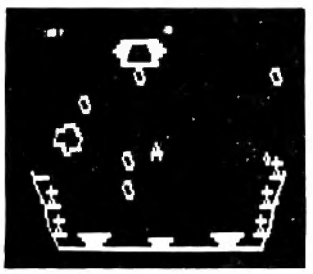

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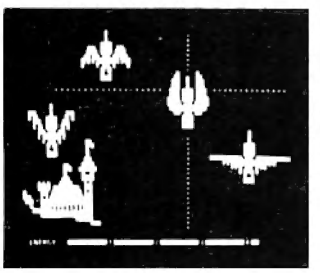

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checking for possible remaining moves is now quite complicated.

Double Triangle

Fig. 6 shows the 19 markers used in this game. There are 42 possible moves; their codes are in line 860 of Program Listing 6. The marker captured in each of the 42 possible jumps is determined in lines 250-280 and stored in J(1) through J(42). ■

Program Listing 1

```
100 '     OPENING GRAPHICS AND CREDITS                :DEFINTA-Z
110 CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X,1):SET(X,1
9):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP2:SET(0,Y):
SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2:SET(0,Y):S
ET(1,Y):SET(121,Y):SET(124,Y):NEXTY:N$="TRIANGLE MARKER GAME"
120 PRINT@586,"PROGRAM DESIGNED BY";:PRINT@714,"CARL a. bEVINGTO
N";:PRINT@778,"1857 EAST THIRD STREET";:PRINT@842,"SALEM, OHIO
  44460";:FORI=1TO5:PRINT@202,"                              ";:FORQ=1TO5
0:NEXTQ:PRINT@202,N$;:FORQ=1TO400:NEXTQ,I
130 '     GRAPHICS FOR DIRCTIONS
140 CLS:FORX=16TO25:SET(X,0):SET(X-4,4):SET(X+4,4):SET(X-8,8):SE
T(X,8):SET(X+8,8):SET(X-12,12):SET(X-4,12):SET(X+4,12):SET(X+12,
12):SET(X-16,16):SET(X-8,16):SET(X,16):SET(X+8,16):SET(X+16,16):
SET(X-16,20):SET(X-8,20):SET(X,20):SET(X+8,20):SET(X+16,20):NEXT
X
150 FORY=16TO0STEP-4:FORX=YTO40-YSTEP4:SET(X,18-Y):SET(X+1,18-Y)
:NEXTX,Y:FORY=16TO0STEP-4:FORX=YTO40-YSTEP8:SET(X,17-Y):SET(X+1,
17-Y):SET(X,19-Y):SET(X+1,19-Y):NEXTX,Y
160 '     TEXT OF DIRECTIONS FOR PLAYING GAME
170 PRINT@38,"DIRECTIONS";:PRINT@152,"THE GAME IS BEGUN BY HAVIN
G MARKERS ON";:PRINT@216,"ALL OF THE CELLS BUT ONE.  THE OBJECT
OF";:PRINT@280,"THE GAME IS TO REMOVE AS MANY OF THE";:PRINT@344
,"MARKERS AS POSSIBLE BY JUMPING OVER ONE";
180 PRINT@408,"ADJACENT MARKER ALONG A STRAIGHT LINE";:PRINT@472
,"TO A VACANT CELL.  THE JUMPED MARKER IS";:PRINT"REMOVED FROM TH
E BOARD.  ALL MARKERS BUT ONE CAN BE REMOVED";:PRINT"IN THIS MANN
ER WITH THE GOAL BEING TO END THE GAME WITH ONE"
190 PRINT"MARKER REMAINING ON THE BOARD.  YOU WILL BEGIN BY TELL
ING THE";:PRINT"COMPUTER WHICH CELL SHOULD BE LEFT VACANT AND THE
N ENTERING";:PRINT"MOVES TO JUMP OVER THE REMAINING MARKERS.  ";
200 DIMP(15),L(15),M(36),F(36),T(36):FORI=1TO36:READM(I):F(I)=IN
T(M(I)/100):T(I)=M(I)-100*F(I):NEXTI:FORI=1TO15:READP(I):NEXTI
210 PRINT"DO NOT USE THE ENTER KEY FOR INPUT OF MOVES.      >>PR
ESS THE SPACE BAR TO CONTINUE<<":M$=CHR$(184)+CHR$(188):B$="   "

220 W$=INKEY$:IFW$=" "THEN240ELSE220
230 '     GRAPHICS FOR GAME
240 CLS:PRINT@26,10;:PRINT@213,11;:PRINT@223,12;:PRINT@400,13;:P
RINT@410,14;:PRINT@420,15;:PRINT@587,16;:PRINT@597,17;:PRINT@607
,18;:PRINT@617,19;:PRINT@774,20;:PRINT@784,21;:PRINT@794,22;:PRI
NT@804,23;:PRINT@814,24;
250 M=18:N=98:P=43:FORT=1TO5:FORX=MTONSTEP20:FORX1=0TO11:SET(X+X
1,P):SET(X+X1,P-5):NEXTX1,X:M=M+10:N=N-10:P=P-9:NEXTT
260 M=18:N=98:FORY=42TO6STEP-9:FORX=MTONSTEP20:FORY1=0TO3:SET(X,
Y-Y1):SET(X+1,Y-Y1):SET(X+10,Y-Y1):SET(X+11,Y-Y1):NEXTY1,X:M=M+1
0:N=N-10:NEXTY
270 PRINT@95,M$;:PRINT@282,M$;:PRINT@292,M$;:PRINT@469,M$;:PRINT
@479,M$;:PRINT@489,M$;:PRINT@656,M$;:PRINT@666,M$;:PRINT@676,M$;
:PRINT@686,M$;:PRINT@843,M$;:PRINT@853,M$;:PRINT@863,M$;:PRINT@8
73,M$;:PRINT@883,M$;
280 '     VACANT POSITION SET TO BEGIN GAME
290 FORI=1TO15:L(I)=I:NEXTI:PRINT@64,"WHICH POSITION VACANT?";
300 F$=INKEY$:IFF$=""THEN300ELSE310
310 PRINT@88,F$;:S$=INKEY$:IFS$=""THEN310ELSE320
320 PRINT@89,S$;:PP=VAL(F$+S$)-9:FORQ=1TO100:NEXTQ
330 PRINT@64,"                                ";
340 C=2:L(PP)=0:H=0:G=PP:GOSUB570
350 '     INPUT FOR MOVES
360 PRINT@65,"FROM?  ";
370 FF$=INKEY$:IFFF$=""THEN370ELSE380
380 PRINT@72,FF$;:SF$=INKEY$:IFSF$=""THEN380ELSE390
390 PRINT@73,SF$;:MP=VAL(FF$+SF$)-9
400 PRINT@131,"TO?";
410 FT$=INKEY$:IFFT$=""THEN410ELSE420
420 PRINT@136,FT$;:ST$=INKEY$:IFST$=""THEN420ELSE430
430 PRINT@137,ST$;:MT=VAL(FT$+ST$)-9:FORQ=1TO100:NEXTQ:PRINT@65,
"                ";:PRINT@130,"                ";
440 '     CHECK OF POSITIONS FOR MOVES
450 FORI=1TO36
460 IFMP=F(I)ANDMT=T(I)THEN490
470 NEXTI
480 PRINT@65,"TRY AGAIN!";:FORQ=1TO300:NEXTQ:PRINT@65,"
   ";:GOTO360
490 IFL(MT)<>0THEN480
500 IFL(MP)=0THEN480
510 MO=INT((T(I)+F(I))/2)
520 IFL(MO)=0THEN480
530 L(MO)=0:L(MT)=MT:L(MP)=0:G=MO:H=MT:C=1
540 GOSUB570
550 GOTO650
560 '     GRAPHICS FOR MARKERS ON BOARD
570 FORZ=1TO15
580 IFG=ZTHENPRINT@P(Z),B$;
590 IFH=ZTHENPRINT@P(Z),M$;
600 NEXTZ
610 IFC=2THEN630
620 C=2:G=MP:GOTO570
630 RETURN
640 '     CHECK FOR POSSIBLE MOVES REMAINING / END OF GAME / WIN
NING
650 FORI=1TO36
660 IFL(P(I))=0THEN700
670 LETM=INT((F(I)+T(I))/2)
680 IFL(M)<>0ANDL(T(I))=0THEN360
690 IFM<>0ANDT(I)=0THEN360
700 NEXTI
710 L=0:FORI=1TO15
720 IFL(I)=0THEN730ELSEL=L+1
730 NEXTI
740 IFL=1THEN760
750 PRINT@65,"NO POSSIBLE MOVE.";:PRINT@128,ABS(L);"MARKERS REMA
IN.";:FORQ=1TO1500:NEXTQ:PRINT@65,"                ";:PRINT@12
```

Program Listing 1 Continues

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Program Listing 1 Continued

```
9,"                    ";:GOTO240
760 PRINT@65,"YOU ARE A WINNER!";:FORQ=1TO1500:NEXTQ:PRINT@65,"
                    ";:GOTO240
770 DATA104,106,207,209,308,310,401,406,411,413,512,514,601,604,
613,615,702,709,803,810,902,907,1003,1008,1104,1113,1205,1214,13
04,1306,1311,1315,1405,1412,1506,1513,95,282,292,469,479,489,656
,666,676,686,843,853,863,873,883
```

Program Listing 2

```
100 '     OPENING GRAPHICS AND CREDITS
110 DEFINTA-Z:CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X,
1):SET(X,19):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP2
:SET(0,Y):SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2:
SET(0,Y):SET(1,Y):SET(121,Y):SET(124,Y):NEXTY
120 N$="SQUARE MARKER GAME":PRINT@586,"PROGRAM DESIGNED BY";:PRI
NT@714,"CARL A. BEVINGTON";:PRINT@778,"1857 EAST THIRD STREET";:
PRINT@842,"SALEM, oHIO    44460";
130 FORI=1TO5:PRINT@202,"                              ";:FORQ=1TO50:NEX
TQ:PRINT@202,N$;:FORQ=1TO400:NEXTQ,I
140 '     GRAPHICS FOR DIRECTIONS
150 CLS:FORY=0TO20STEP4:FORX=0TO41:SET(X,Y):NEXTX,Y:FORX=0TO40ST
EP8:FORY=0TO20:SET(X,Y):SET(X+1,Y):NEXTY,X:FORY=2TO18STEP4:FORX=
4TO36STEP8:SET(X,Y):SET(X+1,Y):NEXTX,Y
160 '     TEXT OF DIRECTIONS FOR PLAYING GAME
170 PRINT@38,"DIRECTIONS";:PRINT@152,"THE GAME IS BEGUN BY HAVIN
G MARKERS ON";:PRINT@216,"ALL OF THE CELLS BUT ONE.  THE OBJECT
OF";:PRINT@280,"THE GAME IS TO REMOVE AS MANY OF THE";
180 PRINT@344,"MARKERS AS POSSIBLE BY JUMPING OVER ONE";:PRINT@4
08,"ADJACENT MARKER ALONG A STRAIGHT LINE";:PRINT@472,"TO A VACA
NT CELL.  THE JUMPED MARKER IS":PRINT"REMOVED FROM THE BOARD.  A
LL MARKERS BUT ONE CAN BE REMOVED IN"
190 PRINT"THIS MANNER WITH THE GOAL BEING TO END THE GAME WITH O
NE MARKER":PRINT"REMAINING ON THE BOARD.  YOU BEGIN BY TELLING T
HE COMPUTER":PRINT"WHICH CELL SHOULD BE LEFT VACANT AND THEN ENT
ER MOVES TO JUMP":PRINT"OVER THE REMAINING MARKERS."
200 DIMM(96),F(96),T(96),P(25),L(25):FORI=1TO96:READM(I):F(I)=IN
T(M(I)/100):T(I)=M(I)-100*F(I):NEXTI:FORI=1TO25:READP(I):NEXTI:M
$=CHR$(153)+CHR$(166):B$="  "
210 PRINT@924,">>PRESS THE SPACE BAR TO CONTINUE<<";
220 W$=INKEY$:IFW$=" "THEN240ELSE220
230 '     GRAPHICS FOR GAME
240 CLS:C=1:FORI=66TO112STEP11:PRINT@I,C:PRINT@I+6,M$:PRINT@128+
I,C+5:PRINT@134+I,M$:PRINT@256+I,C+10:PRINT@262+I,M$:PRINT@384+I
,C+15:PRINT@390+I,M$:PRINT@512+I,C+20:PRINT@518+I,M$:C=C+1:NEXTI

250 FORY=2TO26STEP6:FORX=12TO112STEP22:FORX1=0TO11:SET(X+X1,Y):S
ET(X+X1,Y+4):NEXTX1,X,Y
260 FORX=12TO112STEP22:FORY=3TO27STEP6:FORY1=0TO2:SET(X,Y+Y1):SE
T(X+1,Y+Y1):SET(X+10,Y+Y1):SET(X+11,Y+Y1):NEXTY1,Y,X
270 FORI=1TO25:L(I)=I:NEXTI
280 '     VACANT POSITION SET TO BEGIN GAME
290 PRINT@916,"WHICH CELL VACANT";:INPUTI:PRINT@916,"
                    "
300 C=2:L(I)=0:G=I:GOSUB480
310 '     INPUT FOR MOVES
320 PRINT@915,"MOVE FROM";:INPUTMF:PRINT@930,"TO";:INPUTMT
330 PRINT@915,"                                        ";
340 '     CHECK OF POSITIONS FOR MOVES
350 FORI=1TO96
360 IFMF=F(I)ANDMT=T(I)THEN400
370 NEXTI
380 PRINT@913,"MOVE NOT POSSIBLE, TRY AGAIN.":FORQ=1TO700:NEXTQ
390 PRINT@913,"                                        ":GOTO320
400 IFL(MT)<>0THEN380
410 IFL(MF)=0THEN380
420 MO=(T(I)+F(I))/2
430 IFL(MO)=0THEN380
440 L(MO)=0:L(MT)=MT:L(MF)=0:G=MO:H=MT:C=1
450 GOSUB480
460 GOTO560
470 '     GRAPHICS FOR MARKERS ON BOARD
480 FORY=1TO25
490 IFG=YTHENPRINT@P(Y),B$;
500 IFH=YTHENPRINT@P(Y),M$;
510 NEXTY
520 IFC=2THEN540
530 C=2:G=MF:GOTO480
540 RETURN
550 '     CHECK OF POSSIBLE MOVES REMAINING / END OF GAME / WINN
ING
560 FORI=1TO96
570 IFL(F(I))=0THEN610
580 LETH=(F(I)+T(I))/2
590 IFL(M)<>0ANDL(T(I))=0THEN320
600 IFM<>0ANDT(I)=0THEN320
610 NEXTI
620 P=0
630 FORI=1TO25
640 IFL(I)=0THEN650ELSEP=P+1
650 NEXTI
660 PRINT@905,"NO MORE MOVES POSSIBLE. ";P;"MARKERS REMAIN.";
670 FORQ=1TO1000:NEXTQ
680 IFP>1THEN710
690 PRINT@920,"YOU ARE A WINNER!!!                    "
700 FORQ=1TO1000:NEXTQ
710 PRINT@915,"                                        ";
720 PRINT@905,"ANOTHER GAME (YES / NO)";:INPUTN$
730 PRINT@905,"                                        ";
740 IFN$="YES"THEN240
750 PRINT@960,"THANK YOU FOR PLAYING.                  ";:END

760 DATA103,111,113,204,212,214,301,305,311,313,315,402,414,414,
503,513,515,608,616,618,709,717,719,806,810,816,818,820,907,917,
919,1008,1018,1020,1101
770 DATA1103,1113,1121,1123,1202,1204,1214,1222,1224,1301,1303,1
305,1311,1315,1321,1323,1325,1402,1404,1412,1422,1424,1503,1505,
1513,1523,1525,1606,1608
780 DATA1618,1707,1709,1719,1806,1808,1810,1816,1828,1907,1909,1
917,2008,2010,2018,2111,2113,2123,2212,2214,2224,2311,2313,2315,
2321,2325,2412,2414,2422,2513,2515,2523
790 DATA72,83,94,105,116,200,211,222,233,244,328,339,350,361,372
,456,467,478,489,500,584,595,606,617,628
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Program Listing 3

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100 '     OPENING GRAPHICS AND CREDITS
110 DEFINTA-Z:DIMM(32),F(32),T(32),P(13),L(32):M$=CHR$(160)+CHR$
(191)+CHR$(144):B$="   ":N$="LUCKY 13 NUMBER GAME"
120 CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X,1):SET(X,1
9):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP2:SET(0,Y):
SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2:SET(0,Y):S
ET(1,Y):SET(121,Y):SET(124,Y):NEXTY
130 PRINT@586,"PROGRAM DESIGNED BY";:PRINT@714,"CARL A. BEVINGTO
N";:PRINT@778,"1857 EAST THIRD STREET";:PRINT@842,"SALEM, OHIO
  44460";:FORI=1TO5:PRINT@202,"                ";:FORQ=1T
050:NEXTQ:PRINT@202,N$;:FORQ=1TO400:NEXTQ,I
140 '     GRAPHICS AND TEXT FOR DIRECTIONS
150 CLS:FORX=0TO25:SET(X,0):SET(X,4):SET(X,8):SET(X,12):SET(X,16
):SET(X,20):NEXTX:FORY=0TO4:FORX=0TO24STEP8:SET(X,Y):SET(X+1,Y):
SET(X,Y+8):SET(X+1,Y+8):SET(X,Y+16):SET(X+1,Y+16):NEXTX,Y:FORY=4
TO8:FORX=4TO20STEP8:SET(X,Y):SET(X+1,Y):SET(X,Y+8)
160 SET(X+1,Y+8):NEXTX,Y:FORY=2TO18STEP8:FORX=4TO20STEP8:SET(X,Y
):SET(X+1,Y):NEXTX,Y:SET(8,6):SET(9,6):SET(16,6):SET(17,6):SET(8
,14):SET(9,14):SET(16,14):SET(17,14):PRINT@36,"DIRECTIONS";:PRIN
T@146,"THE GAME IS BEGUN BY HAVING MARKERS ON ALL OF";
170 PRINT@210,"THE CELLS BUT ONE.  THE OBJECT OF THE GAME IS";:P
RINT@274,"TO REMOVE AS MANY OF THE MARKERS AS POSSIBLE";:PRINT@3
38,"BY JUMPING OVER ONE ADJACENT MARKER ALONG A";:PRINT@402,"STR
AIGHT LINE TO A VACANT CELL.  THE JUMPED";
180 PRINT@466,"MARKER IS REMOVED FROM THE BOARD.";:PRINT"ALL MARK
ERS BUT ONE CAN BE REMOVED IN THIS MANNER WITH THE GOAL":PRINT"B
EING TO END THE GAME WITH ONE MARKER REMAINING ON THE BOARD."
190 PRINT"YOU WILL BEGIN BY TELLING THE COMPUTER WHICH CELL SHOU
LD BE":PRINT"LEFT VACANT AND THEN ENTERING MOVES TO JUMP OVER TH
E REMAINING";PRINT"MARKERS.  ";
200 FORI=1TO32:READM(I):F(I)=INT(M(I)/100):T(I)=M(I)-100*F(I):NE
XTI:FORI=1TO13:READP(I):NEXTI
210 PRINT"DO NOT PRESS THE ENTER KEY TO INPUT MOVES.":PRINT@925,
">>PRESS SPACE BAR TO CONTINUE<<";
220 P$=INKEY$:IFP$=" "THEN240ELSE220
230 '     GRAPHICS FOR GAME
240 CLS:FORA=2TO6STEP4:FORY=ATOA+36STEP18:FORX=24TO96STEP36:SET(
X,Y):SET(X+1,Y):SET(X+2,Y):SET(X+3,Y):SET(X+4,Y):SET(X+5,Y):SET(
X+6,Y):SET(X+7,Y):SET(X+8,Y):SET(X+9,Y):NEXTX,Y,A
250 FORA=11TO15STEP4:FORY=ATOA+18STEP18:FORX=42TO78STEP36:SET(X,
Y):SET(X+1,Y):SET(X+2,Y):SET(X+3,Y):SET(X+4,Y):SET(X+5,Y):SET(X+
6,Y):SET(X+7,Y):SET(X+8,Y):SET(X+9,Y):NEXTX,Y,A
260 FORA=24TO32STEP8:FORX=ATOA+72STEP36:FORY=3TO5:SET(X,Y):SET(X
+1,Y):SET(X,Y+18):SET(X+1,Y+18):SET(X,Y+36):SET(X+1,Y+36):NEXTY,
X,A:FORA=42TO50STEP8:FORX=ATOA+36STEP36:FORY=12TO14:SET(X,Y):SET
(X+1,Y):SET(X,Y+18):SET(X+1,Y+18):NEXTY,X,A
270 FORY=4TO40STEP18:FORX=36TO56STEP4:SET(X,Y):SET(X+1,Y):SET(X+
36,Y):SET(X+37,Y):NEXTX,Y:FORY=8TO18STEP2:FORX=28TO100STEP36:SET
(X,Y):SET(X+1,Y):SET(X,Y+18):SET(X+1,Y+18):NEXTX,Y
280 B=7:FORA=34TO52STEP18:FORX=ATOA+36STEP36:FORY=BTOB+18STEP18:
SET(X,Y):SET(X+1,Y):SET(X+2,Y+1):SET(X+3,Y+1):SET(X+4,Y+2):SET(X
+5,Y+2):SET(X+6,Y+3):SET(X+7,Y+3):SET(X+8,Y+4):SET(X+9,Y+4):NEXT
Y,X:B=16:NEXTA
290 B=10:FORA=34TO52STEP18:FORX=ATOA+36STEP36:FORY=BTOB+18STEP18
:SET(X,47-Y):SET(X+1,47-Y):SET(X+2,46-Y):SET(X+3,46-Y):SET(X+4,4
5-Y):SET(X+5,45-Y):SET(X+6,44-Y):SET(X+7,44-Y):SET(X+8,43-Y):SET
(X+9,42-Y):NEXTY,X:B=19:NEXTA
300 FORI=1TO13:PRINT@P(I)-3,CHR$(I+64);:PRINT@P(I),M$;:NEXTI
310 '     VACANT POSITION SET TO BEGIN GAME
320 FORI=1TO22:L(I)=I:NEXTI:PRINT@128,"WHICH CELL";:PRINT@192,"V
ACANT?";
330 Q$=INKEY$:IFQ$=""THEN330ELSE340
340 PRINT@201,Q$;
350 Q=ASC(Q$)-64
360 PRINT@128,"              ";:PRINT@192,"              ";
370 C=2:L(Q)=0:E=0:G=Q:GOSUB600
380 '     INPUT FOR MOVES
390 PRINT@128,"FROM?    ";
400 D$=INKEY$:IFD$=""THEN400ELSE410
410 PRINT@135,D$;
420 MF=ASC(D$)-64
430 PRINT@192,"TO?";
440 E$=INKEY$:IFE$=""THEN440ELSE450
450 PRINT@197,E$;
460 MT=ASC(E$)-64:FORQ=1TO100:NEXTQ:PRINT@128,"              ";:PRIN
T@192,"        ";
470 '     CHECK OF POSITIONS FOR MOVES
480 FORI=1TO32
490 IFMF=F(I)ANDMT=T(I)THEN520
500 NEXTI
510 PRINT@128,"TRY AGAIN!";:FORQ=1TO300:NEXTQ:PRINT@128,"
    ";:GOTO390
520 IFL(MT)<>0THEN510
530 IFL(MF)=0THEN510
540 MO=INT((T(I)+F(I))/2)
550 IFL(MO)=0THEN510
560 L(MO)=0:L(MT)=MT:L(MF)=0:G=MO:H=MT:C=1
570 GOSUB600
580 GOTO680
590 '     GRAPHICS FOR MARKERS ON BOARD
600 FORZ=1TO13
610 IFG=ZTHENPRINT@P(Z),B$;
620 IFH=ZTHENPRINT@P(Z),M$;
630 NEXTZ
640 IFC=2THEN660
650 C=2:G=MF:GOTO600
660 RETURN
670 '     CHECK FOR POSSIBLE MOVES REMAINING / END OF GAME / WIN
NING
680 FORI=1TO32
690 IFL(F(I))=0THEN730
700 M=INT((F(I)+T(I))/2)
710 IFL(M)<>0ANDL(T(I))=0THEN390
720 IFM<>0ANDT(I)=0THEN390
730 NEXTI
740 P=0:FORI=1TO13
750 IFL(I)=0THEN760ELSEP=P+1
760 NEXTI
770 IFP=1THEN790
780 PRINT@128,"NO MOVES";:PRINT@192,ABS(P);"CELLS";:PRINT@256,"
REMAIN";:FORQ=1TO1500:NEXTQ:PRINT@128,"              ";:PRINT@192,"
    ";:PRINT@256,"              ";:GOTO300
790 PRINT@128,"YOU WIN!";:FORQ=1TO1500:NEXTQ:PRINT@128,"
  ";:GOTO300
800 DATA103,107,111,206,208,211,301,307,313,418,509,602,608,612,
701,703,711,713,802,806,812,905,1004,1101,1107,1113,1202,1206,12
08,1303,1307,1311,77,95,113,278,296,461,479,497,662,680,845,863,
881
```


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Program Listing 4

```
100 '     POSSIBLE MOVE CODING
110 DEFINTA-Z:DIMC(14),M(38),A(30),B(38):A$=CHR$(166)+CHR$(153):
FORI=1TO38:READM(I):A(I)=INT(M(I)/100):B(I)=M(I)-100*A(I):NEXTI
120 DATA111,103,210,212,204,301,311,313,402,412,507,608,705,709,
806,907,1002,1012,1101,1103,1113,1210,1202,1204,1311,1303,110,20
5,309,413,502,511,903,912,1001,1105,1209,1304
130 '     OPENING GRAPHICS AND CREDITS
140 CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X,1):SET(X,1
9):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP2:SET(0,Y):
SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2:SET(0,Y):S
ET(1,Y):SET(121,Y):SET(124,Y):NEXTY
150 N$="'ROUND THE END MARKER GAME":PRINT@586,"PROGRAM DESIGNED
BY";:PRINT@714,"CARL A. BEVINGTON";:PRINT@778,"1857 EAST THIRD S
TREET";:PRINT@842,"SALEM, OHIO     44460";
160 FORI=1TO5:PRINT@198,"                                    ";:FORQ=1TO5
0:NEXTQ:PRINT@198,N$;:FORQ=1TO400:NEXTQ:NEXTI
170 '     GRAPHICS FOR DIRECTIONS
180 CLS:FORX=4TO37:SET(X,0):SET(X,12):NEXTX:FORX=0TO41:SET(X,4):
SET(X,8):NEXTX:FORX=4TO36STEP8:FORY=0TO4:SET(X,Y):SET(X+1,Y):SET
(X,Y+8):SET(X+1,Y+8):NEXTY,X:FORX=0TO40STEP8:FORY=4TO8:SET(X,Y):
SET(X+1,Y):NEXTY,X
190 '     TEXT FOR DIRECTIONS FOR PLAYING GAME
200 PRINT@37,"DIRECTIONS";:PRINT@152,"THE GAME IS BEGUN BY HAVIN
G MARKERS ON";:PRINT@216,"ALL OF THE CELLS BUT ONE.  THE OBJECT
OF";:PRINT@280,"THE GAME IS TO REMOVE AS MANY OF THE";:PRINT@344
,"MARKERS AS POSSIBLE BY JUMPING OVER ONE"
210 PRINT"ADJACENT MARKER ALONG A STRAIGHT LINE TO A VACANT CELL
.  tHE":PRINT"JUMPED MARKER IS REMOVED FROM THE BOARD.  ALL MARK
ERS BUT ONE":PRINT"CAN BE REMOVED IN THIS MANNER WITH THE GOAL B
EING TO END THE"
220 PRINT"GAME WITH ONE MARKER REMAINING ON THE BOARD. YOU WILL
BEGIN BY";PRINT"TELLING THE COMPUTER WHICH MARKER SHOULD LEFT VA
CANT AND THEN":PRINT"ENTERING MOVES TO JUMP OVER THE REMAINING M
ARKERS.  MOVES"
230 PRINT"AROUND THE ENDS OF THE CELLS ARE PERMITTED.":PRINT@925
,">>PRESS THE SPACE BAR TO CONTINUE<<";
240 F$=INKEY$:IFF$=" "THEN260ELSE240
250 '     GRAPHICS FOR GAME
260 CLS:FORX=22TO94STEP24:FORX1=0TO11:SET(X+X1,2):SET(X+X1,6):SE
T(X+X1,16):SET(X+X1,26):SET(X+X1,30):NEXTX1,X
270 FORX=10TO106STEP24:FORX1=0TO11:SET(X+X1,14):SET(X+X1,18):NEX
TX1,X:FORY=3TO5:FORX=22TO94STEP24:FORX1=0TO10STEP10:SET(X+X1,Y):
SET(X+X1+1,Y):NEXTX1,X,Y
280 FORY=15TO17:FORX=10TO106STEP24:FORX1=0TO10STEP10:SET(X+X1,Y)
:SET(X+X1+1,Y):NEXTX1,X,Y:FORY=27TO29:FORX=22TO94STEP24:FORX1=0T
O10STEP10:SET(X+X1,Y):SET(X+X1+1,Y):NEXTX1,X,Y
290 FORX=34TO82STEP24:FORX1=0TO11:SET(X+X1,28):SET(X+X1,4):NEXTX
1,X:Y=7:FORX=32TO39:FORX1=0TO72STEP24:SET(X+X1,Y):NEXTX1:Y=Y+1:N
EXTX
300 Y=19:FORX=17TO23:FORX1=0TO72STEP24:SET(X+X1,Y):NEXTX1:Y=Y+1:
NEXTX:Y=7:FORX=52TO59:FORX1=0TO72STEP24:SET(75-X+X1,Y):NEXTX1:Y=
Y+1:NEXTX:Y=19:FORX=34TO41:FORX1=0TO72STEP24:SET(72-X+X1,Y):NEXT
X1:Y=Y+1:NEXTX
310 FORI=1TO13:C(I)=I:NEXTI:Y=1:FORX=9TO45STEP12:PRINT@X,CHR$(Y+
64);:PRINT@X+68,A$;:Y=Y+1:NEXTX:FORX=259TO307STEP12:PRINT@X,CHR$
(Y+64);:PRINT@X+68,A$;:Y=Y+1:NEXTX:FORX=521TO557STEP12:PRINT@X,C
HR$(Y+64);:PRINT@X+68,A$;:Y=Y+1:NEXTX
320 '     VACANT POSITION SET TO BEGIN GAME
330 P=0:PRINT@846,"                                                ";:PR
INT@915,"                                                ";:PRINT@789,"WHIC
H CELL VACANT?";
340 W$=INKEY$:IFW$=""THEN340ELSE350
350 PRINT@809,W$;:FORQ=1TO200:N=ASC(W$)-64:GOSUB640
360 '     INPUT FOR MOVES
370 PRINT@856,"                                    ";:PRINT@788,"
                    ";:PRINT@856,"FROM?";
380 F$=INKEY$:IFF$=""THEN380ELSE390
390 PRINT@863,F$;:F=ASC(F$)-64:PRINT@866,"TO?";
400 T$=INKEY$:IFT$=""THEN400ELSE410
410 PRINT@871,T$;:T=ASC(T$)-64:FORQ=1TO200:NEXTQ
420 '     CHECKS OF POSITIONS FOR MOVES
430 IFF<14ANDF>0THEN440ELSE370
440 IFT<14ANDT>0THEN450ELSE370
450 IFC(F)=0THEN370
460 IFC(T)<>0THEN370
470 FORI=1TO38
480 IFA(I)<>FTHEN500
490 IFB(I)=TTHEN510
500 NEXTI:GOTO370
510 N=F:GOSUB640
520 N=T:GOSUB660
530 FORI=1TO26
540 IFF*100+T=M(I)THEN590
550 NEXTI
560 IF(F*T)/5=INT((F*T)/5)THEN610
570 N=T+F-8:GOSUB640
580 GOTO620
590 N=(T+F)/2:GOSUB640
600 GOTO620
610 N=F+T-6:GOSUB640
620 GOTO740
630 '     GRAPHICS FOR MARKERS ON BOARD
640 C(N)=0:GOSUB680
650 PRINT@G,"  ";:RETURN
660 C(T)=T:GOSUB680
670 PRINT@G+1,A$;:RETURN
680 IFN<5THEN710
690 IFN>9THEN720
700 G=N*12+266:RETURN
710 G=N*12+64:RETURN
720 G=N*12+468:RETURN
730 '     CHECK OF POSSIBLE MOVES REMAINING / END OF GAME / WINN
ING
740 FORK=1TO13
750 IFC(K)=0THEN770
760 P=P+1
770 NEXTK
780 IFP=1THEN910
790 P=0:FORI=1TO3
800 IFC(I)*C(I+1)<>0THEN370
810 NEXTI
820 IFC(4)*C(9)<>0THEN370
830 IFC(13)*C(9)<>0THEN370
840 FORI=5TO8
```

Program Listing 4 Continues

Circle 88 on Reader Service card.→

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850 IFC(I)*C(I+1)<>0THEN370
860 NEXTI
870 FORI=10TO12
880 IFC(I)*C(I+1)<>0THEN370
890 NEXTI:GOTO950
900 PRINT@846,"     NO MOVE MOVES POSSIBLE          ";:GOTO920
910 PRINT@846,"ONLY ONE COUNTER REMAINS - YOU WIN!";
920 PRINT@915,"ANOTHER GAME (YES/NO)";:INPUTN$
930 IFN$="YES"THEN310
940 PRINT@915,"                                     ";:PRINT@846,"     T
HANK YOU FOR PLAYING!           ";:END
950 FORI=1TO3
960 IFC(I)*C(I+5)*C(I+10)<>0ANDC(I-1)+C(I+1)+C(I+4)+C(I+6)+C(I+9
)+C(I+11)=0THEN980
970 NEXTI
980 IFC(2)*C(6)*C(10)<>0ANDC(1)+C(3)+C(5)+C(7)+C(11)=0THEN980
990 IFC(3)*C(7)*C(11)<>0ANDC(2)+C(4)+C(6)+C(8)+C(10)+C(12)=0THEN
980
1000 IFC(4)*C(8)*C(12)<>0ANDC(3)+C(7)+C(9)+C(11)+C(13)=0THEN980
1010 FORI=5TO8
1020 IFC(I)*C(I+5)<>0THEN370
1030 IFC(I)*C(I-4)<>0THEN370
1040 IFC(I+1)*C(I+5)<>0THEN370
1050 IFC(I+1)*C(I-4)<>0THEN370
1060 NEXTI:GOTO980
```

Program Listing 5

```
100 '     OPENING GRAPHICS AND CREDITS
110 DEFINTA-Z:CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X
,1):SET(X,19):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP
2:SET(0,Y):SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2
:SET(0,Y):SET(1,Y):SET(121,Y):SET(124,Y):NEXTY
120 N$="THE STAR MARKER GAME":PRINT@586,"PROGRAM DESIGNED BY";:P
RINT@714,"CARL A. BEVINGTON";:PRINT@778,"1857 EAST THIRD STREET"
;:PRINT@842,"SALEM, OHIO     44460";
130 FORI=1TO5:PRINT@202,"                              ";:FORQ=1TO50:NEXT
Q:PRINT@202,N$;:FORQ=1TO400:NEXTQ,I
140 '     TEXT FOR DIRECTIONS
150 CLS:PRINT@25,"DIRECTIONS";:PRINT:PRINT
160 PRINT"THE OBJECT OF THE GAME OF STAR MARKER IS TO REMOVE NIN
E MARKERS":PRINT"FROM THE INTERSECTIONS OF THE STAR LINES.  TO B
EGIN, ANY ONE":PRINT"MARKER MAY BE REMOVED.  AFTER THE FIRST MAR
KER HAS THUS BEEN"
170 PRINT"REMOVED.  PLAYS ARE MADE BY JUMPING OVER AN OCCUPIED C
ELL TO AN":PRINT"UNOCCUPIED CELL AND REMOVING THE JUMPED MARKER
(AS DONE IN":PRINT"CHECKERS . MOVES MUST BE MADE ALONG ONE OF TH
E STRAIGHT LINES"
180 PRINT"WHICH MAKE UP THE STAR.";:PRINT:PRINT"THE FORM USED BY
THE COMPUTER TO RECORD MOVES AFTER THE FIRST";PRINT"IS: FROM? (E
NTER NUMBER OF CELL)  TO? (ENTER NUMBER OF CELL)";:PRINT:PRINT@923
,">>PRESS THE SPACE BAR TO CONTINUE<<"
190 P$=INKEY$:IFP$=" "THEN210ELSE190
200 '     GRAPHICS FOR GAME
210 CLS:DIMC(9),Q(10),M(20),S(30):A$=CHR$(153)+CHR$(166)
220 DATA5,6,13,17,24,28,31,39,42,47,50,59,60,68,71,74,82,86,93,9
5,2,3,12,15,20,21,23,25,30,32,34,36,43,46,51,52,57,58,63,64,67,6
9,75,76,78,79,85,87,96,97,95,263,282,292,311,469,489,543,781,817

230 FORI=1TO20:READM(I):NEXTI:FORI=1TO30:READS(I):NEXTI:FORI=0TO
9:READQ(I):NEXTI
240 CLS:FORI=12TO19:SET(I,11):SET(I,15):SET(I+30,11):SET(I+30,15
):SET(I+48,2):SET(I+48,6):SET(I+58,11):SET(I+58,15):SET(I+96,11)
:SET(I+96,15):NEXTI
250 FORI=24TO31:SET(I,35):SET(I,39):SET(I+16,28):SET(I+16,24):SE
T(I+36,23):SET(I+36,27):SET(I+56,28):SET(I+56,24):SET(I+72,35):S
ET(I+72,39):NEXTI
260 FORI=12TO14:SET(12,I):SET(13,I):SET(18,I):SET(19,I):SET(50,I
):SET(51,I):SET(56,I):SET(57,I):SET(70,I):SET(71,I):SET(76,I):SE
T(77,I):SET(108,I):SET(109,I):SET(114,I):SET(115,I):NEXTI
270 FORI=21TO23:SET(40,I):SET(41,I):SET(46,I):SET(47,I):SET(60,I
+3):SET(61,I+3):SET(66,I+3):SET(67,I+3):SET(80,I):SET(81,I):SET(
86,I):SET(87,I):NEXTI
280 FORI=36TO38:SET(24,I):SET(25,I):SET(30,I):SET(31,I):SET(60,I
-33):SET(61,I-33):SET(66,I-33):SET(67,I-33):SET(96,I):SET(97,I):
SET(102,I):SET(103,I):NEXTI
290 A=34:FORI=31TO40:SET(I,A):SET(I+56,59-A):A=A-1:NEXTI:A=19:FO
RI=47TO50:SET(I,A):SET(I+30,35-A):A=A-1:NEXTI:A=10:FORI=57TO60:S
ET(I,A):SET(I+10,17-A):A=A-1:NEXTI:FORI=20TO48STEP2:SET(I,13):SE
T(I+59,13):NEXTI
300 FORI=58TO68STEP2:SET(I,13):NEXTI:A=34:FORI=34TO58STEP4:SET(I
,A):SET(I+34,62-A):A=A-1:NEXTI:A=25:FORI=78TO78STEP4:SET(I,A):SE
T(I-21,48-A):A=A-1:NEXTI:A=28:FORI=90TO106STEP4:SET(I,A):SET(I-7
310 FORQ=1TO100:NEXTQ:PRINT@95,A$;:PRINT@263,A$;:PRINT@282,A$;:P
RINT@292,A$;:PRINT@311,A$;:PRINT@469,A$;:PRINT@489,A$;:PRINT@543
,A$;:PRINT@781,A$;:PRINT@817,A$;
320 FORQ=1TO100:NEXTQ:PRINT@27,@;:PRINT@195,1;:PRINT@214,2;:PRIN
T@231,3;:PRINT@250,4;:PRINT@401,5;:PRINT@428,6;:PRINT@475,7;:PRI
NT@713,8;:PRINT@756,9;:FORI=0TO9:C(I)=10:NEXTI:RESTORE
330 '     VACANT POSITION SET TO BEGIN GAME
340 PRINT@915,"                                     ";:
PRINT@915,"WHICH POSITION VACANT";:INPUTN:C=0:PRINT@Q(N),"  ";:C
(N)=0
350 '     INPUT FOR MOVES
360 PRINT@896,"                                     ";:PR
INT@920,"FROM";:INPUTF:PRINT@928,"TO";:INPUTT
370 '     CHECK OF POSITIONS FOR MOVES
380 IFF>9THEN360
390 IFT>9THEN360
400 IFC(T)<>0THEN360
410 IFC(F)=0THEN360
420 G=F*10+T
430 FORI=1TO20
```

Program Listing 5 Continues

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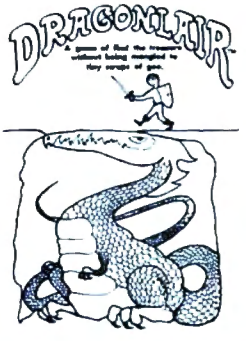

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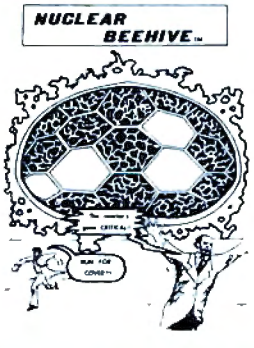

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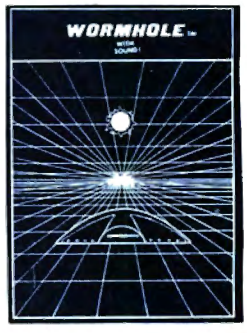

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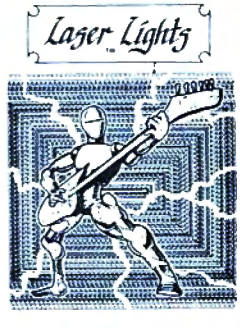

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Program Listing 5 Continued

```
440 IFG=M(I)THEN470
450 NEXTI
460 GOTO360
470 N=F:PRINT@Q(N),"  ";:C(N)=0
480 IFF*T=7THENF=F+2
490 IFF=5ANDT=0THENF=F-1
500 IFF=0ANDT=5THENF=F-1
510 N=INT((F+T+1)/2):C(N)=0:C(T)=10
520 '     GRAPHICS FOR MARKERS ON BOARD
530 PRINT@Q(N),"  ";:C(N)=0
540 PRINT@Q(T),A$;
550 '     CHECK FOR POSSIBLE MOVES REMAINING / END OF GAME / WIN
NING
560 IFC(1)+C(2)+C(3)+C(4)=40ANDC(0)+C(5)+C(6)+C(7)=0THEN740
570 IFC(0)+C(2)+C(5)+C(8)=40ANDC(1)+C(3)+C(6)+C(7)=0THEN740
580 IFC(0)+C(3)+C(6)+C(9)=40ANDC(2)+C(4)+C(5)+C(7)=0THEN740
590 IFC(4)+C(6)+C(7)+C(8)=40ANDC(2)+C(3)+C(5)+C(9)=0THEN740
600 IFC(1)+C(5)+C(7)+C(9)=40ANDC(2)+C(3)+C(6)+C(8)=0THEN740
610 FORI=1TO30
620 A=INT(S(I)/10):B=S(I)-10*A
630 IFC(A)<>0THEN650
640 GOTO660
650 IFC(B)<>0THEN360
660 NEXTI
670 FORI=0TO9
680 IFC(I)=0THEN700
690 C=C+1
700 NEXTI
710 IFC>1THEN730
720 PRINT@910,"            YOU WIN !!!!                    ";:F
ORQ=1TO1500:NEXTQ:PRINT@910,"
          ";:GOTO310
730 PRINT@896,"                          ";C;"PIECES REMAIN.";:FO
RQ=1TO1500:NEXTQ:PRINT@896,"                                    ";
740 PRINT@917,"NO MORE MOVES POSSIBLE.";:FORQ=1TO1500:NEXTQ:PRIN
T@896,"                                                ";:GOTO310
```

Program Listing 6

```
100 '     OPENING GRAPHICS AND CREDITS
110 DEFINTA-Z:DIMM(42),F(42),T(42),J(42),P(19),L(29):M1$=CHR$(18
8)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(188):M2$=CHR$(19
1)+CHR$(128)+CHR$(128)+CHR$(128)+CHR$(128)+CHR$(191):M3$=CHR$(14
3)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(143)
120 M$=CHR$(158)+CHR$(173):N$="DOUBLE TRIANGLE MARKER GAME":B$="
"
130 CLS:PRINTCHR$(23):FORX=0TO126STEP2:SET(X,0):SET(X,1):SET(X,1
9):SET(X,20):SET(X,46):SET(X,47):NEXTX:FORY=3TO17STEP2:SET(0,Y):
SET(1,Y):SET(121,Y):SET(124,Y):NEXTY:FORY=22TO45STEP2:SET(0,Y):S
ET(1,Y):SET(121,Y):SET(124,Y):NEXTY
140 PRINT@586,"PROGRAM DESIGNED BY";:PRINT@714,"CARL A. BEVINGTO
N";:PRINT@778,"1857 EAST THIRD STREET";:PRINT@842,"SALEM, OHIO
   44460";:FORI=1TO5:PRINT@196,"                                ";:FO
RQ=1TO50:NEXTQ:PRINT@196,N$;:FORQ=1TO400:NEXTQ,I
150 '     GRAPHICS AND TEXT FOR DIRECTIONS
160 CLS:FORX=0TO16:SET(X,0):SET(X+17,0):SET(X,4):SET(X+17,4):SET
(X+4,8):SET(X+13,8):SET(X+4,20):SET(X+13,20):SET(X+8,12):SET(X+8
,16):SET(X,24):SET(X+17,24):SET(X,28):SET(X+17,28):NEXTX
170 FORR=0TO32STEP8:FORY=1TO3:SET(R,Y):SET(R+1,Y):SET(R,Y+24):SE
T(R+1,Y+24):NEXTY,R:FORR=4TO28STEP8:FORY=4TO8:SET(R,Y):SET(R+1,Y
):SET(R,Y+16):SET(R+1,Y+16):NEXTY,R:FORR=8TO24STEP8:FORY=8TO12:S
ET(R,Y):SET(R+1,Y):SET(R,Y+8):SET(R+1,Y+8):NEXTY
180 NEXTR:FORY=13TO15:SET(12,Y):SET(13,Y):SET(20,Y):SET(21,Y):NE
XTY:FORX=4TO28STEP8:SET(X,2):SET(X+1,2):SET(X,26):SET(X+1,26):NE
XTX:FORX=8TO24STEP8:SET(X,6):SET(X+1,6):SET(X,22):SET(X+1,22):NE
XTX
190 FORX=12TO20STEP8:SET(X,10):SET(X+1,10):SET(X,18):SET(X+1,18)
:NEXTX:SET(16,14):SET(17,14)
200 PRINT@36,"DIRECTIONS";:PRINT@146,"THE GAME IS BEGUN BY HAVIN
G MARKERS ON ALL OF";:PRINT@210,"THE CELLS BUT ONE.  THE OBJECT
OF THE GAME IS";:PRINT@274,"TO REMOVE AS MANY OF THE MARKERS AS
POSSIBLE";
210 PRINT@338,"BY JUMPING OVER ONE ADJACENT MARKER ALONG A";:PRI
NT@402,"STRAIGHT LINE TO A VACANT CELL.  tHE JUMPED";:PRINT@466,
"MARKER IS REMOVED FROM THE BOARD.  ALL MARKERS";:PRINT@530,"BUT
 ONE CAN BE REMOVED IN THIS MANNER WITH THE";
220 PRINT@594,"GOAL BEING TO END THE GAME WITH ONE MARKER";:PRIN
T@658,"REMAINING ON THE BOARD."
230 PRINT"YOU WILL BEGIN BY TELLING THE COMPUTER WHICH CELL SHOU
LD BE";:PRINT"LEFT VACANT AND THEN ENTERING MOVES TO JUMP OVER TH
E REMAINING":PRINT"MARKERS.  ";
240 FORI=1TO42:READM(I):F(I)=INT(M(I)/100):T(I)=M(I)-100*F(I)
250 IFF(I)>=10ANDINT((F(I)+T(I))/2)=(F(I)+T(I))/2THENJ(I)=INT((F
(I)+T(I))/2)
260 IFF(I)<10THENJ(I)=INT((F(I)+T(I)+1)/2)
270 IFF(I)>=10ANDINT((F(I)+T(I))/2)<>(F(I)+T(I))/2THENJ(I)=INT((
F(I)+T(I)-1)/2)
280 IFF(I)=10ANDT(I)<10THENJ(I)=INT((F(I)+T(I)+1)/2)
290 NEXTI:FORI=1TO19:READP(I):NEXTI
300 PRINT"DO NOT PRESS THE ENTER KEY TO INPUT MOVES.":PRINT@925,
">>PRESS SPACE BAR TO CONTINUE<<";
310 F$=INKEY$:IFF$=" "THEN330ELSE310
320 '     GRAPHICS FOR GAME
330 CLS:FORI=1TO19:PRINT@P(I),M1$;:PRINT@P(I)+64,M2$;:PRINT@P(I)
+128,M3$;:NEXTI:FORX=16TO21:X1=INT((X-4)/2):SET(X,X1):SET(X,44-X
1):SET(X+90,14-X1):SET(X+90,30+X1):NEXTX:FORX=34TO39:X1=INT((X-1
0)/2):SET(X,X1):SET(X,44-X1):SET(X+54,26-X1)
340 SET(X+54,18+X1):NEXTX:FORX=52TO57:X1=INT((X-40)/2):SET(X,X1)
:SET(X,28-X1):SET(X,X1+12):SET(X,32-X1):SET(X,X1+24):SET(X,44-X1
):SET(X+18,14-X1):SET(X+18,X1+6):SET(X+18,26-X1):SET(X+18,X1+18)
:SET(X+18,38-X1):SET(X+18,X1+30):NEXTX
350 FORX=16TO39:SET(X,4):SET(X+36,4):SET(X+72,4):SET(X,40):SET(X
+36,40):SET(X+72,40):SET(X+18,10):SET(X+54,10):SET(X+18,34):SET(
X+54,34):NEXTX:FORY=14TO18:SET(63,Y):SET(64,Y):SET(63,Y+12):SET(
64,Y+12):NEXTY
360 FORI=1TO19:PRINT@P(I)+128,CHR$(I+64);:PRINT@P(I)+66,M$;:NEXT I
370 '     VACANT POSITION SET TO BEGIN GAME
380 FORI=1TO19:L(I)=I:NEXTI:PRINT@448,"WHICH CELL VACANT?";
390 Q$=INKEY$:IFQ$=""THEN390ELSE400
400 PRINT@467,Q$;:FORQ=1TO50:NEXTQ
410 Q=ASC(Q$)-64
420 PRINT@448,"                ";
430 C=2:L(Q)=0:H=0:G=Q:GOSUB680
```

Program Listing 6 Continues

Program Listing 6 Continued

```
440 '      INPUT FOR MOVES
450 PRINT@448,"FROM?   ";
460 D$=INKEY$:IFD$=""THEN460ELSE470
470 PRINT@455,D$;
480 MF=ASC(D$)-64
490 PRINT@460,"TO?";
500 E$=INKEY$:IFE$=""THEN500ELSE510
510 PRINT@465,E$;
520 MT=ASC(E$)-64:FORQ=1TO100:NEXTQ:PRINT@448,"
  ";
530 '      CHECK OF POSITIONS FOR MOVES
540 FORI=1TO42
550 IFMF=F(I)ANDMT=T(I)THEN580
560 NEXTI
570 PRINT@448,"TRY AGAIN!";:FORQ=1TO300:NEXTQ:PRINT@448,"
              ";:GOTO450
580 IFL(MT)<>0THEN570
590 IFL(MF)=0THEN570
630 IFL(J(I))=0THEN570
640 L(J(I))=0:L(MT)=MT:L(MF)=0:G=J(I):H=MT:C=1
650 GOSUB680
660 GOTO760
670 '      GRAPHICS FOR MARKERS ON BOARD
680 FORZ=1TO19
690 IFG=ZTHENPRINT@P(Z)+66,B$;
700 IFH=ZTHENPRINT@P(Z)+66,M$;
710 NEXTZ
720 IFC=2THEN740
730 C=2:G=MF:GOTO680
740 RETURN
750 '      CHECK FOR POSSIBLE MOVES REMAINING / END OF GAME / WIN
NING
760 FORI=1TO42
770 IFL(F(I))=0ORL(T(I))<>0THEN790
780 IFL(F(I))<>0ANDL(T(I))=0ANDL(J(I))<>0THEN450
790 NEXTI
800 P=0:FORI=1TO19
810 IFL(I)=0THEN820ELSEP=P+1
820 NEXTI
830 IFP=1THEN850
840 PRINT@320,"NO MOVES";:PRINT@384,ABS(P);"CELLS";:PRINT@448,"
REMAIN";:FORQ=1TO1500:NEXTQ:PRINT@320,"          ";:PRINT@384,"
      ";:PRINT@448,"          ";:GOTO360
850 PRINT@448,"YOU WIN!";:FORQ=1TO1500:NEXTQ:PRINT@448,"
  ";:GOTO360
860 DATA103,108,204,209,301,308,402,409,507,510,614,705,710,801,
803,812,902,904,911,1005,1007,1013,1015,1109,1116,1118,1208,1217
,1219,1310,1315,1406,1510,1513,1611,1618,1712,1719,1811,1816,191
2,1917
870 DATA2,20,38,56,139,157,175,276,294,413,532,550,651,669,687,7
70,788,806,824
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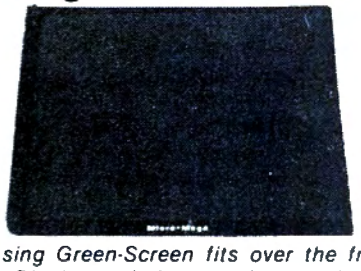

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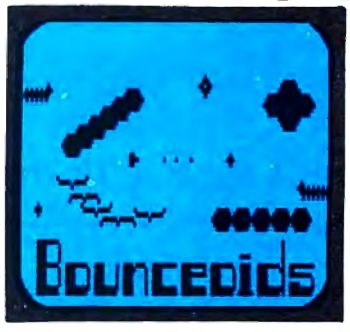

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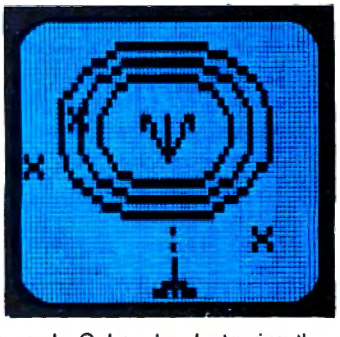

Will you save the Andromeda Galaxy by destroying the Space Castle or will the evil warlord Yugdab continue to rule, uncontested? Locked in battle with Yugdab, your main defense is your ability to skillfully handle your ship and it's projectiles. If you are not careful, Yugdab's intelligent mines will hunt you down and blow you into space dust.

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Star Trek Adventure combines the excitement of an outer space shoot-out with the mysterious riddles of adventure game programming. If you have a TRS-80 with at least 16K of memory, then this version of Star Trek is for you.

You are cast as the captain of the Starship Enterprise. You awake in your quarters to find you are alone on board an eerie and quiet Enterprise.

Making your way to the bridge, you discover the danger: Klingons have taken over the ship, captured the entire crew and disabled the engines. The Enterprise will soon begin to burn in the atmosphere of the planet below. You must do something, quickly! But what can one man do against such odds?

Program Listing 1

```
0 GOSUB5500:'* * * * * * * *
   *   BY RANDY HAWKINS    *
   *  CORPUS CHRISTI, TEX  *

  *    8/81 REVISION      *
   * * * * * * * * * * * * *
5 CLS:PRINT@334,CHR$(23)"S T A R   T R E K":PRINT@398,"A D V E N
 T U R E":CLEAR500:DEFINTA-Z
10 DIMDS$(32),DI(32,5),OB$(26),OB(26),DI$(5),VB$(21),NN$(26),DD$
(5)
20 ML$="THIS SAVES ROOM FOR PRINT SCRAMBLER!"
29 J=PEEK(VARPTR(ML$)+1)+256*PEEK(VARPTR(ML$)+2):J=J+65535*(J>32
767):FORK=JTOJ+35:READX:POKEK,X:NEXTK:DELETE29:DATA221,110,3,221
,102,4,218,154,4,221,126,5,183,40,1,119,121,254,128,210,166,4,25
4,32,218,6,5,254,64,218,125,4,61,195,125,4
30 S1=PEEK(16414):S2=PEEK(16415):POKE16414,PEEK(VARPTR(ML$)+1):P
OKE16415,PEEK(VARPTR(ML$)+2):FX=PEEK(16414)+256*PEEK(16415)+32:I
FPEEK(16396)=201THENPOKE16396,23ELSEPOKE23886,0
35 ONERRORGOTO1620
40 FORI=1TO32:PRINT@62+I*2,CHR$(188);:PRINT@638+I*2,CHR$(143);:F
ORJ=0TO5:READDI(I,J):NEXTJ,I:FORI=1TO26:READOB(I):NEXTI
50 DATA2,0,0,0,0,0,0,3,1,10,0,0,0,0,0,2,0,0,4,4,4,4,0,0,0,11,12,
9,0,0,0,0,10,0,9,17,7,10,0,8,0,0,0,7,0,0,0,0,0,5,0,0,0,6,6,2,0,7
,0,0,0,0,13,5,0,0,5,13,0,0,0,0,11,0,0,12,0,0
60 DATA14,16,18,0,0,0,17,18,0,15,0,0,0,16,0,14,0,0,0,0,15,0,6,24
,14,19,18,15,0,0,0,0,0,18,0,0,24,27,0,23,0,0,0,22,0,0,0,0,22,22,
23,21,0,0,22,20,23,23,0,0,0,0,20,0,17,29
```

Program continues

Two-word Sentences

Like most other adventure games, the screen displays a description of the surrounding area with a list of items around you and indicates the obvious exits from your present location.

After the word Command? a blinking cursor reminds you that the program is waiting for your next instruction. Enter your instructions in simple two word sentences—a verb and a noun. The program recognizes over 40 words.

To move from one room to another, try sentences like "go north," "go up" or simply enter the direction, such as west or down. If you are at a "dead end" and cannot figure out what to do try "help."

To see what you are carrying, type in INVENTORY.

Type in SCORE to see how you are progressing; you receive points for certain important events or items in your possession. You complete your adventure and receive a promotion to commodore with a score of 100 percent.

To stop your game before it is completed, type QUIT. You can see the area around you by typing LOOK AROUND. This is useful, if the description has scrolled off the screen. There are of course many other words that the program will recognize such as get, drop, press and say. Figuring out what words do is all part of the game.

Star Trek Adventure (Program Listing 1) has several unique features. First, and most important, is the print scrambler. Lines 20 through 30 set up a special machine-code routine that intercepts all

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- the INVENTORY CONTROL DATA file is updated by the invoice.
- the SALES DATA file is updated by the invoice.
- the invoice is automatically entered in the ACCOUNTS RECEIVABLE file.

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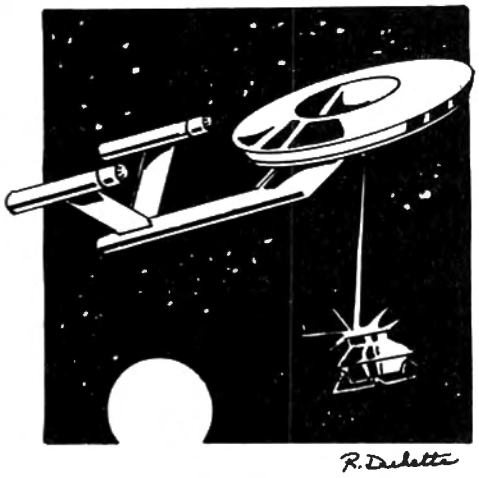
"Just reading the list of nouns, verbs and descriptions gives too much of the mystery away."



print statements and alters them slightly. As a result, all the print statements and strings in the program that appear to be gibberish in the Listing appear unscrambled when you play the game.

I did this for two reasons. First, I have typed several other Basic adventure games myself, but by the time I had read through the program and, laboriously, typed every line, I knew how to solve the adventure's riddles before the first execution. Just reading the list of nouns, verbs and descriptions gives too much of the mystery away.

Secondly, if you should pass this program on to a friend, he will be unable to list it to find the same information.

The program will work with either standard Level II Basic or TRSDOS 2.3 Basic. You can use other disk operating systems, if you know how to disable the Break key. The key is disabled in line 30 and reenabled in line 1650. By taking away the Break function from the user, he is forced to use the quit command to exit the program. This is necessary because of the print scrambler. If you were to leave the program while the scrambler was still activated, all messages such as Ready and your own entries would be garbled. When the quit command is processed, the print scrambler will be turned off and the Break key enabled.

If you know how to disable the Break key with your disk operating system, substitute the disable command for the POKE 23886,0 in line 30 and the enable command for the POKE 23886,1 in line 1650.

I also recommend that you type the entire program before executing it; that way both the print scrambler and Break key functions are turned on and off automatically.

After completing the program entry, save it to tape or disk before executing. An error in the print scrambler could return you to the memory size prompt.

Program continued

```
70 DATA29,28,25,0,0,0,0,0,0,0,27,0,0,0,26,27,20,0,0,28,30,28,25,0,
0,0,0,25,0,24,0,30,32,31,28,0,0,30,0,0,0,0,0,0,0,0,0,30,0,0
80 DATA32,12,13,11,5,10,15,20,25,26,7,14,27,4,8,4,16,19,21,21,21
,27,31,32,1,5
100 DS$(1)="JO UIF DBQUBJO'T RVBSUFST PO CPBSE
UIF GPEFSBUJPO TUBSTIJQ FOUFSQSJTF.":DS$(2)="JO B DPSSJEPS PG UI
F FOUFSQSJTF.
JOUFSTFDUJOH IBMMXBZT MFBE PGG JO BMM EJSFDUJPOT."
105 DS$(3)="JO UIF USBOTQPSUFS SPPN.  PO POF TJEF JT
B DPOUSPM QBOFM ... PO UIF PUIFS UIF USBOTQPSUFS DIBNCFS.":DS$(4
)="PO UIF TVSGBDF PG QMBOFU UFJSBT 80 ...
B SPDLZ EFTPMBUF UFSSBJO VOEFS B TDPSDIJOH TVO."
110 DS$(5)="BU UIF FOUSBODF UP B UVSCPMJGU.":DS$(6)="JO UIF UVSC
PMJGU."
115 DS$(7)=DS$(2):DS$(8)="JO POF PG UIF DSFX'T RVBSUFST.
MJLF BMM UIF PUIFST, JU IBT B CFE, ESFTTJOH SPPN, BOE DMPTFU.":D
S$(9)=DS$(6):DS$(10)=DS$(5)
120 DS$(11)="BU UIF OBWJHBUJPO DPOUSPM DFOUFS...
B UXP NBO QPTU VTVBMMZ NBOOFE CZ TVMV BOE DIFLIPW.":DS$(12)="BU
UIF DPNNVOJDBUJPOT TUBUJPO...
B DPNQMJDBUFE QBOFM PG JOTUSVNFOUT VTVBMMZ NBOOFE CZ VIVSV."
125 DS$(13)="BU UIF TDJFODF PGGJDFS'T TUBUJPO...
UIF QSJNBSZ DPOUSPM QPTU GPS UIF TIJQ'T DPNQVUFS."
130 DS$(14)=DS$(2):DS$(15)=DS$(5):DS$(16)="JO UIF TIJQ'T MJCSBSZ
...
B WBTU SPPN FRVJQQFE XJUI WJFXJOH TDSFFOT BOE UBQFT.":DS$(17)=DS
$(6):DS$(18)=DS$(2):DS$(19)="JO UIF TJDL CBZ...
BSPVOE ZPV BSF WBSJPVT JUFNT PG NFEJDBM FRVJQNFOU.":DS$(20)=DS$(
5)
140 DS$(21)="JO UIF TIJQ'T DFOUSBM TVQQMZ XBSFIPVTF.":DS$(22)=DS
$(2):DS$(23)=DS$(2):DS$(24)=DS$(6):DS$(25)=DS$(5):DS$(26)="JO B
TFDVSJUZ DFMM JO UIF CSJH.":DS$(27)=DS$(2)
150 DS$(28)=DS$(2):DS$(29)=DS$(6):DS$(30)="JO UIF FOHJOFFSJOH TF
DUJPO --
B MBSHF SPPN XJUI UXP TNBMM BEKPJOJOH SPPNT. BU UIF GBS FOE PG
UIJT BSPB JT UIF NBUUFS / BOUJ-NBUUFS XBSQ FOHJOF ESJWF."
155 DS$(31)="BU UIF EJMJUIJVN DSZTUBM QPXFS TUBUJPO.":DS$(32)="B
U UIF BVYJMJBSZ DPOUSPM TUBUJPO."
160 OB$(1)="BO VOBSNFE LMJOHPO DPNNBOEFS":OB$(2)="B CVUUPO MBCFM
MFE TFOTPST":OB$(3)="B CVUUPO MBCFMMFE TIJQ'T TUBUVT":OB$(4)="B
CVUUPO MBCFMMFE GJSF JNQVMTF FOHJOFT"
170 OB$(5)="B TJHO PO UIF PQQPTJUF XBMM":FORI=6TO9:OB$(I)=OB$(5)
:NEXTI:OB$(10)="NS. TQPDL MZJOH VODPOTDJPVT PO UIF GMPPS":OB$(11
)="B LMJOHPO TPMEJFS":OB$(12)="B LMJOHPO HVBSE"
180 OB$(13)="B LMJOHPO TFOUSZ":OB$(14)="B LMJOHPO PGGJDFS":OB$(1
5)="B GVSSZ DSFBUVSF LOPXO BT B USJCCMF":OB$(16)="SBX EJMJUIJVN
DSZTUBMT":OB$(17)="UIF UFDOJDBM NBOVBM GPS UIF TUBSTIJQ FOUFSQSJ
TF"
190 OB$(18)="B IZQP XJUI UIF MBCFM BOUJEPUF JOKFDUJPO":OB$(19)="
B QIBTFS":OB$(20)="B DPNNVOJDBUPS":OB$(21)="BO FMFDUSPOJD TIVOU"
:OB$(22)="TQPDL'T USJDPSEFS":DI$(0)="OPSUI":DI$(1)="FBTU":DI$(2)
="TPVUI":DI$(3)="XFTU":DI$(4)="VQ":DI$(5)="EPXO"
200 OB$(23)="UIF EJMJUIJVN DSZTUBM QPXFS TUBUJPO -- UIF DSZTUBMT
 BSF
GVTFE BOE POMZ QSPWJEJOH B GSBDUJPO PG OPSNBM FOFSHZ MFWFMT.":OB
$(24)="UIF BVYJMJBSZ DPOUSPM QBOFM -- B LFZ DPNQPOFOU
IBT CFFO SFNPWFE JO UIF DFOUFS PG UIF DJSDVJU"
205 OB$(25)="B 3E DIFTT TFU":OB$(26)="TUBS DIBSUT"
210 VB$="!!!OPSFBTTPVXFTVQ!EPXIFMJOWTDPRVJMPPHP!HFUESPTBZUISGJSQ
SFSFBJOTJOK":FORI=1TO21:VB$=RIGHT$(VB$,LEN(VB$)-3):FORJ=1TO3:VB$
(I)=VB$(I)+CHR$(ASC(MID$(VB$,J,1))-1):SET(0,I+5):SET(1,I+5):NEXT
J,I
215 FORI=0TO1:FORJ=27TO29:SET(I,J):NEXTJ,I
220 NN$="!!!!FOFSDPNNCVUUCVUUCVUUTJHOTJHOTJHOTJHOTJHOTQPDLMJOLMJ
OLMJOLMJOUSJCDSZTNBOVIZQPQIBTDPNNTIVOUSJD"
230 FORI=0TO22:NN$=RIGHT$(NN$,LEN(NN$)-4):FORJ=1TO4:NN$(I)=NN$(I
)+CHR$(ASC(MID$(NN$,J,1))-1):SET(124,I+6):SET(125,I+6):NEXTJ,I:P
L=1:SP=0:KE=-1:CR=0:SH=0:DE=-1:TT=0:SET(124,29):SET(125,29):TD!=
1
240 DD$(1)="CSJEHF":DD$(2)="QFSTPOOFM TFDUJPO":DD$(3)="UFDIOJDBM
 EFQBSUNFOUT":DD$(4)="TFDVSJUZ TFDUJPO":DD$(5)="FOHJOFFSJOH EJWJ
TJPO":NN$(25)="CHES":NN$(26)="CHAR"
250 FORTI=1TO1000:NEXTTI
500 CLS:PRINT"ZPV ";:IFSPTHENPRINT"BOE TQPDL BSF ";ELSEPRINT"BSF
 ";
510 PRINTDS$(PL):PRINT:PRINT"PCWJPVT FYJUT BSF:":FORJ=0TO5:IFDI(
PL,J)<>0THENPRINTDI$(J);"   ";:NEXT:PRINTELSENEXT:PRINT
515 IFPL=21THENPRINT:PRINT"ZPV DBO TFF UIF GPMMPXJOH PCKFDUT:";P
```

Program continues

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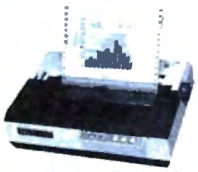

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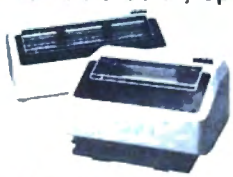

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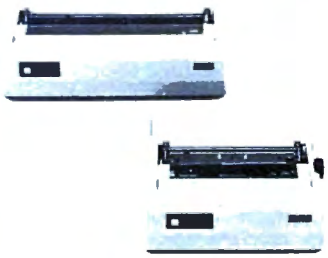

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✓410

Program continued

```
RINT"UIF FOUJSF TIJQ'T TUPSFIPVTF PG TVQQMJFT.":GOTO525
520 K=0:PRINT:PRINT"ZPV DBO TFF UIF GPMMPXJOH PCKFDUT:":FORJ=1TO
26:IFOB(J)=PLTHENK=1:PRINTOB$(J):NEXTJELSENEXTJ:IFK=0PRINT"OPUIJ
OH"
525 IFOB(11)=PLOROB(12)=PLOROB(13)=PLOROB(14)=PLTHEN3000
530 IFKEANDSPANDPL=28THENPRINT"
TQPDL TBZT -- DBQUBJO, NZ USJDPSEFS JOEJDBUFT B MBSHF OVNCFS
PG LMJOHPOT UP UIF FBTU.  UPP NBOZ GPS VT UP EFGFBU XJUI
KVTU IBOE QIBTFST."
540 IFKEANDPL=30THENPRINT"
ZPV BSF TVSSPVOEFE CZ B TRVBESPO PG LMJOHPO TPMEJFST.
ZPV IBWF UJNF GPS POMZ POF BDUJPO CFGPSF UIFZ GJSF!":GOTO3500
1000 GOSUB4000:PRINT:POKEFX,0:CM$="":PRINT"COMMAND ? ";:PP=PEEK(
16416)+256*PEEK(16417)-15360:GOSUB5000:CM$=CM$+"     ":POKEFX,61
1005 VB$=LEFT$(CM$,3):NN$="":FORI=1TOLEN(CM$)-4:IFMID$(CM$,I,1)=
" "THENNN$=MID$(CM$,I+1,4):I=255
1010 NEXTI:VB=0:FORJ=1TO21:IFVB$=VB$(J)THENVB=J
1020 NEXTJ:IFVB=0THENPRINT"DBO ZPV SFQFBU UIBU ";:GOTO1000
1030 NN=-1:FORJ=0TO26:IFNN$=NN$(J)THENNN=J
1040 NEXTJ:IF(NN=-1ANDVB>12)ANDVB<>15THENPRINT"DBO ZPV SFQFBU UI
BU ";:GOTO1000
1050 ONVBGOTO1100,1100,1100,1100,1100,1100,1190,1400,1500,1600,5
00,1700,1800,1900,2000,2100,2200,2300,2400,2500,2600
1100 IFDI(PL,VB-1)<>0THENPL=DI(PL,VB-1):GOTO500
1110 PRINT"ZPV DBOOPU HP JO UIBU EJSFDUJPO.":GOTO1000
1190 IFPL=4THEN1240
1200 IFNOTSPTHENPRINT"TPSSZ, DBQUBJO, ZPV BSF PO ZPVS PXO.":GOTO
1000ELSEONPLGOSUB1210,1220,1230,1240,1220,1220,1250,1260,1220,12
20,1270,1270,1270,1250,1220,1220,1220,1220,1220,1220,1280,1220,1
220,1220,1220,1220,1250,1290,1220,1220,1300,1295:GOTO1000
1210 PRINT"QFSIBQT ZPV XPVME MJLF UP UBLF B OBQ?":RETURN
1220 PRINT"J TFF OPUIJOH PVU PG UIF PSEJOBSZ, DBQUBJO.":RETURN
1230 PRINT"ZPV VTVBMMZ TBZ <<FOFSHJ[F>> BU UIJT QPJOU, DBQUBJO."
:RETURN
1240 PRINT"XJUIPVU B DPNNVOJDBUPS ZPV BSF USBQQFE PO UIJT QMBOFU
 GPSFWFS.":RETURN
1250 KH=0:FORJ=11TO14:IFOB(J)=PLTHENKH=1:NEXTJELSENEXTJ
1255 IFKH=1THENPRINT"J TVHHFTU ZPV GJSF B QIBTFS.":RETURNELSE122
0
1260 IFOB(15)=8THENPRINT"EP ZPV UIJOL UIJT DSFBUVSF DPVME CF VTF
GVM?":RETURNELSE1220
1270 PRINT"EP ZPV XBOU NF UP QSFTT UIF CVUUPO?":RETURN
1280 PRINT"BMNPTU BOZ FRVJQNFOU ZPV SFRVJSF JT BWBJMBCMF.":RETUR
N
1290 IFKETHENPRINT"QFSIBQT JG XF IBE TPNFUIJOH UP GSJHIUFO UIFN
BXBZ!":RETURNELSE1220
1295 IFOB(1)=32THENPRINT"J CFMJFWF UIF LMJOHPO-FTF QISBTF GPS <<
EP ZPV TVSSFOEFS>>
JT <<USPYBFUJ>>.  QFSIBQT JG ZPV USJFE UIBU, DBQUBJO ?":RETURN
1300 PRINT"J TVHHFTU XF DPOTVMU UIF UFDIOJDBM NBOVBM.":RETURN
1400 PRINT:PRINT"ZPV BSF DBSSZJOH UIF GPMMPXJOH JUFNT:":K=0:FORJ
=15TO26:IFOB(J)=0THENPRINTOB$(J):K=1
1410 NEXTJ:IFK=0THENPRINT"OPUIJOH"
1420 GOTO1000
1500 SC=(OB(16)=0ORCR)+(OB(19)=0)+CR+SH+(OB(1)=26)+(DE=0)+(KE=0)
+SP:SC=SC*10:FORI=11TO14:IFOB(I)=-1THENSC=SC-5
1510 NEXTI:PRINT"ZPVS TDPSF UIVT GBS JT";-SC;"%":IFSC=-100THENPR
INT"DPOHSBUVMBUJPOT ... ZPV IBWF CFFO QSPNPUFE UP DPNNPEPSF!":GO
TO1600ELSE1000
1600 PRINT"XPVME ZPV MJLF UP USZ BHBJO ?":GOSUB1650
1610 CM$=INKEY$:IFCM$="Y"THENRUN5ELSEIFCM$="N"THENENDELSE1610
1620 GOSUB1650:PRINT:PRINT"ERROR CODE";ERR/2+1;"IN LINE";ERL:END

1650 POKE16414,51:POKE16415,52:IFPEEK(16396)=23THENPOKE16396,201
:RETURNELSEPOKE23886,1:RETURN
1700 VB$=LEFT$(NN$,3):VB=0:FORJ=1TO6:IFVB$=VB$(J)THENVB=J
1710 NEXTJ:IFVB=0THENFORJ=1TO1:GOTO1020ELSE1100
1800 IFNN<15THENPRINT"UIBU DBOOPU CF EPOF.":GOTO1000
1810 IFOB(NN)=PLANDTT<5THENPRINT"P.L.  BEE ";OB$(NN):PRINT"UP ZP
VS JOWFOUPSZ.":OB(NN)=0:TT=TT+1:GOTO1000
1815 IFOB(NN)=PLTHENPRINT"ZPV BSF DBSSZJOH UPP NVDI.  ESPQ TPNFU
IJOH.":GOTO1000
1820 IFOB(NN)=0THENPRINT"ZPV BMSFBEZ IBWF UIBU!":GOTO1000
1830 PRINT"XIFSF EP ZPV TFF UIBU?":GOTO1000
1900 IFOB(NN)<>0THENPRINT"ESPQ XIBU?":GOTO1000
1910 IFNN=16ANDOB(16)=0THENPRINT"P.L.  BT ZPV ESPQ UIFN, UIF DSZ
TUBMT TIBUUFS JOUP VTFMFTT EVTU.":OB(16)=4:TT=TT-1:GOTO1000
1920 PRINT"P.L.  ZPV IBWF ESPQQFE ";OB$(NN):OB(NN)=PL:TT=TT-1:GO
TO1000
2000 IFPL=3IFSPIFNN=0THENPRINT"TQPDL TBZT -- BZF BZF DBQUBJO.":F
ORI=1TO50:PRINT"*";:FORJ=1TO50:NEXTJ,I:FORJ=1TO1000:NEXTJ:PL=4:S
P=0:GOTO500
2010 IFPL=4IFOB(20)=0IFNN=0THENPRINT"TQPDL SFTQPOET -- CFBNJOH Z
PV BCPBSE DBQUBJO.":FORI=1TO50:PRINT"*";:FORJ=1TO50:NEXTJ,I:FORJ
=1TO1000:NEXTJ:PL=3:SP=-1:GOTO500
2020 IFPL=3IFNN=0THENPRINT"ZPV OFFE TPNFPOF UP XPSL UIF DPOUSPMT
.":GOTO1000
2030 IFPL=32IFNN$="TROX"IFOB(1)=32THENPRINT"UIF DPNNBOEFS IBT TV
```

Program continues

Program continued

```
SSFOEFSFE BOE XJMM BXBJU USJBM JO UIF
CSJH.  IF IBT BMTP DPOGFTTFE UIBU UIF DSFX JT VOIBSNFE PO UIF
QMBOFU'T TVSGBDF BOE XJMM TVQQMZ USBOTQPSUFS DP-PSEJOBUFT.":OB(1
)=26:GOTO1000
2040 PRINT"P.L.  ZPV TBJE JU CVU"
2050 PRINT"OPUIJOH IBQQFOFE.":GOTO1000
2100 IFOB(NN)<>0THENPRINT"ZPV DBOOPU UISPX TPNFUIJOH ZPV EP OPU
IBWF.":GOTO1000ELSETT=TT-1
2110 IFNN=16THENPRINT"P.L.  BT B SFTVMU UIF DSZTUBMT IBWF
TIBUUFSFE JOUP VTFMFTT EVTU.":OB(16)=4:GOTO1000
2120 IFNN>16THENPRINT"P.L.":IFSPTHENPRINT"TQPDL TBZT -- B NPTU J
MMPHJDBM NPWF DBQUBJO."
2130 IFNN>16THENOB(NN)=PL:GOTO1000
2140 FORI=11TO14:IFOB(I)=PLTHENPRINT"UIF LMJOHPO XBT TP BGSBJE P
G UIF USJCCMF UIBU IF
UVSOFE BOE SBO BXBZ UP IJEF.  EPO'U XPSSZ BCPVU IJN BOZNPSF!":OB
(I)=-1:OB(15)=PL:I=15:NEXTI:GOTO1000ELSENEXTI
2150 IFOB(1)=PLTHENPRINT"UIF LMJOHPO DPNNBOEFS JT FTQFDJBMMZ CSB
WF
BOE TIBLJMZ IPMET IJT HSPVOE.":OB(15)=PL:GOTO1000
2160 IFPL=30ANDKETHENPRINT"PODF UIF LMJOHPOT SFBMJ[F UIFZ IBWF B
 USJCCMF JO UIJFS NJETU,
UIFZ UVSO BOE SVO JO BMM EJSFDUJPOT.";
2165 IFPL=30IFKEIFSPTHENPRINT"  TQPDL TBZT -- FYDFMMFOU
DBQUBJO.  ZPV NVTU IBWF SFNFNCFSFE IPX JMMPHJDBMMZ GSJHIUFOFE
UIF LMJOHPOT BSF PG USJCCMFT."ELSEPRINT
2170 IFPL=30ANDKETHENKE=0:OB(15)=30:GOTO1000
2180 PRINT"P.L.":OB(15)=PL:GOTO1000
2200 IFNN<>19THENPRINT"ZPV DBOOPU EP UIBU.":GOTO1000
2210 IFOB(19)<>0THENPRINT"ZPV DBOOPU EP UIBU ZFU.":GOTO1000
2220 FORI=11TO14:IFOB(I)=PLTHENPRINT"P.L.":PRINTSTRING$(64,131);
:FORK=1TO10:NEXTK:PRINTCHR$(27);CHR$(30):PRINT"UIF LMJOHPO IBT C
FFO SFNPWFE.":OB(I)=-1:I=15:NEXTI:GOTO1000
2230 NEXTI:IFOB(1)=PLTHENPRINT"P.L.":PRINTSTRING$(64,131);:FORK=
1TO10:NEXTK:PRINTCHR$(27);CHR$(30):PRINT"UIF DPNNBOEFS IBT CFFO
SFNPWFE.":IFSPTHENPRINT"TQPDL TBZT -- IJHIMZ JMMPHJDBM UP LJMM B
O VOBSNFE NBO, DBQUBJO.":OB(1)=-1:GOTO1000ELSEOB(1)=-1:GOTO1000
2240 PRINT"P.L.":PRINTSTRING$(64,131);:FORK=1TO10:NEXTK:PRINTCHR
$(27);CHR$(30):IFSPTHENPRINT"TQPDL TBZT -- XIZ XBTUF WBMVBCMF QI
BTFS DIBSHF, DBQUBJO?":GOTO1000ELSE1000
2300 IFNN<20RNN>4THENPRINT"EP XIBU, DBQUBJO?":GOTO1000
2310 IFPL<11ORPL>13THENPRINT"XIBU CVUUPO, DBQUBJO?":GOTO1000
2320 IFPL=12ANDKETHENPRINT"UIF DPNQVUFS SFTQPOET -- TFOTPST JOEJ
DBUF POF IVNBJOPJE MJGF
GPSN PO CPBSE, NBOZ LMJOHPO MJGF GPSNT, ... BOE POF WVMDBO.":GOT
O1000
2330 IFPL=12THENPRINT"UIF DPNQVUFS SFTQPOET -- TFOTPST JOEJDBUF
POF IVNBOPJE MJGF
GPSN BOE POF WVMDBO MJGF GPSN PO CPBSE.":GOTO1000
2340 IFPL=13THENPRINT"UIF DPNQVUFS SFTQPOET -- UIF FOUFSQSJTF JT
 JO PSCJU BSPVOE
QMBOFU UFJSBT 80 ... B DMBTT N QMBOFU ... PYZHFO - OJUSPHFO
BUNPTQIFSF ... SJDI JO DSZTUBMMJUF NJOFSBMT."
2350 IFPL=13IFDEPRINT"UIF FOUFSQSJTF XJMM CFHJO UP CVSO VQ JO UI
F BUNPTQIFSF PG UIF
QMBOFU WFSZ TPPO VOMFTT JNQVMTF FOHJOFT BSF GJSFE."
2360 IFPL=13THEN1000
2370 IFPL=11IFSHIFCRTHENPRINT"UIF TIJQ TIBLFT WJPMFOUMZ ...
UIF DPNQVUFS SFTQPOET -- TUBCMF PSCJU BDIJFWFE !":DE=0:TD!=1:GOT
O1000
2380 PRINT"OPUIJOH IBQQFOFE.":GOTO1000
2400 IFNN=9AND(INT(PL/5)*5=PLANDPL<26)THENPRINT"JU TBZT:
TUBSTIJQ FOUFSQSJTF -- ODD 1701":PRINT"EFDL";PL/5;" -- ";DD$(PL/
5):GOTO1000
2410 IFNN=17ANDOB(17)=0THEN2420ELSEPRINT"SFBE XIBU, DBQUBJO?":GO
TO1000
2420 IFPL=11THENPRINT"JU TBZT UP DIFDL CPUI UIF EJMJUIJVN DSZTUB
MT BOE UIF DPOUSPMT
JO UIF FOHJOFFSJOH TFDUJPO.":GOTO1000
2430 IFPL=21ANDOB(21)=PLTHENPRINT"JU TBZT UIJT TIVOU JT JNQPSUBO
U JO
UIF FOHJOFFSJOH DPOUSPM NFDBOJTN.":GOTO1000
2440 IFPL=31THENPRINT"JU TBZT JOTFSU UIF DSZTUBMT JOUP UIF QPXFS
 TUBUJPO.":GOTO1000
2450 IFPL=32THENPRINT"JU TBZT JOTUBMM UIF TIVOU JO UIF DPOUSPM Q
BOFM.":GOTO1000
2460 PRINT"JU EPFT OPU NFOUJPO BOZUIJOH PG WBMVF JO UIJT TJUVBUJ
PO.":GOTO1000
2500 IFPL<31THENPRINT"IFSF, DBQUBJO?":GOTO1000
2510 IFPL=31IFOB(16)=0IFNN=16IFCRPRINT"UIBU JT OPU OFDFTTBSZ OPX
, DBQUBJO.":GOTO1000
2520 IFPL=31IFOB(16)=0IFNN=16IFCR=0THENPRINT"B MPX WJCSBUJPO CFH
JOT ...
QPXFS MFWFMT OPX BU";90+RND(9)+RND(0);"%":CR=-1:TT=TT-1:OB(16)=4
:OB(23)=-1:GOTO2560
2530 IFPL=32IFOB(21)=0IFNN=21IFSHPRINT"UIBU JT OPU OFDFTTBSZ OPX
, DBQUBJO.":GOTO1000
```

Program continues

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Program continued

```
2540 IFPL=32IFOB(21)=0IFNN=21IFSH=0THENPRINT"B HSFFO QBOFM MJHIU
 HMPXT ...
BVYJMJBSZ DPOUSPM OPX PQFSBUJPOBM.":OB(24)=-1:TT=TT-1:SH=-1:OB(2
1)=21:GOTO2560
2550 PRINT"ZPV DBOOPU EP UIBU, DBQUBJO.":GOTO1000
2560 IFCRANDSHTHENTD!=-17-RND(3)-RND(0):GOTO1000ELSE1000
2600 IF(NN=18ORNN=10)IFOB(10)=26IFOB(18)=0THENPRINT"P.L.  TQPDL
BXBLFOT BOE TBZT -- J BN JOEFCUFE UP CPUI ZPV BOE
ES. NDDPZ. J BN XFMM FOPVHI UP BTTJTU ZPV OPX.":SP=-1:OB(10)=-1:
GOTO1000
2610 PRINT"OPU OPX, DBQUBJO.":GOTO1000
3000 IFOB(19)<>0ANDOB(15)<>0THENPRINT:PRINT"XJUIPVU B QIBTFS, ZP
V NVTU TVSSFOEFS.":GOTO1600
3010 PRINT:POKEFX,0:CM$="":PRINT"COMMAND ? ";:PP=PEEK(16416)+256
*PEEK(16417)-15360:GOSUB5000:CM$=CM$+STRING$(10,32):POKEFX,61:C2
$=LEFT$(CM$,10)
3020 C3$=VB$(16)+"OW "+NN$(15):IFC2$=C3$THENIFOB(15)=0THENTT=TT-
1:GOTO2140ELSEPRINT"XIBU USJCCMF?  ZPV IBWF CFFO UBLFO DBQUJWF":
GOTO1600
3030 C3$=VB$(17)+"E "+NN$(19)+"E":IFC2$=C3$THEN2220ELSEPRINT"UPP
 TMPX, DBQUBJO.  ZPV IBWF CFFO UBLFO DBQUJWF":GOTO1600
3500 PRINT:POKEFX,0:CM$="":PRINT"COMMAND ? ";:PP=PEEK(16416)+256
*PEEK(16417)-15360:GOSUB5000:CM$=CM$+STRING$(10,32):POKEFX,61:C2
$=LEFT$(CM$,10):IFOB(15)<>0THEN3520
3510 IFC2$=VB$(16)+"OW "+NN$(15)THENTT=TT-1:GOTO2160
3520 PRINT"UPP TMPX, DBQUBJO. ZPV IBWF CFFO DBQUVSFE!
UIF FOUFSQSJTF IBT CFFO MPTU!":GOTO1600
4000 IFTD!>0THENRETURNELSETD!=TD!+1+RND(0)
4010 IFTD!>0THENPRINT"UPP MBUF, DBQUBJO!  UIF FOUFSQSJTF XJMM TP
PO CVSO
VQ JO UIF QMBOFU'T BUNPTQIFSF.  HPPECZF, DBQUBJO!":GOTO1600
4020 IFSPTHENPRINT"TQPDL TBZT -- POMZ";-TD!;" NJOVUFT VOUJM PSCJ
U EFDBZT"
4030 RETURN
5000 PRINT@PP+LEN(CM$),CHR$(143);:FORXE=1TO30:WY$=INKEY$:IFWY$="
"THENNEXT:PRINT@PP+LEN(CM$)," ";:FORXE=1TO30:WY$=INKEY$:IFWY$=""
THENNEXT:GOTO5000
5010 IFWY$=CHR$(13)THENPRINT@PP+LEN(CM$)," ":RETURN
5020 IFASC(WY$)=8ANDLEN(CM$)>0THENCM$=LEFT$(CM$,LEN(CM$)-1):PRIN
T@PP,STRING$(LEN(CM$)+2,32);:PRINT@PP,CM$;:GOTO5000ELSEIFASC(WY$
)=8THEN5000
5030 CM$=CM$+WY$:PRINT@PP,CM$;:GOTO5000
5500 CLS:PRINT@128,"CAPTAIN'S LOG -- STARDATE 4295.2  -- WHERE A
M I ?  WHAT HAS
HAPPENED TO MY CREW ?  I AWOKE MOMENTS AGO TO FIND THAT I HAD
BEEN DEPOSITED UNCONSCIOUS IN MY QUARTERS BY AN UNKNOWN EMEMY."
5510 PRINT"I HAVE TRIED REPEATEDLY TO CONTACT MY CREW BUT NONE R
ESPONDS --
SPOCK, SCOTTY, MCCOY, SULU, CHECKHOV ...  THE ENTERPRISE IS
EERILY QUIET, THE SILENCE BROKEN ONLY BY A SNATCH OF CONVERSA-
TION IN A STRANGE LANGUAGE SPOKEN IN THE CORRIDOR OUTSIDE MY"
5520 PRINT"CABIN.  COULD THIS BE THE KLINGON'S FINAL VICTORY ?":
PRINT:PRINT"YOU ARE THE CAPTAIN OF THE STARSHIP ENTERPRISE.  PRE
SS ENTER":PRINTTAB(20)"AND WELCOME TO ... ":PP=807:CM$="":GOSUB5
000:RETURN
```

Program Listing 2

```
10 ML$="THIS SAVES ROOM FOR PRINT SCRAMBLER!"
20 J=PEEK(VARPTR(ML$)+1)+256*PEEK(VARPTR(ML$)+2):J=J+65535*(J>32
767):FORK=JTOJ+35:READX:POKEK,X:NEXTK:DATA221,110,3,221,102,4,21
8,154,4,221,126,5,183,40,1,119,121,254,128,210,166,5,254,32,218,
6,5,254,64,218,125,4,61,195,125,4
30 S1=PEEK(16414):S2=PEEK(16415):POKE16414,PEEK(VARPTR(ML$)+1):P
OKE16415,PEEK(VARPTR(ML$)+2):IFPEEK(16396)=201THENPOKE16396,23EL
SEPOKE23886,0
40 ONERRORGOTO100
50 CLS
60 READA$:IFA$="***"THEN100
70 FORI=1TOLEN(A$):PRINTMID$(A$,I,1);:FORJ=1TO10
80 B$=INKEY$:IFB$=""THEN90ELSEIFASC(B$)=2THEN100
90 NEXTJ,I:PRINT:GOTO60
100 POKE16414,S1:POKE16415,S2:IFPEEK(16396)=23THENPOKE16396,201E
LSEPOKE23886,1
```

Program continues

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"This program is a last resort for extremely confused adventurers. . ."

The error trapping routine at line 35 will help you debug the program. When it encounters an error, it performs the quit routine, and the error identification number and line are displayed.

Three other comments are in order. When the line listing suddenly drops to the line below before reaching the right margin, use the down arrow key. Also, my printer substitutes an open bracket for the up arrow. Make that substitution when you see the bracket.

I delete line 29 after it's executed. The first time you run the program the string ML$ in line 20 is altered by POKEing the numbers in the data statement of line 29. Once this change is made, the program no longer needs line 29 and deletes it. This causes the TRS-80 to stop execution and return to the ready message. Simply run the program again to play the game; this time there will be no pause at line 29.

You can now save the revised program because the effects of line 29 have been left behind in line 20. List line 20 and see how it has changed.

Program Listing 2 contains the solution

Program continued

```
110 DATAQSFTT UIF CSFBL LFZ XIFO ZPV IBWF TFFO FOPVHI!
120 DATAQSPDFFE OPSUI GSPN ZPVS DBCJO JOUP UIF IBMMXBZ. IFBE XFT
U VOUJM
130 DATAZPV DPNF UP UIF UVSCPMJGU FOUSBODF.  FOUFS CZ IFBEJOH OP
SUI
140 DATABOE HP VQ. FYJU UIF MJGU UP UIF FBTU BOE FYQMPSF UIF CSJ
EHF.
150 DATAGFFM GSFF UP QSFTT CVUUPOT BOE SFDFJWF UIF WBSJPVT SFQPS
UT.
160 DATAHP CBDL UP UIF MJGU BOE HP EPXO UXP MFWFMT.  FYJU UIF UV
SCPMJGU
170 DATABOE IFBE FBTU VOUJM ZPV DPNF UP UIF TJDL CBZ.  UBLF UIF
 IZQP
180 DATABOE SFUVSO UP UIF UVSCPMJGU.  HP EPXO POF NPSF MFWFM BOE
 UVSO
190 DATAXFTU BGUFS FYJUJOH UIF MJGU.  DPOUJOVF XFTU VOUJM ZPV GJ
OE UIF
200 DATAXBSFIPVTF. ZPV XJMM OFFE B QIBTFS BOE DPNNVOJDBUPS JNNFE
JBUFMZ
210 DATAHP OPSUI PVU PG UIF XBSFIPVTF BOE UIFO DPOUJOVF FBTU.  Z
PV XJMM
220 DATAFODPVOUFS B LMJOHPO HVBSE CVU GJSJOH ZPVS QIBTFS XJMM EJ
TQPTF
230 DATAPG IJN. TQPDL'T USJDPSEFS JOEJDBUFT IF JT DMPTF CZ BOE P
OF NPSF
240 DATATUFQ FBTU GJOET IJN VODPOTDJPVT JO UIF CSJH.  JOKFDU UIF
 IZQP
250 DATABOE IF XJMM CF SFWJWFE BOE IFMQ ZPV.  SFUVSO UP UIF FOUS
BODF
260 DATAUP UIF UVSCPMJGU BOE HP VQ.  FYJU PO EFDL 3 BOE IFBE FBT
```

Program continues

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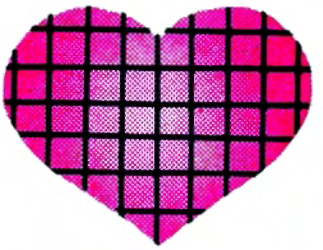

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"You are cast as the captain of the Starship Enterprise."

Program continued

```
U UIFO
270 DATAOPSUI.  QIBTFS UIF LMJOHPO BOE IFBE FBTU BOE HFU UIF NBO
VBM. HP
280 DATACBDL UP UIF MJGU -- HP VQ -- BOE IFBE FBTU.  USBOTQPSU E
PXO UP
290 DATAUIF TVSGBDF PG UIF QMBOFU BOE HFU UIF EJMJUIJVN DSZTUBMT
. SF-
300 DATAUVSO UP UIF TIJQ. HP XFTU UP UIF DSFX'T RVBSUFST BOE UBL
F UIF
310 DATAUSJCCMF.  HP CBDL UP UIF UVSCPMJGU BOE HP EPXO UP UIF CP
UUPN
320 DATAMFWFM -- FOHJOFFSJOH EFDL 5.  GBDF UIF TRVBESPO PG LMJOH
POT JO
330 DATAFOHJOFFSJOH BOE UISPX UIF USJCCMF BU UIFN. SFNFNCFS -- L
MJOHPOT
340 DATABSF FYUSFNFMZ GSJHIUFOFE PG USJCCMFT. HP TPVUI BOE SFQMB
DF UIF
350 DATAEJMJUIJVN DSZTUBMT.  HP OPSUI UIFO FBTU UP BVYJMJBSZ DPO
USPM.
360 DATATQPDL XJMM IFMQ ZPV XJUI UIF LMJOHPO DPNNBOEFS ... UIFO
JOTFSU
370 DATAUIF TIVOU (JG ZPV EPO'U IBWF JU JU JT JO UIF XBSFIPVTF).

380 DATAZPV POMZ IBWF B MJNJUFE BNPVOU PG UJNF TP IVSSZ CBDL UP
UIF
390 DATACSJEHF BOE QSFTT UIF CVUUPO UP GJSF UIF FOHJOFT.  XIFO T
UBCMF
400 DATAPSCJU JT BDIJFWFE ... ZPV IBWF TVDDFTTGVMMZ DPNQMFUFE ZP
VS
410 DATAT U B S   U S F L   B E W F O U V S F !
420 DATA***
```

to Star Trek Adventure in scrambled form. Type in the program and run it to get detailed directions. This program is a last resort for extremely confused adventurers or a final check for you successful ones.

Special Note for Model III Owners: For the adventure program to operate as described on a Model III TRS-80, the following changes must be made. First, replace lines 29 and 30 as shown below:

```
29 J=PEEK(VARPTR(ML$)+1)+256*PEEK(VARPTR
(ML$)+2):J=J+65535*(J 32 767):FORK=JTOJ+13:
READX:POKEK,X:NEXTK:DELETE29:DATA121,254,
128,48,6,254,64,56,2,61,13,195,115,4
```

```
30 S1=PEEK(16414):S2=PEEK(16415):POKE16414,PEEK
(VARPTR(ML$)+1):POKE16415,PEEK(VARPTR(ML$)+2):
FX=PEEK(16414)+256*PEEK(16415)+10:IFPEEK
(16396)=201THENPOKE16396,23ELSEPOKE23886,0
```

Finally, replace the phrase POKEFX,61 found in lines 1000, 3010 and 3500 with the phrase POKEFX,13.

In the adventure solution program, delete line 20 in the listing and copy line 29 as shown above.■

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A software toolbox for your TRS-80 Model I and III. Each issue of TAS features utilities and applications that enhance your investment in the revolution. And more. We tackle comparison reviews, Model I/III compatibility, useful patches for popular programs, modifying BASIC, using Z80 assembler and many other languages. The Alternate Source is $24 for 12 issues. If you haven't seen our journal, request a sample copy with any product on this page.

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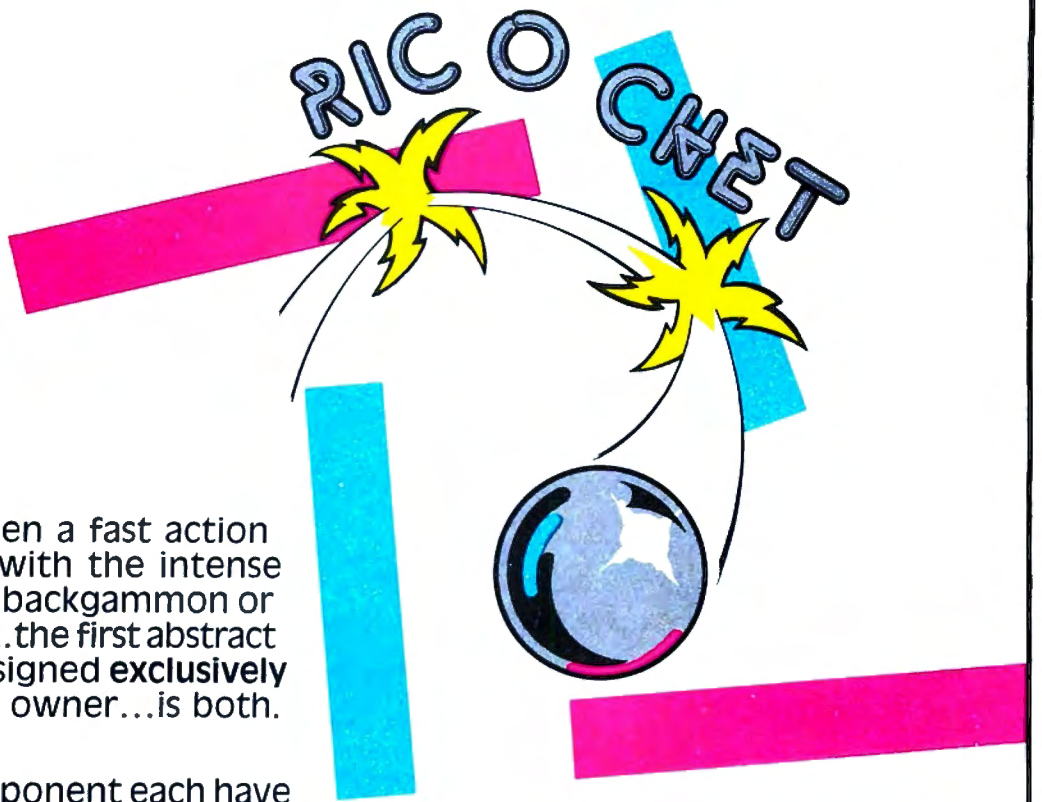

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Just thinking out loud.

The Master Muses

Charlie Heath
2 Swetts Court
Watertown, MA 02172

Computer Othello/Reversi has come of age. Othello is one of the first strategic computerized board games to offer a significant challenge to the very best human players.

Othello is the trademarked name for a board game marketed by Gabriel Industries. It was adapted from the game of Reversi, which was popular in England in the late 1800s.

The Rules

Othello/Reversi is a two-player game played on an eight by eight grid similar to a chess board. The squares are all the same color. There are four symmetric dots distinguishing the board's different sections.

Othello playing pieces are white on one side and black on the other. Each player owns one of the colors. The players alternate turns by playing one disk onto the board. If a player has no legal moves, he passes his turn to his opponent; but if he does have a legal move, he must make it no matter how bad it might be for him.

The game ends when the board is filled with disks, or when neither player can move. The winner is the player with the most disks on the board.

Legal Moves

The player places a disk, with his color face-up, onto an empty square. The piece he puts down must *bracket* one or more of the opponent's pieces. The bracketed pieces are then flipped over to become the player's own color.

To bracket an opponent's piece, there must be a straight line of one or more of the opponent's pieces between the empty square the player is moving to, and another one of the player's pieces on the board prior to his move. Bracketing can occur in any of eight directions radially outward from the square being moved to.

Why Computer Programs Play So Well

There are three reasons why computers play Othello/Reversi as well as they do. The end of the game is any easily bounded event. The game is over when all 64 squares are occupied. The game tree becomes very narrow as the end of the game approaches. The program can always make the move that guarantees it the best result, assuming perfect play by the opponent.

The endgame search begins when there are 15 empty squares on the board—one-quarter of the entire game! Humans, on the other hand, must rely on heuristic methods of choosing the best move until there are only a few squares left. Even in expert tournament competition serious miscalculations are often made with as few as four or five empty squares left.

In Othello/Reversi it is difficult for a human to foresee all tactical consequences of a move under consideration. Any given move changes the board's composition making it difficult for a human to judge a move's consequences.

Computers are ideally suited to tactical search methods. An average Othello/Reversi position has about 10 possible legal moves. Using Alpha-Beta pruning reduces the average branching factor to about four moves per branch. This allows the program to avoid short-term traps.

Othello/Reversi is a young game, as far as master level play goes. The strategy considered to be best involves maximizing your mobility while minimizing your opponent's.

The two most important aspects to Othello/Reversi playing strategy are easily accomplished by a computer program. These are: number of moves available to a player, and quantity of perimeter disks. The more legal moves a player has, the more likely it is that he will have at least one reasonable move to make. The second aspect, perimeter disks, indicates current and future mobility: All legal moves must flip at least one perimeter disk. Using these two items as primary evaluation criteria allows for a very "intelligent" computer opponent.

Your Micro: Opponent and Friend

Othello/Reversi programmers direct more effort into designing versions that will assist and improve the player's skills while giving a good game, rather than just producing a program that will simply beat your pants off.

Some programs have features allowing you to review a past game, try out different lines of play, ask the computer to suggest a move, and even get the computer to predict the game's final outcome once it has completed its endgame search.

There is no doubt that some Othello/Reversi programs are better than others, but, even so, most will make you work for your victories.■

Charlie Heath is the author of one of the best Reversi programs available. It is distributed by Instant Software.

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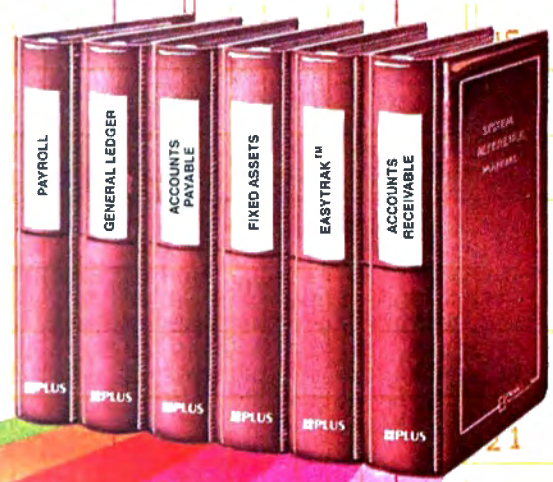

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Program Listing

```
2 GOTO960
3 '(C)1981 RICHARD A WHITE 44DOW CT FAIRFIELD, OH 513-829-5163
10 CLEAR1000:DIMSQ(15,11):GOTO900
18 PRINT" ***TO PROCEED TOUCH ANY KEY***";
19 RD=RND(10):Z$=INKEY$:IFZ$=""THEN 19ELSERETURN
20 PRINT"TO SET TAPE RECORDER AND        POSITION TAPE TO SAVE O
R LOAD,  PRESS ANY KEY FOR MOTORON ON ANDTHEN ANY KEY FOR MOTORO
FF"
21 Z1$=Z$:GOSUB19
22 AUDIOON:MOTORON:GOSUB19:MOTOROFF:Z$=Z1$:RETURN
32 INPUTZ$:IFZ$<>"" THEN MB=VAL(Z$):IFMB>0 THEN MA=MB-1
34 RD=RND(2)-1:RETURN
36 POKE65494,0:P=0:Z$=INKEY$:IFZ$<>""THENU=ASC(Z$)ELSEP=1:RETURN
37 H=2:V=2:IFU=8THENH=0ELSEIFU=9THENH=1ELSEIFU=10THENV=1ELSEIFU=
94THENV=0ELSEP=1
38 RETURN
41 POKE65495,0:Z=CW:DRAW"BM"+STR$(X)+","+STR$(Y)+";BM-8,+8":IFFN
LH(Z)=8 THEN DRAW"C2;M+0,-16"ELSEGOSUB48
42 IFFNTH(Z)=4 THEN DRAW"C2;M+16,-0"ELSEGOSUB50
43 IFFNRH(Z)=2 THEN DRAW"C2;M+0,+16"ELSEGOSUB52
44 IFFNBH(Z)=1 THEN DRAW"C2;M-16,-0"ELSEGOSUB54
45 DRAW"BM+8,-8":RETURN
47 POKE65495,0:DRAW"BM"+STR$(X)+","+STR$(Y)+";BM-8,+8":GOSUB48:G
OSUB50:GOSUB52:GOSUB54:DRAW"BM+8,-8":POKE65494,0:RETURN
48 IFFNLB(Z)=128 THEN DRAW"C3;M-0,-16"ELSEDRAW"C1;M-0,-16"
49 RETURN
50 IFFNTB(Z)=64 THEN DRAW"C3;M+16,-0"ELSEDRAW"C1;M+16,-0"
51 RETURN
52 IFFNRB(Z)=32 THEN DRAW"C3;M-0,+16"ELSEDRAW"C1;M-0,+16"
53 RETURN
54 IFFNBB(Z)=16 THEN DRAW"C3;M-16,-0"ELSEDRAW"C1;M-16,-0"
55 RETURN
70 '
90 CLS:PRINT:PRINT"PRESS <F> IF TAPE FILE ELSE ANY KEY":GOSUB19:
IFZ$="F" THEN FT$="I":GOTO805
100 POKE65495,0:CLS:NA=15:ND=11:X1=20:X=X1:Y1=14:Y=Y1
110 PMODE1,3:COLOR3,1:PCLS1:PMODE1,1:COLOR3,1:PCLS1:SCREEN1,0
120 Y=Y1-16:FORD=1TOND:Y=Y+16:X=X1-16:FORA=1TONA:X=X+16:OP=0:BL=
0:HO=0:HB=0:CW=0:IFRND(3)=3 THEN BL=1:OP=-1
121 IFRND(3)=3THENIFRND(2)=2THENHB=1ELSEHO=1
122 IFA>1THEN140
125 GOSUB34:IFRD=1THENCW=128:BL=1:GOSUB34:IFRD=0THEN150ELSEHB=1:
GOTO135
130 CW=0:OP=1:GOSUB34:IFRD=0THEN150ELSEHO=1
135 CW=CW+8:GOTO150
140 Z=SQ(A-1,D):IFFNRB(Z)=32THEN145ELSEOP=OP+1:IFFNRH(Z)<>2THEN1
50ELSEHO=1:CW=CW+8:GOTO150
145 BL=BL+1:CW=CW+128:IFFNRH(Z)<>2THEN150ELSEHB=1:CW=CW+8
```

Program continues

Richard A. White
44 Dow Court
Fairfield, OH 45015

At some time or another, everyone has tried to find their way through a maze. Good mazes are quite complex and are not suited for display on a microcomputer screen. Simple ones are solved at a glance and are no fun.

A solution to the computer maze problem is to hide part or most of it. My Color Maze program (see the listing) makes a simple maze based on squares and then randomly hides two sides of each square.

The TRS-80 Color Computer with Extended Color Basic does the job. The 192 by 128-pixel,

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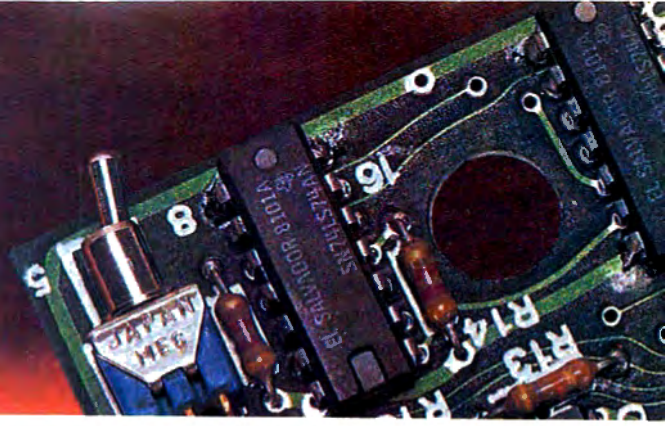

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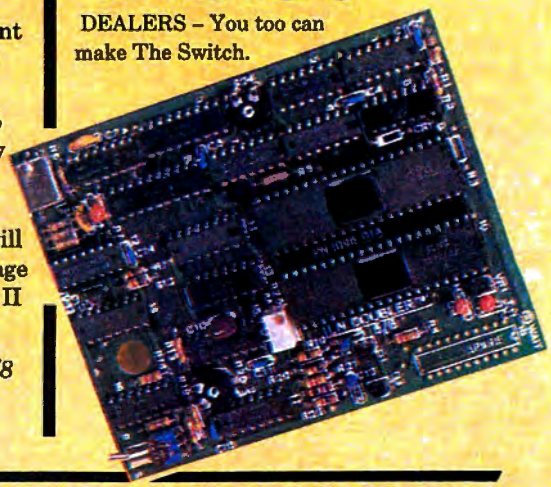

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*8" drive operation requires special cable, 8" double-density requires 3.55MHz CPU speed-up modification or LNW-80 4MHz computer. TRS-80 is a trademark of Tandy Corporation.

four-color graphics mode with the Draw command generates all graphics. Data for each square is packed into an integer and later recovered using the logical AND function. (Dennis Kitsz discussed the method in *80 Micro*, October 1981, page 53.) Data can be packed using an OR, or by adding the decimal number representing the bit to be set to the working number. In this program a single value smaller than 255 carries all the data needed to draw each square.

The maze is a random 15 by 11-square array with generally two sides of each square blocked. Occasionally only one side is blocked to assure there will be a way through most mazes. Two sides of each square are hidden (yellow). Blocked exposed sides are blue.

The computer selects a random starting point at the left side, where a flashing point appears. Your objective is to reach the right side by using the arrow keys. As you move you leave a red trail. When you try to go through a blocked side, your trail stops at the side and the flashing point returns to the center of the square. Once in the maze, you will occasionally have to backtrack to get out of a box.

When you solve the maze, the right side flashes. Press one of the arrow keys to display the number of moves and the time to complete the maze. A menu also appears. You can play the same maze again, make a new one or display the hidden lines of the one just played. Here the maze is drawn and flashed alternately with the hidden maze. You can stop either display by pressing Shift @.

You can save the tough mazes to cassette for your friends. When you first enter the output file mode, rewind the tape. The program times a run past the leader on the first save and spaces each dump about two seconds apart. The program automatically numbers each save, but you can change the number if you want. The file input mode works much the same way. Once you use either the input or the output mode, the program remains in that mode until

Program continued

```
150 IFD>1THEN170ELSEGOSUB34:IFRD=1THEN160ELSEOP=OP+1:IFHO=1THEN1
62ELSEIFOP=2THEN155ELSEGOSUB34:IFRD=0THEN162
155 HO=1:CW=CW+64:GOTO225
160 CW=CW+64:BL=BL+1:IFHB=1THEN225ELSEIFBL=2THEN165ELSEGOSUB34:I
FRD=1THEN165ELSE225
162 CW=CW+64:GOTO225
165 HB=1:GOTO225
170 Z=SQ(A,D-1):IFFNBB(Z)=16THEN175ELSEOP=OP+1:IFFNBH(Z)<>1THEN1
80ELSEHO=1:CW=CW+4:GOTO180
175 BL=BL+1:CW=CW+64:IFFNBH(Z)<>1THEN180ELSEHB=1:CW=CW+4
180 IFA=NA THEN225
185 Z=SQ(A+1,D-1):IFFNBB(Z)=16THEN190ELSENT=0:GOTO205
190 NT=1:IFOP=2THEN210
195 OP=OP+1:IFHO=1THEN250ELSEIFOP=2THEN200ELSEGOSUB34:IFRD=0THEN
250
200 CW=CW+2:HO=1:GOTO250
205 IFBL<2THEN210ELSE:OP=OP+1:IFHO=1THEN250ELSEIFFNBH(Z)=1THEN25
0ELSE200
210 GOSUB34:IFRD=0THEN195ELSEBL=BL+1:CW=CW+32:IFNT=0THENIFHB=1TH
EN250ELSEIFBL=2THEN220ELSEGOSUB34:IFRD=0THEN250
215 IFFNBH(Z)=-1THEN250
220 CW=CW+2:HB=1:GOTO250
225 IFBL<2THEN230ELSEOP=OP+1:GOSUB34:IFRD=0THEN250ELSEHO=1:CW=CW
+1:GOTO250
230 IFOP=2THEN240ELSEGOSUB34:IFRD=0THEN240ELSEOP=OP+1:IFHO=1THEN
250ELSEIFOP=2THEN235ELSEGOSUB34:IFRD=0THEN250
235 CW=CW+2:HO=1:GOTO250
240 BL=BL+1:CW=CW+32:IFHB=1THEN250ELSEIFBL=2THEN245ELSEGOSUB34:I
FRD=0THEN250
245 CW=CW+2:HB=1
250 IFD=ND THENCW=CW+16ELSEIFBL=2THEN255ELSECW=CW+16:IFHB=1THEN2
65ELSE260
255 IFHO=1THEN265ELSE260
260 IFD<>ND THENCW=CW+1
265 SQ(A,D)=CW: GOSUB41:NEXTA,D:POKE65494,0
275 GOTO400
400 'MAZE PLAY
410 A=0:Z=SQ(1,1):IFFNLB(Z)=128THENSQ(0,1)=128+64+32ELSESQ(0,1)=
128+64
420 FORD=2TO10:Z=SQ(1,D):IFFNLB(Z)=128THENSQ(0,D)=128+32ELSESQ(0
,D)=128
425 NEXT:Z=SQ(1,11):IFFNLB(Z)=128THENSQ(0,11)=128+32+16ELSESQ(0,
11)=128+16
430 A=0:MV=0:D=1+RND(9):X=4:Y=14+16*(D-1):PMODE1,1:SCREEN1,0:DRA
W"BM"+STR$(X)+","+STR$(Y)+"C4NU2NR2ND2":TIMER=0:Z=SQ(A,D)
435 FORZ=1TO10:NEXT:Z=SQ(A,D):GOSUB36:IFP=0THEN440ELSEIFC=1THENP
SET(X,Y,2):C=0:GOTO435
436 PSET(X,Y,4):C=1:GOTO435
440 IFH=0THEN450ELSEIFH=1THEN460
445 IFV=0THEN470ELSEIFV=1THEN480ELSE435
450 IFA=0THEN435ELSEDRAW"C4M-6,-0":IFFNLB(Z)=128THENDRAW"M+6,+0"
:MV=MV+1:GOTO435
455 DRAW"M-10,-0":X=X-16:A=A-1:MV=MV+1:GOTO435
460 DRAW"C4M+6,-0":IFFNRB(Z)=32THENDRAW"M-6,-0":MV=MV+1:GOTO435
465 IFA+1>15THEN490ELSEDRAW"M+10,-0":X=X+16:A=A+1:MV=MV+1:GOTO43
5
470 DRAW"C4M+0,-6":IFFNTB(Z)=64THENDRAW"M+0,+6":MV=MV+1:GOTO435
475 DRAW"M+0,-10":Y=Y-16:D=D-1:MV=MV+1:GOTO435
480 DRAW"C4M+0,+6":IFFNBB(Z)=16THENDRAW"M+0,-6":MV=MV+1:GOTO435
485 DRAW"M+0,+10":Y=Y+16:D=D+1:MV=MV+1:GOTO435
490 TI=TIMER/60:MV=MV+1:DRAW"R4C2M254,182"
495 DRAW"C3U176":FORZ=1TO50:NEXT:DRAW"C2D176":FORZ=1TO50:NEXT:DR
AW"C4U176":FORZ=1TO30:NEXT:DRAW"BD176"
500 GOSUB36:IFP=0THEN505ELSE495
505 SCREEN0,1:CLS:PRINT:PRINT"  "MV" MOVES",,"  "INT(TI/60)" MIN
UTES ";:PRINTUSING"##.##";TI-60*INT(TI/60);:PRINT" SECONDS"
510 PRINT:PRINT"PRESS KEY IN <> TO;",,,"  <F> SAVE MAZE OR GET N
EW FILE","  <P> PLAY AGAIN ","  <N> MAKE NEW MAZE","  <D> DISPLA
Y HIDDEN LINES","  <E> END"
515 FORZ=1TO50:GOSUB19:IFZ$="F"THEN800ELSEIFZ$="P"THEN535ELSEIFZ
$="N"THEN100ELSEIFZ$="D"THEN524ELSEIFZ$<>"E"THEN515
520 STOP
524 PMODE1,3:SCREEN1,0:PCLS:X=4:FORA=1TO15:X=X+16:Y=14-16:FORD=1
```

Program continues

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Program continued

```
TO11:Y=Y+16:Z=SQ(A,D):GOSUB47:NEXT:NEXT
525 IFT=3THENT=1ELSET=3
530 GOSUB36:IFP=0THEN505ELSEPMODE1,T:SCREEN1,0:FORX=1TO200:NEXT:
GOTO525
535 PMODE1,3:SCREEN1,0:PCLS:PMODE1,1:SCREEN1,0:PCLS:X=4:FORA=1TO
15:X=X+16:Y=14-16:FORD=1TO11:Y=Y+16:CW=SQ(A,D):GOSUB41:NEXT:NEXT
:GOTO400
800 IFMA>0THEN805ELSECLS:PRINT"PRESS <KEY> TO ENTER FILE TYPE",,
,"  <O> OUTPUT MAZES TO TAPE",,,"  <I> INPUT MAZES FROM TAPE":GO
SUB19:FT$=Z$
801 CLS:PRINT:PRINT"PLACE CASETTE IN RECORDER.",,,"PRESS<Y> TO P
OSITION TAPE.",,,"RECORDER WILL RUN PAST LEADER   BEFORE RECORDI
NG.":GOSUB18:IFZ$="Y"THENGOSUB20
802 IFZ$="I"THENPRINT"SET RECORDER TO PLAY & PRESS ANYKEY":GOSUB
19:GOTO830
803 IFZ$="O" THEN PRINT"SET RECORDER TO RECORD & PRESS  ANY KEY"
:GOSUB19
805 Z$="":IFFT$="I"THEN831ELSEIFFT$<>"O"THEN800
810 CLS:PRINT:PRINT"COMPUTER WILL NUMBER SAVED MAZE AUTOMATICALL
Y AS MAZE "MA+1,SF$:GOSUB32
815 PRINT:INPUT"SET RECORDER TO RECORD AND PRESS <ENTER>.";Z$:MO
TORON:AUDIOON:IFMA=0THENFORZ=1TO6000ELSEFORZ=1TO1000
820 NEXT:MA=MA+1:NF$="MAZEL"+STR$(MA):OPEN"O",-1,NF$:FORA=1TO15:
FORD=1TO11:PRINT#-1,SQ(A,D):NEXT:NEXT:CLOSE-1:GOTO510
830 CLS:PRINT:PRINT"PLACE CASETTE IN RECORDER.",,,"THIS PROGRAM
ACCEPTS FILES      NAMED 'MAZEL XX'":PRINT:PRINT"PRESS <Y> TO PO
SITION TAPE":PRINT:GOSUB18
831 IFZ$="Y"THENGOSUB20ELSEPRINT:PRINT"COMPUTER WILL INPUT MAZE
","NUMBER "MA+1,,SF$:GOSUB32
835 PRINT:INPUT"SET RECORDER TO PLAY AND PRESS  <ENTER>";Z$
840 MA=MA+1:NF$="MAZEL"+STR$(MA):OPEN"I",-1,NF$:FORA=1TO15:FORD=
1TO11:INPUT#-1,SQ(A,D):NEXT:NEXT:CLOSE-1:GOTO535
900 DEF FNLH(Z)=(Z)AND(8):DEF FNTH(Z)=(Z)AND(4):DEF FNRH(Z)=(Z)A
ND(2):DEF FNBH(Z)=(Z)AND(1)
910 DEF FNLB(Z)=(Z)AND(128):DEF FNTB(Z)=(Z)AND(64):DEF FNRB(Z)=(
Z)AND(32):DEF FNBB(Z)=(Z)AND(16)
920 SF$="UNLESS A DIFFERENT NUMBER IS    ENTERED NOW."
930 CLS:PRINT"   THE PROGRAM WILL MAKE A MAZE AND SELECT A START
 POINT ON THE LEFT FOR YOU. GENERALLY, EACH   SQUARE IN THE MAZE
 WILL HAVE    TWO SIDES OPEN AND TWO SIDES","BLOCKED."
940 PRINT"THIS IS A BLOCKED SIDE- "STRING$(5,175),"THIS IS A HID
DEN SIDE-  "STRING$(5,159),"IT MAY OR MAY NOT BE BLOCKED.   ALL
SIDES NOT SHOWN ARE OPEN.","USE THE ARROW KEYS TO MOVE","THROUGH
 THE MAZE AND TO GO TO"
950 PRINT"THE SCORE AND MENU DISPLAY WHEN YOU HAVE SOLVED IT":GO
SUB18:GOTO90
960 PCLEAR4:GOTO3
```

you end and run it again.

If you break the program and want to restart without losing the current maze or the tape file number, enter GOTO 505. This returns you to the menu.

Any Changes?

How about joysticks and sound? I thought of but did not include, many similar ideas.

The 15 by 11-maze graphics and program uses over 15.5K RAM. More squares or code for multiple player scorekeeping would need more than 16K of memory.

The cassette file routines are in lines 800–840. Here the key variable is MV. If you remove this from line 800 and change it to MI in the input routine and to MO in the output routine, you will be able to choose input or output and keep track of the file number of each. But you will continually be swapping cassettes—a better solution may be disks.

I have tried joysticks and sound. Sound slows the program and changes the action when moving through the maze. You can substitute a joystick subroutine for the INKEY$ subroutine in lines 36 and 37. I like the arrow keys better, but don't let that stop you! ■

Richard White has an MS in metallurgical engineering and is employed by Proctor & Gamble.

OMNITERM

What is OMNITERM?

OMNITERM is a professional communications package for the TRS-80 that allows you to easily communicate and transfer files or programs with almost any other computer. We've never found a computer that **OMNITERM** can't work with. It's a complete package because it includes not only the terminal program itself, but also **conversion utilities**, a **text editor**, special **configuration files**, **serious** documentation and **serious** support.

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What do I need to use OMNITERM?

A Model I or Model III TRS-80, at least 32K of memory, one disk, and the RS-232 interface, or Microconnection modem. **OMNITERM** works with all ROMs and DOSes, and **will** work with your special keyboard drivers.

What will it do?

OMNITERM allows you to translate any character going to any device: printer, screen, disk, keyboard, or communications line, giving you complete control and allowing you to redefine the character sets of all devices. It will let you transfer data, and run your printer while connected for a record of everything that happens. **OMNITERM** can reformat your screen so that 80, 32, or 40 column lines are easy to read and look neat on your TRS-80 screen. It even lets you get on remote computers with just one keystroke! The program lets you send special characters, echo characters, count UART errors, configure your UART, send True Breaks and use lower case. It accepts VIDEOTEX codes, giving you **full cursor control**. It will even let you review text that has scrolled off the screen! Best of all, **OMNITERM** will save a special file with all your changes so you can quickly use **OMNITERM** for any one of many different computers by loading the proper file. It's easy to use since it's menu driven, and gives you a full status display so you can examine and change everything.

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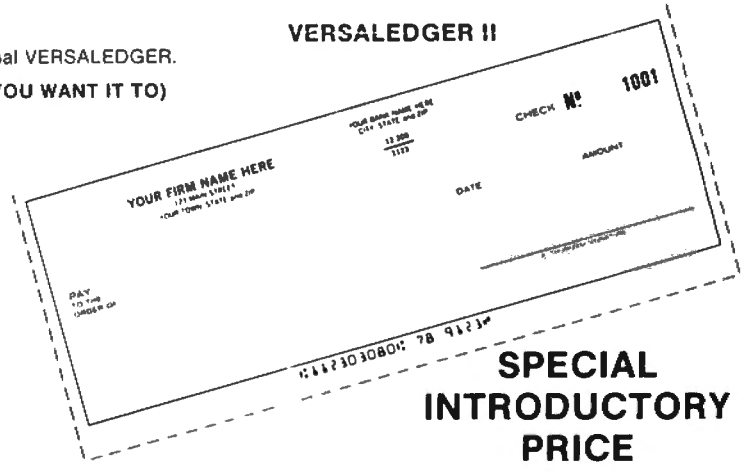
HOW IT WORKS . . . .

VERSALEDGER II is a complete accounting system that grows as you or your business grows. To start, your VERSA-LEDGER II acts as a simple method of keeping track of your checkbook. Just enter your check number, date and whom the check is made out to. As you or your business grows, you may add more details to your transactions . . . . . account number, detailed account explanations, etc.

- VERSALEDGER II is an expanded and enhanced version of our original VERSALEDGER.
- VERSALEDGER II gives you an instant cash balance at anytime. **(IF YOU WANT IT TO)**
- VERSALEDGER II can be used as a small personal checkbook register. **(IF YOU WANT IT TO)**
- VERSALEDGER II can run your million dollar corporation. **(IF YOU WANT IT TO)**
- VERSALEDGER II prints checks. **(IF YOU WANT IT TO)**
- VERSALEDGER II stores all check information forever. **(IF YOU WANT IT TO)**
- VERSALEDGER II can distribute one check to multiple expense accounts. **(IF YOU WANT IT TO)**
- VERSALEDGER II can handle more than one checkbook. **(IF YOU WANT IT TO)**
- VERSALEDGER II can be used to replace a general ledger. **(IF YOU WANT IT TO)**
- VERSALEDGER II prints balance sheets and income statements. **(IF YOU WANT IT TO)**
- VERSALEDGER II can interact with any of the other four modules of the VERSABUSINESS SYSTEM.



SPECIAL INTRODUCTORY PRICE

$99.95

($199.95 after Dec. 31, 1982)

- VERSALEDGER II comes with a professionally written manual (created for the first-time computer user), which includes sample report print-outs.
- VERSALEDGER II HAS AN ALMOST UNLIMITED CAPACITY . . . .
  - (300 checks per month on single density 5¼" disk drives such as the TRS-80 Model I)
  - (500 checks per month on the Apple II)
  - (2400 checks per month on the TRS-80 Model III)
  - (6000 checks per month on the TRS-80 Model II)
  - (3000 checks per month on single density 8" CP/M)
  - (almost unlimited capacity on hard disk drive)
- VERSALEDGER II OUTPERFORMS ALL OTHER COMPETITIVE SYSTEMS NOW AVAILABLE TO MICROCOMPUTER USERS, AT A FRACTION OF THE COST (AND WE OFFER A 30-DAY MONEY BACK GUARANTEE TO BACK UP OUR CLAIM!)

— CAN BE USED WITH 1 or MORE DISK DRIVES with 48K —

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VERSA-- PAYROLL

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★ QUICK QUARTERLY AND END OF YEAR SUMMARIES

★ PERFECT FOR A SMALL BUSINESS

★ EXPANDS TO HANDLE LARGE CORPORATE PAYROLLS

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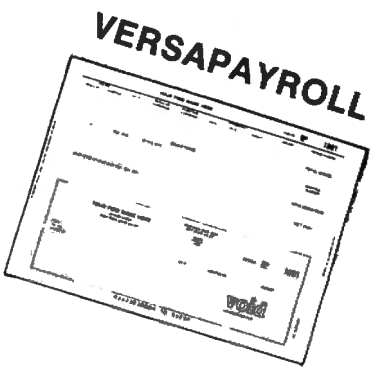
HOW IT WORKS . . . .

VERSAPAYROLL is a complete menu driven payroll system that grows as you or your business grows. Your VERSA-PAYROLL acts as a simple payroll system keeping track of all government required payroll information. Just enter the employees, VERSAPAYROLL will perform all the necessary payroll calculations automatically and display to totals on your screen. The user has complete control to accept the totals, to print or not print out a check and to post or not post the total to our **VERSALEDGER** system.

- VERSAPAYROLL automatically prints out your PAYROLL checks. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows you to override any payroll deduction. **(IF YOU WANT IT TO)**
- VERSAPAYROLL automatically posts all checks written to our VERSALEDGER system. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows the user to print out PAYROLL checks one at a time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows the user to print out all your PAYROLL checks at the same time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL gives you a summary of any employee's year to date payroll totals or all employee totals at any time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL will allow you to correct any error made at any time and automatically refigure all totals. **(IF YOU WANT IT TO)**
- VERSAPAYROLL works in every state. **(IF YOU WANT IT TO)**
- VERSAPAYROLL automatically calculates all federal and states taxes. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows for all of the standard deductions plus state, city and three miscellaneous deductions. **(IF YOU WANT IT TO)**
- VERSAPAYROLL prints all government required reports. **(IF YOU WANT IT TO)**
- VERSAPAYROLL permanently stores all PAYROLL transactions. **(IF YOU WANT IT TO)**
- VERSAPAYROLL HAS AN ALMOST UNLIMITED CAPACITY . . . .

  Can handle up to 300 employees on a TRS-80 MODEL I, 600 employees on a TRS-80 MODEL III, 1200 employees on a TRS-80 MODEL II, 500 employees on an APPLE II, 600 employees on any single density 8" CP/M computer and almost unlimited capacity on hard disk systems.



INTRODUCTORY PRICE
$99.95

CAN BE USED WITH 1 or MORE DISK DRIVES (AND 48K)

VERSAPAYROLL HAS BEEN CREATED WITH THE FIRST TIME COMPUTER USER IN MIND

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NEW NEW

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FOR THE TRS-80 MODEL I AND MODEL III

System Diagnostic

NEW

Tests Every Component Of Your TRS-80 and Verifies Proper Operations

For Cassette or Disk

IS YOUR COMPUTER WORKING?

ARE YOU SURE?

DISK

$99.95

CASSETTE

$94.95

ROM:	checksum test
RAM:	four separate tests including every address and data value.
VIDEO DISPLAY:	character generator, video RAM, and video signal.
KEYBOARD:	every key contact tested.
LINE PRINTER:	character test.
CASSETTE RECORDER:	read/write/verify data.
RS-232-C INTERFACE:	connector fault, data transmission, framing, data loop, baud rate generator.
DISK DRIVES:	disk controller, drive select and restore, track seek and verify data, read/write/verify all tracks and sectors with or without erasing, sector formatting, disk drive timer, disk head cleaner.

— Individual tests of each device with operator monitoring and intervention.
— Continuous sysem tests run continually for hours testing each component, with diagnostic reports optionally written on line printer.
— One program adapts to any system configuration and hardware.
— Complete instructions and documentation.

SMART TERMINAL

Enables your TRS-80 to be used as a data communications terminal to a time-sharing system, computer bulletin board, or another computer, via the RS-232-C interface.

- MEMORY BUFFER holds data for transmission or data received from other computer.
- CASSETTE or DISK may be used to load or save data from memory.
- AUTOMATIC TRANSMISSION of data from memory.
- AUTOMATIC STORAGE of incoming data at user's option.
- TRANSMIT or RECEIVE WITH VERIFICATION options included for communication between two TRS-80s using Smart Terminal.
- Full CONTROL KEYS, including control key mapping into any ASCII character. True BREAK key. Lower case supported on Model I.
- Buffered LINE PRINTER ECHO for incoming data.
- Disk and cassette files fully compatible with ELECTRIC PENCIL™ and SCRIPSIT™ programs.
- BAUD RATE and RS-232-C CHARACTERISTICS can be reset from within the program.
- SAVE PROGRAM option creates "personalized" back-up copy of program with all options set as specified by user.
- ONE PROGRAM supports both cassette and disk systems. Program is compatible with PMC-80 and other TRS-80 "work alike" computers.

Model I or III Version — **supplied on cassette $69.75**, **supplied on diskette $74.95**

Model II (CP/M) Version — **$79.95**

MON-3 and MON-4

The TRS-80 Monitor Programs #3 and #4 are powerful utility programs enabling you to interact directly with the TRS-80 in Machine Language. They are as useful for beginners as for advanced programmers.

- BEGINNERS can learn to interact directly with the computer in Machine Language.
- 40-PAGE MANUAL provided with each program.
- SIMPLE commands, easy to use.

The Features Of The Monitor Programs Enable You To The Following.....

- DISPLAY memory in different ways.
- DISASSEMBLE memory to see Machine Language commands.
- MOVE and COMPARE memory areas.
- SEARCH through memory to find specific values.
- MODIFY memory in various ways.
- RELOCATE object programs.
- PRINT output on video display or line printer.
- READ and WRITE object tapes in SYSTEM Format.
- UNLOAD programs using low RAM on disk.
- SAVE and READ disk files (MON-4 Only).
- INPUT and OUTPUT of disk sectors (MON-4 Only).
- SEND and RECEIVE data over RS-232-C Interface (MON-4 Only).
- Create SYMBOLIC Tapes (MON-3) or Files (MON-4) of Disassembled output for Editor/Assembler program.

MON-3 (For Cassette Systems) $39.95
MON-4 (For Disk Systems) $49.95

MAILING LIST

Maintains mailing lists of over 1000 names. Commands allow adding, changing, deleting, and finding names. Sorting is done by machine language according to the information in any field (i.e., name, address, zip code). Labels printed in 1, 2, or 3 columns, in master list on one line, or on video display.

Disk Version Only $69.95

HOME BUDGET

Combines the maintenance of your checkbook with analysis of your income, expenses, and monthly bills. Handles data including bills, including bills, income, deposits, checks and debits to your checking account, and cash expenses. Computes checkbook balance, list of unpaid bills, monthly and year-to-date summaries of income and expenses showing income tax deductions. All output printed on video display or line printer at user's option. Complete instructions for customizing to suit your own budget.

Cassette $29.95
Disk $49.95

SMALL BUSINESS ACCOUNTING

Based on Dome Bookkeeping Record #612, this program keeps track of income, expenditures, and payroll for a small business of up to 16 employees. Income and expenditures can be entered on a daily, weekly, or monthly basis, and the program computes monthly, through last month, and year-to-date summaries. Payroll section keeps record of individual employees and their paychecks with up to six categories of payroll deductior Employee payroll record and year-to-date payroll totals can be computed. Manual contains complete instructions for customizing to suit your business.

Disk Version $49.95
Cassette Version $29.95
(Cassette Version does not contain payroll)

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Inventory Control.....Payroll.....Bookkeeping System.....Stock Calculations.....
Checkbook Maintenance.....Accounts Receivable.....Accounts Payable.....

USINESS 100 PROGRAM LIST

	NAME	DESCRIPTION
1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNUI	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAPI	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVBD	Investor's rate of return on convertable bond
100	PORTVAL9	Stock market portfolio storage-valuation program

☐ Cassette Version (TRS-80 Only) $99.95
☐ 5-1/4" Diskette Version $99.95
☐ TRS-80* Model II & CPM Versions $149.95

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Experience Shows - S.B.S.G. has over 11,000 Installed Systems!

If you're not running Small Business Systems Group software . . . chances are you're not running!

GENERAL ACCOUNTING SYSTEM For TRS-80™

S.B.S.G. has created the first completely user-configurable accounting system available for the TRS-80™.

User configurable? Each S.B.S.G. General Accounting System Module (except Order Entry) can be operated independently, or any of the modules can be combined in any configuration, providing a complete, coordinated system to fit the needs of your business.

The S.B.S.G. System allows you the maximum efficient use of available disk space. Each module will run on a standard 1 disk drive system (except for Model I systems, which require 2 drives). As you add more disk drives to your system, the amount of on-line data storage increases. Now here's an important fact..... the S.B.S.G. General Accounting System "spans" your disk drives - that means that you can instantly access your data on any of **up to 8 disk drives** at any time! Since your S.B.S.G. Accounting System is user-configurable, it will work with 1, 2, 3, 4 or more disk drive systems - and it is fully compatible with most hard disk drive systems (at additional cost).

General Ledger

The General Ledger accounting system consolidates financial data from other accounting subsystems in an accurate and timely manner. Major reports include Trial Balance, Income Statement, Balance Sheet, a user-defined report, and more. All data is maintained and reported by month, quarter, year and previous three quarters. Transactions may be entered via direct posting and external posting generated by A/R, A/P, Payroll -- or any other user source.

Accounts Receivable

The objective of a computerized A/R system is to prepare accurate and timely monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. This system is invoice-oriented. Invoices can be entered before they're ready for billing, after billing, or even after they are paid. Accounts Receivable allows entry of new invoices, credit memos, debit memos, or modification or deletion invoice and allows for progress payment. The transaction information includes: type of A/R transaction, P.O. #, description of P.O., billing date, general ledger sales account #, invoice amount, shipping and transportation charges, tax charges, payment, and progress payment information. Reports include: summary or detail listing of invoices not yet billed, open items (unpaid invoices), closed items (paid invoices), and aging. Statements may be printed at any time and follow the format of nationally available forms.

Order Entry

The Order Entry Module was designed as a supplement to the Accounts Receivable Module, and will not operate independently. This system allows you to add, change, delete, list and print invoices; apply an invoice to correct customer account; generate computer assigned invoice numbers; note type (invoice credit memo, debit memo); record customer order number, invoice date, shipping date, FOB location, method of shipping, salesman, and payment terms; print selected number of shipping labels; enter, display and correct 10 lines of data per invoice, noting the part number, description, price, quantity ordered, extension, taxable or not. It also allows the user to enter, display a correct invoice totals, noting the invoice subtotal, taxes, shipping and handli with disbursement up to 5 General Ledger accounts; print a transaction repo maintain a terms code file in the system; update Account Receivable a generate summary report totals. It automatically coordinates to the Invento Module (if used) to determine description, price and out of stock status, and immediately deplete inventory stock. Price fields are easily modified to inclu percent or dollar discount.

Payroll

Payroll involves many complex calculations and the production of reports a documents, many of which are required by government agencies. The Payr system performs all necessary payroll tasks including file maintenance, pay da entry and verification, computation of pay and deduction amounts, and t printing of reports and checks. State and Federal Tax changes are easily i plemented by the user via menu prompting. In its link to General Ledger, ea employee's payroll information is distributed to as many as 12 different accounts; system automatically posts to cash account.

Accounts Payable

The Accounts Payable system receives data concerning purchases fr suppliers and produces checks in payment of outstanding invoices. Seve reports are available to supply information needed for the analysis of paymer expenses, purchases and cash requirements. The Accounts Payable systen invoice-oriented. It handles new invoices, credit memos and even debit mem and allows modification and deletion of invoices. The flexible check calculat procedures allows checks to be calculated for a set of vendors, specific vend or even specific invoices. The reports include open item listings and clos item listings (both detail and summary), debit and credit memo listings, agi check register report (to give an audit trail of checks printed), and vendor listi and vendor activity. Update reports are useful for audit trails and checking accuracy. Checks may be printed at any time and follow the format of nationa available forms.

Inventory

Status reports and minimum reorder reports help to reduce the potential haz of overstocking which results in cash flow problems. Program selection allo the user to store data for inventory located at up to five separate sites (divisio coding up to 9 sales people. Available reports include inventory master price listings, period and year-to-date sales, stock status, minimum reor point and commission information.

Model I, 48K and 2 Disk Drives . . . $195.00 Per Modu
Model III, 48K . . . . . $195.00 Per Modu
Model II, 64K . . . . . $295.00 Per Modu
Sample Report Printouts . . . . . $ 10.00

H & E COMPUTRONICS Gives You A 30-Day Money Back Guarantee On All Modules

Experience Shows - S.B.S.G. has over 11,000 Installed Systems!

COMMUNICATIONS SYSTEMS

Small Business Systems Group markets a complete line of software which interfaces the TRS-80™ with ANY computer that communicates in ASCII. This family of products offers both terminal and host capabilities to users with even the most minimal hardware configurations. There has been wide interest in these products from "comm buffs," the educational community, and **businesses and individuals who need to communicate on a regular basis.** Our systems are among the most versatile and comprehensive on the market today for TRS-80™ microcomputers.

ST80-III™ -- The Ultimate Communications System

The "state of the art" in communications processors, designed for complex commercial applications. Included in this package is a set of programs that allow your TRS-80™ to talk to a timesharing computer, transfer files to and from your central business computer, and customize your ST80-III to your specific application.

Features Include: Selectable RS232 Setting • Help Display • Echo Feedback • Job Log (LDOS Mod I, Mod III) • 2-User Translation Tables • Auto Logon • 10 Function Keys (Definable) • RUBOUT Key (Definable) • Warm Restart • Automatic I.D. • True Break • Direct Cursor Addressing • DOS Command Support • Transmit Line Feed • Printer Support • Video Display Modes: SCROLL, FORMAT, PAGE, REVERSE VIDEO (Mod II), CURSOR ON/OFF • Auto-answer • Autodial (certain modems) • Append to memory buffer • Big buffer for printer • Off hook / on hook • 10 predefined ASCII strings in translation tables, • Registered users include NASA, USN, UPS, Westinghouse, and many colleges, universities and major banks.

Minimum Requirements: One disk drive, RS232-C, 32K Model I or III, 64K Model II.

Model I or III **$150.00**
Model II **$250.00**

FORUM-80™ -- Communications Network

With Bill Abney's hot new communications product, you and your TRS-80™ can become part of one of the fastest growing communications networks in the country; your computer becomes an on-line bulletin board system: users can leave messages, get messages, swap information; exchange VisiCalc™ reports, charts, graphs or other correspondence with other computers.

Features Include: Security System • Constantly displayed time-in-use figure • User Friendly • User Configurable or can be modified for custom application • Future updates and upgrades available to register owners • Multiple command strings • Non-technical user and operator manuals.

Minimum Requirements: TRS-80™ (3-drive Mod I, 2-drive Mod III), 48K, RS232-C, Auto-answer modem.

Model I or III **$350.00**

ST-80-PBB™ -- Personal Bulletin Board

A small yet powerful bulletin board for the individual to gather and leave electronic mail. Messages reside in data base in memory, eliminating the problem of scanning magnetic media.

Features Include: Password Security System • Four levels of Access--Guest, Member, Owner, Operator • User Log • Four message types • Smart reverse scan to view messages from most recent to oldest.

Minimum Requirements: TRS-80™ (Mod I or III), 16K, Level II, Auto-answer modem, ST80-X10 Host Program ($50), RS232-C.

Model I or III **$50.00**

ST-80-CC™ -- Communications Center

More than a personal bulletin board, this is a complete communications system for low to moderate traffic. Like ST80-PBB™ it supports four levels of users and four levels of messages with text editing and reverse scan of messages.

Additional Features Include: Transmit same message to many individuals • Auto logon and multiple command scanning • Print messages on line printer, save messages in memory buffer, maintain database without user intervention.

Minimum Requirements: TRS-80™ (Mod I or III), Level II, 48K, one disk, Auto-answer modem, ST80-X10 Host Program ($50), RS232-C.

Model I or III **$100.00**

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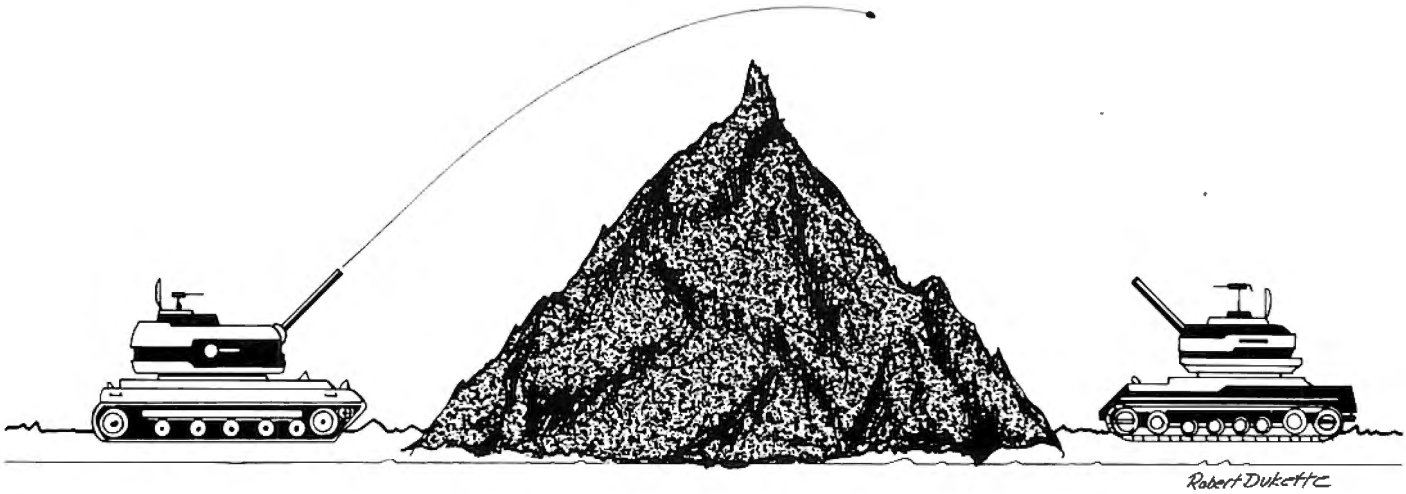

Larry D. Becker
410A Fir Avenue
Niceville, FL 32578

Color Computer games do not have to cost $40 to be good, nor do you have to type your fingers to the bone entering reams of instruction code. These five programs are not only fun, they are short. Well, four are fun; the fifth is a utility.

The first two are adaptations of the games Breakout and Simon. My versions are called Brickout and Poindexter. Both are short enough to fit in 4K RAM. Mathtalk and Tank-Gun are written in Extended Color Basic. They are also short enough to keep typing them in from becoming a project. The utility, Pixprint, also a minor typing chore, is a screen dump for your Color Computer.

Brickout

This version is a translation of a Forth program created by Arnold Schaeffer. Since Forth is a fast language and Basic is slow, some sacrifices had to be made. In the original version the ball speed increased with each layer of bricks removed. Basic has to run at full speed just to keep things interesting so no speed changes are incorporated. Some improvement was achieved by changing the input from the keyboard to joysticks.

The screen is redrawn when all bricks are gone and the ball must break through to the bottom before play resumes.

C—Board color
BC—Ball color: same as board color
P$—Graphics string for paddle
PP—Paddle position (character position, not set position)
SC—Score
N—Loop variable: one ball played on each pass
NB—Number of balls: input
XD—X direction: one is ball moving right, minus one is ball moving left
BX—Horizontal coordinate of ball
YD—Y direction: one is ball moving down, minus one is ball moving up
BY—Vertical coordinate of ball
PD—Paddle displacement
T—Temporary storage
I,J—Loop variables

Table 1. Brickout Variable List

Poindexter

This game involves memorizing an increasing number of tones and colors to be reentered in the correct sequence. After entering and running the program, the screen blacks out until a bar of color appears as a tone sounds. Above the bar will be a number (one-four). Press this key to echo the bar and tone. If you did it correctly the machine will respond with the same first bar followed by a second. Echo these in the correct order.

The sequence will repeat adding a new note/bar until you make an incorrect entry. The speed increases as you progress. If you input the wrong key, the screen will clear and a message will tell you how many correct notes you entered. The maximum is 32 (Y in line 130). No one has reached it.

Mathtalk

Mathtalk is an elementary exercise in artificial intelligence programming. It relies on pattern matching techniques to extract the operation and uses the ASCII sequence to determine which characters are numbers.

Operations like plus, minus and times are stored in data statements and read sequentially. Each one is checked for a match against the input string by using the INSTR(A$,B$) function which returns the character position of B$ in A$, or zero if B$ is not contained in A$. A counter is incremented for use in an On...GOSUB statement each time a new class of operations is tried. Once an operation is identified, the program scans

The Key Box

Color Basic and Extended Basic
Color Computer
4K and 16K RAM
Line Printer VII
Joysticks

left until it finds a number and stores it in N1. The program then looks to the right of the operation and stores that number in N2. The operation class counter is then used to route the program to the proper subroutine to determine the answer.

The expression FNNUM(C) is a user-defined function used to determine whether a character is numeric. Characters 48–57 in the ASCII sequence are numeric digits.

The decimal point (ASCII 46) is included to instruct the program to process digits to the right of the decimal point. To use this function it must first be defined (line 120). It is a Boolean expression, which means that it determines whether something is true or false. If a Boolean expression is assigned to a variable, the variable may be used in place of the expression in an If statement. Mathtalk will probably run without modification on a Model I or III with Disk Basic.

Operation synonyms such as *plus*, *and*, *added to* can be inserted in the data statement before the word *stop* as long as they do not reverse the expected order of the numbers. Questions like "what is 5-3?" and "what is 5 minus 3?" are equivalent, while "what is 5 subtracted from 3?" is not. New classes of operations can be created to take care of these exceptions.

Questions as complex as "if you take 2.56 and add 5.7 to it what would you get?" may be answered correctly because the program ignores everything except "2.56 *and* 5.7." Such occurrences are merely lucky side effects. The program is not intelligent, it merely takes advantage of the way we normally phrase questions about two numbers and uses programming tricks to determine the answer. You needn't tell your friends though.

Pixprint

This is a graphics screen print utility written in Extended Color Basic using machine language subroutines to dump the graphics screen to a Line Printer VII. It works in either PMODE 3 or 4, but is best in PMODE 4. PMODE 3 sometimes produces unexpected results because of the program's inability to produce more than one shade of grey.

Save a copy of Pixprint before running it. Any error in the data could cause a crash with no recovery.

To use Pixprint, set the selector switch on the back of your LPVII to the eight bit position. Put in your graphics program and hit the Break key when the screen is the way you want it. Load and run Pixprint. In a few minutes your printout should be done.

Some Basic customizing is possible. Change the start and end values in the For statement in line 480 to select screen portions. Consult the memory map in the *Extended Color Basic Manual* for addresses. Do not change the step value.

After using Pixprint, turn off both the printer and the computer and power up again. This will remove the printer driver routine which stays active even after the Basic program has been deleted.

The last four screen lines are not dumped to the printer because you must print seven lines at a time (it's a seven-wire printer). Seven does not go into 192 (the vertical resolution) evenly, so the remainder is dropped. This is the easy way out. If the memory above the end of page four is clear or contains more graphics, you can extend the range of the For statement. All eight pages can be dumped at once using this method.

Tank-Gun

Tank-Gun is a real-time arcade/simulation game with sound and high resolution color graphics for two players using joysticks.

The scenario is similar to games like Pillbox and Mountain Shoot. Two players take turns entering gun angle and muzzle velocity to fire at each other over a mountain. Tank-Gun uses a real-time entry of all game parameters. Instead of having to stop the game and take turns at the keyboard, players can change gun angle or muzzle velocity and fire at any time using joystick input. Pressing both fire buttons at the same time is no problem. The guns will fire simultaneously.

Only one shot per player is allowed in the air at any time. The end of a shot is when the shell makes contact with a solid object or goes off the screen in any direction but up.

A typical game: The screen clears and the program asks if winds are desired. If the answer is yes, a readout of wind force and direction is provided; otherwise winds are zero.

The game screen has two tanks positioned on either side of a randomly large mountain. The gun barrels appear and flash, signalling the program is ready.

Gun angle is fairly easy to obtain. Each tank's gun moves up and down in response to the joystick. Muzzle velocity is based on previous experience or initially, guessed. Velocity increases as you move the joystick toward the other tank. The center is a good place to start. Once the button is pressed, angle and velocity are set and cannot be changed until your next shot. While the shot is in the air, the gun barrel locks in position and stops flashing.

It is advisable to not move the joystick during a shot to maintain your frame of reference for the next shot. A direct hit explodes the tank, leaving behind a blasted hulk. The program then displays the score and again asks the winds question.

Tank-Gun Dissection

This may be useful to you for writing games of your own. Explosions are common in arcade games. The Play function of Extended Color Basic can produce realistic sounding explosions. A$, as defined in line 160, can be used for large explosions, while B$, defined in line 170, is used for sharp reports such as a gun firing. You only need to insert Play A$, or B$, where you wish the explosion to occur.

Visual explosions are more difficult and should be tailored to each individual game. The explosions in Tank-Gun are different depending on what the projectile hits.

When two shells collide in the air, the result is complete destruction of both. When the

CN—Number of colors
L—Length of color bar
M—Number of notes
Y—Maximum number of note/bars
D—Duration of note
C—Temporary variable
N(Y)—Note/bar array
B(M)—Note-pitch array
I$—Keyboard input: INKEY$
V—Value of I$
I,J,K—Loop variables

Table 2. Poindexter Variable List

F1—If true then left tank has shot in air
X1,Y1—Coordinates of left tank
S1—Score for left tank
A1,V1—Angle and velocity of left tank's shell
T1—Time coordinate of left tank
F2,X2,Y2,S2,V2,A2,T2—Same as above for right tank
XO,YO—Coordinates of the end of left tank's barrel
XT,YT—Coordinates of the end of right tank's barrel
F3—If true then at least one tank destroyed
BT—Fire button: one—both buttons, two—left, three—right
TS—Time step
S—Start time
X4,Y4—Coordinates of left tank shell
XA,YA—Coordinates of right tank shell
TK—Tank graphic array
W—Wind force
C1,C2,K1,K2—Parametric equation constants
LI—Joystick limit: 63
N,M—Coordinates of mountaintop

Table 3. Tank-Gun Variable List

shell hits the mountain, the flash is above ground and cracks are left in the mountain. A direct hit on the tank will partially destroy it. All these effects are produced by the same subroutine.

First a yellow border is drawn around the explosion area. The inside is painted red stopping at the yellow. This destroys blue tanks, but leaves yellow mountains alone. The inside is then painted green, stopping at yellow, and the border is redrawn in green erasing all traces of the explosion except for cracks in the mountain. A short delay must be inserted in order to see the red flash.

The main loop is between lines 450–520. The joysticks are read and the information converted to a usable form. The program then checks flags to see if either tank has a shell in the air. If it does, the shell position is updated and checked for collision; otherwise the gun barrel position is updated.

A flag is then checked to determine if a tank has been destroyed. If at least one tank has been destroyed, the program checks to see if there is still a shell in the air. If there is, the program continues until shot end, otherwise it ends and displays the score.

If the program continues, a branch to a subroutine is made depending on the condition of the joystick buttons. The program then loops back and starts the whole process over.

Standard parametric equations for earth's gravity are used to cause the projectile to fall back to the bottom of the screen. To experiment with the gravity constant, change G in line 360.

Game Writing Tips

Arcade programming is as challenging as it is misunderstood. The only book I recommend is *Principles of Interactive Computer Graphics* by Newman Sproull, published by McGraw-Hill. Beware of books on how to build video games. Most of these are hardware-oriented.

To program arcade games successfully you should have some knowledge of Assembly language, mathematics and physics. Those of you who are already familiar with the basic concepts of microcomputers should obtain a copy of *6809 Assembly Language Programming* by Lance Leventhal, Osborne/McGraw-Hill. Another book I have found useful is the *CRC Standard Mathematical Tables* published by CRC Press.

Not all arcade games require such extensive knowledge. But programs which attempt to simulate portions of the real world must operate by the same natural laws and principles—laws best described in the language of mathematics.

But computers are not limited to reality when it comes to games. Don't wait for someone else to write your favorite game, do it yourself! And when you are finished, don't forget about the rest of us.■

Larry Becker is a research scientist with the Georgia Institute of Technology.

```
100 ' FOR COLOR BASIC
110 ' BY LARRY BECKER
120 'USE LEFT JOYSTICK
130 CLS:INPUT "NUMBER OF BALLS";NB
140 C=4:BC=4  'COLOR, CHANGE TO SUIT
150 FOR I=1 TO 8 'BUILD PADDLE
160 READ D:P$=P$+CHR$(D)
170 NEXT
180 DATA 128,128,172,172,172,172,128,128
190 GOSUB 450 'DRAW BOARD
200 PP=16:SC=0
210 FOR N=1 TO NB
220 IF RND(2)=1 THEN XD=1 ELSE XD=-1
230 BX=5+RND(50):YD=1:BY=17
240 PD=INT(JOYSTK(0)/12.8-2):PP=PP+PD
250 IF PP>25 THEN PP=25 ELSE IF PP<3 THEN PP=3
260 PRINT@ 478+PP,P$;
270 RESET(BX,BY):BX=BX+XD:BY=BY+YD
280 IF BX<6 THEN XD=-XD:BX=6:SOUND 170,1:GOTO 300
290 IF BX>57 THEN XD=-XD:BX=57:SOUND 180,1
300 IF BY<5 THEN YD=1:BY=5:SOUND 190,1
310 IF BY>=29 THEN BY=29:T=BX-PP*2:IF T>=0 AND T<8 THEN YD=-1:SO
UND 200,1:ON T+1 GOSUB 410,410,420,420,430,430,440,440 ELSE 340
320 IF POINT(BX,BY)>0 THEN T=((BX-2) AND 124)+2:SOUND 140,1:FOR
I=T TO T+3:RESET(I,BY):NEXT:YD=-YD:SC=SC+17-BY:PRINT@ 4,"  "SC;:
IF (SC/715)=INT(SC/715) THEN GOSUB 460:BY=6
330 SET(BX,BY,BC):GOTO 240
340 FOR I=1 TO 4:SOUND RND(200)+50,1:NEXT
350 PRINT@ 18,"BALLS";NB-N;
360 NEXT N
370 PRINT@11,"PLAY AGAIN (Y/N)";:INPUT Q$
380 IF Q$<>"N"THEN 190
390 CLS:END
400 'SUBROUTINES
410 XD=-2:RETURN
420 XD=-1:RETURN
430 XD=1:RETURN
440 XD=2:RETURN
450 CLS0 'DRAW BOARD
460 FOR I=4 TO 59
470 SET(I,3,C):SET(I,4,C)
480 FOR J=7 TO 16:SET(I,J,C):NEXT
490 NEXT I
500 FOR I=5 TO 29
510 SET(4,I,C):SET(5,I,C)
520 SET(58,I,C):SET(59,I,C)
530 NEXT I
540 RETURN
```

Program Listing 1. Brickout

Program Listing 2. Poindexter

```
100 '-IN COLOR BASIC-
110 ' BY LARRY BECKER
120 'USE KEYS 1 THROUGH 4
130 CN=4:L=5:M=4:Y=32:D=10
140 DIM N(Y),B(M)
150 CLS0
160 FOR I=1 TO CN
170 READ C
180 FOR J=1 TO L
190 A$(I)=A$(I)+CHR$(C)
200 NEXT J
210 DATA 159,191,223,175
220 NEXT I
230 FOR I =1 TO M:READ B(I):NEXTI
```

Program Listing 2 Continues

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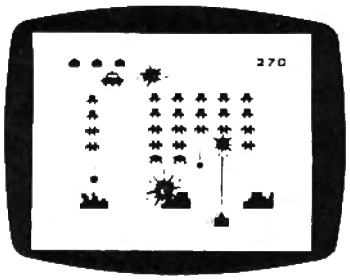

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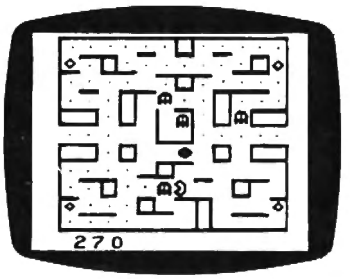

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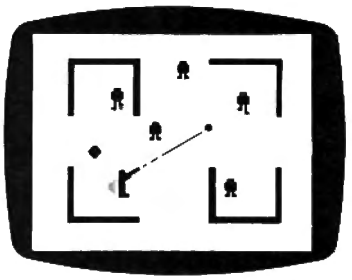

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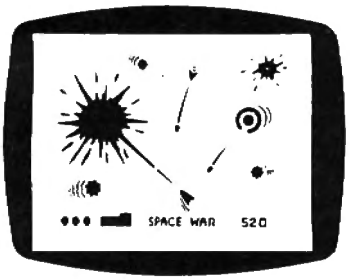

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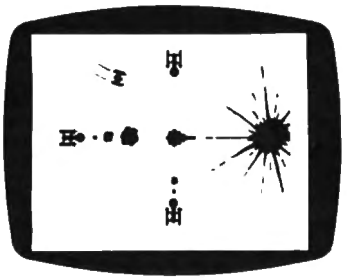

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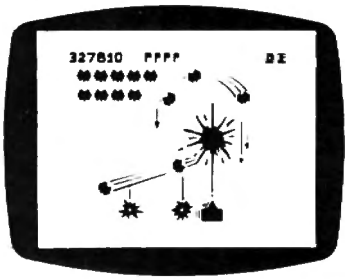

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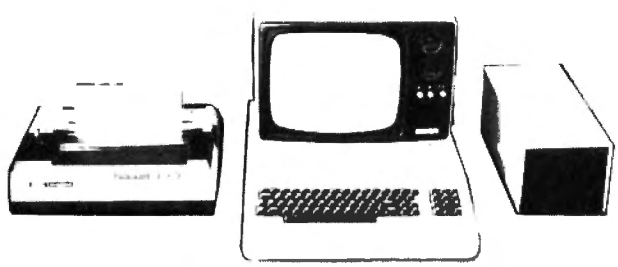

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Program Listing 2 Continued

```
240 DATA 89,133,147,176
250 FOR I=1 TO Y:N(I)=RND(4):NEXT I
260 FOR I=1 TO Y
270 D=D-.5:IF D<1 THEN D=1
280 FOR J=1 TO I
290 PRINT@ 225+6*N(J),N(J);
300 PRINT@ 256+6*N(J),A$(N(J));
310 SOUND B(N(J)),D:CLS0
320 NEXT J
330 FOR J= 1 TO I
340 I$=INKEY$:IF I$="" THEN 340
350 V=VAL(I$)
360 IF V<>N(J) THEN 420
370 PRINT@ 256+6*V,A$(V);
380 SOUND B(V),3:CLS0
390 NEXT J
400 FOR V=1 TO 600:NEXT V
410 NEXT I
420 FOR K=1 TO 3
430 CLS(K):SOUND 5,4
440 NEXT K
450 CLS1
460 PRINT I;" NOTES PLAYED -HIT ANY KEY-"
470 IF INKEY$="" THEN 470
480 RUN
```

```
100 'MATHTALK  -IN EXTENDED COLOR BASIC-
110 ' BY LARRY BECKER
120 DEF FNNUM(C)=(C>=48 AND C<=57) OR C=46
130 CLS:PRINT"HELLO, I AM YOUR SUPER"
140 PRINT"MATHEMATICAL COMPUTER, ASK ME"
150 PRINT"ANY QUESTION INVOLVING 2 NUMBERS"
160 PRINT:INPUT A$
170 IF RIGHT$(A$,1)="?" THEN A$=LEFT$(A$,LEN(A$)-1)
180 D=1:RESTORE
190 READ B$
200 IF B$="STOP" THEN D=D+1:GOTO190
210 IF B$="END" THEN 250
220 GOSUB 510
230 IF P<>0 THEN 280
240 GOTO 190
250 PRINT"I MUST BE DENSE"
260 PRINT"I CAN'T UNDERSTAND YOU."
270 GOTO 160
280 FOR I=P TO 1 STEP-1
290 C=ASC(MID$(A$,I,1))
300 IF FNNUM(C) THEN 330
310 NEXT I
320 GOTO 250
330 FOR J=I TO 1 STEP-1
340 C=ASC(MID$(A$,J,1))
350 IF NOT(FNNUM(C)) THEN 370
360 NEXT J
370 N1=VAL (MID$(A$,J+1,I-J))
380 FOR I=P TO LEN(A$)
390 C=ASC(MID$(A$,I,1))
400 IF FNNUM(C) THEN430
410 NEXT I
420 GOTO 250
430 FOR J=I TO LEN(A$)
440 C=ASC(MID$(A$,J,1))
450 IF NOT(FNNUM(C)) THEN 470
460 NEXT J
470 N2=VAL(MID$(A$,I,J-I))
480 ON D GOSUB 530,540,550,560,570
490 PRINT N1;MID$(A$,P);" IS ";A
500 GOTO 160
510 P=INSTR(A$,B$)
520 RETURN
530 A=N1+N2:RETURN
540 A=N1-N2:RETURN
550 A=N1*N2:RETURN
560 A=N1/N2:RETURN
570 A=N1^N2:RETURN
580 DATA +,PLUS,AND,ADDED TO,STOP
590 DATA -,MINUS,STOP
600 DATA *,TIMES,MULTIPLIED BY,STOP
610 DATA /,DIVIDED BY,OVER,STOP
620 DATA ^,RAISED TO THE,END
```

Program Listing 3. Mathtalk

Program Listing 4. Pixprint

```
100 'GRAPHICS SCREEN PRINT
110 ' BY LARRY D. BECKER
120 'SET LP VII SWITCH TO 8 BIT
130 CLEAR 300,&H3F33
140 M=&H3F33
150 DEF USR1=M
160 READ D$:D=VAL("&H"+D$)
170 IF D=&H100 THEN 190
180 POKE M,D:M=M+1:GOTO 160
190 DATA 10,AE,02,E6,84,34,04,86
200 DATA 80,A7,A0,5A,26,FB,F7,03
210 DATA B2,EE,02,BE,03,B0,86,80
220 DATA 1F,12,C6,01,34,02,A4,A4
230 DATA 35,02,27,0B,F7,03,B2,34
240 DATA 04,EA,C4,E7,C4,35,04,31
250 DATA A8,20,58,C1,80,26,E5,6A
260 DATA E4,27,09,33,41,44,24,D8
270 DATA 30,01,20,D2,35,02,F6,03
280 DATA B2,BD,B4,F4,39
290 DATA 86,7E,B7,01,67,8E,3F,8C
300 DATA BF,01,68,39,34,04,D6,6F
310 DATA C1,FE,35,04,27,0E,10,BE
320 DATA 00,00,10,8C,45,58,26,03
330 DATA 7E,02,73,39,32,62,34,17
340 DATA 1A,50,8D,30,5F,8D,2F,C6
350 DATA 88,34,04,5F,44
360 DATA 59,58,8D,25,35,04,5A,26
370 DATA F3,8D,1C,35,03,81,0D,27
380 DATA 08,0C,9C,D6,9C,D1,9B,25
390 DATA 06,0F,9C,8D,14,8D,12,F6
400 DATA FF,22,54,25,FA,35,94,C6
410 DATA 02,F7,FF,20,8D,00,9E,95
420 DATA 0C,9E,97,7E,A7,D3,100
430 EXEC &H3F88
440 SCREEN 1,0
450 POKE &H3B0,6:POKE &H3B1,0 'TELL GRAPHICS DRIVER WHERE SCREEN
 IS
460 A$=STRING$(255,255)  'SET A$ TO MAX LENGTH
470 'LOOP FOR WHOLE SCREEN
480 FOR SP=&H600 TO &H1DFF-223 STEP 224
490 LB=SP AND &HFF : HB=INT(SP/256)
500 POKE &H3B0,HB:POKE &H3B1,LB
510 'INSERT THE FOLLOWING LINE WHERE YOU WISH TO PRINT SEVEN PIX
EL LINES
520 IF USR1(A$) THEN PRINT #-2,CHR$(18);CHR$(27);CHR$(16);CHR$(0
);CHR$(111);A$;CHR$(26) ELSE PRINT #-2,CHR$(26)
530 NEXT SP
540 END
550 PRINT@ 10,"TANK GUNNER":PRINT
560 PRINT "   LEFT TANK","  RIGHT TANK"
570 PRINT "     SCORE",    "     SCORE":PRINT
580 S1=S1+H1 : S2=S2+H2
590 H1=0:H2=0
600 PRINT TAB(6) S1 TAB(22) S2
610 PRINT:PRINT
620 GOTO 110 'REDRAW BOARD
630 END
640 'EXPLOSION SUBROUTINE
650 D$="BM"+STR$(INT(X3+14))+","+STR$(INT(Y3+19))
660 COLOR 2,1  'YELLOW BOARDER
670 DRAW D$+C$
680 PAINT(X3+14,Y3+6),4,2 'RED
690 FOR I=1 TO 10:NEXT I
700 PAINT(X3+14,Y3+6),1,2 'GREEN
710 COLOR 1,3 'UNDRAW BOARDER
720 DRAW D$+C$
730 COLOR 3,1 'COLOR TO NORMAL
740 PLAY A$
750 RETURN
760 'POSITION TANKS AND DRAW MOUNTAINS
770 X1=RND(30)
780 Y1=191-RND(50)-20
790 PUT (X1,Y1)-(X1+28,Y1+20),TK,PSET  'LEFT TANK
800 X2=RND(30)+197
810 Y2=191-RND(50)-20
820 PUT (X2,Y2)-(X2+28,Y2+20),TK,PSET  'RIGHT TANK
830 DT=X2-X1
840 COLOR 2,1  'YELLOW
850 LINE (0,Y1+20)-(X1+30,Y1+20),PSET
860 LINE (X2-8,Y2+20)-(255,Y2+20),PSET
870 LINE (0,Y1+20)-(0,191),PSET
880 LINE (0,191)-(255,191),PSET
890 LINE (255,Y2+20)-(255,191),PSET
900 M=(Y1+Y2)/2-20-RND(60)
910 N=X1+RND(14)+DT/2
920 'DRAW MOUNTAIN
930 LINE (X1+30,Y1+20)-(N,M),PSET
940 LINE (N,M)-(X2-8,Y2+20),PSET
950 PAINT (N,M+2),2,2 'PAINT IT YELLOW
960 COLOR 3,1
970 RETURN
980 'RIGHT TANK FIRE SUBROUTINE
990 IF F2 THEN RETURN ELSE F2=1
1000 C2=V2*SIN(A2)
1010 C1=V2*COS(A2)+W
1020 PLAY B$
1030 XA=0:YB=0
1040 RETURN
1050 'LEFT TANK FIRE SUBROUTINE
1060 IF F1 THEN RETURN ELSE F1=1
1070 K1=V1*COS(A1)
1080 K2=V1*SIN(A1)
1090 PLAY B$
1100 X4=0:Y4=0
1110 RETURN
1120 'UPDATE LEFT TANK'S FIRE
1130 T1=T1+TS 'INCREASE TIME
1140 IF Y4>0 THEN X5=X4:Y5=Y4
1150 X4=K1*T1+P1:Y4=Q1-(K2*T1-G*T1*T1)
1160 PRESET(X5,Y5)
1170 IF X4>255 THEN F1=FALSE:T1=S:RETURN
1180 IF Y4<0 THEN RETURN
```

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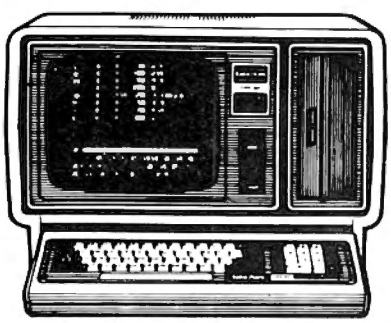

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1190 ON PPOINT(X4,Y4)-1 GOTO 1250,1220,1280
1200 PSET(X4,Y4,4)
1210 RETURN
1220 F1=FALSE:F3=1:T1=S:H1=1
1230 X3=X2:Y3=Y2:GOSUB 640:T1=S
1240 LINE (P2,Q2)-(B2,D2),PRESET:RETURN
1250 F1=FALSE:X3=X4-14:Y3=Y4-10:GOSUB 640:T1=S
1260 PUT (X2,Y2)-(X2+28,Y2+20),TK,PSET
1270 GOTO 1560
1280 X3=X4-14:Y3=Y4-10
1290 GOSUB 640:T1=S:T2=S
1300 F1=FALSE:F2=FALSE:RETURN
1310 'LEFT GUN SUBROUTINE
1320 XO=P1+L*COS(A1)
1330 YO=Q1-L*SIN(A1)
1340 LINE (P1,Q1)-(B1,D1),PRESET:LINE (P1,Q1)-(XO,YO),PSET
1350 B1=XO:D1=YO:RETURN
1360 'UPDATE RIGHT TANK'S FIRE
1370 T2=T2+TS
1380 IF YA>0 AND XA>0 THEN XB=XA:YB=YA
1390 XA=C1*T2+P2:YA=Q2-(C2*T2-G*T2*T2)
1400 PRESET(XB,YB)
1410 IF XA<0 THEN F2=FALSE:T2=S:RETURN
1420 IF YA<0 THEN RETURN
1430 ON PPOINT(XA,YA)-1 GOTO 1490,1460,1520
1440 PSET(XA,YA,4)
1450 RETURN
1460 F2=FALSE:F3=1:T2=S:H2=1
1470 X3=X1:Y3=Y1:GOSUB 640:T2=S
1480 LINE (P1,Q1)-(B1,D1),PRESET:RETURN
1490 F2=FALSE:X3=XA-14:Y3=YA-10:GOSUB 640 :T2=S
1500 PUT (X1,Y1)-(X1+28,Y1+20),TK,PSET
1510 GOTO 1320
1520 X3=XA-14:Y3=YA-10
1530 GOSUB 640:T2=S:T1=S
1540 F1=FALSE:F2=FALSE:RETURN
1550 'RIGHT TANK GUN SUBROUTINE
1560 XT=P2+L*COS(A2)
1570 YT=Q2-L*SIN(A2)
1580 LINE (P2,Q2)-(B2,D2),PRESET:LINE (P2,Q2)-(XT,YT),PSET
1590 B2=XT:D2=YT:RETURN
1600 'BOTH BUTTONS PUSHED
1610 IF F1 AND F2 THEN RETURN
1620 GOSUB 990
1630 GOTO 1060
1640 END 'PROGRAM TANK-GUNNER
```

```
0 'PROGRAM TANK-GUNNER
20 '  BY LARRY BECKER
30 'INSTRUCTIONS FOR TWO PLAYERS :
40 ' USE JOYSTICKS TO DESTROY THE ENEMY TANK
50 ' UP AND DOWN CONTROL THE SHOT ANGLE
60 ' MOVE THE JOYSTICK TOWARD THE TARGET FOR HIGHER MUZZLE VELOC
ITY
70 PMODE 3,1 '128X192
80 PCLEAR 4
90 DIM TK(28,20)
100 CLS
110 INPUT"DO YOU WISH WINDS (Y OR N)";Q$
120 IF Q$="N" THEN W=0 ELSE W=RND(20)-10
130 IF W>0 THEN PRINT "WINDS FROM LEFT AT FORCE";W ELSE PRINT "W
INDS FROM RIGHT AT FORCE";ABS(W)
140 PRINT"WAIT JUST A NANOSECOND, PLEASE"
150 'SET UP EXPLOSION STRINGS
160 A$="L255;O1V31BV30FV29DV28GV27EV25CV23FV21CV19GV17BV15;L210;
O2;D#V13C#V11F#V9DV7AV5BV3EV1G"
170 B$="L200;O1;V31BV28AV24GV20FV16DV10C#V5C"
180 C$="H4G3U3L4E4H4E4U2F4E4D3R4G3F2R3G4F3L3D2L2"
190 PCLS
200 COLOR 3,1
210 'DRAW TANK
220 CIRCLE (6,14),4,3
230 CIRCLE (14,14),4,3
240 CIRCLE (22,14),4,3
250 LINE (6,10)-(22,10),PSET
260 LINE (6,18)-(22,18),PSET
270 CIRCLE (14,10),8,3,1,.5,1
280 PAINT (14,8),3
290 GET (0,0)-(28,20),TK,G
300 PCLS
310 GOSUB 760 'DRAW BOARD
320 SCREEN 1,0
330 'SET CONSTANTS
340 FALSE =0
350 MASK=127:KO=123:LI=63
360 BU=65280:TS=.09:G=16:S=.1  'INCREASE TS TO MOVE POINTS FASTE
R
370 P1=X1+20:P2=X2+8
380 F1=FALSE:F2=FALSE:F3=FALSE
390 Q1=Y1+5:Q2=Y2+5
400 O=70:L=10
410 T1=.1:T2=.1
420 X4=-1:Y4=-1:X5=0:Y5=0
430 B1=P1:B2=P2:D1=Q1:D2=Q2
440 PI=3.14159256:PH=PI/3:M=PI/8:PM=PI-M:LP=LI*PH
450 'MAIN LOOP
460 V2=LI-JOYSTK(0)+O:V1=JOYSTK(2)+O:A2=PM-(LI-JOYSTK(1))/LP
470 A1=(LI-JOYSTK(3))/LP+M:BT=(PEEK(BU) AND MASK) - KO
480 IF F1 THEN GOSUB 1130 ELSE  GOSUB 1320
490 IF F2 THEN GOSUB 1370 ELSE  GOSUB 1560
500 IF F3 THEN IF F1 OR F2 THEN  510 ELSE 530
510 ON BT GOSUB 1610,1060,990
520 GOTO 460  'LOOP BACK
530 FOR I=1 TO 800:NEXT I
540 CLS: SCREEN 0,0
```

Program Listing 5. Tank-Gun

SCM

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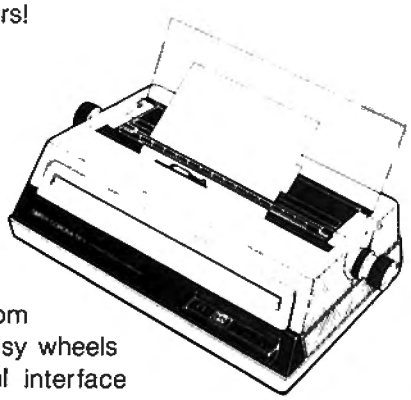

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Birth of a legend.

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A whole new generation of Epson MX printers has just arrived. And while they share the family traits that made Epson famous — like unequalled reliability and ultra-fine printing — they've got a lot more of what it takes to be a legend.

For instance, they've got a few extra type styles. Sixty-six, to be exact, including italics, a handy subscript and superscript for scientific notation, and enough international symbols to print most Western languages.

What's more, on the new-generation MX-80, MX-80 F/T and MX-100, you get GRAFTRAX-Plus dot addressable graphics. Standard. So now you can have precision to rival plotters in a reliable Epson printer. Not to mention true backspace, software printer reset, and programmable form length, horizontal tab and right margin.

All in all, they've got the features that make them destined for stardom. But the best part is that beneath this software bonanza beats the

Uh...three legends.

heart of an Epson. So you still get a bidirectional, logical seeking, disposable print head, crisp, clean, correspondence quality printing, and the kind of reliability that has made Epson the best-selling printers in the world.

All of which should come as no surprise, especially when you look at the family tree. After all, Epson *invented* digital printers almost seventeen years ago for the 1964 Tokyo Olympics. We were the first to make printers as reliable as the family stereo. And we introduced the computer world to correspondence quality printing and disposable print heads. And now we've given birth to the finest printers for small computers on the market.

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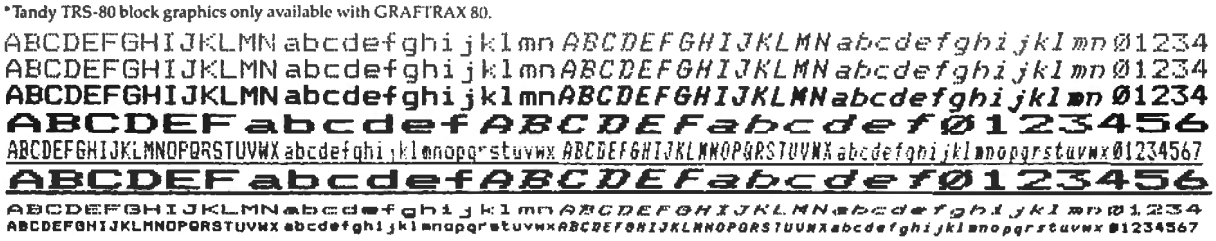
Bidirectional printing	X	X	X	X	X	X
Logical seeking function	X	X	X	X	X	X
Disposable print head	X	X	X	X	X	X
Speed: 80 CPS	X	X	X	X	X	X
Matrix: 9 x 9	X	X	X	X	X	X
Selectable paper feed			X		X	X
PAPER HANDLING FUNCTIONS						
Line spacing to n/216		X		X	X	X
Programmable form length	X	X	X	X	X	X
Programmable horizontal tabs	X	X	X	X	X	X
Skip over perforation			X	X	X	X
PRINT MODES AND CHARACTER FONTS						
96 ASCII characters	X	X	X	X	X	X
Italics character font		X		X	X	X
Special international symbols				X	X	X
Normal, Emphasized, Double-Strike and Double/Emphasized print modes	X	X	X	X	X	X
Subscript/Superscript print mode				X	X	X
Underline mode				X	X	X
10 CPI	X	X	X	X	X	X
5 CPI	X	X	X	X	X	X
17.16 CPI	X	X	X	X	X	X
8.58 CPI	X	X	X	X	X	X
DOT GRAPHICS MODE						
Line drawing graphics				X	X	X
Bit image 60 D.P.I.		X	X	X	X	X
Bit image 120 D.P.I.		X	X	X	X	X
CONTROL FUNCTIONS						
Software printer reset		X		X	X	X
Adjustable right margin			X	X	X	X
True back space		X		X	X	X
INTERFACES						
Standard — Centronics-style 8-bit parallel	X	X	X	X	X	X
Optional — RS-232C current loop w/2K buffer	X	X	X	X	X	X
RS-232C x-on/x-off w/2K buffer	X	X	X	X	X	X
IEEE-488	X	X	X	X	X	X

*Tandy TRS-80 block graphics only available with GRAFTRAX 80.



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All work and no play makes a good machine dull.

Sub Destroy, Model II Style

Patricia Steele
308 Dante
Glenwood, IL 60425

The Model II is not an all-work-no-play machine. Game playing is an enjoyable diversion from business tasks. We Model II users are not adverse to dropping a few depth charges on enemy submarines.

Imagine my dismay after keying in page after page of Leo Christopherson's "Android Nim," hitting Enter and seeing my screen display just a big splat. In all my years working on IBM mainframes, I never experienced such total failure. I thought this micro was going to be a piece of cake; instead, my computer spit crumbs at me. To give credit where credit is due, Mr. Christopherson taught me Level II Basic for my Model II. The game is now playable, but the Androids are still a mess.

In the June 1981 issue of *80 Micro* was a Sub-Destroy program written by John Cominio, in Level II Basic. I modified John's program for the Model II.

The Program

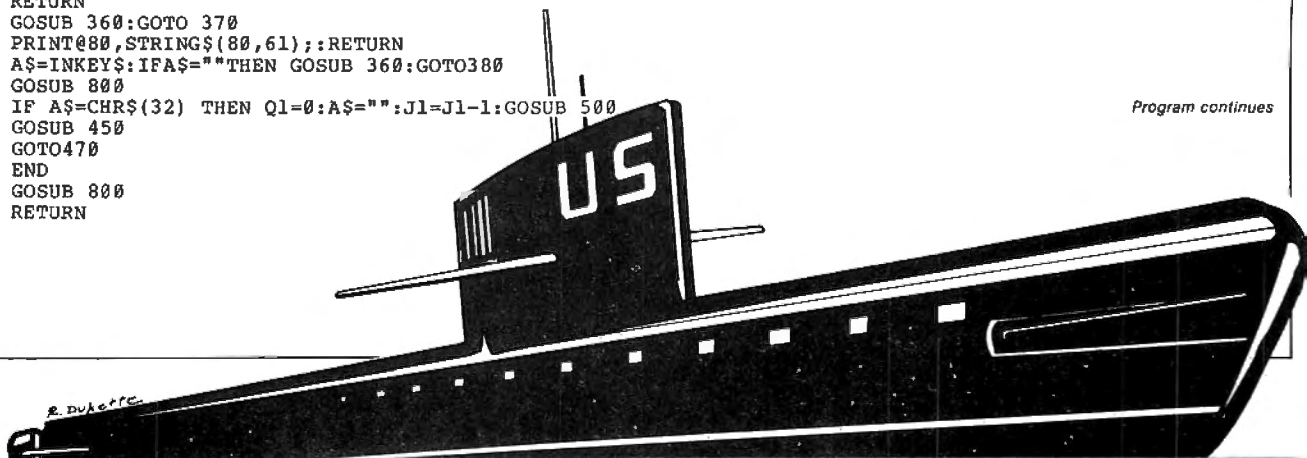
Lines 280-330 take the place of lines 180-230 of Mr. Cominio's program. The CHR$s between the two Basic languages are quite different. The subs and destroyer will also look different. The PRINT@ and value of Q had to be changed to coincide with the Model IIs screen print positions. ■

Patricia has worked with mainframe computers as a systems programmer for the last 15 years.

Program Listing

```
120 CLEAR 400
130 DEFINTA-A
140 RANDOM
150 CLS
160 PRINTTAB(15)"--------S U B  D E S T R O Y--------- ":PRINT:PRINT"DO YOU WANT
 INSTRUCTION (Y/N) ?"
170 R$=INKEY$:IF R$=""THEN 170
180 IF R$="Y" THEN 1000ELSE IF R$="N"THEN CLS:GOTO 190ELSE 170
190 Q=80:J1=20
200 GOSUB 210:GOTO350
210 E1$=STRING$(4,160)
220 E2$=STRING$(6,160)
230 A=RND(290):S=A+RND(250)
240 Z=RND(1220):IFZ>1220 OR Z < 420 THEN 230
250 IF Z+A > 1760 OR Z+A < 640 THEN 230
260 IF Z+A+S > 1760 OR Z+A+S < 960 THEN 230
270 X=960
280 L$=STRING$(79,172)
290 B2$=CHR$(160)+CHR$(153)+CHR$(158)+CHR$(158)+CHR$(153)+CHR$(153)
300 E$=STRING$(79,160)
310 B$=CHR$(153)+CHR$(133)+CHR$(135)+CHR$(153)
320 B1$=CHR$(153)+CHR$(153)+CHR$(135)+CHR$(153)
330 S$=CHR$(153)+CHR$(158)+CHR$(158)+CHR$(158)+CHR$(153)+CHR$(153)+CHR$(153)
340 RETURN
350 GOSUB 360:GOTO 370
360 PRINT@80,STRING$(80,61);:RETURN
370 A$=INKEY$:IFA$=""THEN GOSUB 360:GOTO380
380 GOSUB 800
390 IF A$=CHR$(32) THEN Q1=0:A$="":J1=J1-1:GOSUB 500
400 GOSUB 450
410 GOTO470
420 END
430 GOSUB 800
440 RETURN
```

Program continues



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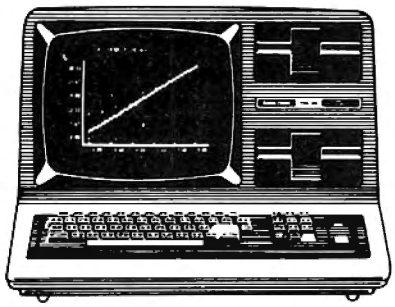

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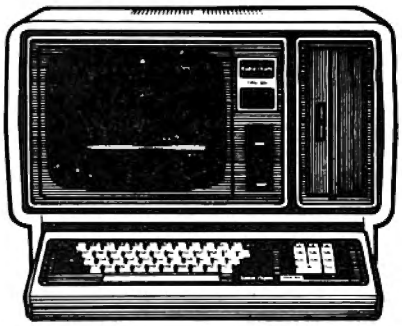

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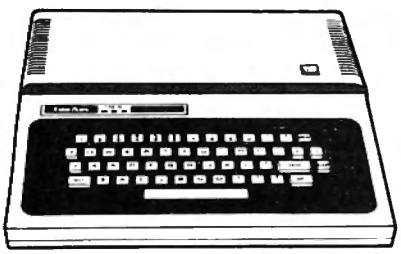

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Program continued

```
450 IF Q>153 THEN Q=80:PRINT@73,"        ";
460 GOSUB 750
470 GOSUB 570
480 PRINT@Q-80,E2$;:PRINT@Q-79,S$;:Q=Q+1:GOTO 370
490 GOTO750
500 IF Q+Q1+80 >X THEN PRINT@Q+Q1+80,"****";:PRINT@Q+Q1-1,CHR$(32);:FOR R= 1 TO
10:NEXT R:PRINT@Q+Q1+80,"    ";:RETURN ELSE 510
510 GOSUB 360:PRINT@Q+Q1+80,CHR$(170);
520 GOSUB 570
530 IF Q+Q1+80 >= Z+S+A+1 AND  Q+Q1+80 < Z+S+A+12  THEN J=J+30: FOR P = 1 TO 10:
PRINT@Q+Q1+80,"****GLUG";:NEXT P: GOSUB 760:GOTO 560
540 IF Q+Q1+80 >=Z+A AND Q+Q1+80 < Z+A+8 THEN J=J+10:FOR P=1 TO 10:PRINT@Q+Q1+80
,"****GLUG";:NEXT P:GOSUB 760:GOTO 560
550 IF Q+Q1+80 >=Z+1 AND Q+Q1+80 < Z+8 THEN J=J+5:FOR P=1 TO 10:PRINT@Q+Q1+80,"*
***GLUG";:NEXT P:GOSUB 760
560 PRINT@Q+Q1+80,CHR$(170):PRINT@Q+Q1-1,CHR$(32):Q1=Q1+81:GOTO 500
570 PRINT@Z+4,B$;:Z=Z+1:GOSUB 430
580 PRINT@Z-1,E1$;
590 IF Z+A+S>1760  THENGOSUB 650
600 PRINT@Z+S+A+6,B2$;:S=S+1:GOSUB430
610 PRINT@Z+S+A-1,E2$;
620 PRINT@Z+A+4,B1$;:A=A+1:GOSUB 430
630 PRINT@Z+A-1,E1$;
640 RETURN
650 PRINT@1680,STRING$(160,160);
660 PRINT @Z+3,"    ";
670 PRINT @Z+A+2,"    ";
680 PRINT@Q+Q1+80,"  ";
690 Z=0:A=0:S=0:Z=RND(1220):IF Z > 1220 OR Z < 420 THEN 690
700 A=RND(290):S=RND(250)
710 IF Z+A > 1760 OR Z+A < 640 THEN 690
720 IF Z+A+S > 1760 OR Z+A+S < 960 THEN 700
730 RETURN
740 Q1 = 0:Z2=0:Z1=0:Z4=0:A$="":GOSUB 750:FOR T = 1 TO 1000:NEXT:GOTO 380
750 PRINT@160,"SCORE=";J;:PRINT@174,"CHARGES LEFT=";J1;
760 IF J1 = 0 THEN 780ELSE RETURN
770 Q1=0:RESUME 370
780 GOTO 880
790 GOTO 790
800 IF A$=CHR$(30)THEN 810ELSE 840
810 IF X <= 400 THEN X = X + 80
820 X= X-80:PRINT@ X,L$;:FOR R = 1 TO 5: NEXT R:PRINT@X,E$;
830 A$="":RETURN
840 IF A$=CHR$(31) THEN 850ELSE RETURN
850 IF X >= 1760 THEN X = X - 80
860 X = X + 80:PRINT@X,L$;:FOR R = 1 TO 5:NEXT R:PRINT@ X,E$;
870 A$="":RETURN
880 CLS
890 IF J<35 THEN PRINT@ 0,"THE GAME IS OVER. YOU HAD ";J+JA;"TOTAL POINTS.";:GOT
O 1230ELSE 900
900 IF J > 34 AND J <= 150 THEN J1 = 2
910 IF J>150 AND J<=200 THEN J1 = 6
920 IF J>200 AND J<= 300 THEN J1 = 9
930 IF J>300 AND J<= 500 THEN J1=14
940 IF J>500 THEN J1 = 20
950 PRINT@0,"THE GAME IS OVER, BUT YOU ARE LUCKY."
960 PRINT"YOUR SCORE WAS";J;"AND THAT ENTITLES YOU TO";J1;"BONUS";
970 PRINT " MISSLES."
980 PRINT "CREDIT GAME WILL RESUME WHEN THE TIMER REACHES ZERO."
990 FOR R = 1000 TO 0 STEP-1:PRINT@640,R;:NEXT:CLS:Q=80:JA=J:J=0:A$ = "":GOTO 21
0
1000 CLS:PRINTTAB(10)"*********** S U B  D E S T R O Y ***********"
1010 PRINT:PRINTTAB(5)"THE OBJECT OF THE GAME IS TO TRY AND SINK THE SUBMARINES"
1020 PRINT"TRAVELING BELOW YOU. YOU CAN ACCOMPLISH THIS BY DROPPING DEPTH"
1030 PRINT"CHARGES FROM YOUR DESTROYER SHIP CRUSING AT THE SURFACE OF THE"
1040 PRINT"OCEAN. YOU MUST SET THE LEVEL WHERE YOU WANT THE DEPTH CHARGE"
1050 PRINT"TO EXPLODE. TO DO THIS YOU POSITION A WHITE LINE AT THE PROPER"
1060 PRINT "DEPTH. TO MOVE THE LINE YOU MAY USE THE UP ARROW  OR THE"
1070 PRINT"DOWN ARROW .";
1080 PRINT " TO DROP YOUR CHARGES JUST PRESS THE SPACE BAR."
1090 PRINTTAB(5)"SCORING IS AS FOLLOWS:"
1100 PRINTTAB(10)"30 POINTS FOR THE LARGE SUBMARINE"
1110 PRINTTAB(10)"10 POINTS FOR THE SMALLER SUBMARINE"
1120 PRINTTAB(10)" 5 POINTS FOR THE SLOWEST SUBMARINE"
1130 PRINTTAB(5)"IF YOU SCORE WELL ENOUGH YOU WILL RECEIVE BONUS CHARGES."
1140 PRINTTAB(10)"POINTS  35 - 150 =  2 BONUS CHARGES."
1150 PRINTTAB(10)"POINTS 155 - 200 =  6 "
1160 PRINTTAB(10)"POINTS 205 - 300 =  9 "
1170 PRINTTAB(10)"POINTS 305 - 500 = 14 "
1180 PRINTTAB(10)"POINTS OVER  500 = 20 "
1190 PRINTTAB(10)"HIGHEST SCORE POSSIBLE IS 600"
1200 PRINT "THE HIGHER YOU SCORE THE MORE BONUS CHARGES YOU WILL RECEIVE. REMEMB
ER YOU HAVE 20 CHARGES TO START WITH. PRESS ENTER.";
1210 R$=INKEY$:IF R$=""THEN 1210
1220 IF R$=CHR$(13)THEN CLS: GOTO 190:60 ELSE 1210
1230 END
```

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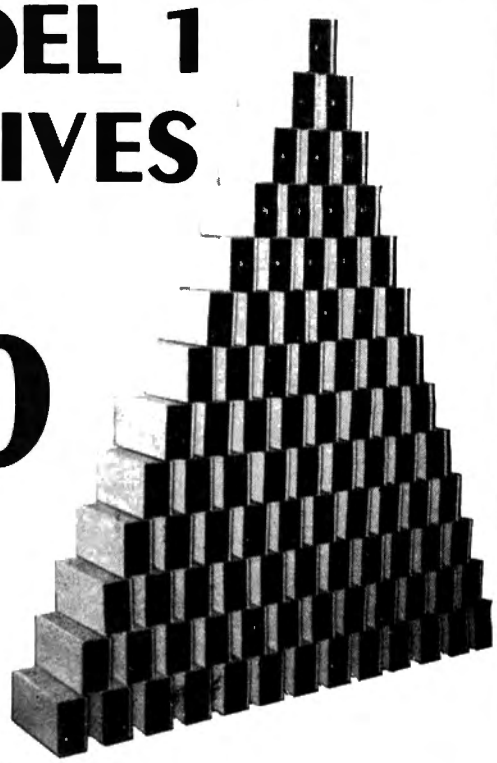

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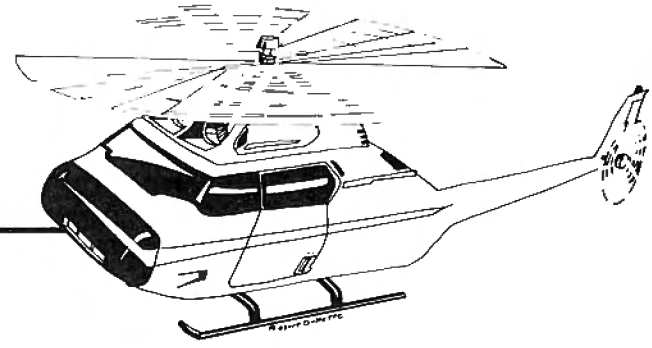

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Subs 'n Choppers

Charles and Glenn Gillen
American Embassy, Seoul
APO San Francisco 96301

A single helicopter patrols a lonely, distant quadrant of the sea. A periscope breaks the surface, then disappears in a froth of bubbles. The chopper darts to the attack.

The periscope reappears. The pilot climbs, hovers over his target, and fires, sending a bomb hurtling down. Missed. As the sub begins to move, the pilot corrects his aim. His next bomb narrowly misses the periscope. The sub retaliates: a sea-to-air missile (SAM) climbs toward the chopper and explodes. Shaken, the pilot knows his chopper will not survive another close hit. He squints and tries to send his next bomb right on the periscope.

Thus begins this real-time animated game pitting a lone helicopter against a pack of submarines. Do not dismiss the reference to the pilot's joystick as a flight of fancy—you actually fly this chopper with the Alpha Product Company's Stick 80 joystick. Without any changes, the program works just as well with the arrow keys. A machine-language sound routine is tucked away in reserved RAM and needs no memory size setting.

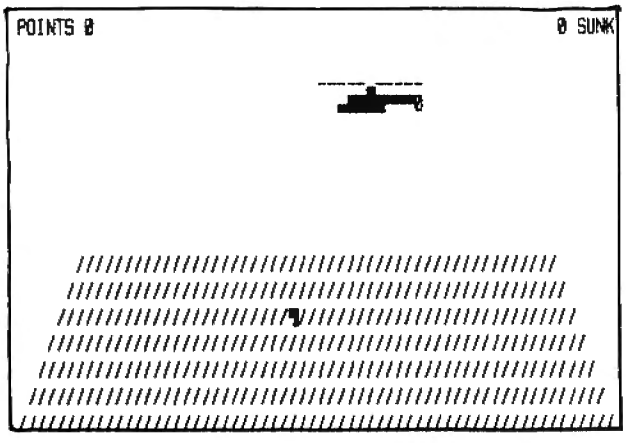

Fig. 1. Game begins with chopper hovering above sub's periscope

E$	Used to erase chopper
F$	Graphic front view of chopper
HH$	Prints F$, L$ or R$ graphics
L$	Graphic chopper going left
R$	Graphic chopper going right
SB$	Graphic sub in profile
S1$	Graphic tail of sinking sub
S2$	Graphic body of sinking sub
T$	Graphic chopper rotor
TI$	Program title
X1$	Top line of graphic blast
X2$	Middle line of blast
X3$	Bottom line of blast

Table 1. String Variables

Rules and Scoring

Position yourself over the sub, drop your bomb and cross your fingers. The sub moves a bit after each attack, disappearing if you fail to nail it after five bombs. Another will pop up and you will have to grab your joystick and take after it anew. The subs are not defenseless—a near miss persuades the sub captain to fire a SAM. His second missile will get you. I guarantee it.

Besides earning a brush with destruction, each near miss gets you 30 points. If you hit the sub squarely, it will up-end and sink as you chalk up 100 points. Your

Program Listing 1

```
0 '        Listing Number ONE   ( Vertical bombs & SAMs )
1 '
10 '       *************************      CHARLES E. GILLEN
20 '       **  SUBS 'N CHOPPERS   **      AMERICAN  EMBASSY
30 '       **    28 NOV, 1981     **      APO SAN FRANCISCO
40 '       *************************           96301
50 '       ALL REMS CAN BE DELETED.
60 '
- - - - - - - - MACHINE LANGUAGE SOUND ROUTINE BELOW BASIC RAM:
70 CLS :POKE 16527, 64 :POKE 16526, 62 ' USR ADDRESS 16446
80 FOR A = 16446 TO 16474 :READ D :POKE A, D :NEXT ' POKE SOUND
90 DATA 205, 127, 10, 62, 1, 14, 0, 237, 91, 61, 64, 69, 47
100 DATA 230, 3, 179, 211, 255, 13, 40, 4, 16, 246, 24, 242
110 DATA 37, 32, 241, 201
120 '
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - INITIALIZATION:
130 CLEAR300 :DEFINT A - Z :RANDOM
140 POKE 16396, 165 ' DISABLE <BREAK>.  SHIFT+<BREAK> IS OK.
150 TITLE$ = "S U B S   'N   C H O P P E R S"
160 '
- - - - - - - - - - - - - -GRAPHIC STRINGS FOR 3 VIEWS OF CHOPPER:
170 T$ = STRING$(5,95) + CHR$(176) + STRING$(5,95) + CHR$(26) ' TOP LINE OF
 CHOPPER
180 L$ = T$ + STRING$(9,8) + CHR$(140) + STRING$(4,143) + STRING$(3,131) +
"8" ' CHOPPER GOING LEFT
```

Program Listing 1 Continues

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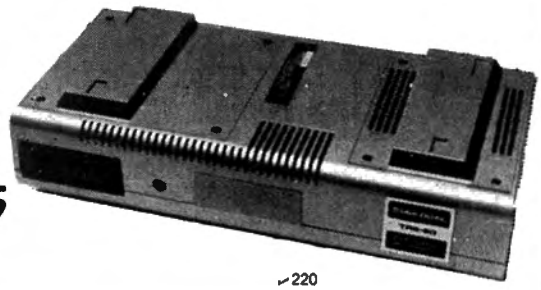

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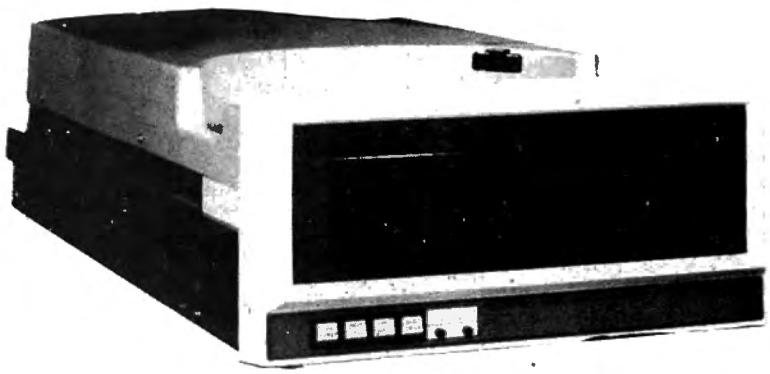

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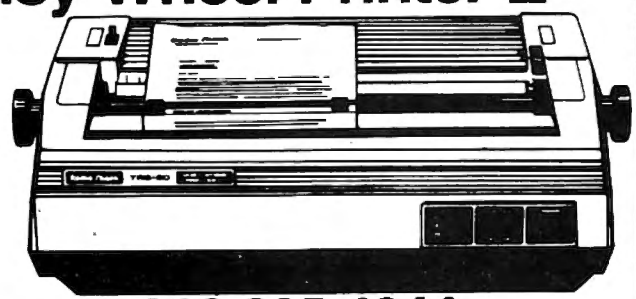

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Program Listing 1 Continued

```
190 R$ = T$ + STRING$(11,8) + "0" + STRING$(3,131) + STRING$(4,143) + CHR$(
140) ' CHOPPER GOING RIGHT
200 P$ = T$ + STRING$(7,8) + CHR$(142) + CHR$(143) + CHR$(141) ' CHOPPER GO
ING UP/DOWN
210 E$ = CHR$(203) + CHR$(26) + STRING$(11,8) + CHR$(203) ' THIS ERASES THE
 CHOPPER
220 '
- - - - - - - - - - - - - - - - - - - - - - - - - -SUB GRAPHICS:
230 S1$ = CHR$(130) + CHR$(185) + CHR$(147) ' SUB PINS
240 S2$ = CHR$(186) + STRING$(2, 191) ' SUB BODY
250 SB$ = STRING$(3,176) + CHR$(190) + CHR$(188) + STRING$(4,176) ' SUB PRO
FILE
260 '
- - - - - - - - - - - - - - - - - - - - - - -BLAST CHOPPER GRAPHIC:
270 X1$ = CHR$(131) + CHR$(140) + CHR$(176) + CHR$(140) + CHR$(131) + CHR$(
140) + CHR$(176) + CHR$(140) + CHR$(131) + " "
280 X2$ = CHR$(140) + CHR$(179) + "    " + CHR$(179) + CHR$(140)
290 X3$ = CHR$(176) + CHR$(140) + CHR$(131) + CHR$(140) + CHR$(176) + CHR$(
140) + CHR$(131) + CHR$(140) + CHR$(176)
300 '
- - - - - - - - - - - - - - - - - - - -
```

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Program Listing 1 Continued

```
1130 NEXT :GOSUB 1420 ' BLANK THE SKY
1140 PRINT @ JJ, X1$; :PRINT @ JJ + 64, X3$; :FOR TD = 1 TO 300 :NEXT
1150 GOSUB 1420
1160 HT = HT + 1 :IF HT < 2 THEN PRINT @ JJ, HH$; :RETURN ' ON SECOND HIT,
KILL CHOPPER:
1170 '
- - - - - - - - - - - - - - - - - - - - - - - - -KILL THE CHOPPER:
1180 PRINT @ JJ + 64, X3$; ' BOTTOM LINE OF BLAST
1190 PRINT @ JJ, X2$; ' MIDDLE OF BLAST
1200 IF JJ > 64  THEN PRINT @ JJ - 64, X1$; ' TOP OF BLAST
1210 FOR TD = 1 TO 150 :SE = USR(506) :NEXT
1220 GOSUB 1420 ' BLANK SKY
1230 PRINT @ 276,"THE SUB WON THIS TIME";
1240 PRINT @ SP - 64, CHR$(176); :PRINT @ SP - 3, SB$; '
1250 FOR TD = 1 TO 2000 :NEXT
1260 CLS :WI = 0 :PT = 0 :GOTO 330 ' ZERO SCORE AND TRY AGAIN
1270 '
- - - - - - - - - - - - - - - - - - - - - - - - -SINK THE SUB:
1280 GOSUB 800 ' GET SEA
1290 PRINT @ SP - 65, S1$; :PRINT @ SP - 1, S2$; ' SINK SUB
1300 FOR SG = 3333 TO 3600 STEP 30 :SE = USR(SG) :NEXT ' SINK GURGLE
1310 PRINT @ SP - 1, S1$; ' THERE SHE GOES
1320 IF SP > 640 THEN PRINT @ SP - 65, "///"; ELSE PRINT @ SP - 65, "   ";
1330 FOR TD = 1 TO 500 : NEXT ' REST IN PEACE
1340 FOR TD = 1 TO 3
1350     GOSUB 800 ' RIPPLE THE SEA
1360 NEXT
1370 IF WI > 4 THEN 1660 ' VICTORY
1380 PRINT @ SP - 1, "///";
1390 GOSUB 850 ' GET NEW SUB
1400 GOTO 370 ' BEGIN CONTROL LOOP
1410 '
- - - - - - - - - - - - - - - - - - - - - - - - - ERASE THE SKY:
1420 PRINT @ 0, ; ' BEGIN BLANKING HERE
1430 FOR TD = 1 TO 9
1440     PRINT CHR$(254);
1450 NEXT :RETURN
1460 '
- - - - - - - - - - - - - - - - - - - - - - - - -UPDATE SCORE:
1470 PRINT @ 0, "POINTS" PT; :PRINT @ 55, WI "SUNK"; :RETURN
1480 '
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - TITLE:
1490 GOSUB 800 ' GET SEA
1500 PRINT @ 16, TITLE$
1510 GOSUB 850 ' GET SUB
1520 FOR SG = 3333 TO 3600 STEP 20
1530     PRINT @ SP + RND(3) - 2, "O"; ' BUBBLES
1540     SE = USR(SG) ' GURGLE
1550 NEXT
1560 CLS :PRINT @ 16, TITLE$
1570 PRINT @ 192, "STICK IT TO THE    " SB$
```

Program Listing 1 Continues

tour of sub-patrol duty ends if you sink five subs (or earn 600 points) before getting blasted out of the sky. If you do get hit by a sub's second SAM missile, the sub will surface to mock you and the game begins anew.

Winning depends on your reflexes and good aim. There is some random action in the program, but only to simulate the chopper's hovering against the chill sea wind, and to control the position and movements of the target sub.

Almost 3-D

The game's genesis was an attempt at portraying three-dimensional action on the TRS-80 video screen. The quadrant of sea you patrol seems to recede toward the horizon. You can fly left or right, and into or out of the screen. The forward joystick or the up arrow moves your chopper In (down) toward the horizon. Try to imagine your controls moving the chopper in an X-Y plane over the sea, rather than changing its altitude. The

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chopper, however, does not get smaller as it nears the horizon. I admit the three-dimensional idea is still largely in the imagination.

The Programs

Subs 'n Choppers is presented here in two forms with slightly different action. Program Listing 1 consists mostly of single statement lines, with abundant remarks. Besides making the program easier to understand, the extra spaces make it easier to type without mistakes. The Listing 1 version drops the bombs straight down, and launches the sub's SAMs vertically.

Program Listing 2 is the same program boiled down to a minimum of memory space. No features were sacrificed in the process. In fact, the game is a bit harder because the bombs fall in a slant trajectory. SAMs fired by the sub climb at an angle, adding a bit more realism. Listing 2 required limiting the chopper's flight path to prevent dropping bombs off the screen. The speed of the two listings is essentially the same. The short listing's only savings are reduced CLOAD time and RAM storage.

The variables used are listed in Tables 1 and 2. The improved action in Listing 2 requires only one new variable, PB, to angle the path of the bomb left or right depending on the chopper's direction. ■

A1	Chopper's bomb release point
A2	Bomb impact point
B	Number of bombs
DT	Counter or time delay
HV	Switch for random hover
JJ	Position to print chopper
JS	Joystick input
KB	PEEK keyboard arrow keys
L	Line chopper is located
M	Chopper position on line L
PB	Bomb drop angle (Listing 2 only)
PT	Points scored
SB	CHR$ code for periscope
SE	Sound effect USR call
SG	Sound effect USR call
SP	Sub print location
SX	Sub's horizontal position
SY	Sub's vertical position
TD	Counter or time delay
WI	Number of subs sunk
X	Counter
Z	Counter

Table 2. Numeric Variables

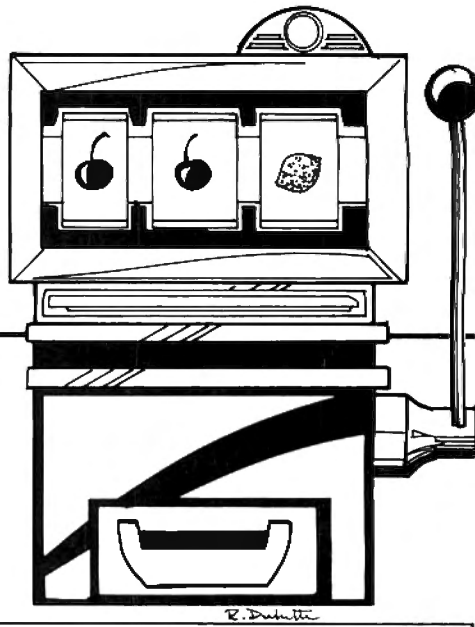
Program Listing 1 Continued

```
1580 PRINT :PRINT "WITH YOUR 'STICK 80' JOYSTICK
1590 PRINT "MADE BY THE ALPHA PRODUCT COMPANY" :PRINT TAB(50) L$
1600 PRINT @ 512, "OR USE THE PLAIN OLD ARROW KEYS AND SPACEBAR
1610 PRINT :PRINT "FOR SOUND, PLUG THE AUX CABLE
1620 PRINT "INTO A SMALL AMPLIFIER" :PRINT :PRINT TAB(11) S1$
1630 PRINT "SINK FIVE  "S2$"  (OR GAIN 600 POINTS) TO WIN THE GAME";
1640 FOR TD = 1 TO 55 :SE=USR(276) :FOR DT = 1 TO 170 :NEXT :NEXTTD :CLS :R
ETURN
1650 '
- - - - - - - - - - - - - - - - - - - - - - - - - -VICTORY ENDING:
1660 CLS :PRINT @ 80, TITLE$
1670 GOSUB 800 ' GET SEA
1680 PRINT @ 199,L$ "  YOU SANK"WI"SUBMARINES
1690 PRINT @ 404, "AND SCORED"PT"POINTS  "R$
1700 PRINT @ 715, ; :FOR X = 1 TO WI ' # OF SUNK SUBS TO PRINT
1710     PRINT S1$ "//////";
1720 NEXT
1730 PRINT @ 779, ;
1740 FOR X = 1 TO WI
1750     PRINT S2$ "//////";
1760 NEXT :PRINT @ 978, " < ENTER > FOR NEW GAME ";
1770 IF INKEY$ <> CHR$(13) THEN SE = USR(2570) :GOTO 1770
1780 WI = 0 :PT = 0 ' ZERO THE SCORES
1790 CLS :GOTO 340 ' START OVER
```

```
0 '
Listing Number TWO  ( Diagonal bombs & SAMs )
1 '
10 '      ************************    CHARLES E. GILLEN
20 '      **  SUBS 'N CHOPPERS  **    AMERICAN  EMBASSY
30 '      **    29 NOV, 1981    **    APO SAN FRANCISCO
40 '      ************************        96301
50 '
70 CLS:POKE16527,64:POKE16526,62:FORA=16446TO16474:READD:POKEA,D:NEXT:DATA2
05,127,10,62,1,14,0,237,91,61,64,69,47,230,3,179,211,255,13,40,4,16,246,24,
242,37,32,241,201:CLEAR300:DEFINTA-Z:RANDOM:POKE16396,165:TI$="S U B S   'N
   C H O P P E R S"
170 T$=STRING$(5,95)+CHR$(176)+STRING$(5,95)+CHR$(26):L$=T$+STRING$(9,8)+CH
R$(140)+STRING$(4,143)+STRING$(3,131)+"@":R$=T$+STRING$(11,8)+"@"+STRING$(3
,131)+STRING$(4,143)+CHR$(140):F$=T$+STRING$(7,8)+CHR$(142)+CHR$(143)+CHR$(
141)
210 E$=CHR$(203)+CHR$(26)+STRING$(11,8)+CHR$(203):S1$=CHR$(130)+CHR$(185)+C
HR$(147):S2$=CHR$(186)+STRING$(2,191):SB$=STRING$(3,176)+CHR$(190)+CHR$(188
)+STRING$(4,176)
270 X1$=CHR$(131)+CHR$(140)+CHR$(176)+CHR$(140)+CHR$(131)+CHR$(140)+CHR$(17
6)+CHR$(140)+CHR$(131)+"  ":X2$=CHR$(140)+CHR$(179)+"      "+CHR$(179)+CHR$(1
40)
290 X3$=CHR$(176)+CHR$(140)+CHR$(131)+CHR$(140)+CHR$(176)+CHR$(140)+CHR$(13
1)+CHR$(140)+CHR$(176):SB=135:HH$=L$:M=30:L=4:PB=63:GOSUB1490
330 GOSUB800:JJ=L*64+M:PRINT@JJ,HH$;:GOSUB850
370 PRINT@0,"POINTS"PT;:PRINT@55,WI"SUNK";:IFB<1THENGOSUB850:GOTO370ELSEIFP
T>599THEN1660ELSEJS=255-INP(0):KB=PEEK(14400)
420 IFJS=1ORKB=8THENL=L+1:HH$=F$:PB=64:GOTO490ELSEIFJS=2ORKB=16THENL=L-1:HH
$=F$:PB=64:GOTO490ELSEIFJS=4ORKB=32THENM=M-RND(4):HH$=L$:PB=63:GOTO490ELSEI
FJS=8ORKB=64THENM=M+RND(4):HH$=R$:PB=65:GOTO490ELSEIFJS=3ORKB=128THEN590
470 IFJS=0ORKB=0THENSE=USR(257):M=M+RND(3)-2
490 PRINT@JJ,E$;:IFM<=8THENM=8:HH$=R$:PB=65ELSEIFM>=43THENM=43:HH$=L$:PB=63

520 IFL<=0THENL=0ELSEIFL>=6THENL=6
530 JJ=L*64+M:PRINT@JJ,HH$;:SE=USR(276):IFHV=1THENRETURNELSE370
590 B=B-1:A1=JJ+133:A2=A1+(-L*2+13)*PB:FORZ=A1TOA2STEPPB:PRINT@Z,CHR$(140);
:SE=USR(200+Z):IFZ>576THENPRINT@Z,"/";ELSEPRINT@Z," ";
650 NEXT:PRINT@A2," * ";:FORTD=1TOL:SE=USR(A2*3):NEXT:PRINT@A2,"///";:IFA2=
SPTHENPT=PT+100:WI=WI+1:GOSUB1470:GOTO1280ELSEIFA2=SP+1ORA2=SP-1THENPT=PT+3
0:GOSUB1470:GOSUB1050:GOSUB800
730 IFHH$=L$THENSP=SP+RND(2):SB=135:GOTO770ELSEIFHH$=R$THENSP=SP-RND(2):SB=
139:GOTO770ELSEIFHH$=F$THENPRINT@SP,"/";:SP=SP+64
760 IFSP>1000THENSP=SP-128
770 PRINT@SP-2,"//"CHR$(SB)"//";:GOTO370
800 PRINT@576,;:FORX=6TO1STEP-1:PRINTSTRING$(X,32)STRING$(62-X*2,"/")STRING
$(X,32):NEXT:PRINTSTRING$(62,"/");:RETURN
850 SX=14+RND(39):GOSUB800:SY=8+RND(7):GOSUB800:SP=SX+SY*64:HV=1:FORTD=1TO4
:GOSUB800:SE=USR(257):L=L+RND(3)-2:GOSUB490:FORDT=1TO40:NEXT:NEXT:HV=0
990 PRINT@SP,CHR$(140);:SE=USR(9999):FORTD=1TO200:NEXT:PRINT@SP,CHR$(135);:
SE=USR(6666):FORTD=1TO200:NEXT:PRINT@SP,CHR$(139);:SE=USR(3333):FORTD=1TO20
0:NEXT:HT=0:B=5:RETURN
1050 FORZ=SPTOJJ+64STEP-PB:PRINT@Z,CHR$(145);:SE=USR(200+Z):IFZ>576THENPRIN
T@Z,"/";ELSEPRINT@Z," ";
1090 NEXT:PRINT@SP,CHR$(SB)"///";:FORSS=1TO3:FORTD=1TO5:SE=USR(506):NEXT:NE
XT:GOSUB1420
1140 PRINT@JJ,X1$;:PRINT@JJ+64,X3$;:FORTD=1TO300:NEXT:GOSUB1420:HT=HT+1:IFH
T<2THENPRINT@JJ,HH$;:RETURNELSEPRINT@JJ+64,X3$;:PRINT@JJ,X2$;:IFJJ>64THENPR
INT@JJ-64,X1$;
1210 FORTD=1TO150:SE=USR(506):NEXT:GOSUB1420:PRINT@276,"THE SUB WON THIS TI
ME";:PRINT@SP-64,CHR$(176);:PRINT@SP-3,SB$;:FORTD=1TO2000:NEXT:CLS:WI=0:PT=
0:GOTO330
1280 GOSUB800:PRINT@SP-65,S1$;:PRINT@SP-1,S2$;:FORSG=3333TO3600STEP30:SE=US
R(SG):NEXT:PRINT@SP-1,S1$;:IFSP>640THENPRINT@SP-65,"///";ELSEPRINT@SP-65,"
  ";
1330 FORTD=1TO500:NEXT:FORTD=1TO3:GOSUB800:NEXT:IFWI>4THEN1660ELSEPRINT@SP-
1,"///";:GOSUB850:GOTO370
1420 PRINT@0,;:FORTD=1TO9:PRINTCHR$(254);:NEXT:RETURN
1470 PRINT@0,"POINTS"PT;:PRINT@55,WI"SUNK";:RETURN
1490 GOSUB800:PRINT@16,TI$:GOSUB850:FORSG=3333TO3600STEP20:PRINT@SP+RND(3)-
2,"O";:SE=USR(SG):NEXT:CLS:PRINT@16,TI$:PRINT@192,"STICK IT TO THE    "SB$:
PRINT:PRINT"WITH YOUR 'STICK 80' JOYSTICK
1590 PRINT"MADE BY THE ALPHA PRODUCT COMPANY":PRINTTAB(50)L$:PRINT@512,"OR
USE THE PLAIN OLD ARROW KEYS AND SPACEBAR":PRINT:PRINT"FOR SOUND, PLUG THE
AUX CABLE":PRINT"INTO A SMALL AMPLIFIER":PRINT:PRINTTAB(11)S1$
1630 PRINT"SINK FIVE  "S2$"  (OR GAIN 600 POINTS) TO WIN THE GAME";:FORTD=1
TO45:SE=USR(276):FORDT=1TO170:NEXT:NEXT:CLS:RETURN
1660 CLS:PRINT@80,TI$:GOSUB800:PRINT@199,L$"  YOU SANK"WI"SUBMARINES";PRINT
@404,"AND SCORED"PT"POINTS  "R$:PRINT@715,;:FORX=1TOWI:PRINTS1$"//////";:NE
XT:PRINT@779,;:FORX=1TOWI:PRINTS2$"//////";:NEXT:PRINT@978," < ENTER > FOR
NEW GAME ";
1770 IFINKEY$<>CHR$(13)THENSE=USR(2570):GOTO1770ELSEWI=0:PT=0:CLS:GOTO330
```

Program Listing 2



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Casino Slot Machine

Ron Balewski
412 East Ridge Street
Nanticoke, PA 18634

This hybrid slot machine program uses machine language for graphics and Basic for set-up, housekeeping and control functions. Program Listing 1 is the Basic program. I apologize for the strange numbering scheme. Sections and subroutines start on even 100 and 1000 boundaries for easy location.

The Basic Program

Lines 10-115 print instructions and call a routine to POKE the machine language routine into high memory. Line 120 points to where the wheel image will start.

The wheel image consists of the 1512 bytes of memory between 31256 and 32767. It is arranged as 126 rows of 12 bytes each. Three rows make up one symbol space on the wheel. I kept one blank symbol space between each wheel symbol making a total of 21 symbols and 21 blanks on the wheel (Fig. 1). To see the wheel, type in the following after running the program:

```
FOR K = 31256 TO 32767 STEP 12:FOR
L = 0 TO 11: PRINT CHR$
(PEEK(K + L));:NEXT L:PRINT:NEXT K
```

The Key Box

Model I
16K RAM
Cassette Basic
Editor/Assembler Optional

Program Listing 1. Basic

```
1 '*****************************
2 '*  THE LUCKY 7 SLOT MACHINE *
3 '*****************************
4 '             BY
5 '        RON BALEWSKI
6 '
7 '
8 '  SEPTEMBER 26, 1981
9 '
10 CLEAR150:DEFINTA-Y
15 CLS:PRINT@5,"T H E   L U C K Y   7   S L O T   M A C H I N E"
:PRINT@69,STRING$(47,"=")
20 PRINT:PRINTTAB(10)"THE FOLLOWING FUNCTIONS ARE AVAILABLE TO Y
OU:    ":PRINTTAB(10)STRING$(45,"-"):PRINT"   ";CHR$(92);"
-PUT A COIN INTO THE MACHINE
<ENTER>   -PULL THE SLOT MACHINE'S LEVER"
25 PRINT"   Q      -QUIT
30 PRINT"   M      -ADD MONEY TO YOUR POT
   P      -DISPLAY THE PAYOFF TABLE


YOU CAN ENTER UP TO FIVE COINS PER PLAY.  iN ORDER TO WIN THE
JACKPOT, YOU MUST PLAY FIVE COINS AND GET THREE 7'S."
40 PRINT
110 PRINT@975,"JUST A MINUTE, PLEASE.";
115 GOSUB12000    ' SET UP MACHINE LANGUAGE SUBROUTINE
120 K1=31256
130 WH$="7SDSTDSTSDS7STDSDSTDS":'  WHEEL IMAGE
131 FORK=1TO21:A$=MID$(WH$,K,1):IFA$="S"THENGOSUB1000ELSEIFA$="D
"THENGOSUB2000ELSEIFA$="T"THENGOSUB3000ELSEIFA$="7"GOSUB4000ELSE
GOSUB5000:GOSUB5000
132 NEXTK:PRINT@975,"PRESS ANY KEY TO BEGIN.";
133 A$=INKEY$:IFA$=""THEN133
135 V=31166:L=16526:GOSUB9000:L=31196:V=31268:GOSUB9000:L=31198:
V=31268:GOSUB9000:L=31200:V=31268:GOSUB9000:PO=50:AT=50
136 TC=5000
137 PT(1,1)=10:PT(2,1)=15:PT(3,1)=20:PT(4,1)=40:PT(5,1)=100:'  P
AYOFF TABLE
138 FORK=2TO5:FORL=1TO5:PT(L,K)=PT(L,1)*K:NEXTL:NEXTK
139 '  DRAW WHEEL AND PRINT MESSAGES
140 CLS:FORK=15488TO16128STEP64:POKEK,191:POKEK+1,149:POKEK+14,1
70:POKEK+15,149:POKEK+28,170:POKEK+29,149:POKEK+42,170:POKEK+43,
191:NEXTK:PRINT@448,"-";CHR$(94);:PRINT@490,CHR$(93);"-";:POKE15
822,174:POKE15823,157:POKE15836,174:POKE15837,157
145 FORK=15490TO15531:POKEK,140:POKEK+640,140:NEXTK:POKE15488,18
8:POKE15489,156:POKE16128,143:POKE16129,141:POKE15530,172:POKE15
531,188:POKE16170,142:POKE16171,143:POKE15502,172:POKE15503,156:
POKE15516,172:POKE15517,156
146 POKE16142,142:POKE16143,141:POKE16156,142:POKE16157,141:PRIN
T@10,"LUCKY 7 SLOT MACHINE";:PRINT@906,"CURRENT JACKPOT:";:PRINT
@753,"COINS PLAYED";:PRINT@943,"YOUR TOTAL";
148 PRINT@45,"CURRENT OPTIONS:";
150 NC=0:PRINT@173,"DEPOSIT COIN";:JP=.3*TC:PRINT@975,JP;:PRINT@
1010,PO;:PRINT@820,NC;
160 A$=INKEY$:IFA$="O"THENGOTO600ELSEIFA$="P"THEN700ELSEIFA$=""T
HEN160ELSEIFA$="Q"THENGOTO800ELSEIFASC(A$)=13THENGOTO10000ELSEIF
A$="M"THENGOTO900ELSEIFASC(A$)<>10THEN160
170 IFPO=0ORNC=5GOTO160ELSENC=NC+1:PO=PO-1:TC=TC+1:PRINT@1010,PO
```

Program Listing 1 Continues

FOR FAST RELIEF

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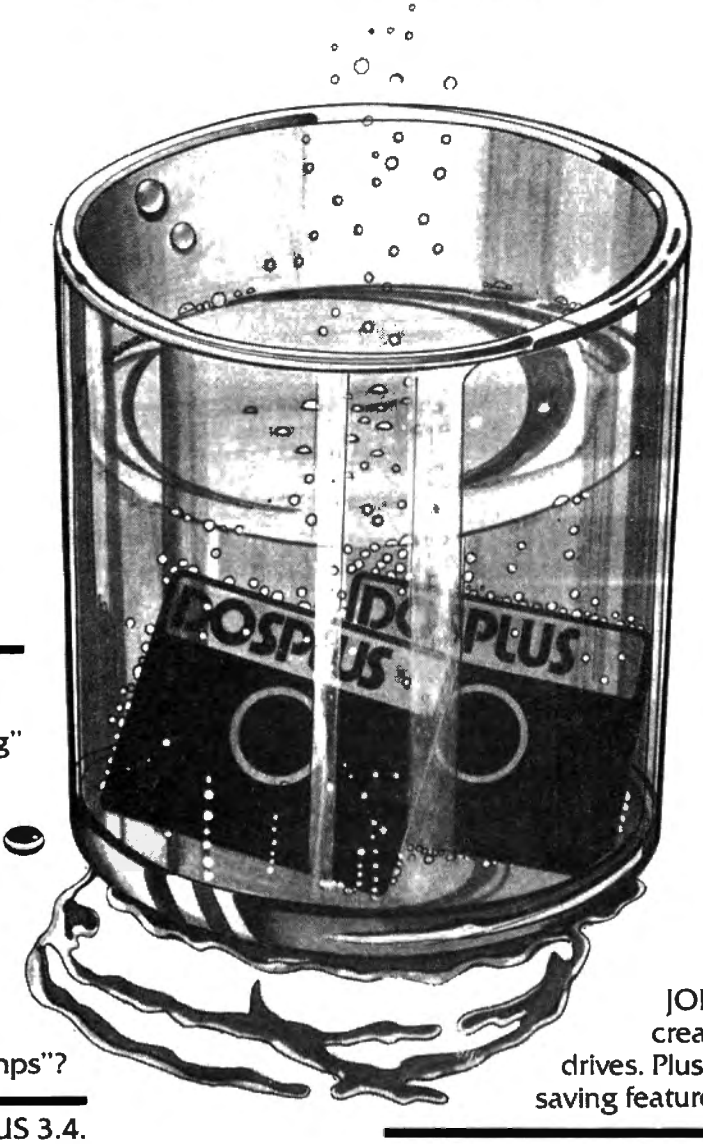

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Program Listing 1 Continued

```
;:PRINT@820,NC;:PRINT@493,"COIN ACCEPTED";:X=USR(296):X=USR(266)
:FORL=1TO30:NEXT:PRINT@493,"                ";
180 IFNC=5PRINT@173,"            ";
190 PRINT@301,"PULL ARM";
200 GOTO160
600 'CALCULATE ODDS
610 PO=PO+NC:TC=TC-NC:CS=0:CD=0:CT=0:C7=0:FORKA=1TO21:A$=MID$(WH
$,KA,1):IFA$="S"THENCS=CS+1ELSEIFA$="D"THENCD=CD+1ELSEIFA$="T"TH
ENCT=CT+1ELSEIFA$="7"THENC7=C7+1
620 NEXTKA:ZS=(CS/42)[3:ZD=(CD/42)[3:ZT=(CT/42)[3:Z7=(C7/42)[3:Z
B=((CS+CD+CT)/42)[3:ZA=ZB-ZS-ZD-ZT:ZM=(ZA*PT(1,1))+(ZS*PT(2,1))+
(ZD*PT(3,1))+(ZT*PT(4,1))+(Z7*PT(5,1))
630 CLS:PRINTTAB(13);"C A L C U L A T E D   O D D S":PRINTTAB(13
);STRING$(30,"="):PRINT:PRINTTAB(10)"SEVENS";TAB(30);"1 IN";1/Z7
:PRINTTAB(10)"TRIPLE BARS";TAB(30);"1 IN";1/ZT
640 PRINTTAB(10)"DOUBLE BARS";TAB(30)"1 IN";1/ZD:PRINTTAB(10)"SI
NGLE BARS";TAB(30)"1 IN";1/ZS:PRINTTAB(10)"ANY THREE BARS";TAB(3
0);"1 IN";1/ZA
650 PRINT:PRINT:PRINT"FAIRNESS:  ";:PRINTUSING"$#.##";ZM;:PRINT"
 RETURNED FOR EACH DOLLAR PLAYED."
660 PRINT@970,"PRESS ANY KEY TO RETURN TO GAME.";
670 A$=INKEY$:IFA$=""THEN670ELSEGOTO140
699 '  DISPLAY THE PAYOFF CHART
700 PO=PO+NC:TC=TC-NC:PT(5,5)=JP:CLS:PRINT@30,"PAYOFF CHART":PRI
NTTAB(25)"NUMBER OF COINS PLAYED";PRINTTAB(18)"1";TAB(28)"2";TAB
(38)"3";TAB(48)"4";TAB(58)"5":FORK=1TO6:PRINTSTRING$(64,140);" "
:NEXT
710 FORK=15502TO16206STEP64:POKEK,191:POKEK+10,191:POKEK+20,191:
POKEK+30,191:POKEK+40,191:POKEK+49,191:NEXTK
720 PRINT@256,"SEVENS";:PRINT@384,"TRIPLE BARS";:PRINT@512,"DOUB
LE BARS";:PRINT@640,"SINGLE BARS";:PRINT@768,"ANY THREE BARS";
730 FORK=1TO5:FORL=1TO5:PRINT@135+(128*K)+(10*L),PT(6-K,L);:NEXT
L:NEXTK
740 PRINT@980,"PRESS ANY KEY TO RETURN TO GAME";
750 A$=INKEY$:IFA$=""THEN750ELSEGOTO140
799 '  END OF GAME ANALYSIS
800 PO=PO+NC:TC=TC-NC:CLS:PRINT:PRINTTAB(10)"A N A L Y S I S:"
810 PRINT:PRINT"PERSONAL MONEY USED";TAB(20);"==>";AT;"COINS":PR
INT"MONEY LEFT IN POT";TAB(20);"==>";PO;"COINS":PRINTTAB(20)"===
=======":PRINT"NET GAIN/LOSS";TAB(20);"==>";ABS(PO-AT);"COINS ";

820 IFPO>ATPRINT"GAINED"ELSEIFPO=ATPRINT" *** EVEN ***"ELSEPRINT
"LOST"
830 PRINT:PRINT:PRINTTAB(10)"TRY YOUR LUCK AGAIN SOMETIME SOON."

840 PRINT:PRINT"ANOTHER PLAYER (Y/N)?"
850 A$=INKEY$:IFA$=""THEN850ELSEIFA$="N"THENSTOPELSEIFA$<>"Y"THE
N850
860 PO=50:AT=50:GOTO140
899 '  ADD MONEY TO POT
900 PO=PO+NC:TC=TC-NC:CLS:PRINT@266,"YOU HAVE";PO;"COINS CURRENT
LY IN YOUR POT."
910 PRINT@394,"";:INPUT"HOW MANY WOULD YOU LIKE TO ADD";AC:PO=PO
+AC:AT=AT+AC:PRINT@650,"SO FAR YOU ADDED";AT;"COINS TO YOUR POT.
":FORL=1TO300:NEXTL:GOTO140
1000 ' PUT SINGLE BAR
1010 FORL=1TO12:POKEK!,128:K!=K!+1:NEXTL:FORL=1TO12:POKEK!,191:K
!=K!+1:NEXTL:FORL=1TO12:POKEK!,128:K!=K!+1:NEXTL:GOSUB5000:RETUR
N
2000 ' DOUBLE BAR
2010 FORL=1TO12:POKEK!,188:K!=K!+1:NEXTL:FORL=1TO12:POKEK!,128:K
!=K!+1:NEXTL:FORL=1TO12:POKEK!,143:K!=K!+1:NEXTL:GOSUB5000:RETUR
N
3000 ' TRIPLE BAR
3010 FORL=1TO36:POKEK!,140:K!=K!+1:NEXTL:GOSUB5000:RETURN
4000 ' 7
4010 POKEK!,128:K!=K!+1:POKEK!,160:K!=K!+1:POKEK!,190:K!=K!+1:FO
RL=1TO4:POKEK!,143:K!=K!+1:NEXTL:POKEK!,175:K!=K!+1:POKEK!,191:K
!=K!+1:POKEK!,159:K!=K!+1:FORL=1TO6:POKEK!,128:K!=K!+1:NEXTL:POK
EK!,160:K!=K!+1:POKEK!,184:K!=K!+1:POKEK!,158:K!=K!+1
4020 POKEK!,135:K!=K!+1:POKEK!,129:K!=K!+1:FORL=1TO6:POKEK!,128:
K!=K!+1:NEXTL:POKEK!,184:K!=K!+1:POKEK!,143:K!=K!+1:POKEK!,129:K
!=K!+1:FORL=1TO6:POKEK!,128:K!=K!+1:NEXTL:GOSUB5000:RETURN
5000 ' SPACE
5010 FORL=1TO36:POKEK!,128:K!=K!+1:NEXTL:RETURN
8999 '  POKE 2-BYTE NUMBER IN V INTO LOCATION L
9000 VH=INT(V/256):VL=((V/256)-INT(V/256))*256:POKEL,VL:POKEL+1,
VH:RETURN
9999 '  RUN THE WHEEL AND CHECK FOR WINS
10000 IFNC=0GOTO150ELSEPRINT@173,"            ";:PRINT@301,"
    ";:V1=99+RND(42)*3:V2=V1+42+RND(28)*3:V3=V2+42+RND(28)*3
10010 L=31190:V=V1:GOSUB9000:L=31192:V=V2:GOSUB9000:L=31194:V=V3
:GOSUB9000
10020 POKE16526,0:POKE16527,121:X=USR(0):V=31166:L=16526:GOSUB90
00
10030 DN(1,1)=PEEK(15816):DN(1,2)=PEEK(15752):DN(2,1)=PEEK(15830
```

Program Listing 1 Continues

The entire wheel will roll once before your eyes.

The string defined in line 130 configures the symbols as they will appear on the slot machine wheel.

Lines 131–133 analyze the wheel order string and call appropriate subroutines to POKE the necessary graphics characters into the wheel image area.

Lines 135–138 do some housekeeping, 137 and 138 set up the payoff table, 140–150 set the slot machine on the screen and 160–200 accept and decode commands and execute the drop coin command.

Section 600 uses the wheel image string and the payoff table to calculate current payoff odds. This routine is useful for customizing payoff odds.

Section 700 displays a payoff chart on the screen.

After playing, section 800 prints how much you won or lost and lets you restart the game.

Section 900 lets you add money to your pot if you go broke. All additional money is kept track of by section 800.

Subroutines at lines 1000, 2000, 3000, 4000 and 5000 POKE graphics for the single bar, double bars, triple bars, seven and blank space, respectively, into the wheel image starting at K.

The subroutine beginning at line 9000 POKEs the two-byte integer value of variable V into memory locations L and L plus one.

Section 10000 spins the wheels via a USR command and determines if you have won. There are three calls to subroutine 9000. The three two-byte numbers POKEd into locations 31190, 31192 and 31194 determine how long the first, second and third wheels will spin. These locations correspond with NOTCH1, NOTCH2 and NOTCH3 on the Assembly listing (Program Listing 2).

Win determination is done by PEEKing at certain locations in the video display. Section 11000 is accessed each time section 10000 determines you won. After looking up your winnings in the payoff table, it drops coins into your pot (complete with the plinking sound).

Subroutine 1200 POKEs the machine language routine into

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Program Listing 1 Continued

```
):DN(2,2)=PEEK(15766):DN(3,1)=PEEK(15844):DN(3,2)=PEEK(15780)
10040 IFDN(1,1)=191ANDDN(2,1)=191ANDDN(3,1)=191THENWV=2:GOTO1100
0
10050 IFDN(1,2)=188ANDDN(2,2)=188ANDDN(3,2)=188THENWV=3:GOTO1100
0
10060 IFDN(1,1)=140ANDDN(2,1)=140ANDDN(3,1)=140THENWV=4:GOTO1100
0
10065 IFDN(1,1)=158ANDDN(2,1)=158ANDDN(3,1)=158THENWV=5:GOTO1100
0
10070 IF(DN(1,1)=158ORDN(2,1)=158ORDN(3,1)=158)THEN10090ELSEIF(D
N(1,1)<>128ORDN(1,2)<>128)AND(DN(2,1)<>128ORDN(2,2)<>128)AND(DN(
3,1)<>128ORDN(3,2)<>128)THENWV=1:GOTO11000
10090 GOTO150
10999 '  DETERMINE PAYOFF AND PAY WINS
11000 PT(5,5)=JP:MP=PT(WV,NC):IFMP>TCTHENMP=TC:TC=0ELSETC=TC-MP
11005 IFWV=5ANDNC=5GOTO11030
11010 FORK=1TOMP:PO=PO+1:PRINT@1010,PO;:X=USR(261+RND(15)):FORL=
1TO30:NEXTL:NEXTK
11020 GOTO150
11030 FORK=qTO10:PRINT@498,"J A C K P O T";:FORL=350TO257STEP-1:
X=USR(L):NEXTL:PRINT@498,"              ";:FORL=350TO257STEP-1:X=
USR(L):NEXTL:NEXTK:PO=PO+PT(5,5):PRINT@1010,PO;:GOTO150
12000 ' POKE MACHINE LANGUAGE ROUTINE
12010 FORK=30976TO31202
12020 READX:POKEK,X:NEXTK
12030 RETURN
12040 DATA  42,214,121,124,181,204,181,121, 40, 31
12050 DATA  43, 34,214,121, 17,194, 60, 42,220,121
12060 DATA 205,152,121, 42,220,121, 17, 12,  0, 25
12070 DATA 124,254,128, 32,  3, 33, 24,122, 34,220
12080 DATA 121, 42,216,121,124,181,204,181,121, 40
12090 DATA  31, 43, 34,216,121, 17,208, 60, 42,222
12100 DATA 121,205,152,121, 42,222,121, 17, 12,  0
12110 DATA  25,124,254,128, 32,  3, 33, 24,122, 34
12120 DATA 222,121, 42,218,121,124,181,200, 43, 34
12130 DATA 218,121, 17,222, 60, 42,224,121,205,152
12140 DATA 121, 42,224,121, 17, 12,  0, 25,124,254
12150 DATA 128, 32,  3, 33, 24,122, 34,224,121, 62
12160 DATA   2,211,255,  1,  2,  0,205, 96,  0, 62
12170 DATA   1,211,255,  1,  2,  0,205, 96,  0, 62
```

Program Listing 1 Continues

upper memory. It also contains the machine language data; thanks to Dan and Cass Lewart (see "DATAGEN," *80 Micro*, August 1981).

The Assembly Listing, ROLLEM

A separate block of code is used to spin each wheel. Each block has its own notch counter (how many more lines to scroll the wheel through the wheel image) and pointer (pointing to where to start copying the wheel from next time) and each puts its output to a different area on the screen. The ROLLEM section explanation (lines 250–420 in Listing 2) also applies to the sections ROLL2 and ROLL3.

The program first checks the notch counter, set in Basic line 10010. If it is at zero, this wheel does not have to spin anymore. A time delay routine is called and the program moves to the next section. The time delay keeps the other wheels from speeding up after one stops.

To spin the wheel, Notch is decremented and put back. Registers DE are set to point to

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Program Listing 1 Continued

```
12180 DATA   0,211,255,  1,  0,  2,205, 96,  0,195
12190 DATA   0,121,  6,  9,197,  6, 12,126, 18, 35
12200 DATA  19, 16,250,235,  1, 52,  0,  9,235,124
12210 DATA 254,128, 32,  3, 33, 24,122,193, 16,230
12220 DATA 201,245,  1,195,  0,205, 96,  0,241,201
12230 DATA 205,127, 10, 62,  1, 14,  0, 69, 47,230
12240 DATA   3,211,255, 13, 40,  4, 16,247, 24,243
12250 DATA  37, 32,242,201,  0,  0,  0,  0,  0,  0
12260 DATA   0,  0,  0,  0,  0,  0,255
```

"To win the jackpot, you have to play five coins and get three sevens."

where the wheel goes on the screen and HL will point to the next line in the wheel image. Then subroutine PUTCOL puts the wheel image on the screen. Finally 12 is added to the wheel image pointer (each horizontal line is 12 bytes long; adding 12 sets the pointer to the next horizontal line). After making sure it's not pointing past the wheel image, PUTCOL saves the pointer for the next pass.

After each wheel spins one notch, a click sound is sent to the cassette port. The third wheel will stop last because Basic line 10000 POKEs the largest number into NOTCH3. Assembly line 720 checks for this.

The PUTCOL routine, used by the three wheel moving sections, moves a chunk of the wheel image to the video screen. First a counter is set to move nine lines (the length of one wheel display window—line 1090). Twelve bytes are then moved to the video display (lines 1100–1160), and the video

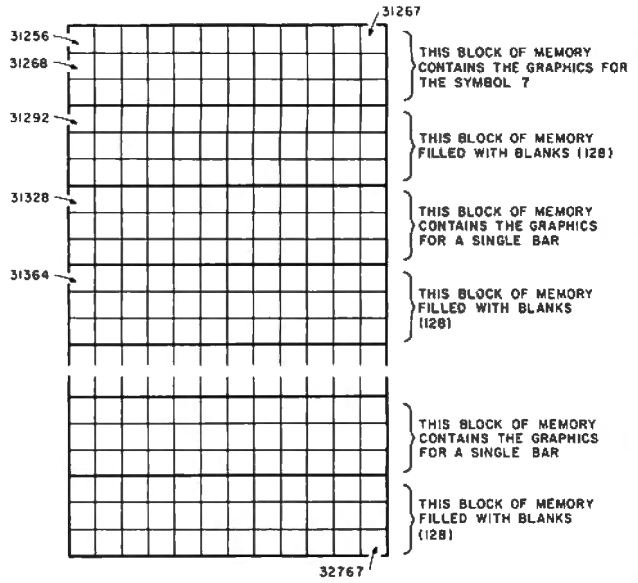

Fig. 1. Layout of the slot machine wheel image. Memory locations run sequentially from the upper left to the lower right corners. The order of the symbols is dictated by Basic line 130.

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pointer register DE is moved to the next line (lines 1170–1200). This repeats until all nine lines are moved (lines 1260–1270). If the wheel image pointer (register HL) goes past the wheel image, it is pointed back to the top of the image (lines 1210–1250).

The subroutine BALANC is a time delay routine (0060H is a ROM time delay routine) and Sound is a sound routine (see "Super Sound," *80 Micro* May 1980).

How to Play

Before CLOADing set your memory size to 30900. This allows room for the ROLLEM routine and the wheel image. Then run the program.

After the instruction set you will be asked to wait a minute while the program sets up the wheel and machine language routine.

You start with 50 coins in your pot. The jackpot starts with 15,000 coins. Pressing the down arrow drops a coin into the machine—you'll hear a "kerklink" sound. You can deposit up to five coins per play. To pull the arm, press Enter. The three wheels will spin and stop one by one. Winning combinations are (in order from most to least payoff) three sevens, three triple bars, three double bars, three single bars and three bars of any type. The symbols have to line up with the center arrows to win. Symbols which stop above or below the arrows do not count in the win. The jackpot changes continuously depending on how many coins are in the machine. To win the jackpot you have to play five coins and get three sevens.

Real slot machines have payoff tables attached to them. You can get one, at any time, by pressing the P key. The win combinations are along the left side of the table and the number of coins played is along the top. If you were to get three double bars after depositing two coins you would win 80 coins. Press any key to return to the game.

Your 50 coin allotment probably won't last long. To dig up more cash hit the M key. Type in how much you want and hit Enter. All additions are reported when you quit.

You will have to stop sooner or later. To do so, hit the Q key. You will then be given an analysis of how much money you used, how much you have left and how much you lost or gained.

Changing the Odds

The wheels and payoff table part of the program is in Basic. Before we start changing things, the odds function should be explained.

Press the O key. This feature will make your job of customizing a lot easier. The chart gives you the odds for all five win pos-

Program Listing 2. Assembly Language

```
                00100 ;**********************
                00110 ;*  SLOT MACHINE SUB   *
                00120 ;**********************
                00130 ;
                00140 ;  BY RON BALEWSKI
                00150 ;
                00160 ;   SPINS SLOT MACHINE WHEELS
                00170 ;  ALSO CONTAINS A SOUND ROUTINE
                00180 ;
                00190 ;
3C00            00200 VIDEO   EQU     3C00H
7900            00210         ORG     7900H
                00220 ;
                00230 ; IF (NOTCH1)<>0 THEN DEC (NOTCH1), SLIDE FIRST WHEEL ONE
                00240 ;    LINE   ELSE CALL BALANC
7900 2AD679     00250 ROLLEM  LD      HL,(NOTCH1)
7903 7C         00260         LD      A,H
7904 B5         00270         OR      L               ;NOTCH 1 ZERO?
7905 CCB579     00280         CALL    Z,BALANC        ;IF SO, BALANCE TIMES
7908 281F       00290         JR      Z,ROLL2         ;  AND GO ROLL SECOND
790A 2B         00300         DEC     HL              ;DEC (NOTCH1)
790B 22D679     00310         LD      (NOTCH1),HL
790E 11C23C     00320         LD      DE,VIDEO+192+2  ;FIRST WHEEL GOES HERE
7911 2ADC79     00330         LD      HL,(PTR1)       ;CURRENTLY HERE IN WHEEL
7914 CD9879     00340         CALL    PUTCOL          ;MOVE SECT. OF WHEEL
7917 2ADC79     00350         LD      HL,(PTR1)
791A 110C00     00360         LD      DE,12           ;12 BYTES MOVED EACH LINE
791D 19         00370         ADD     HL,DE
791E 7C         00380         LD      A,H
791F FE80       00390         CP      80H             ;PAST END OF WHEEL?
7921 2003       00400         JR      NZ,OK1
7923 21187A     00410         LD      HL,7A18H        ;SET TO START OF WHEEL
7926 22DC79     00420 OK1     LD      (PTR1),HL
                00430 ;
                00440 ;
                00450 ; ROLL SECOND WHEEL -- IDENTICAL TO FIRST, EXCEPT WITH
                00460 ;   DIFFERENT POINTERS & WHEEL LOCATION
7929 2AD879     00470 ROLL2   LD      HL,(NOTCH2)
792C 7C         00480         LD      A,H
792D B5         00490         OR      L
792E CCB579     00500         CALL    Z,BALANC
7931 281F       00510         JR      Z,ROLL3
7933 2B         00520         DEC     HL
7934 22D879     00530         LD      (NOTCH2),HL
7937 11D03C     00540         LD      DE,VIDEO+192+16
793A 2ADE79     00550         LD      HL,(PTR2)
793D CD9879     00560         CALL    PUTCOL
7940 2ADE79     00570         LD      HL,(PTR2)
7943 110C00     00580         LD      DE,12
7946 19         00590         ADD     HL,DE
7947 7C         00600         LD      A,H
7948 FE80       00610         CP      80H
794A 2003       00620         JR      NZ,OK2
794C 21187A     00630         LD      HL,7A18H
794F 22DE79     00640 OK2     LD      (PTR2),HL
                00650 ;
                00660 ;
                00670 ; THIRD WHEEL ROLL -- SAME AS 1ST AND 2ND EXCEPT
                00680 ;     RET WHEN (NOTCH3) GETS TO 0
7952 2ADA79     00690 ROLL3   LD      HL,(NOTCH3)
7955 7C         00700         LD      A,H
7956 B5         00710         OR      L
7957 C8         00720         RET     Z
7958 2B         00730         DEC     HL
7959 22DA79     00740         LD      (NOTCH3),HL
795C 11DE3C     00750         LD      DE,VIDEO+192+30
795F 2AE079     00760         LD      HL,(PTR3)
7962 CD9879     00770         CALL    PUTCOL
7965 2AE079     00780         LD      HL,(PTR3)
7968 110C00     00790         LD      DE,12
796B 19         00800         ADD     HL,DE
796C 7C         00810         LD      A,H
796D FE80       00820         CP      80H
796F 2003       00830         JR      NZ,OK3
7971 21187A     00840         LD      HL,7A18H
7974 22E079     00850 OK3     LD      (PTR3),HL
```

Program Listing 2 Continues

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Program Listing 2 Continued

```
                00860 ;
                00870 ;
                00880 ; OUTPUT A CLICK TO THE CASSETTE PORT AND DELAY
 7977 3E02      00890         LD      A,2             ;SEND OUTPUT HIGH
 7979 D3FF      00900         OUT     (255),A
 797B 010200    00910         LD      BC,2            ;DELAY
 797E CD6000    00920         CALL    0060H
 7981 3E01      00930         LD      A,1             ;SEND OUTPUT LOW
 7983 D3FF      00940         OUT     (255),A
 7985 010200    00950         LD      BC,2            ;DELAY
 7988 CD6000    00960         CALL    0060H
 798B 3E00      00970         LD      A,0             ;OUTPUT OFF
 798D D3FF      00980         OUT     (255),A
 798F 010002    00990         LD      BC,0200H        ;DELAY
 7992 CD6000    01000         CALL    0060H
 7995 C30079    01010         JP      ROLLEM          ;ROLL WHEELS AGAIN
                01020 ;
                01030 ;
                01040 ;           **********
                01050 ;           * PUTCOL *
                01060 ;           **********
                01070 ; MOVE 9 LINES OF THE WHEEL STARTING AT (HL) TO THE VIDEO
                01080 ; SCREEN STARTING AT LOCATION (DE)
 7998 0609      01090 PUTCOL  LD      B,9             ;MOVE 9 LINES
 799A C5        01100 NXTLIN  PUSH    BC
 799B 060C      01110         LD      B,12            ;EACH LINE 12 BYTES LONG
 799D 7E        01120 NXTBYT  LD      A,(HL)          ;MOVE A BYTE
 799E 12        01130         LD      (DE),A
 799F 23        01140         INC     HL              ;BUMP SOURCE & DEST. PTRS
 79A0 13        01150         INC     DE
 79A1 10FA      01160         DJNZ    NXTBYT          ;DO WHOLE LINE
 79A3 EB        01170         EX      DE,HL
 79A4 013400    01180         LD      BC,52           ;GET TO NEXT VIDEO LINE
 79A7 09        01190         ADD     HL,BC
 79A8 EB        01200         EX      DE,HL
 79A9 7C        01210         LD      A,H
 79AA FE80      01220         CP      80H             ;IF POINTER TO WHEEL PAST
                01230                                 ;END OF WHEEL,FOLD TO TOP
 79AC 2003      01240         JR      NZ,NOROLL
 79AE 21187A    01250         LD      HL,7A18H        ;START OF WHEEL IMAGE
 79B1 C1        01260 NOROLL  POP     BC
 79B2 10E6      01270         DJNZ    NXTLIN          ;DO ALL 9 LINES
 79B4 C9        01280         RET
                01290 ;
                01300 ;
                01310 ;
                01320 ;               **********
                01330 ;               * BALANC *
                01340 ;               **********
                01350 ;  DELAY TO KEEP WHEELS RUNNING AT THE SAME SPEED NO
                01360 ;  MATTER HOW MANY ARE RUNNING.  IE. WHEN THE FIRST
                01370 ;  WHEEL STOPS, BABANC WILL BE CALLED ONCE.  WHEN THE
                01371 ;  FIRST & SECOND STOP, BALANC WILL BE CALLED TWICE.
 79B5 F5        01380 BALANC  PUSH    AF
 79B6 01C300    01390         LD      BC,195
 79B9 CD6000    01400         CALL    0060H
 79BC F1        01410         POP     AF
 79BD C9        01420         RET
                01421 ;
                01422 ;
                01423 ;               *********
                01424 ;               * SOUND *
                01425 ;               *********
                01426 ;  SOUND GENERATING ROUTINE CALLED BY BASIC -- NOT CALLED
                01427 ;  BY ABOVE ASSEMBLY-LANGUAGE PROGRAM
 79BE CD7F0A    01430 SOUND   CALL    0A7FH
 79C1 3E01      01440         LD      A,1
 79C3 0E00      01450         LD      C,0
 79C5 45        01460 SOUND2  LD      B,L
 79C6 2F        01470         CPL
 79C7 E603      01480 SOUND3  AND     3
 79C9 D3FF      01490         OUT     (255),A
 79CB 0D        01500         DEC     C
 79CC 2804      01510         JR      Z,SOUNDD
 79CE 10F7      01520         DJNZ    SOUND3
 79D0 18F3      01530         JR      SOUND2
 79D2 25        01540 SOUNDD  DEC     H
 79D3 20F2      01550         JR      NZ,SOUND3
 79D5 C9        01560         RET
 79D6 0000      01570 NOTCH1  DEFW    0
 79D8 0000      01580 NOTCH2  DEFW    0
 79DA 0000      01590 NOTCH3  DEFW    0
 79DC 0000      01600 PTR1    DEFW    0
 79DE 0000      01610 PTR2    DEFW    0
 79E0 0000      01620 PTR3    DEFW    0
 0000           01630         END
 00000 TOTAL ERRORS
```

sibilities. My set-up returns $1.04 for each dollar played. In a casino, the machine would lose money over the long run. (If the amount returned is less than a dollar, the casino makes money.)

To change the symbols on the wheels, you have to change Basic line 130. In the string, seven stands for the symbol seven, T is for the triple bar, D is the double bar, and S is the single bar. The order from left to right is the order of the wheel from top to bottom. Changing a character in this string changes the wheel.

As an experiment, change the first seven to an S and then run the program. Once the program is running, press O for the odds table. The odds against sevens went way up while the odds against single bars went down. Also the amount to win went up to $1.20 per dollar.

Changing the payoff table is just as easy, in Basic line 137.

"Pressing the down arrow drops a coin into the machine."

PT(1,1) is the payoff for three bars any kind, PT(2,1) is for three single bars, PT(3,1) is for three double bars, PT(4,1) is for triple bars and PT(5,1) is for sevens. All payoffs set are for one coin played. The payoffs for two to five coins are calculated from these values, so you needn't worry about them. To change the three bars any kind payoff to 20 per coin, change PT(1,1) = 10 to PT(1,1) = 20. Then run the program and get an odds table. Winnings went up to $1.83 for each dollar played. By requesting a payoff chart you can see that the three bars line is indeed different.

I hope this program saves you money by alleviating the urge to lose to a real slot machine. It did for me. If you hit the jackpot using the odds presented, let me know—I've never done it. Good luck, and may your wheels forever stop on sevens! ■

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In case you don't understand how this works, I'll give you a brief explanation. The Color Computer was designed so that the roms in the system could be turned off under software control. In a normal Color Computer this would only make it go away. However, if you put a program in memory to do something first (like boot in FLEX or OS-9), when you turn off the roms, you will have a full *64K RAM* System with which to run your program.

Now, we need the other half of the 64K ram chips to work, and this seems to be the case most of the time, as the article states. Of course, you could also put 64K chips in.

Some neat utilities are included.

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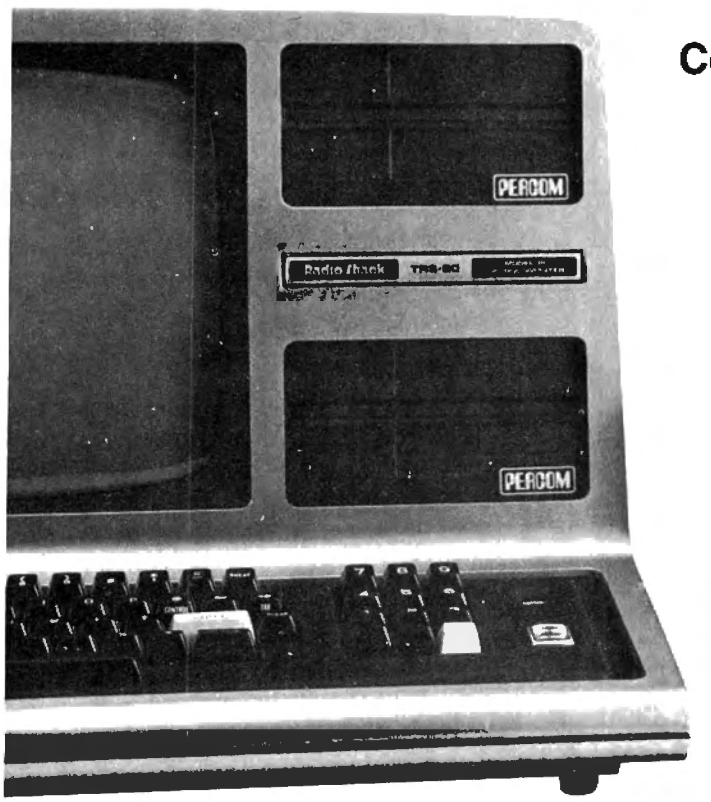

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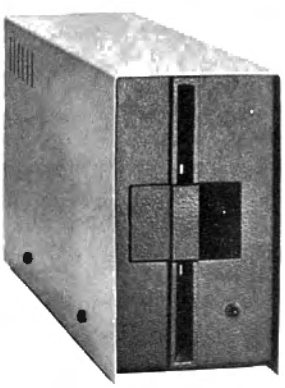

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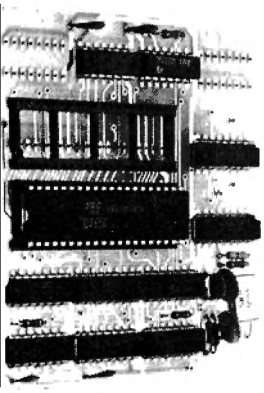

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GAME

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Games don't have to be complicated to be fun.

Cram

Hardin Brothers
280 North Campus Ave.
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CRAM came from my experiments in using the INKEY$ and Set...Reset Functions. Cram has become the most popular game in my library.

Why? It is easy to play. Games usually last less than a minute. The computer does not let you quit. As soon as one game is finished, the next one starts. Playing only one game of Cram is like trying to eat just one potato chip. Cram is a skill game that does not require the usual multi-fingered coordination of so many skill games. Cram can be be played solitaire or against as many other players as you like.

The Rules

The computer, using Set graphics, generates a moving line. To change the line's direction push any key except shift. The line then turns a 90 degree angle and continues.

If you wait too long to change direction the line runs into itself ending the game. You are given one point for each corner turned.

Wait as long as possible before changing the line's direction to leave as much space as possible for future moves.

The Program

You can skip the title and instructions by omitting lines 130 and 680-910. Program Listing 1 is the original stripped down program. All variables are defined as integers in line 120 to increase program speed. The opening title screen and instructions subroutine start at line 130. Line 140 initializes the three variables used in the main program loop and line 160 calls a subroutine to set the playing board boundaries.

Starting with line 109, there are four similar blocks of instructions comprising the main program loop. To move right, the row index (I) is incremented to point to the next pixel. Then a test is made to determine if the line will collide with a previously drawn line. If so, the program jumps to the end game and score routine. If not, the next pixel is set and the keyboard is scanned by INKEY$ to determine if a key has been pressed. If there has been no keystroke, the program flow jumps backwards to set the next point to the right. If there has been a keystroke, the score counter is incremented and program flow moves on to the move down routine.

The move down, move left and move up routines are almost identical to the move right routine, except for the initial statement in each determining whether the row or column index is incremented or decremented.

The move routines could have been made into a common subroutine. But this would slow down the game to allow the computer to search for the appropriate line numbers.

To speed up the game, take out all REMarks and spaces in the main program loop and condense each move routine to a single line.

Adding Sound

Program Listing 2 includes a short Assembly language routine to generate sounds for Cram. Program Listing 3 is the complete, fully enhanced Cram.

The source code in Listing 2 is similar to many other sound generating programs. A value from the Basic USR command is loaded into HL by the instruction Call 0A7FH. This value is a combination of two bytes controlling the pitch (frequency) of the tone to be produced and its duration. These values are decoded and used to toggle the 0FFH port (the cassette port) to create sounds.

I translated the object code from the hex notation created by EDTASM into standard decimal numbers and used those for the data statements in lines 1030-1050 in Listing 3. Line 930 sets up a dummy string, AA$, to hold the machine language program. Lines 940-1020 POKE the necessary values into the string.

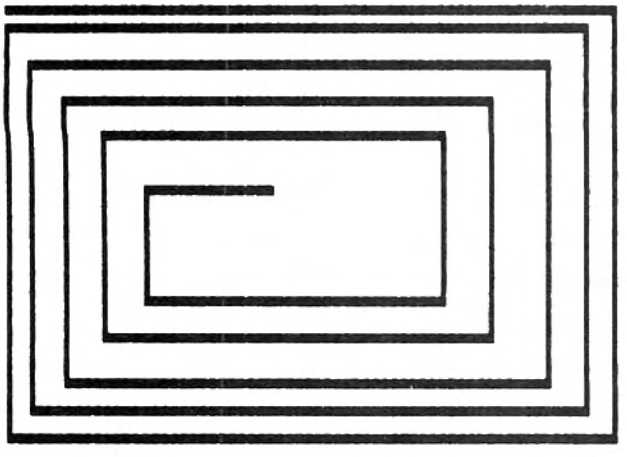

Fig. 1. Cram game in progress

The Key Box

Basic Level II
Models I and III
16K RAM

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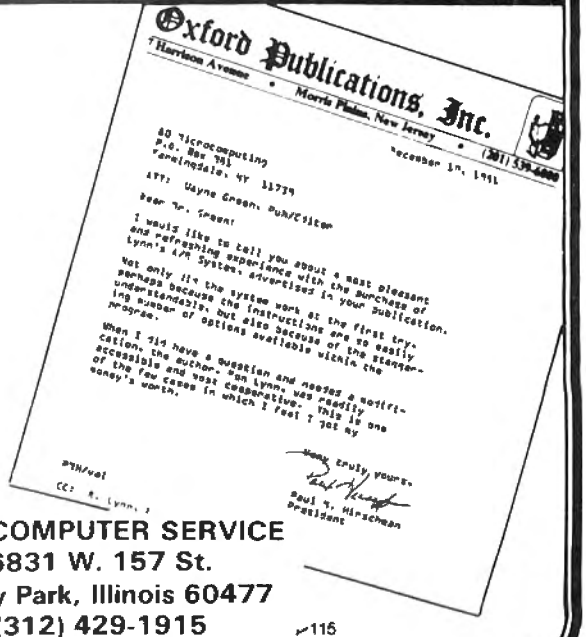
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Very truly yours,

Paul T. Hirschman
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(For more information on how to pack strings with machine language accessible from USR, see Bill Barden's *Programming Techniques for Level II Basic* or Louis Rosenfelder's *Basic Faster and Better & Other Mysteries.*)

Lines added throughout the program accommodate sound in the title, main loop and end game sections. Each time the program wants a tone it uses the USR() command and includes a value to determine the tone's frequency and duration.

To add the sound routines to the Listing 1 version add lines 110, 240, 310, 380, 450, 630-650, 720, 760 and 920-1230. Also modify lines 580 and 680-700.

With Disk Basic, line 100 will improve the quality of sound and line 960 will work as listed. If you use Level II Basic, omit line 100 and change line 960 as shown in the Remarks for lines 960-970.

Cram is as much fun as it is addictive.■

Hardin Brothers teaches drama and English for the Chaffey High School District.

Program Listing 1. Level II Basic

```
1 ' ****  C R A M  ****
2 ' **** VERSION 1.1 ****
3 '                        WRITTEN BY HARDIN BROTHERS
4 '                                   280 NORTH CAMPUS AVE.
5 '                                   UPLAND, CALIFORNIA 91786
6 '
7 ' **  THIS IS THE SIMPLEST VERSION
8 '
9 '
120 DEFINT A - Z
130 GOSUB 680
140 C = 0 : I = 0 : J = 2 : REM *** C IS COUNTER FOR POINTS
150 '                                 I & J MARK CURSOR POSITION
160 GOSUB 500
170 '                              ****  MAIN PROGRAM LOOP ****
180 '*** MOVE RIGHT ***
190 I = I + 1
200 IF POINT(I,J) THEN 590
210 SET(I,J)
220 IF INKEY$="" THEN 190
230 C = C + 1
250 '*** MOVE DOWN ***
260 J = J + 1
270 IF POINT(I,J) THEN 590
280 SET(I,J)
290 IF INKEY$="" THEN 260
300 C = C + 1
320 '*** MOVE LEFT ***
330 I = I - 1
340 IF POINT(I,J) THEN 590
350 SET(I,J)
360 IF INKEY$="" THEN 330
370 C = C + 1
390 '*** MOVE UP ***
400 J = J - 1
410 IF POINT(I,J) THEN 590
420 SET(I,J)
430 IF INKEY$="" THEN 400
440 C = C + 1
460 GOTO 190
480 '
490 '                              **** SET SCREEN BORDER ****
500 CLS
510 FOR A=0 TO 127 : SET (A,0) : NEXT A
520 FOR A = 0 TO 47 : SET (127,A) : NEXT A
530 FOR A = 127 TO 0 STEP -1 : SET (A,47) : NEXT A
540 FOR A = 47 TO 2 STEP -1 : SET (0,A) : NEXT A
550 A$ = INKEY$
560 RETURN
570 '                              **** END GAME & SHOW SCORE ****
580 '
590 IF C<10 THEN B$="1 " ELSE B$ = "1"
600 PRINT@ 476, B$ ; C ; " !";
610 IF C=1 THEN C$ = "TURN " ELSE C$="TURNS"
620 PRINT@ 540, "!"; C$ ; "!";
660 FOR A = 1 TO 1500 : NEXT : GOTO 140
670 '                              **** TITLE SCREEN & INSTRUCTIONS
****
680 CLS : PRINT CHR$(23);
690 FOR A = 1 TO 15
700   PRINT TAB(3+A) "CRAM"
710 NEXT A
730 FOR B = 1 TO 1500 : NEXT B
740 CLS
750 PRINT TAB(8) "WELCOME TO THE GAME OF 'CRAM'"
770 PRINT : PRINT "DO YOU WANT INSTRUCTIONS?"
780 A$ = INKEY$ : IF A$ = "" THEN 780
790 IF A$ = "N" THEN 900
800 IF A$ <> "Y" THEN 780
810 PRINT : PRINT TAB(8) "THE OBJECT OF THE GAME IS TO CRAM AS M
ANY"
820 PRINT "LINES AS YOU CAN ONTO THE SCREEN.  EACH TIME YOU"
830 PRINT "WISH TO CHANGE THE DIRECTION OF THE MOVING LINE,"
840 PRINT "PRESS ANY KEY EXCEPT <SHIFT> OR <BREAK>."
850 PRINT TAB(8) "THE GAME IS OVER WHEN THE MOVING LINE RUNS INT
O"
```

Listing 1 continues

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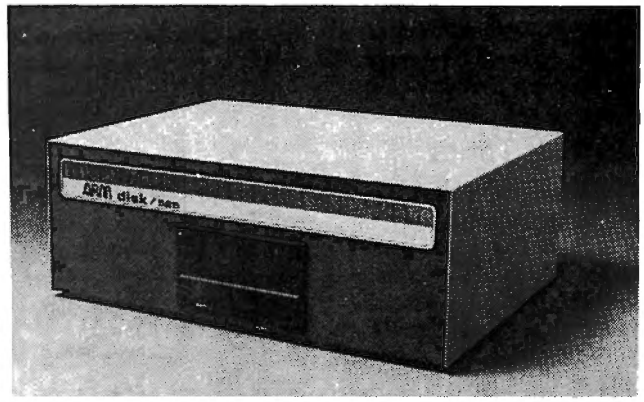

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Program Listing 1 Continued

```
860 PRINT "A PREVIOUSLY-DRAWN LINE,  AT THE END OF THE GAME I"
870 PRINT "WILL REPORT YOUR SCORE."
880 PRINT : PRINT TAB(8) "PRESS <ENTER> TO START THE GAME."
890 A$ = INKEY$ : IF A$ = "" THEN 890
900 CLS
910 RETURN
```

```
                00100 ;************************************
                00110 ;
                00120 ; SIMPLE, RELOCATABLE SOUND ROUTINE
                00130 ;  THAT CAN BE INTERFACED WITH 'CRAM'
                00140 ;  AND OTHER BASIC PROGRAMS
                00150 ;
                00160 ;************************************
                00170 ;
0000            00180           ORG     0000H       ;NO SPECIFIC ORIGIN NEEDED
0000 CD7F0A     00190           CALL    0A7FH       ;GET VALUE FROM USR CALL
0003 4C         00200           LD      C,H         ;GET HIGH BYTE INTO C
0004 45         00210 LOOP1     LD      B,L         ; AND LOW BYTE INTO B
0005 3E01       00220           LD      A,01H       ;TURN ON OUTPUT BIT
0007 D3FF       00230           OUT     (0FFH),A    ;AND SEND TO PORT
0009 10FE       00240 LOOP2     DJNZ    LOOP2       ;WAIT 1/2 CYCLE
000B 45         00250           LD      B,L         ;RELOAD WITH LOW BYTE
000C 3E10       00260           LD      A,10H       ;TOGGLE OUTPUT BIT
000E D3FF       00270           OUT     (0FFH),A    ;AND SEND TO PORT
0010 10FE       00280 LOOP3     DJNZ    LOOP3       ;WAIT 1/2 CYCLE
0012 0D         00290           DEC     C           ;DROP DURATION COUNT
0013 20EF       00300           JR      NZ,LOOP1    ;GO BACK UNTIL DONE
0015 C9         00310           RET                 ;THEN RETURN TO BASIC
0000            00320           END
```

Program Listing 2. Assembly language Sound routine. . .

Program Listing 3. Level II Basic with sound

```
1 ' ****  C R A M  ****
2 ' **** VERSION 2.1 ****
3 '                        WRITTEN BY HARDIN BROTHERS
4 '                                280 NORTH CAMPUS AVE.
5 '                                UPLAND, CALIFORNIA 91786
6 '
7 ' **  THIS IS THE ENHANCED VERSION
8 '
9 '
100 '
110 GOSUB 920
120 DEFINT A - Z
130 GOSUB 680
140 C = 0 : I = 0 : J = 2 : REM *** C IS COUNTER FOR POINTS
150 '                                  I & J MARK CURSOR POSITION
160 GOSUB 500
170 '                                ****  MAIN PROGRAM LOOP ****
180 '*** MOVE RIGHT ***
190 I = I + 1
200 IF POINT(I,J) THEN 590
210 SET(I,J)
220 IF INKEY$="" THEN 190
230 C = C + 1
240 X = USR(8305)
250 '*** MOVE DOWN ***
260 J = J + 1
270 IF POINT(I,J) THEN 590
280 SET(I,J)
290 IF INKEY$="" THEN 260
300 C = C + 1
310 X = USR(8319)
320 '*** MOVE LEFT ***
330 I = I - 1
340 IF POINT(I,J) THEN 590
350 SET(I,J)
360 IF INKEY$="" THEN 330
370 C = C + 1
380 X = USR(8343)
390 '*** MOVE UP ***
400 J = J - 1
410 IF POINT(I,J) THEN 590
420 SET(I,J)
```

Program Listing 3 Continues

Program Listing 3 Continued

```
430 IF INKEY$="" THEN 400
440 C = C + 1
450 X = USR(8335)
460 GOTO 190
480 '
490 '                              **** SET SCREEN BORDER ****
500 CLS
510 FOR A=0 TO 127 : SET (A,0) : NEXT A
520 FOR A = 0 TO 47 : SET (127,A) : NEXT A
530 FOR A = 127 TO 0 STEP -1 : SET (A,47) : NEXT A
540 FOR A = 47 TO 2 STEP -1 : SET (0,A) : NEXT A
550 A$ = INKEY$
560 RETURN
570 '                              **** END GAME & SHOW SCORE ****
580 '
590 GOSUB 1060 : IF C<10 THEN B$="! " ELSE B$ = "!"
600 PRINT@ 476, B$ ; C ; " !";
610 IF C=1 THEN C$ = "TURN " ELSE C$="TURNS"
620 PRINT@ 540, "!"; C$ ; "!";
630 IF C>20 THEN GOSUB 1130
640 IF C>30 THEN GOSUB 1130
650 IF C>30 THEN GOSUB 1130 : GOSUB 1130
660 FOR A = 1 TO 1500 : NEXT : GOTO 140
670 '                              **** TITLE SCREEN & INSTRUCTIONS
****
680 CLS
690 FOR A = 1 TO 15
700   PRINT TAB(6+A*2) "C R A M"
710 NEXT A
720 GOSUB 1060 : GOSUB 1060 : PRINT CHR$(23);
730 FOR B = 1 TO 1500 : NEXT B
740 CLS
750 PRINT TAB(8) "WELCOME TO THE GAME OF 'CRAM'"
760 PRINT TAB(8) "PLEASE CONNECT YOUR AMP/SPEAKER"
770 PRINT : PRINT "DO YOU WANT INSTRUCTIONS?"
780 A$ = INKEY$ : IF A$ = "" THEN 780
790 IF A$ = "N" THEN 900
800 IF A$ <> "Y" THEN 780
810 PRINT : PRINT TAB(8) "THE OBJECT OF THE GAME IS TO CRAM AS M
ANY"
820 PRINT "LINES AS YOU CAN ONTO THE SCREEN.  EACH TIME YOU"
830 PRINT "WISH TO CHANGE THE DIRECTION OF THE MOVING LINE,"
840 PRINT "PRESS ANY KEY EXCEPT <SHIFT> OR <BREAK>."
850 PRINT TAB(8) "THE GAME IS OVER WHEN THE MOVING LINE RUNS INT
O"
860 PRINT "A PREVIOUSLY-DRAWN LINE.  AT THE END OF THE GAME I"
870 PRINT "WILL REPORT YOUR SCORE."
880 PRINT : PRINT TAB(8) "PRESS <ENTER> TO START THE GAME."
890 A$ = INKEY$ : IF A$ = "" THEN 890
900 CLS
910 RETURN
920 '                              **** SOUND ROUTINES ****
930 AA$="                          " : REM ** 22 SPACES
940 QA! = VARPTR (AA$)
950 QB! = PEEK(QA!+1) + PEEK(QA!+2) * 256
960 POKE 16526,PEEK(QA!+1) : POKE 16527, PEEK(QA!+2)
970 '           ** FOR DISK BASIC, CHANGE 960 TO DEFUSR = QB!
980 FOR A! = QB! TO QB! + 21
990   B! = A! : IF B! > 32767 THEN B! = B! - 65536
1000   READ Q : POKE B!,Q
1010 NEXT A
1020 RETURN
1030 DATA 205, 127,  10,  76,  69,  62,   1
1040 DATA 211, 255,  16, 254,  69,  62,  16
1050 DATA 211, 255,  16, 254,  13,  32, 239, 201
1060 FOR A = 1 TO 3
1070   X = USR(8319)
1080   X = USR(8343)
1090   X = USR(8335)
1100   X = USR(8305)
1110 NEXT A
1120 RETURN
1130 X = USR(32383)
1140 X = USR(32383)
1150 X = USR(14479)
1160 X = USR(13719)
1170 X = USR(27287)
1180 X = USR(12966)
1190 X = USR(13719)
1200 X = USR(27287)
1210 X = USR(27287)
1220 X = USR(27287)
1230 RETURN
```


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This double-acrostic program will not help you solve puzzles, but it will greatly simplify the task of making and printing one.

In double-acrostics, definitions are given like those in a regular crossword puzzle. Each letter in the definition is coded to spell out a message in the accompanying diagram. In Fig. 1, clue A, "Fog at Radio Shack Headquarters," has the answer "FORTWORTHMIST." The W in Worth is coded to Box 28 in the diagram. To solve acrostics work up from the definitions and down from the context of the message. In addition, the first letters of each definition spell out the author's name and title of the work. In this short example, only the author's name appears.

I tried composing a puzzle in my unenlightened pre-computer days. It was a disaster. The composition algorithm was simple, but execution was hopelessly error-prone.

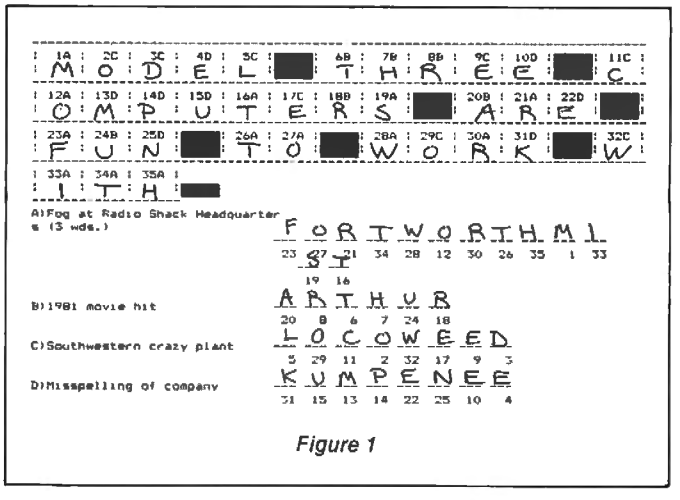

Figure 1

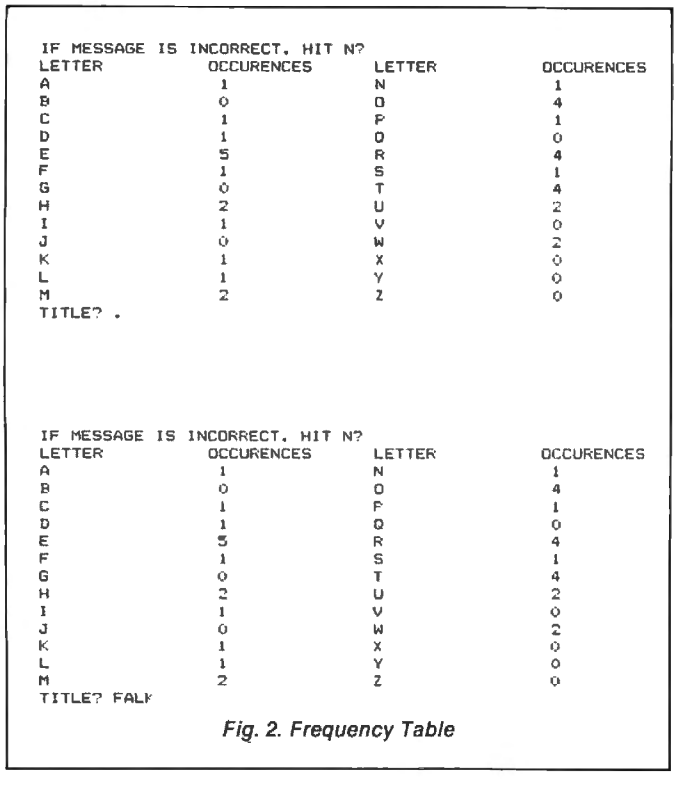

Fig. 2. Frequency Table

- Find a humorous message between 180 and 220 letters.
- Construct a table of how many times each letter appears.
- Find a title compatible with the table.
- Try out words, subtracting them from the table if they fit.
- Keep adding or subtracting words until all the letters are used.
- Assign each letter of the message to a definition letter.
- Write up the results.

This procedure consumed huge amounts of time and paper. I would get almost to the end and discover I had a T that could not be accounted for anywhere!

Now with my Model III, all the steps except the first are done by the computer quickly and without error.

How it Works

In Fig. 1 we are asked to input the message: "Model Three Computers are Fun to Work With." Do not use punctuation in the message. Your message can be no longer than 255 characters including blanks. You can input messages until the @ sign is encountered. After inputting, the message will appear on the screen for double-checking. Make sure it is exactly the right format for the answer, including spacing.

As a title I chose my name, Falk. The computer checks against the frequency table to make sure this title is available.

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The computer then prints the title-adjusted frequency table (Fig. 2). Now we have to come up with words beginning with F, A, L and K. After every command we are returned to the menu, which gives a choice of adding a word, subtracting a word, or listing the definition words or frequency table.

Suppose we tried to make the F word Face. The program reports that we already used up our supply of As in the message (one was used in the title). When I try "FORTWORTHDEW", the program subtracts the letters "ORTWORTHDEW" from the frequency table (the F was subtracted as part of the title) and would prompt me with the menu.

Once the frequency table is finished, the command five from the menu begins the diagramming. This is apt to take some time for printout on long messages.

Program operation follows the algorithm pretty closely. T$(I) contains the Ith element of the message. T$ holds the title. P$() contains the message with all blanks removed. W$(I) contains the Ith definition. F is the frequency table. Thus F(0) is the number of As remaining, F(1) is the number of Bs remaining and so on. D$ holds the definition clues.

Fig. 3. Try this one out yourself

```
A)Tory opponents                  --- --- --- --- ---
                                   80  58 144 100 150

B)A position at a distance from
shore
                                  --- --- --- --- --- ---
                                  134  94 135  26  14 146

C)A steak recipe                  --- --- --- --- ---
                                   70 114 138 145 153

D)Insect studies                  --- --- --- --- --- --- --- --- --- ---
                                    5 108   9 111  54 155 119  11  41 125

E)Poet and satirist               --- --- --- --- --- ---
                                  151  13 117 116 136  42

F)Female germ cells               --- --- --- --- --- --- ---
                                    2 147  60 168 154 164 124

G)Unsuitable; unqualified         --- --- --- --- ---
                                  161  12 156 101  82

H)Hissing                         --- --- --- --- --- --- --- ---
                                   63 118  88 158 139 130 103 131

I)Adding greater quality value o
r significance to
                                  --- --- --- --- --- --- --- --- ---
                                   38  40 112  71  67  37  24  99  48

J)Genuine reliable or good (Angl
o-Indian)
                                  --- --- --- --- ---
                                   28  46 128  97  75

K)A colloquial black eye          --- --- --- --- --- ---
                                   25  85  32 169  35  76

L)Pacify; appease                 --- --- --- --- --- --- ---
                                   95  87 126 142  81 140 173

M)Medical apprentice (alt. sp.)   --- --- --- --- --- --- ---
                                  171 115  64  90  65 121  53

N)Cardinality of the faces of a
dodecahedron
                                  --- --- --- --- --- ---
                                  102  57  86  34   4  69

O)People pursuing an avocation    --- --- --- --- --- --- --- --- ---
                                   16  45 160  20  23 127  73  51  30

P)Waggish; facetious              --- --- --- --- --- --- ---
                                   89 104  91  66  52 165   6

Q)Football-shaped                 --- --- --- --- --- ---
                                   61  33 167  55  36 129

R)uncompleted; brought to ruin    --- --- --- --- --- ---
                                   19 159  79  93 133  49

S)Outcome of a division           --- --- --- --- ---
                                  163 149  77 123 137

T)Disgustingly unclean; morally
filthy; obscene
                                  --- --- --- --- ---
                                   62 141   7  68 120

U)Observant care; consideration;
 notice
```

Figure 3 continues

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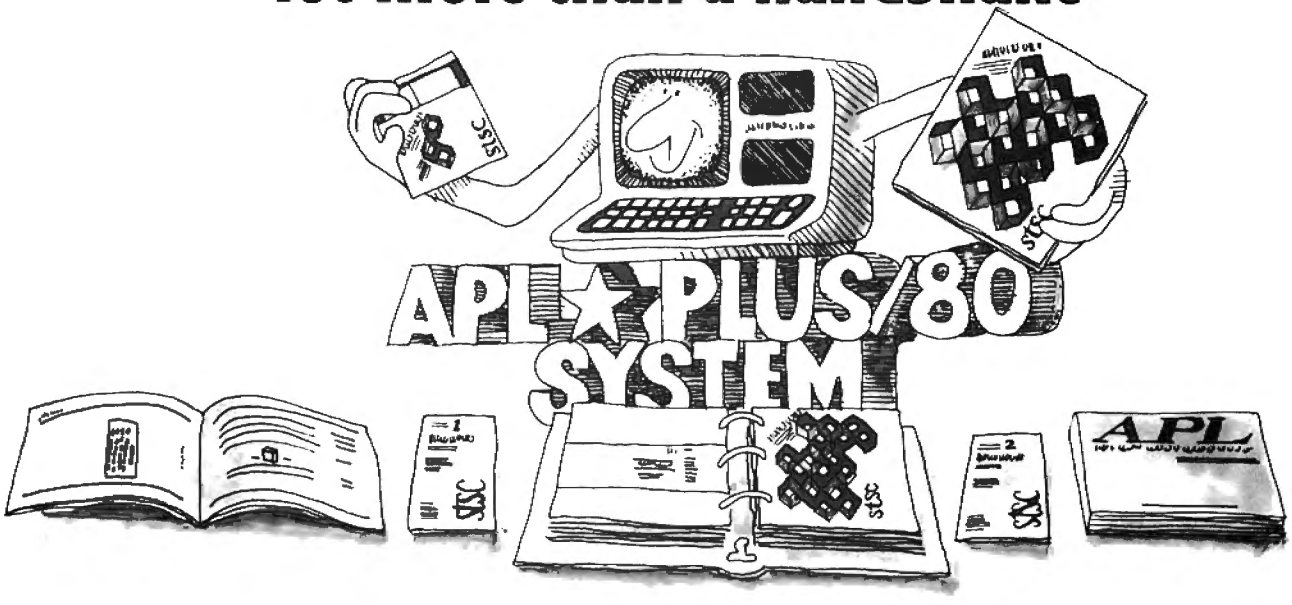

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Challenge to BASIC

Build a data file with 15 records of 21 random numbers between 1 and 100 chosen without duplicates (in a record) and arranged in tables with 3 rows and 7 columns. Write a subroutine that reads a specified record and prints the table with row and column totals in fields 6 columns wide. Here is an APL solution:

```
     ∇ RANDOMTABLES;I
[1]    'RTABLES' ⎕FCREATE 10 ◇ I←1
[2]   L:(3 7⍴21?100)⎕FAPPEND 10 ◇ →(15≥I←I+1)⍴L
     ∇
     ∇ SHOWTABLE N;M
[1]    'I6' ⎕FMT M,[1]+/[1]M←M,+/M←⎕FREAD 10,N
     ∇
     RANDOMTABLES ◇ SHOWTABLE 12
    89     1    45    30    84    50   100   399
    52     8    93    13    99    40    77   382
    14    69    29    96     3    44    68   323
   155    78   167   139   186   134   245  1104
```

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Figure 3 continued

```
                                   --- --- --- --- --- --- --- --- ---
                                    96 157  15 152  50  74  10 109 148

V)Nuts; wacko                      --- --- --- --- ---
                                   166  29 122  56 107

W)Chang and Eng e.g.?              --- --- --- --- --- --- --- --- --- --- ---
                                   105 113  78   3  72  39   1   8 143 110  21
                                      --- --- ---
                                       44  43 172

X)Equilibrium; stagnation          --- --- --- --- --- ---
                                    18 162  22  31  98  47

Y)Palatable; attractive or desir
able
                                   --- --- --- --- --- --- --- --- ---
                                    92 170  59  84  83 106 132  27  17
```

1W	2F	3W	4N	5D	6P	7T	8W	9D	10U	11D	12G	
13E	14B		15U	16O	17Y		18X	19R	20O	21W	22X	23O
	24I	25K		26B	27Y	28J	29V	30O	31X	32K	33Q	34N
35K		36Q	37I	38I		39W	40I	41D	42E	43W	44W	45O
46J	47X		48I	49R	50U	51O	52P	53M	54D	55Q	56V	
57N	58A	59Y		60F	61Q	62T	63H	64M	65M	66P	67I	68T
69N	70C		71I	72W		73O	74U	75J	76K	77S	78W	79R
	80A	81L	82G	83Y		84Y	85K	86N		87L	88H	89P
90M	91P	92Y		93R	94B		95L	96U	97J	98X	99I	100A
	101G	102N		103H	104P	105W	106Y	107V		108D	109U	110W
	111D	112I	113W	114C	115M	116E	117E	118H	119D	120T		121M
122V	123S	124F	125D		126L	127O	128J	129Q		130H		131H
132Y	133R		134B	135B		136E	137S	138C	139H		140L	141T
142L	143W	144A	145C	146B		147F	148U		149S		150A	151E
152U	153C	154F		155D	156G		157U	158H	159R		160D	161G
162X		163S	164F	165P	166V	167Q	168F		169K	170Y	171M	172W
173L												

ANSWER:

CONVERSATION ON THE SUBWAY IS IMPOSSIBLE THE INGENIOUS GENTLEMAN WHO CONSTRUCTED IT STARTED WITH THE OBJECT OF MAKING IT NOISY NOT ORDINARILY NOISY LIKE A TON O F COAL FALLING ON A SHEET OF TIN BUT REALLY NOISY

This program uses the graphics capabilities of the Epson MX-80 printer. The boxes are printed by the command in line 670 LPRINT STRING$(5,223). In the standard Epson mode, CHR$(223) is the same as CHR$(191) on video. If your printer has graphics capabilities, substitute whatever gives the full fill-in. If you do not have graphics capability, you might try using Xs by changing line 670 to read: . . . . STRING$(5,"X"). . . .

Good luck! ■

Jonathan Falk, a graduate student in Economics at Yale, is writing his doctoral dissertation on his Model III.

Program Listing

```
10 '******** Acrostic Generator ********
20 '******** Jonathan Falk       ********
30 '******** (c) 1982            ********
40 CLEAR 10000
50 DIM T$(400), P$(300), W$(40), F(26), G(26), B(80), D$(40), Q(
300)
60 ' ******** INPUT MODULE ********
70 ' INPUTS THE DESIRED ACROSTIC MESSAGE, PLACING THE MESSAGE IN
```

Program continues

Program continued

```
 T$(), WITHOUT BLANKS IN P$(), AND PLACING OCCURRENCES FOR EACH
LETTER IN F().
80 PRINT"INPUT TEXT, ALL CAPS, ENDING WITH @"
90 INPUT A$
100 FOR I=1 TO LEN(A$)
110 H$=MID$(A$,I,1): IF H$="@" THEN 150
120 T$(L)=H$: L=L+1
130 IF H$<>" " THEN P$(K)=H$: K=K+1: F(ASC(H$)-65)=F(ASC(H$)-65)
+1: NEXTI ELSE NEXTI
140 GOTO 80
150 PRINT"TEXT READS AS FOLLOWS: IF INCORRECT, START OVER"
160  FORI=0TOL-1:PRINTT$(I);:NEXTI
170 PRINT
180 INPUT "IF MESSAGE IS INCORRECT, HIT N";N$:IF N$="N"GOTO40

190 PRINT"LETTER","OCCURENCES","LETTER","OCCURENCES"
200 B=0
210 GOSUB920
220 '******* TITLE INITIALIZATION
230 '     PUTS TITLE IN W$
240 'TESTS TITLE AGAINST FREQUENCY TABLE
250 INPUT "TITLE";T$
260 FOR I=1 TO LEN(T$)
270 H$=MID$(T$,I,1):IF H$=" " THEN NEXTI: GOTO 310
280 W$(B)=H$:B=B+1
290 G(ASC(H$)-65)=G(ASC(H$)-65)+1
300 NEXTI
310 FOR I=0TO25:IFG(I)<=F(I) THEN NEXTI:GOTO330
320 PRINT"TITLE HAS TOO MANY ";CHR$(I+65);"'S":FORJ=0TO25:G(J)=0
:NEXTJ:GOTO190
330 FORI=0TO 25:F(I)=F(I)-G(I):G(I)=0:NEXTI
340 PRINT"MENU---------- (1)UNUSED TABLE        (2)CLUE TABLE"
350 PRINT"               (3)DELETE WORD         (4)ADD WORD     (5
)DIAGRAM"
360 INPUT "COMMAND";H
370 ONHGOTO380  ,430  ,470  ,540  ,630
380 PRINT"LETTER","OCCURRENCES","LETTER","OCCURRENCES"
390 GOSUB920
400 INPUT"HIT <ENTER> TO CONTINUE";H$
410 GOTO340
420 '***** WORD TABLE SUBROUTINE
430 FORI=0TOB:PRINTW$(I);" ";:NEXTI
440 PRINT:INPUT"HIT <ENTER> TO CONTINUE";H$
450 GOTO340
460 '****** CHANGE WORD SUBROUTINE
470 INPUT"WHICH WORD";W$
480 FORJ=0TOB:IFW$<>W$(J)THENNEXTJ:PRINTW$;" NOT FOUND":GOTO340

490 FORI=2TOLEN(W$):G(ASC(MID$(W$,I,1))-65)=G(ASC(MID$(W$,I,1))-
65)+1:NEXTI
500 FORI=0TO25:F(I)=F(I)+G(I):G(I)=0:NEXTI
510 W$(J)=LEFT$(W$,1)
520 GOTO340
530 '***** ADD WORD SUBROUTINE
540 INPUT"INPUT WORD";W$
550 FORJ=0TOB:IFLEFT$(W$,1)=LEFT$(W$(J),1) AND LEN(W$(J))=1 THEN
 560  ELSE NEXTJ:PRINT"NO AVAILABLE WORD WITH THAT LETTER":GOTO5
40
560 FORI=2TOLEN(W$)
570 H$=MID$(W$,I,1):IFH$=" "THENNEXTI:GOTO590
580 G(ASC(H$)-65)=G(ASC(H$)-65)+1:NEXTI
590 FORI=0TO25:IFG(I)>F(I) PRINT"WORD HAS TOO MANY ";CHR$(I+65);
"'S";FORI1=0TO25:G(I1)=0:NEXTI1:GOTO340  ELSE NEXTI
600 FORI=0TO25:F(I)=F(I)-G(I):G(I)=0:NEXTI:W$(J)=W$
610 GOTO340
620 '*****CHECK FOR PUZZLE COMPLETE
630 FORI=0TO25:IFF(I)=0 NEXTI:GOSUB740  ELSE PRINT"PUZZLE NOT FI
NISHED":GOTO340
640 '******** PRINT ROUTINE
650 LPRINT STRING$(79,"-")
660    L=L-1:FORI=0TOL
670 H$=T$(I):IFH$=" "THENLPRINTTAB(M);CHR$(124);STRING$(5,223);:
M=M+6:B(M-6)=1:GOTO690
680 B(M)=0:Z=Z+1:LPRINTTAB(M);CHR$(124);:LPRINTUSING"###";Z;:LPR
INT CHR$(ASC(P$(Z-1))-35);:M=M+6
690 IFM>72THENLPRINTTAB(78);CHR$(124)::FORI1=0TO78STEP6:LPRINTTA
B(I1);CHR$(124);:GOSUB940  :NEXTI1:LPRINT:LPRINTSTRING$(79,"-"):
M=0:C=0
700 NEXTI
710 LPRINTTAB(M);CHR$(124):FORI1=0TOMSTEP6:LPRINTTAB(I1);CHR$(12
4);:GOSUB940  :NEXTI1      :LPRINT:LPRINTSTRING$(M+1,"-")
720 GOTO820
730 '******* LETTER ASSIGNMENT ROUTINE
740 FORI=0TOB-1
750    FORJ=1TOLEN(W$(I))
760    Y=RND(K)-1::IFP$(Y)<>MID$(W$(I),J,1)THEN760
770 P$(Y)=CHR$(I+100)
780 Q(PP)=Y:PP=PP+1
790 NEXTJ,I
800 RETURN
810 '********DEFINITION INPUT ROUTINE
820 FORI=0TOB-1:PRINT"DEFINITION OF ";W$(I);:INPUTD$(I):NEXTI
830 II=0
840 IF LEN(D$(II))>30 THEN LPRINT CHR$(II+65)+")";:FOR HH=1 TO L
EN(D$(II)) STEP30:LPRINTMID$(D$(II),HH,30);:IF HH<LEN(D$(II)) TH
EN LPRINT:NEXTHH ELSENEXTHH ELSE LPRINT CHR$(II+65)+")";D$(II);
850 IFLEN(W$(II))>12 THEN880  ELSE LPRINTTAB(31);:FORJ=1TOLEN(W$
(II));:LPRINT"--- ";:NEXTJ:LPRINT:LPRINTTAB(31);:FORJ=1TOLEN(W$(I
I));:LPRINTUSING"###";Q(NN)+1;:NN=NN+1:LPRINT" ";:NEXTJ
860 LPRINT:LPRINT:II=II+1:IFII<BTHEN840
870 END
880 HH=1
890 LPRINTTAB(31);:FORJ=1TO11:LPRINT"--- ";:NEXTJ:LPRINT:LPRINTT
AB(31);:FORJ=1TO11:LPRINTUSING"###";Q(NN)+1;:NN=NN+1:LPRINT" ";:
NEXTJ:HH=HH+11
900    LPRINT:LPRINTTAB(34);:FORJ=1TOLEN(MID$(W$(II),HH,11)) :LP
RINT"--- ";:NEXTJ:LPRINT:LPRINTTAB(34);:FORJ=1TOLEN(MID$(W$(II),
HH,11)):LPRINTUSING"###";Q(NN)+1;:NN=NN+1:LPRINT" ";:NEXTJ:IFLEN
(MID$(W$(II),HH,11))<11THEN860  ELSEHH=HH+11:GOTO900
910 '********FREQUENCY TABLE MODULE
920 FORI=0TO12:PRINTCHR$(I+65),F(I),CHR$(I+78),F(I+13)
930 NEXTI:RETURN
940 IFB(I1)<>1THENRETURN
950 LPRINTSTRING$(5,223);:RETURN
```


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<<<< PLEASE INCLUDE THIS INFORMATION WHEN ORDERING >>>>
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CHECKS--MONEY ORDERS PREFERRED - COD'S ALSO ACCEPTED

CRAYON

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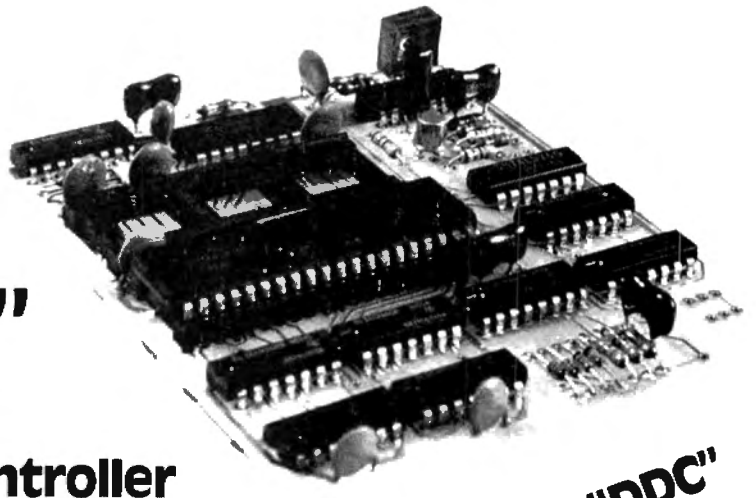
Aerocomp's Proven Best-By Test! The "DDC"



Double Density Controller

"DDC"

★ Technical Superiority

At last! A double density controller for Model I with HIGHER PROBABILITY OF DATA RECOVERY THAN WITH ANY OTHER DOUBLE DENSITY CONTROLLER ON THE MARKET TODAY! The "DDC" from Aerocomp. No need to worry about the problems that keep cropping up on existing products. AEROCOMP'S design phase lock loop data separator has a wider capture window than the digital types currently allows high resolution data centering. The finest resolution available with digital circuitry is 1 "DDC" analog circuit allows infinately variable tuning. Attack and settling times are opt
The units presently on the market use a write precompen Board to board tolerance is extremely wide - in the order of ± 100 ns. T s.
The bottom line is state of the art reliability!

Satisfied customer writes

A. Brandwein, D.D.S.
New York, New York

11/07/81

I received your (DDC) on . . . to my astonishment the first attempt to copy my system disk was successful . . . prior to purchasing your double density board I had tried LNW's and Percom's boards without success. My drives are the oldest RS ones that came out . . . The serial numbers are below 33000. Percom says you should have . . . numbers above 70000 for double density to work . . .

Yours truly,
A. Brandwein

★ Test Proven

Tests were conducted on AEROCOMP'S "DDC", Percon d LNW's "LNDoubler"** using a Radio Shack TRS80*** Model I, Level 2, 48 K with T om TFD100 * disk drive (Siemens Model 82). Diskette was Memorex 3401. T ed piece of media to determine performance under adverse conditions. The re installed sequentially in the expansion interface.
The test consisted of formatting 40 tracks on th pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as turers of drives and diskettes. An attempt was then made to read each sector on the dis ng system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were . The test was run ten times with each double density controller and the data averaged. Test res the table.

★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

★ Value

$139.95 for the BEST double density controller on the market.

$179.95 for "DDC" complete with DOSPLUS 3.3D
$229.95 for "DDC" complete with LDOS

★ TEST RESULTS ★

MFR & PRODUCT	SECTORS LOCKED OUT (AVG)
AEROCOMP "DDC"	0
PERCOM "DOUBLER II"	18
PERCOM "DOUBLER A"	250
LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only.
Specials will be prorated. Shipping $2.00 in Cont. US. See opposite page for details.

Data Separators

The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Den and Double Density Data Separator ("DDS").

★ Has your original manufacturer left you holding the bag?

If you already own a Percom "Doubler A", "Doubler II" or LNW "LNDoubler", the AEROCOMP "DDS" will make it right. Look at the test results:

MFR. & PRODUCT	SECTORS LOCKED OUT	
	WITHOUT "DDS"	WITH "DDS"
PERCOM "DOUBLER II"	18	1
PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".
* Trademark of Percom Data Co.
** Trademark of LNW
*** Trademark of Tandy Corporation

★ "DDS" $49.95

(Use 1791 chip from your DD Controller)

★ "DDS" with disk controller chip included $79.95

★ Disk controller chip $34.95

(Shipping $2.00 Cont. US - see opposite page for details)

Plugs directly into your existing Double Density Controller.

Happy DDS customer writes . . .

I don't often write letters such as this, but I feel I should in this case . . I am suprised and pleased with your DDS. It is not often a product is better than one expects . . . This (these) test (s) used a Percom Doubler "A". (Test without DDS installed showed many errors). (With DDS) not one error!!! After ten (10) tests of formatting and verifing and zeroing NOT ONE FAILURE OR LOCK OUT. Great!!!

Phil Gnadt
Kansas City, Kansas

See opposite page ▸▸▸▸▸▸

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40 & 80 TRACK
as low as $259.95

NEW LOW PRICES
Thanks to you our sales volume has allowed us to cut costs and we're passing the savings along. We offer the best disk drive value in the market place. Reliability, features and cost tough to beat. We deliver...and we stand behind our products. AEROCOMP is the only manufacturer to offer FREE TRIAL! Buy Aerocomp drives today. You deserve the best.

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- ★ Fast 5 ms. track-track access time.
- ★ Operates single or double density.
- ★ "FLIPPY" feature for lower media cost (40-1 & 80-1).
- ★ Head load solenoid.
- ★ Disk ejector.
- ★ Easy entry door.
- ★ **NEW** EXTERNAL DRIVE CABLE CONNECTION. (no longer need to remove the cover to hook up cable)

ORDER TODAY!
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- ★ 80-Track Drive. $409.95
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All above drives are complete with silver enclosure, power supply and external drive cable connection. 115 VAC, 50/60 Hz. 230 VAC 50/60 Hz available on special order.

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COMBO F. $989.00
Two 80-Track "FLIPPY" Drives, 4-drive **LDOS** Ins.

COMBO G. $889.00
Two 40-Track Dual-Head Drives, cable, TRSDOS 2.3 Disk & Manual, Freight & Ins.

COMBO H. $1289.00
Two 80-Track Dual-Head Drives, cable, **LDOS**, Freight & INS.

DOSPLUS 3.3 or NEWDOS / 80,2.0 available with any package

Add $5.00 per drive for shipping & handling (Cont. US)

FREE TRIAL OFFER
Order your AEROCOMP Disk Drive and use it with your system for up to 14 days. If you are not satisfied for ANY REASON (except misuse or improper handling), return it, packed in the original shipping container, for a full refund. (Hardware only. Special packages will be prorated) We have complete confidence in our products and we know you will be satisfied! **ORDER TODAY!!!**

WARRANTY
We offer you a 120 day unconditional warranty on parts and labor against any defect in materials and workmanship. In the event service, for any reason, becomes nescessary, our service department is fast, friendly and cooperative.

100% TESTED
AEROCOMP Disk Drives are completely assembled at the factory and ready to plug in when you receive them. Each drive is 100% bench tested prior to shipment. We even enclose a copy of the test checklist, signed by the test technician, with every drive. AEROCOMP MEANS RELIABILITY!!

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To order by mail, specify Model Number(S) of Drive, cable, etc. (above), enclose check, money order, VISA or MASTERCHARGE card number and expiration date, or request C.O.D. shipment. Texas residents add 5% sales tax. Add $5.00 per drive for shipping & handling (Cont. US). Please allow 2 weeks for personal checks to clear our bank. No personal checks will be accepted on C.O.D. shipments-cash, money orders or certified checks only. You will receive a card showing the exact C.O.D. amount before your shipment arrives. Be sure to include your name and shipping address. You will be notified of the scheduled shipping date. Your bank credit card will NOT be charged until the day we ship.!!

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2-DRIVE. $24.95
4-DRIVE. $34.95

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EPSON MX80 PRINTERS
$469.00

TRS80 Cable (I & III). $9.95*
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Ribbon Cartridge, Black. . . $9.95
Add $6.00 shipping (Cont. U.S.) does not include cable.

MX80 F/T
All the features of MX80 plus Friction Feed. Shipping & cables as above.

$579.00
*With Purchase of Printer

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The Key Box

Basic Level II
Model I or III
16K RAM

A Kung Fu battle even Bruce Lee might have lost.

Enter the Dragon

Brice Hadlock
5645 Fulton Avenue
Van Nuys, CA 91401

Have you recently tried to entertain guests with your computer? Then you know a contest taking three days to play is too involved for most people who want to play a game or two on your machine.

The TRS-80 versions of arcade games are a far cry from the real thing and can be disappointing to amusement center devotees.

So what do you show your guests? Kung Fu.

The game is adapted from the television series starring David Carradine. Action takes place on a 10 by 10 grid populated with Shaolin temples, dungeons, outlaws and mystics. You must race against the clock to free Syndi, who has been placed in a dungeon by outlaws.

But before you can free her, you must have two Shaolin masters and five Shaolin priests with you. You can find them in the temples. Also there, you may have one flashback revealing a significant location.

During your travels, you must battle outlaws and mystics who will try to deter you from Syndi.

There's no arcade original of Kung Fu; it won't take longer than the length of your guest's visit to play; but best of all, you won't spend a lot of time and effort entering it or getting it to work.

If you've typed programs from magazines into your computer, you know how discouraging it can be. Program lines are numbered inconsistently. The letter O is used as a variable. Worse than that, the programs contain character strings composed of nothing but spaces without any reference to the number of spaces in the string.

When you get the program running, you find it can't handle invalid entries. The program crashes and to get it ready for guests to play requires hours of modifications. Kung Fu was made to type in. You may use automatic line numbering. There are no spaces to count and no guessing about a character being a zero or O. The program uses INKEY$ for all inputs and won't crash with any invalid input.

However, if you have 16K of RAM, don't embellish the listing with extra spaces; the program runs tight in 16K. If you want to cut down on memory usage you can eliminate the instructions by deleting lines 80–100 and 2270–2380. If you delete the instructions you will save more than 2,000 bytes.

The game's map works like a road map: north is up; east to the right. A location like (5,2) can be located by starting in the upper left corner, counting five letters to the right and two letters down. On the map, D stands for dungeon, T for temple, O for outlaws, M for mystic, E for empty land and ? for what's in the unknown spot.

Model III owners will have to change the program. That model doesn't have printable arrows, so insert a new line 120:

```
120L6$(1) = CHR$(33):L6$(2) = CHR$(63):
  L6$(3):CHR$(60):L6$(4) = CHR$(62)
```

With a minimum of problems you should have a good addition to your collection of programs.■

Program Listing

```
10 CLEAR150
20 ' KUNG FU
30 ' BY BRICE HADLOCK
40 CLS:PRINT"INITIALIZING"
50 DIMS(18,10),R(10,10),P(15),T(5),TX(22),M(5),D(2),M1(5),F(5),P
$(15),M$(5),M1$(5),T$(5),D$(2),M2(5),P1(15),PA(5),MA(5)
60 A1$=STRING$(28,CHR$(188)):A2$=STRING$(28,CHR$(191)):A3$=STRIN
G$(28,CHR$(131)):A4$=CHR$(149):A5$=CHR$(148):A6$=CHR$(129):RANDO
M
70 RESTORE:FORA=1TO5:READM$(A):NEXTA:FORA=1TO15:READP$(A):NEXTA:
FORA=1TO5:READT$(A):NEXTA:READ D$(1):READ D$(2):FORA=1TO5:READM1
$(A):NEXTA
80 CLS:PRINT@28,"KUNG FU":PRINT:PRINT"DO YOU WANT INSTRUCTIONS?"
;
90 Y$=INKEY$:IFY$=""THEN90
100 IFY$="Y"THENGOSUB2270
110 CLS:GOSUB2390:Z9=128-(R7*8):CLS:PRINT"INITIALIZING":FORA=1TO
5:PA(A)=3:MA(A)=1:NEXTA
120 L6$(1)=CHR$(91):L6$(2)=CHR$(92):L6$(3)="-"+CHR$(94):L6$(4)=C
HR$(93)+"-"
130 K3$(1)="BANG":K3$(2)="KICK":K3$(3)="FALL":K3$(4)="OUCH":K3$(
5)="TRIP":K3$(6)="THROW":K3$(7)="BREAK"
140 T2$(1)="WHEW!":T2$(2)="WOW!":T2$(3)="SHEW BOY!":T2$(4)="OH M
AN!":T2$(5)="INCREDIBLE":T2$(6)="THAT WAS TOUGH!"
150 FORA=1TO15:P1(A)=0:P(A)=1:NEXTA:FORA=1TO5:M(A)=1:F(A)=1:NEXT
A
160 FORA=1TO10:FORB=1TO10:S(A,B)=1:R(A,B)=0:NEXTB,A
170 FORA=1TO5
180 T=RND(10):T1=RND(10):IFR(T,T1)<>0THEN180
190 T(A)=T+(T1/100)
200 R(T,T1)=A*10:NEXTA
210 FORA=1TO22
220 TE=RND(10):TF=RND(10):IFR(TE,TF)<>0THEN220
230 TX(A)=TE+(TF/100)
240 N=RND(21)+1:N=-N:R(TE,TF)=N:NEXTA
250 FORA=1TO5
260 M4=RND(10):M5=RND(10):IFR(M4,M5)<>0THEN260
270 M1(A)=M4+(M5/100)
280 R(M4,M5)=A*100:NEXTA
290 S2=RND(2)
300 FORA=1TO2
310 D1=RND(10):D2=RND(10):IFR(D1,D2)<>0THEN310
320 D(A)=D1+(D2/100):IFINT(S2)=INT(A)THENS8=D(A)
```

Program continues

Program continued

```
330 R(D1,D2)=A*1000:IFA=S2THENR(D1,D2)=R(D1,D2)+3
340 NEXTA
350 CLS
360 Y=INT(T(1)):X=T(1)-Y:X=X*100:X=INT(X+.5)
370 S(Y,X)=R(Y,X)
380 PRINT"YOU ARE AT THE ";T$(1);" TEMPLE";:GOSUB2610:PRINT@576,
"YOU ARE STARTING AT";X;",";Y:T3=X:X=Y:Y=T3:GOSUB490:PRINT"YOU W
ILL START WITH ";J$;" TO AID YOU":PRINT"YOU HAVE";Z9;"DAYS TO SA
VE SYNDI BEFORE THE OUTLAWS KILL HER":GOTO1570
390 GOTO1570
400 CLS:T=3:FORA=1TO10:FORB=1TO10:IFS(A,B)=0PRINTTAB(T);"S";:GOT
O460
410 IFS(A,B)=1THENPRINTTAB(T);"?";:GOTO460
420 IFS(A,B)>9 AND S(A,B)<51THENPRINTTAB(T);"T";:GOTO460
430 IFS(A,B)<501 AND S(A,B)>99THENPRINTTAB(T);"M";:GOTO460
440 IFS(A,B)<0THENPRINTTAB(T);"O";:GOTO460
450 IFS(A,B)>999THENPRINTTAB(T);"D";
460 T=T+6:NEXTB:T=3:PRINT:NEXTA
470 PRINT:PRINT"YOU ARE NOW AT";Y;",";X
480 PRINT:GOTO840
490 Q=R(X,Y)/10
500 U=RND(2):A=2
510 IFU=1THEN530ELSE570
520 IFA=0GOTO600
530 IFPA(Q)>0THENPA(Q)=PA(Q)-1ELSEA=A-1:GOTO560
540 R1=RND(15):IFP(R1)=1THENP1(R1)=1:P(R1)=0ELSE540
550 J$="PRIEST "+P$(R1):RETURN
560 IFA=0GOTO600
570 IFMA(Q)>0THENMA(Q)=0:A=A-1ELSEA=A-1:GOTO520
580 R1=RND(5):IFM(R1)=1THENM2(R1)=1:M(R1)=0ELSE580
590 J$="MASTER "+M$(R1):RETURN
600 J$="SORRY, NO PRIESTS OR MASTERS LEFT TO SPARE IN THIS TEMPL
E":RETURN
610 ' FLASHBACKS
620 Q=R(X,Y)/10:IFF(Q)=0PRINT"THE BEST WE CAN OFFER YOU IS PROTE
CTION, SORRY GRASSHOPPER...":RETURN
630 PRINT"FLASHBACK...":F(Q)=0
640 P3=0
650 P3=P3+1:IFP3=6THEN820ELSEU=RND(6):ONUGOTO660,700,730,760,790
,760
660 FORA=1TO22:J=INT(TX(A)):K=TX(A)-J:K=K*100:K=INT(K+.5):IFS(J,
K)=1THEN680
670 NEXTA:GOTO650
680 PRINT"MASTER ON THE WAY TO THE CASTLE I SAW OUTLAWS AT";K;",
";J;"!"
690 PRINT"GRASSHOPPER, ONLY REMEMBER WHERE tHEY STAY, AND AVOID
THEM...":GOTO830
700 FORA=1TO5:J=INT(T(A)):K=T(A)-J:K=K*100:K=INT(K+.5):IFS(J,K)=
1THEN720
710 NEXTA:GOTO650
720 PRINT"MASTER WHERE IS THE TEMPLE THAT I MUST DELIVER THIS PA
RCHMENT?":PRINT"GRASSHOPPER IT'S";K;"ON THE X AXIS, AND";J;"ON T
HE Y AXIS.":GOTO830
730 FORA=1TO2:J=INT(M1(A)):K=M1(A)-J:K=K*100:K=INT(K+.5):IFS(J,K
)=1THEN750
740 NEXTA:GOTO650
750 PRINT"MASTER, HOW SHALL I AVOID THE MYSTIC ON MY JOURNEY?":P
RINT"GRASSHOPPER, ONE IS HIDING AT";K;",";J;"!":GOTO830
760 FORA=1TO2:J=INT(D(A)):K=D(A)-J:K=K*100:K=INT(K+.5):IFS(J,K)=
1THEN780
770 GOTO740
780 PRINT"MASTER WHERE WILL THE OUTLAWS TAKE THEIR PRISONER?":PR
INT"GRASSHOPPER IT MAY BE THE DUNGEON AT";K;",";J;"WHO CAN SAY?"
:GOTO830
790 J=INT(S8):K=S8-J:K=K*100:K=INT(K+.5):IFR(J,K)<>1006 AND R(J,
K)<>2006THEN800ELSE810
800 PRINT"MASTER WHERE HAVE THE OUTLAWS HIDDEN THE PRINCESS?":PR
INT"GRASSHOPPER, ALL GIRLS ARE TAKEN TO THE DUNGEON AT";K;",";J;
".":S(J,K)=R(J,K)+3:R(J,K)=S(J,K):RETURN
810 GOTO650
820 PRINT"MASTER HOW WILL I COMPLETE THIS TASK?":PRINT"GRASSHOPP
ER, YOU MUST LOOK TO YOUR INNER SELF FOR DIRECTION...":RETURN
830 S(J,K)=R(J,K):RETURN
840 GOSUB2510:PRINT"YOUR MOVE?"
850 W$=INKEY$:IFW$=""THEN850
860 IFW$="N"THEN960
870 IFW$="R"THEN1060
880 IFW$="M"THEN400
890 IFW$="D"THEN1290
900 IFW$="S"THEN970
910 IFW$="E"THEN950
920 IFW$="W"THEN940
930 GOTO840
940 IFY-1<1THEN980ELSEY=Y-1:GOTO990
950 IFY+1>10THEN980ELSEY=Y+1:GOTO990
960 IFX-1<1THEN980ELSEX=X-1:GOTO990
970 IFX+1>10THEN980ELSEX=X+1:GOTO990
980 PRINT"THAT IS ON THE OTHER SIDE OF THE GREAT WALL, TRY AGAIN
.":GOTO840
990 S(X,Y)=R(X,Y):PRINT"YOU ARE NOW AT";Y;",";X:Z9=Z9-1
1000 IFR(X,Y)<51 AND R(X,Y)>9THENS2=R(X,Y)/10:CLS:PRINT"YOU ARE
AT THE ";T$(S2);" TEMPLE":GOSUB2610:GOTO1500
1010 IFR(X,Y)<0CLS:PRINT"OH NO, YOU HAVE RAN INTO A BAND OF";ABS
(R(X,Y));"OUTLAWS":GOTO1610
1020 IFR(X,Y)>999THEN2030
1030 IFR(X,Y)=100 OR R(X,Y)=200 OR R(X,Y)=300 OR R(X,Y)=400 OR R
(X,Y)=500THEN2140
1040 PRINT"YOU ARE ON AN EMPTY PIECE OF LAND"
1050 GOTO840
1060 CLS:PRINT"REPORT...":PRINT
1070 J=INT(D(1)):K=D(1)-J:K=K*100:K=INT(K+.5):IFR(J,K)=1006THENP
RINT"YOU KNOW THAT SYNDI IS IN THE DUNGEON AT";K;",";J:PRINT
1080 J=INT(D(2)):K=D(2)-J:K=K*100:K=INT(K+.5):IFR(J,K)=2006THENP
RINT"YOU KNOW THAT SYNDI IS IN THE DUNGEON AT";K;",";J:PRINT
1090 G6=0:FORA=1TO15:IFP1(A)=1THENG6=G6+1
1100 NEXTA:IFG6=0PRINT"YOU DON'T HAVE ANY PRIESTS":GOTO1150
1110 IFG6=1PRINT"YOU HAVE ONE PRIEST, HE IS PRIEST ";:GOTO1270
1120 PRINT"YOU HAVE";G6;"PRIESTS, THEY ARE..."
1130 PRINT"* ";:FORA=1TO15:IFP1(A)=1:PRINTP$(A);" * ";
1140 NEXTA:PRINT
1150 PRINT:G6=0:FORA=1TO5:IFM2(A)=1THENG6=G6+1
1160 NEXTA:IFG6=0:PRINT"YOU DON'T HAVE ANY MASTERS":GOTO1240
1170 IFG6>1THEN1210
1180 IFG6=1PRINT"YOU HAVE ONE MASTER, HE IS MASTER ";:FORA=1TO5:
IFM2(A)=1PRINTM$(A)
1190 NEXTA
1200 GOTO1240
```

Program continues

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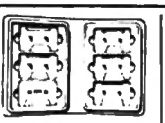

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Program continued

```
1210 PRINT"YOU HAVE";G6;"MASTERS, THEY ARE..."
1220 PRINT"* ";:FORA=1TO5:IFM2(A)=1PRINTM$(A);" * ";
1230 NEXTA:PRINT
1240 PRINT:PRINT"YOU HAVE";Z9;"DAYS LEFT BEFORE THEY KILL SYNDI"

1250 PRINT"LEGAL MOVES: 'N' NORTH, 'S' SOUTH, 'E' EAST, 'W' WEST
, 'M' MAP":PRINT"'R' REPORT, 'D' DISCOVER."
1260 GOTO840
1270 FORA=1TO15:IFP1(A)=1PRINTP$(A):GOTO1150
1280 NEXTA
1290 Z9=Z9-1:PRINT"WHICH DIRECTION DO YOU WISH TO EXPLORE AND NO
T ENTER?"
1300 W1$=INKEY$:IFW1$=""THEN1300
1310 IFW1$="N"THEN1360
1320 IFW1$="S"THEN1370
1330 IFW1$="E"THEN1380
1340 IFW1$="W"THEN1390
1350 PRINT"COME AGAIN...":GOTO1290
1360 IFX-1<1THEN1400ELSEQ3=X-1:GOTO1410
1370 IFX+1>10THEN1400ELSEQ3=X+1:GOTO1410
1380 IFY+1>10THEN1400ELSEQ4=Y+1:GOTO1420
1390 IFY-1<1THEN1400ELSEQ4=Y-1:GOTO1420
1400 PRINT"THAT'S ON THE OTHER SIDE OF THE GREAT WALL, WHY LOOK
THERE?":GOTO840
1410 Q4=Y:GOTO1430
1420 Q3=X:GOTO1430
1430 PRINT"AT";Q4;",";Q3;"LIES ";
1440 S(Q3,Q4)=R(Q3,Q4):IFR(Q3,Q4)<0PRINT"A BAND OF OUTLAWS":GOTO
1490
1450 IFR(Q3,Q4)=0PRINT"A PIECE OF LAND THAT IS EMPTY":GOTO1490
1460 IFR(Q3,Q4)>9 AND R(Q3,Q4)<51THENPRINT"A TEMPLE":GOTO1490
1470 IFR(Q3,Q4)>99 AND R(Q3,Q4)<501THENPRINT"A MYSTIC":GOTO1490
1480 IFR(Q3,Q4)>999THENPRINT"A DUNGEON"
1490 GOTO840
1500 PRINT@575,CHR$(32);:PRINT:J$="":PRINT"A=GET A PRIEST OR A M
ASTER  F=GET A FLASHBACK"
1510 W1$=INKEY$:IFW1$="A"THENS3=1:GOTO1540
1520 IFW1$="F"THENS3=2:GOTO1540
1530 GOTO1510
1540 ONS3GOSUB490,610
1550 IFLEN(J$)>50THENPRINTJ$:GOTO1570
1560 IFS3=1 AND J$<>""THENPRINT"YOU NOW HAVE ";J$;" TO ASSIST YO
U"
1570 PRINT"DO YOU WANT TO WAIT AT THE TEMPLE FOR A DAY?"
1580 Q5$=INKEY$:IFQ5$=""THEN1580
1590 IFQ5$="Y"THENZ9=Z9-1:A=576:FORA1=1TO6:PRINT@A,CHR$(30);:A=A
+64:NEXTA1:PRINT@575,CHR$(32);:GOTO1500
1600 GOTO840
1610 GOSUB2570:U$=" ":PRINT@703,U$;:V=ABS(R(X,Y))
1620 GOSUB1630:GOTO1700
1630 W=0
1640 FORA=1TO15:IFP1(A)=1THENW=W+1
1650 NEXTA
1660 W1=0
1670 FORA=1TO5:IFM2(A)=1THENW1=W1+1
1680 NEXTA
1690 RETURN
1700 IFW1+W<3 AND V>9THENPRINT@704,"YOU HAVE BEEN KILLED BY THE
OUTLAWS":GOTO2240
1710 GOTO1740
1720 T6=RND(12):IFT6=4PRINT@704,"ALL YOUR ASSISTANTS HAVE BEEN K
ILLED BY THE OUTLAWS, YOU BARELY ESCAPE":FORA=1TO15:P1(A)=0:NEXT
A:FORA=1TO5:M2(A)=0:NEXTA:GOTO840
1730 GOTO1760
1740 IFW1+W=0PRINT@704,"YOU HAVE BEEN GIVEN A TORTUROUS DEATH BY
 THE OUTLAWS...":GOTO2240
1750 GOTO1720
1760 W5=W+W1:IFV/3.5>W5THEN1790
1770 IFV/2>W5THEN1950
1780 A=RND(2)+1:Z9=Z9-A:PRINT@704,"ALL OF THE OUTLAWS HAVE BEEN
KILLED, GOOD WORK":PRINT"YOU LOSE";A;"DAYS IN DEFEATING THEN THO
UGH...":S(X,Y)=0:R(X,Y)=0:GOTO840
1790 IFW5<3THEN E=RND(W5)ELSE E=RND(3)
1800 IFE<1THEN840
1810 GOSUB1820:GOTO840
1820 L9=W:TG=0:FORA=1TOE
1830 Y7=RND(15):IFP1(Y7)=1THENP1(Y7)=0:PRINT"PRIEST ";P$(Y7);" D
IES FIGHTING THE OUTLAWS":GOTO1850
1840 IFW=0THEN1870ELSE1830
1850 TG=TG+1:L9=L9-1:IFL9=0THEN1870
1860 NEXTA:IFTG=3RETURN
1870 IFW1=0THENRETURN
1880 IFTG=3RETURN
1890 E=E-TG:IFE>W1THENE=W1
1900 IFW1<=0 OR E<=0THEN840
1910 FORA=1TOE
1920 Y7=RND(5):IFM2(Y7)=1THENM2(Y7)=0:PRINT"MASTER ";M$(Y7);" DI
ES IN BATTLE AGAINST THE OUTLAWS":GOTO1940
1930 GOTO1920
1940 NEXTA:RETURN
1950 S(X,Y)=0:R(X,Y)=0
1960 PRINT"ALL THE OUTLAWS HAVE BEEN KILLED, BUT...":S(X,Y)=0:R(
X,Y)=0
1970 IFW=0THEN2000
1980 Y7=RND(15):IFP1(Y7)=1PRINT"PRIEST ";P$(Y7);" HAS BEEN INJUR
ED":GOTO2020
1990 GOTO1980
2000 Y7=RND(5):IFM2(Y7)=1PRINT"MASTER ";M$(Y7);" HAS BEEN INJURE
D":GOTO2020
2010 GOTO2000
2020 C4=RND(3)+1:Z9=Z9-C4:PRINT"YOU LOSE";C4;"DAYS":GOTO840
2030 CLS:S3=R(X,Y)/1000:S3=INT(S3):PRINT"YOU ARE AT THE ";D$(S3)
;" DUNGEON":GOSUB2580:W2$=" ":PRINT@639,W2$;
2040 GOSUB1630:IFW<5 OR W1<2PRINT"YOU DON'T HAVE ENOUGH PRIEST'S
 & MASTER'S TO OPEN THE DUNGEON":PRINT"THOUGH.":GOTO840
2050 PRINT"DO YOU WANT TO OPEN THE DUNGEON?"
2060 W3$=INKEY$:IFW3$="Y"THEN2080
2070 IFW3$="N"THEN2110ELSE2060
2080 IFR(X,Y)=1000 OR R(X,Y)=2000THEN2100
2090 GOSUB2690:IFZ9<=1THEN2120ELSEPRINT"YOU HAVE FOUND SYNDI, AN
D HELPED HER TO GET FREE IN TIME!!!":PRINT:PRINT"YOU WIN WITH";Z
9;"DAYS LEFT":GOTO2240
2100 Y7=RND(3)+1:Z9=Z9-4:PRINT"WRONG DUNGEON, SYNDI IS NOT HERE,
 YOU LOSE";Y7;"DAYS LOOKING.":PRINT
2110 GOTO840
2120 IFZ9=0THEN2130ELSEPRINT"WOW, JUST IN TIME, YOU GOT SYNDI OU
```

Program continues

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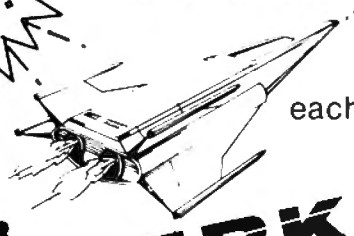

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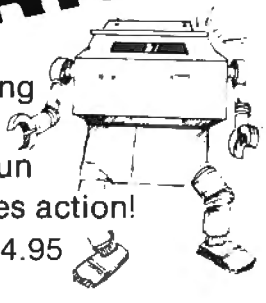

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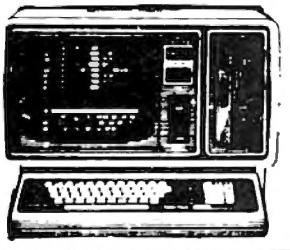

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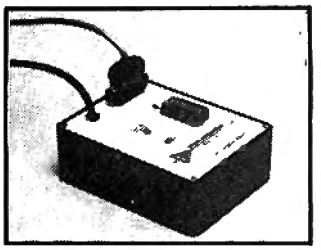
Program continued

```
T 1 DAY BEFORE SHE WOULD":PRINT"HAVE BEEN KILLED. GOOD WORK!!!":
GOTO2240
2130 PRINT"OH WOW, YOU GRABBED HER OUT OF ONE OF THE OUTLAWS ARM
S,":PRINT"ANOTHER MOMENT AND SHE WOULD HAVE BEEN KILLED!!!":GOTO
2240
2140 S3=R(X,Y)/100:S3=INT(S3+.5)
2150 CLS
2160 PRINT"YOU HAVE INVADED THE LAND OF THE GREAT MYSTIC ";M1$(S
3)
2170 FORA=1TO200:NEXTA
2180 FORA=1TO100:B=RND(4):C=RND(638)+64:PRINT@C,L6$(B);:NEXTA
2190 GOSUB1630:IFW<3 OR W1<1THENPRINT@704,"THE MYSTIC ";M1$(S3);
" HAS MADE YOU KILL YOURSELF!!!":GOTO2240
2200 Y7=12:IFZ9<12THENY7=Z9-1
2210 Y7=RND(Y7)+1
2220 PRINT@704,"YOU HAVE DESTROYED ";M1$(S3);" THE MYSTIC, BUT I
T TOOK";Y7:PRINT"DAYS TO DO IT!!!":S(X,Y)=0:R(X,Y)=0:Z9=Z9-Y7:PR
INT:GOTO840
2230 GOTO840
2240 PRINT:PRINT"WANT TO PLAY AGAIN (Y/N)"
2250 Q$=INKEY$:IFQ$=""THEN2250
2260 IFQ$="Y"THEN10ELSEPRINT:PRINT"WE SHALL MEET AGAIN. (HUMBLE
BOWS)...":END
2270 CLS:PRINT"THE GAME TAKES PLACE IN CHINA. THE AREA IS REPRES
ENTED BY A 16":PRINT"BY 16 GRID. ON THE GRID ARE SHAOLIN TEMPLES
, DUNGEONS, OUTLAWS,":PRINT"MYSTICS, AND EMPTY SPACES.":PRINT
2280 PRINT"THE OBJECT OF THE GAME IS TO FREE SYNDI FROM A DUNGEO
N THAT":PRINT"THE NEFARIOUS OUTLAWS HAVE PUT HER IN. TO OPEN THE
 DUNGEON":PRINT"YOU MUST HAVE TWO SHAOLIN MASTERS AND FIVE SHAOL
IN PRIESTS."
2290 PRINT:PRINT"THERE ARE FIVE SHAOLIN TEMPLES, TWO DUNGEONS, F
IVE MYSTICS,":PRINT"AND A LOT OF OUTLAWS.":PRINT
2300 PRINT"EACH TEMPLE WILL GIVE YOU UP TO THREE PRIESTS AND ONE
 MASTER,":PRINT"BUT ONLY ONE AT A TIME. YOU MAY ALSO GET ONE FLA
SHBACK FROM":PRINT"EACH TEMPLE WHICH WILL TELL YOU AN IMPORTANT
LOCATION.":GOSUB2430
2310 CLS:PRINT"THE OUTLAWS ARE MEAN, AND CAN KILL ALL OR SOME OF
 YOUR PRIESTS":PRINT"AND MASTERS IF YOU ENCOUNTER THEM. THE MYST
ICS ARE A BIT LESS":PRINT"DEADLY, HOWEVER, THEY USUALLY TAKE MAN
Y DAYS TO OVERCOME.":PRINT
2320 PRINT"YOU CAN MOVE NORTH, SOUTH, EAST, AND WEST. IN ADDITIO
N YOU CAN":PRINT"LET YOUR PRIESTS OR MASTERS SPY ON A NEIGHBORIN
G AREA WITHOUT":PRINT"ENTERING IT. MOVING, AND 'DISCOVERING' TAK
E ONE DAY EACH.":PRINT
2330 PRINT"YOU MAY ALSO ASK FOR A MAP WHICH WILL SHOW YOU ALL TH
AT YOU":PRINT"CURRENTLY KNOW ABOUT THE LOCATION OF THINGS. IN AD
DITION TO":PRINT"THIS YOU MAY ASK FOR A REPORT THAT WILL TELL YO
U LEGAL MOVES,"
2340 PRINT"HOW MANY PRIESTS AND MASTERS YOU HAVE, AND DAYS LEFT.
":GOSUB2430
2350 PRINT"THE LEGAL MOVES ARE 'N' NORTH, 'S' SOUTH, 'E' EAST, '
W' WEST,":PRINT"'R' REPORT, 'D' DISCOVER, AND 'M' MAP.":PRINT
2360 PRINT"THE SKILL LEVEL YOU CHOOSE DETERMINES THE NUMBER OF D
AYS YOU":PRINT"HAVE TO SAVE SYNDI BEFORE THE OUTLAWS KILL HER. T
HE HIGHER THE":PRINT"NUMBER YOU PICK AS YOUR SKILL LEVEL THE LES
S DAYS YOU WILL HAVE":PRINT"TO SAVE SYNDI.":PRINT
2370 PRINT"YOU START AT THE NANCHANG SHAOLIN TEMPLE WITH A PRIES
T OR":PRINT"MASTER TO HELP YOU. WHEN AT A TEMPLE YOU HAVE THE OP
TION OF":PRINT"STAYING FOR A DAY; IN DOING THIS YOU MAY POSSIBLY
 GET MORE"
2380 PRINT"THAN ONE ASSISTANT WHILE YOU'RE AT THE TEMPLE.":PRINT
:PRINT"GOOD LUCK!!!  PRESS ANY KEY TO BEGIN YOUR HONORABLE MISSI
ON";:GOSUB2440:RETURN
2390 PRINT"SKILL LEVEL 1-8"
2400 Y2$=INKEY$:IFY2$=""THEN2400
2410 R7=VAL(Y2$):IFR7<1 OR R7>8PRINT:PRINT"1-8 PLEASE":PRINT:GOT
O2390
2420 RETURN
2430 PRINT:PRINT"PRESS ANY KEY TO CONTINUE";
2440 C9$=INKEY$:IFC9$<>""THENCLS:RETURN
2450 GOTO2440
2460 DATAKAHN,POE,CHOU,CONFUCIUS,HAN
2470 DATALUN YI,CHUN-TZU,TAO,TUAN-MU,YU JO,PU SHANG,TSENG TS'AN,
HO-CHI,YEN HUI,CHUAN-SUN SHIH,CHI-SUN FEI,LIN PANG,WANG-SUN CHIA
,KWAI CHANG CAINE,TA-HSIANG
2480 DATANANCHANG,TEHCHOW,CANTON,HANKOW,CHAOTUNG
2490 DATALUCHOW,CHAMDO,SUCHOW,TUMEN
2500 DATAJAN YUNG,KUAN CHUNG,CHOU JEN
2510 IFZ9<=0PRINT"SORRY, TIME RAN OUT, SYNDI HAS ALREADY BEEN KI
LLED...":PRINT:GOTO2240
2520 GOSUB1630
2530 M3=0:FORA=1TO5:M3=M3+PA(A)
2540 NEXTA:M4=0:FORA=1TO5:IFMA(A)=1THENM4=M4+1
2550 NEXTA:IFM3+W<5 OR M4+W1<2PRINT:PRINT"NOT ENOUGH HELP IS LEF
T TO OPEN THE DUNGEON, SHE WILL DIE...":GOTO2240
2560 RETURN
2570 FORT=1TO200:NEXTT:Q$=STRING$(6,32):FORA=1TO12:B=RND(630)+64
:C=RND(7):PRINT@B,K3$(C);:FORT=1TO100:NEXTT:PRINT@B,Q$:NEXTA:A=R-
ND(6):B=LEN(T2$(A)):B=(63-B)/2:B=INT(B):PRINT@B+320,T2$(A);:RETU
RN
2580 FORA=53TO73:SET(A,5):SET(A,28):NEXTA:FORA=5TO28:SET(52,A):S
ET(74,A):SET(53,A):SET(73,A):NEXTA
2590 FORA=57TO69:SET(A,10):SET(A,16):NEXTA:FORA=10TO16:SET(57,A)
:SET(69,A):SET(60,A):SET(63,A):SET(66,A):NEXTA
2600 RETURN
2610 ' DRAW TEMPLE
2620 PRINT@330,A1$;A5$;:PRINT@482,A2$;A4$;:PRINT@466,A2$;A4$;:PR
INT@530,A3$;A6$;
2630 B=54:C=74:C1=15:FORA=1TO5:FORB1=BTOC:SET(B1,C1):NEXTB1:C1=C
1-1:B=B+2:C=C-2:NEXTA
2640 SET(36,15):SET(92,15):SET(64,10)
2650 FORA=1TO3:FORB=1TO3:SET(A+34,B+11):SET(90+A,B+11):SET(62+A,
6+B):NEXTB,A
2660 FORA=1TO5STEP4:SET(A+33,13):SET(A+89,13):SET(A+61,8):NEXTA
2670 FORA=0TO1:SET(36,A+10):SET(92,A+10):SET(64,A+5):NEXTA
2680 RETURN
2690 A=64:FORB=1TO9:PRINT@A,CHR$(30);:A=A+64:NEXTB
2700 FORA=1TO3:SET(A+62,6):SET(A+62,7):NEXTA:SET(64,8):SET(65,8)
:FORA=1TO4:FORB=1TO3:SET(A+61,B+8):NEXTB,A:A=9:FORB=1TO5:SET(B+6
5,A):A=A+1:NEXTB:SET(62,10):SET(61,11):SET(60,10):SET(59,9)
2710 FORA=1TO9:FORB=1TO3:SET(B+62,A+11):NEXTB,A:FORA=1TO7:SET(62
,A+13):SET(66,A+13):NEXTA:FORA=1TO6:SET(61,A+14):SET(67,A+14):NE
XTA:FORA=1TO4:SET(60,A+16):SET(68,A+16):NEXTA:FORA=1TO2:SET(59,A
+18):SET(69,A+18):NEXTA
2720 PRINT@516,"***  YOU HAVE SAVED ME, I AM FOREVER IN YOUR DEB
T  ***":PRINT@639,CHR$(32):RETURN
2730 END
```

Model 953A EPROM PROGRAMMER



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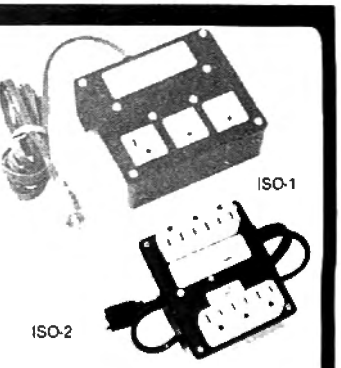

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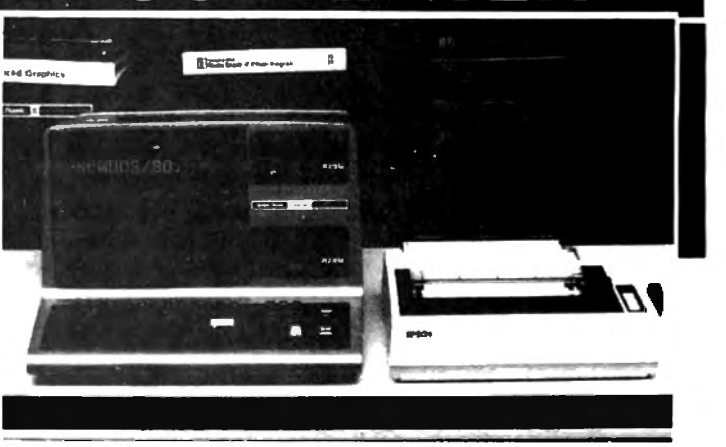

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Buck Starton and you take on the Klaxons.

Conquest of Memory Alpha

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The time period is the 24th century. Earth has colonized hundreds of planets throughout the galaxy. In 2320 A.D. an evil race, the Klaxons, attacked the colonies in an attempt to obliterate homo sapiens forever.

And so began the galactic conflict of 2330 A.D. After 10 years of war the Klaxons, without warships to continue the struggle, retreated to remote corners of the universe.

Many years passed until, finally, the Earth was able to boast of peaceful commerce between the stars. During the war, however, many people were killed and families separated. Their survivors asked the Galactic Council to search for missing loved ones, but were told it was not cost-effective.

The Game Scenario

Buck Starton shook his head groggily as he awoke in his cell. He felt a peculiar bump at the back of his neck near the base of his skull. With his fingers he felt the outline of a beetle-shaped device under his skin.

Starton, from a backwards planet in the Grenly sector, was educated enough to know a surgical implant when he felt one. He quivered as he considered the implant's implications. Here he was, a Klaxon prisoner, held on some unknown remote planet, in an unpopulated section of the galaxy, with an implant in his neck.

Starton remembered hearing about Klaxon prisoners during the war; human robots they were called. They still had their minds, but via surgical implants, could be switched to remote control whenever the aliens so desired. And now, thought Buck, I am one of those human robots.

The sound of the cell door opening made Buck jump to his feet. A massive Klaxon guard motioned Starton to follow him. Buck tried to form a rebelling thought, but could not. They were testing their new toy. Following sluggishly behind, Buck was led into the Great Central Chamber of the Klaxon ruler.

He walked with spastic jerks to the ornate throne where the ruler sat watching with a grin on his ugly face. As Buck stood, intimidated, the king spoke.

"You are not cooperating!" he said in a gruff voice. "If you wish to live, you will not fight it human."

Buck tried to raise his hand to strangle the repugnant creature, but the increased pain emanating from the implant threw him to the ground. He found that if he relaxed the pain subsided. For the remainder of the Klaxon ruler's talk he stood motionless.

"I have a very important mission for you, my feisty human. Before we made our unfortunate error in the battle of Orion, we learned of a human-designed super dreadnaught for their navy. From what we have learned, it is the most powerful ship in the galaxy. And I want it! With it I will be able to take my rightful place as master of the galaxy. Then I will eradicate you puny humans once and for all!"

Buck leaped at the crazed alien. He got within inches before he was struck down by an alert guard's stun beam. He smiled as he sunk into unconsciousness: He had taken an action too fast for the controllers of his mind. Maybe he could escape.

He awoke aboard a tiny robot ship flying through the cosmos at ultra-light velocity. He was alone with only the ship's central computer as a companion. The master control panel was covered and stripped bare, except for a single red button. Figuring he had nothing to lose he pushed it. The Klaxon ruler's voice then emanated from the

The Key Box

Basic Level II
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plastoid walls around him.

"Hope you enjoyed your nap my puny friend. Now, about your mission." Buck sank into the only seat on the ship with his head in his hands. The voice continued:

"The plans for this magnificent dreadnaught are contained on a data wafer stored on the small planet Algar V. Here the total collection of human knowledge is kept in a building called Memory Alpha, whatever that means. Get into this structure and steal that data wafer. You will find a few small weapons at your disposal. You will be given a printout of the life forms inhabiting Algar V. Study it carefully."

The voice paused as a sheet of paper crawled out of a slot beneath the console. The Almighty Ruler of Klaxon continued:

"Remember Earthman, we are watching you. Should you try to escape, or let the humans on Algar V know of your mission, you will be extinguished instantly! Should you complete your mission, you will be picked up and delivered to me. Good luck human."

Buck rolled his eyes in disgust. "Oh well," he muttered, "might as well try it." He wondered if that was his thought or an implanted one.

For three days Buck travelled through space until the ship finally descended onto Algar V. It was dark. The planet had recently started its 12-day period of night.

Buck looked at his small inventory of supplies—a strange selection indeed. According to the digital display on the hand laser he was only given 10 shots. He clipped a small grapefruit-sized grenade to his coveralls. It had been stolen from a terrestrial starship. Buck recognized the L.G.E. (low ground effect gre-

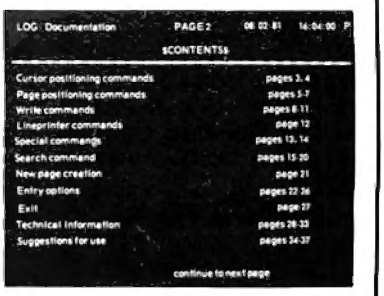
A$ — Message output
AC — Front door open/shut flag
B — String variable for general input
C — Main command input string
CC — String matrix for life form names
CO — String matrix for object names
D — String matrix for location descriptions
D1 — Location code. First letter is description, second is direction
D2 — General string manipulation
D3 — " " "
D6 — " " "
DA — " " "
DB — " " "
DP — " " "
E1 — East direction flag
EP — Your experience points
ER — Poison flag
FS — Your strength points
GA — Guard attack flag
I — General loop variable
J — " " "
K — " " "
L — Creature number
LF — Creature location matrix
LS — Light status flag
N1 — North direction flag
NB — Number of barbarians
ND — Number of dead bodies
NG — Number of robot guards
NM — Number of minutes of torch light
NS — Number of shots in laser
NT — Number of computer technicians
O — Object location matrix
PL — Your present location
Q — CHR$(34) variable
RF — Robot follows flag
S1 — South direction flag
SB — Tech's box activated flag
UC — Chameleon man camouflaged flag
W1 — West direction flag
X — General purpose
Y — General purpose
YG — Fall in darkness flag
YS — Matrix for location and type of dead body
Z — General purpose

Table 1. Variable List

Announcing

LOG

ELECTRONIC NOTEBOOK



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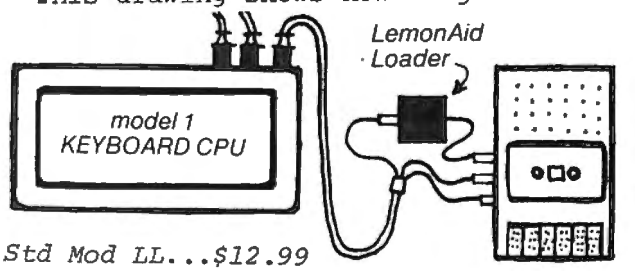

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nade) as being one of the experimental models produced at Rigel War Laboratories during the conflict. They were too sensitive and had to be discontinued. The Klaxons had also given him a standard electrotorch for light. Equipment in hand, Buck leaped onto the surface of Algar V to begin his mission...

The Program

The program's modular form allowed me to create a central command input section in lines 60–210 to branch to the various routines to handle the action of the adventure. Since the Search ...Compare section looks for keywords, the player is not restricted to one or two-word commands.

Once a particular subroutine has completed its action, it jumps back to line 60 where flags are checked and the status of certain individual items are changed and acted upon.

For instance, in line 70 strength points are decreased with the passage of a turn. Then it is checked to see if you are getting weak or have fallen unconscious. In line 150 the program waits for you to enter data.

Some of the creatures will be more apt to follow you than others. This happens in the move section at lines 330–640. You can change the possibility of an encounter by changing the RND statements in lines 410–440.

How to Modify

You can also change the number of each different type of life form by changing the variables in line 40 to whatever you desire. Remember to keep the game within reasonable limits. If you were to place 100 robot guards on the planet, your chances of survival would be mighty slim.

Try the game as is and then, if you like, use the variable list (Table 1) and the Program Listing to customize the adventure to your own taste.■

L.L. Myers serves aboard a nuclear submarine in the US Navy.

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Program Listing

```
10 CLS:CLEAR200:RANDOM:POKE16553,255:DEFSTRC,Q,D,B:DEFINTA,E,S,Y
,I,J,X:READD1:DIMC1(20),C(36),LP(5),O(4),CC(5),CO(4),D(13),YS(11
,1),D6(5):Q=CHR$(34)
20 PRINT@18,"CONQUEST OF MEMORY ALPHA";PRINT:PRINT"  AS YOU EXIT
 FROM THE TINY ROBOT SHIP YOU WONDER JUST HOW YOU  CAN POSSIBLY
GET INTO THE BUILDING OF ";Q;"MEMORY ALPHA";Q;".":PRINT"LOOKING
BACK OVER YOUR SHOULDER YOU SEE THE BLAST OF THE ENGINE"
30 PRINT"AS YOUR SHIP LIFTS OFF TO WAIT FOR YOU IN ORBIT, THEN Y
OU ARE   PLUNGED INTO DARKNESS ON THE PLANET!";PRINT:LP(1)=10:LP
(2)=2:LP(3)=11:LP(4)=20
40 FORI=1TO36:READC(I):NEXT:FORI=0TO13:READD(I):NEXTI:FORI=0TO5:
READCC(I):NEXTI:FORI=0TO4:READCO(I):NEXTI:O(1)=100:O(2)=100:O(3)
=100:NS=10:NT=2:NG=6:NR=3:NB=2:NM=75:LF(5)=43:O(0)=37:LF(0)=47:E
P=10:FS=40:SD=1:O(4)=RND(99)
50 GA=0:FORI=0TO5:READD6(I):NEXT:LS=0:KB=0:ND=0:FORI=1TO4:LF(I)=
100:NEXTI:PRINT"YOU ARE PRESENTLY ON A DARK PLANET.":GOTO60
60 IFLF(1)=PLANDGA=1ANDLS=1THENL=1:GOTO790ELSEIFLP(1)=PLANDLS=1A
NDRND(12)>10THENL=1:GOTO790
70 FS=FS-.5:IFFS<0ANDFS>4THENPRINT"YOUR GETTING VERY WEAK. YOU N
EED FOOD!":ELSEIFFS<1THENPRINT"YOU HAVE FALLEN UNCONCIOUS FROM L
ACK OF STRENGTH!":GOTO1430
80 IFLS=1THENNM=NM-1:IFNM<4THENPRINT"YOUR ";CO(1);"'S BATTERIES
ARE GETTING VERY WEAK!":IFNM<1THENPRINT"YOUR ";CO(1);" DIMS AND
GOES OUT.":LS=0
90 IFO(0)=100ANDPL=LF(5)ANDRND(6)>4THEN1420
100 IFD3="A"ANDO(0)=100THEN1490
110 IFLF(3)=PLAND(KB=10RRND(12)>8)THENL=3:GOTO890
120 IFO(0)=100ANDLF(0)=PLANDSB=1ANDRND(6)>3THENPRINT"THE ";CC(0)
;" PRESSES A BUTTON ON THE BOX!  OH NO!":GOTO1520ELSEIFO(0)=100A
NDLF(0)=PLANDRND(20)>18THENA$="WATCH OUT! THE TECH HAS PRESSED A
 HIDDEN SWITCH!":GOSUB1470:GOTO1520
130 IFER=1ANDRND(2000)=199THENA$="YOU ARE GETTING VERY FEVERISH!
":GOSUB1470:A$="YOU ARE SLOWLY BEING POISONED BY THE RAT YOU EAT
!":GOSUB1470:ER=5
140 IFER=5THENSP=SP-2:IFSP<2THENA$="THE POISON HAS MADE YOU FALL
 UNCONCIOUS!":GOSUB1470:A$="YOUR BODY QUIVERS AND DIES!":GOSUB14
70:GOTO1430
150 C="":X=0:C1(0)="":INPUTC:IFC=""THENPRINT"WHAT?":GOTO150ELSEF
ORI=1TOLEN(C):B=MID$(C,I,1):IFB=" "ORB="'"ORB=","ORB="!"ORB="?"O
RB=";"ORB=":"THENX=X+1:C1(X)="":GOTO170
160 C1(X)=C1(X)+B:IFX=20THENPRINT"TOO MANY WORDS!":GOTO150
170 NEXTI:FORI=0TOX:B=C1(I):IFLEFT$(B,5)="KLAXO"THEN1520
180 FORJ=1TO36:IFB=C(J)THEN210ELSENEXTJ
190 NEXTI
200 PRINT"I DON'T KNOW HOW TO ";Q;C;Q:GOTO60
210 ONJGOTO330,330,330,330,330,330,330,330,320,310,310,280,280,6
70,670,820,820,910,910,910,960,960,460,460,650,650,1110,1110,120
0,1200,1280,1280,1350,1440,1370,1390
220 PRINT"YOU DON'T HAVE IT!":EP=EP-1:GOTO60
230 PRINT"YOU CAN'T DO THAT...YET!":GOTO60
240 PRINT"IT'S ALREADY ";B;"!":EP=EP-1:GOTO60
250 PRINTB;" WHAT?":GOTO60
260 PRINT"WHAT ";B;"?":GOTO60
270 PRINT"DON'T BE RIDICULOUS!":GOTO60
280 IFO(1)<100THEN220ELSEIFLS=0THEN240ELSEPRINT"YOUR ";CO(1);" I
S NOW ";B:LS=0:GOTO60
290 IFRND(18)>2PTHENX=1:RETURNELSEX=0:RETURN
300 IFRND(22)>2STHENX=1:RETURNELSEX=0:RETURN
310 IFO(1)<100THEN220ELSEIFLS=1THEN240ELSEIFNM<1THENPRINT"THE BA
TTERIES ARE DEAD.":GOTO60ELSEA$="YOUR "+CO(1)+" IS NOW ON. THE G
LOW SPREADS OUT OVER THE":GOSUB1470:A$="DESOLATE ALIEN PLANET.":
GOSUB1470:LS=1:GOTO470
320 IFSD>0THENPRINT"STRANGE...IT WON'T BUDGE.":GOTO60ELSEPRINT"T
HE DOOR OPENS!":AC=1:GOTO60
330 IFLS=0THENPRINT"THE PLANET IS DARK. YOU CAN'T SEE ANYTHING!"
:YG=YG+1:IFYG>3THENPRINT"YEEOOOW! YOU FELL INTO A DEEP RAVINE!":
GOTO1430ELSEGOTO60
340 B=LEFT$(B,1):IF(B="N"ANDN1=0)OR(B="W"ANDW1=0)OR(B="S"ANDS1=0
)OR(B="E"ANDE1=0)THENPRINT"IMPOSSIBLE TO GO THAT DIRECTION.":GOT
O60
350 IFPL=43ANDAC=0ANDB="W"THENPRINT"THE MASSIVE FRONT DOOR IS ST
ILL CLOSED.":GOTO60
360 IFLF(5)=PLTHENPRINT"THE ";CC(5);"'S LASER CANNON REVOLVES TO
 YOUR.":IFRND(12)>10THENL=5:GOTO790
370 FORI=1TO4:IFLF(I)=300THENNEXTELSEIFLF(I)>499THENNEXTELSEIFLF
(I)<>PLANDRND(12)>6THENLF(I)=100:NEXTIELSENEXTI
380 RP=0:IFLF(1)=PLANDRND(6)>2THENPRINT"THE ROBOT LOOKS AT YOU K
IND OF PUNNY AND FOLLOWS YOU.":RP=1
390 FB=0:IFLF(3)=PLANDRND(6)>4THENFB=1
400 IFB="N"THENPL=PL-10ELSEIFB="W"THENPL=PL+1ELSEIFB="S"THENPL=P
L+10ELSEIFB="E"THENPL=PL-1
410 IFLF(0)=100ANDNT>0THENIFRND(12)=8THENLF(0)=PL:NT=NT-1
420 IFLF(1)=100ANDNG>0THENIFRND(12)>7THENLF(1)=PL:NG=NG-1
430 IFLF(2)=100ANDNR>0THENIFRND(12)>6THENLF(2)=PL:NR=NR-1
440 IFLF(3)=100ANDNB>0THENIFRND(12)>8THENLF(3)=PL:NB=NB-1
450 GOTO470
460 IFX>0THEN970
470 IFLS=0THEN330ELSEFORI=1TO9:PRINT:NEXTI:A=PL*2+1:DP=MID$(D1,A
,2):D2=LEFT$(DP,1):D3=RIGHT$(DP,1):PRINT@448,CHR$(31):PRINT@576,
"YOUR PRESENT LOCATION : THE ";D(ASC(D3)-65);".":PRINT"POSSIBLE
DIRECTIONS : ";:N1=0:S1=0:E1=0:W1=0:A=ASC(D2)-65
480 IFA=0THENN1=1ELSEIFA=1THENW1=1ELSEIFA=2THENS1=1ELSEIFA=3THEN
E1=1ELSEIFA=4THENN1=1:E1=1ELSEIFA=5THENN1=1:W1=1ELSEIFA=6THENN1=
1:S1=1ELSEIFA=7THENE1=1:W1=1ELSEIFA=8THENE1=1:S1=1ELSEIFA=9THENS
1=1:W1=1ELSEIFA=10THENN1=1:W1=1:S1=1
490 IFA=11THENN1=1:W1=1:E1=1ELSEIFA=12THENN1=1:E1=1:S1=1ELSEIFA=
13THENE1=1:W1=1:S1=1ELSEIFA=14THENN1=1:W1=1:E1=1:S1=1
500 IFN1=1THENPRINTC(5);" ";
510 IFW1=1THENPRINTC(6);" ";
520 IFS1=1THENPRINTC(7);" ";
530 IFE1=1THENPRINTC(8);" ";
540 PRINT:IFRP=1THENLF(1)=PL:IFRND(20)>17THENL=1:GOTO790
550 X=0:PRINT"LOOKING AROUND, YOU CAN SEE :":FORI=0TO3:IFPL=LF(I
)THENPRINT"A ";CC(I);".":X=1:NEXTELSENEXT
560 IFPL=LF(4)ANDUC=0THENPRINT"A ";CC(4);".":X=1
570 IFPL=LF(5)THENPRINT"A SINISTER LOOKING ";CC(5);".":X=1
580 FORI=0TO4:IFPL=O(I)THENPRINT"A ";CO(I);".":X=1:NEXTELSENEXT
590 IFND>0THENFORI=0TOND-1:IFPL=YS(I,1)THENPRINT"A DEAD ";CC(YS(
I,0));".":X=1:NEXTELSENEXT
```

Program continues

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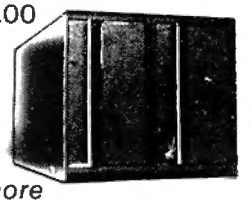

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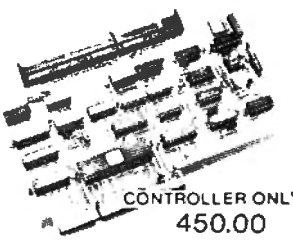

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Program continued

```
600 IFLF(2)-500=PLTHENPRINTCC(2);" BONES."ELSEIFX=0THENPRINT"NOT
HING."
610 IFFB=1THENLF(3)=PL:PRINT:FB=0:A$="THE "+CC(3)+" WALKS UP BEH
IND YOU!":GOSUB1470
620 IFLF(3)=PLANDKB=1THENPRINT"THE ";CC(3);" HAS HEARD ABOUT YOU
 KILLING HIS BROTHER!":KB=0:L=3:GOTO890
630 IFPL=43THENPRINT"THE FRONT DOOR TO ";Q;"MEMORY ALPHA";Q;" IS
 TO THE WEST OF YOU."
640 GOTO60
650 PRINT"YOU HAVE";FS;"STRENGTH POINTS AND";EP;"EXPERIENCE POIN
TS.":PRINT"YOU ARE PRESENTLY CARRYING :";:FORI=0TO4:IFO(I)=100THE
NPRINT"A ";CO(I);:IFI=2THENPRINT" WITH";NS;"SHOTS LEFT."ELSEIFI=
1THENPRINT" WITH";NM;"MINUTES LEFT."ELSEPRINT"."
660 NEXTI:IFLF(2)=300THENPRINT"A DEAD ";CC(2);".":GOTO60ELSEGOTO
60
670 IFNS<=0THENPRINT"YOUR CHARGE IS GONE!":GOTO60ELSEGOSUB1180:I
FL=5ANDPL<>LF(5)THENL=1ELSEIFL=8THENNS=NS-1:PRINT"YOU FIRE AT TH
E STRANGE METAL DOOR.":GOTO720
680 IFLF(L)<>PLTHEN260ELSEPRINT"A POWERFUL BLAST OF ENERGY ERUPT
S FROM YOUR WEAPON!":NS=NS-1
690 IFL<5ANDL<>1THENGOSUB290:IFX=0THENEP=EP+2:GOTO730ELSEEP=EP-1
:GOTO750
700 IFL=1THENGOSUB290:IFX=1THEN780ELSEIFRND(6)=3THEN780ELSEGOTO7
30
710 IFL<>5THEN770ELSEIFRND(30)>28THEN730ELSEPRINT"BUT THE ARMOR
 PROTECTS THE ";CC(L):GOTO790
720 IFL=8ANDPL<>43THEN260ELSEIFSD<1THENPRINT"THE DOOR SEEMS TO C
RUMBLE ALITTLE.":GOTO60ELSEPRINT"THE DOOR GLOWS RED BUT SEEMS TO
 ABSORB THE ENERGY.":SD=SD-1:GOTO60
730 IFRND(6)=LTHEN800ELSEPRINT"AND VAPORIZES THE ";CC(L):LF(L)=1
00
740 IFL=3THENKB=1:A$="YOU HEAR A WARLIKE CRY IN THE DISTANCE!":G
OSUB1470:GOTO60ELSEIFL=1ANDGA=0THENA$="YOUR IMPLANT BEEPS AS THE
 GUARDS ARE ALERTED OF AN INTRUDER!":GOSUB1470:GA=1:GOTO60ELSEGO
TO60
750 IFL>0ANDRND(12)>6THENPRINT"THE ";CC(L);" RUNS FROM YOU!":LF(
L)=RND(99):GOTO60
760 IFL=2ANDRND(12)>10THENPRINT"THE ";CC(L);" BITES YOU!":FS=FS-
8:GOTO60ELSEIFL=8ANDRND(12)=11THENPRINT"THE ";CC(L);"REACHES INT
O HIS POCKET AND PULLS OUT A SMALL BAG!":SB=1:GOTO60
770 PRINT"AND YOU MISS EVERYTHING!":GOTO60
780 PRINT"BUT THE BEAM MISSES THE ";CC(L);"!":IFRND(12)>8THEN790
ELSEIFRND(12)=5THENPRINT"THE ";CC(L);" MOVES AWAY FROM YOU.":GOT
O810ELSEGOTO60
790 PRINT"YOU ARE SHOT AT BY THE ";CC(L);"!":GOSUB290:IFX=1ORL=5
THEN800ELSEPRINT"BUT YOU DODGE THE SEARING BLAST!":EP=EP+1:GOTO7
0
800 IFRND(20)>FSTHENPRINT"THE BEAM CUTS RIGHT THROUGH YOU!":GOTO
330ELSEPRINT"AND YOU ARE BURNED BY THE BEAM!":FS=FS-1:GOTO70
810 IFPL>9THENLF(L)=LF(L)-10:GOTO60ELSELF(L)=LF(L)+10:GOTO60
820 IFFS<4THENPRINT"YOU HAVEN'T ENOUGH STRENGTH TO DO BATTLE!":G
OTO60ELSEGOSUB1180:IFLF(L)<>PLTHEN260ELSEIFL=5ANDPL<>LF(5)THENL=
1ELSEIFL=5THEN270
830 PRINT"YOU SWING A POWERFUL RIGHT ARM!":IFL=2ANDRND(12)>4THEN
880ELSEIFL=2THENPRINT"BUT THE LITTLE RASCAL IS TO FAST!":GOTO750

840 IFL=1ANDRND(20)>18THEN880ELSEIFL=1THENPRINT"BUT YOU MISS!":G
OTO790
850 IFL=3ANDRND(20)>16THENKB=1:GOTO880ELSEIFL=3THENPRINT"AND YOU
 MISS THE ";CC(L):GOTO890
860 IFL=4ANDRND(12)>9THEN880ELSEIFL=4ANDRND(12)>10THENPRINT"AND
THE ";CC(L);" HAS CAMOFLAGED HIMSELF!":PRINT"YOU CAN'T SEE HIM!"
:GOTO980ELSEIFL=4THEN750
870 IFL=0ANDRND(12)<7THEN760
880 PRINT"YOU HAVE KILLED THE ";CC(L);".":YS(ND,0)=L:YS(ND,1)=PL
:ND=ND+1:LF(L)=100:GOTO740
890 IFRND(12)>4THENPRINT"THE ";CC(L);" SWINGS AT YOU!":GOSUB300:
IFX=1THENPRINT"AND PULVERIZES YOU!":GOTO1430ELSEPRINT"BUT YOU DU
CK UNDER IT!":EP=EP+1:GOTO60ELSEGOTO60
900 IFRND(12)>8THENLF=RND(99):GOTO60ELSEUC=1:GOTO60
910 FORL=0TO5:IFPL=LF(L)THEN920ELSENEXTL:PRINT"NO RESPONSE.":GOT
O60
920 IFL=1THENPRINT"THE ";CC(1);" SAYS IN A METALLIC VOICE :";PRI
NTQ;"SHOW PROPER IDENTIFICATION PLEASE!";Q:IFRND(12)>10THEN790EL
SEGOTO60
930 IFL=0ANDSB=1THENPRINT"THE ";CC(L);" YELLS : ";Q;"NO MORE!";Q
:PRINT"AND HE PRESSES THE BUTTON ON THE BOX!":FORI=1TO900:NEXTI:
PRINT"YOU ARE SUDDENLY DIZZY AND EVERYTHING BLURS!":GOTO1520
940 IFL=0THENPRINT"THE ";CC(0);" SAYS TO YOU :";PRINTQ;"MAY I HE
LP YOU?";Q;" BUT HE DOESN'T SEEM TO BE LISTENING!":IFRND(12)>10T
HENPRINT"HE PULLS SOMETHING OUT OF HIS POCKET. ALITTLE BOX.":SB=
1:GOTO60ELSEGOTO60
950 PRINT"THE ";CC(L);" JUST GLARES AT YOU!":IFL<>2THEN890ELSEPR
INT"AND THEN IT RUNS AWAY!":LF(2)=RND(99):GOTO60
960 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFB="AREA"ORB="ROOM"ORLEFT
$(B,4)="MOUN"ORLEFT$(B,4)="PLAI"ORLEFT$(B,4)="HALL"THEN970ELSEIF
LEFT$(B,4)="GUAR"ORB="TANK"ORB="BODY"THEN1060ELSEIFB="DOOR"THEN1
100ELSENEXTK:GOTO200
970 IFD3=""THENPRINT"YOU CAN'T SEE ANYTHING!":GOTO60ELSEA$="YOU
START LOOKING AROUND. YOU SEE...":GOSUB1470:A=ASC(D3)-65:IFA>5TH
EN1010ELSEFORK=1TOLEN(D6(A))STEP2:Y=VAL(MID$(D6(A),K,1)):Z=VAL(M
ID$(D6(A),K+1,1)):GOSUB1040:NEXTK
980 FORK=0TO4:IFPL=LF(K)THENAS="A "+CC(K)+" RIGHT NEXT TO YOU! L
OOKING YOU OVER.":GOSUB1470:NEXTKELSENEXTK
990 FORK=0TO4:IFPL=O(K)THENAS="A "+CO(K)+" HERE.":GOSUB1470:NEXT
KELSENEXTK
1000 PRINT:IFA=4THENPRINT"YOU ALSO SEE ";Q;"MEMORY ALPHA";Q;" HE
RE.":GOTO60ELSEGOTO60
1010 DA="DOORWAY":IFA=6THENDB=C(7)+C(6):GOSUB1050ELSEIFA=7THENDB
=C(5)+C(6):GOSUB1050:DB=C(5)+C(8):GOSUB1050:DB=C(7)+C(8):GOSUB10
50:DB=C(7)+C(6):GOSUB1050ELSEIFA=8THENDB=C(8):GOSUB1050:DB=C(5):
GOSUB1050
1020 IFA=9THENDB=C(7):GOSUB1050:DB=C(8):GOSUB1050ELSEIFA=10THEND
B=C(6):GOSUB1050:DB=C(5):GOSUB1050ELSEIFA=11THENDB=C(7):GOSUB105
0ELSEIFA=12THENDB=C(8):GOSUB1050ELSEIFA=13THENDB=C(6):GOSUB1050:
GOTO60ELSEGOTO60
1030 GOTO60
1040 IFY=1ORY=5THENAS=D(Y)+" TO THE "+C(Z)+".":GOSUB1470:RETURNE
LSEA$="A "+D(Y)+" TO THE "+C(Z)+".":GOSUB1470:RETURN
1050 A$="THERE IS A "+DA+" ON THE "+DB+" WALL.":GOSUB1470:RETURN
1060 IFLF(1)=PLTHENPRINT"THE ";CC(1);" WON'T LET YOU!":L=1:GOTO7
90ELSEFORI=0TOND-1:IFYS(I,0)=1ANDYS(I,1)=PLTHEN1090ELSENEXTI
1070 IFLF(5)=PLTHENPRINT"THE TANK IS STILL ACTIVE!":L=5:GOTO790
1080 FORI=0TOND-1:IFYS(I,0)>2ANDYS(I,0)<5ANDYS(I,1)=PLTHENPRINT"
YOU FIND NOTHING ON THE ";B;".":GOTO60ELSENEXTI:GOTO260
1090 IFO(4)<100THENPRINT"YOU SEE A ";CO(4);" HERE.":O(4)=PL:EP=E
P+2:GOTO60
1100 IFPL<>43THEN260ELSEPRINT"YOU SEE A LEVER AND A SMALL SLOT N
EXT TO THE DOOR.":GOTO60
1110 GOSUB1160:IFL>4THEN1120ELSEIFO(L)<>PLTHEN260ELSEO(L)=100:GO
TO1140
1120 IFLF(2)=300THENPRINT"YOU ALREADY HAVE ONE.":GOTO60ELSEFORI=
0TOND-1:IFYS(I,0)=2THENYS(I,0)=0:LF(2)=300:GOTO1150ELSENEXTI
1130 IFLF(2)=PLTHENPRINT"MAYBE YOU BETTER KILL IT FIRST!":GOTO60
ELSEIFLF(2)-500=PLTHENPRINT"THE BONES DISSOLVE AS YOU TOUCH THEM
!":LF(2)=100:GOTO60
1140 PRINT"YOU NOW HAVE THE ";B;".":IFL=3ANDRND(50)>45THENPRINT"
THE ";CO(L);" HAS DETONATED IN YOUR HANDS!":GOTO1430ELSEGOTO100
1150 FORJ=ITOND-2:YS(J,0)=YS(J+1,0):YS(J,1)=YS(J+1,1):NEXTJ:ND=N
D-1:GOTO1140
1160 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFB="DATA"ORB="WAFER"THEN
L=0:RETURNELSEIFB="TORCH"ORB=CO(1)THENL=1:RETURNELSEIFB="LASER"O
RB="WEAPON"ORB="GUN"THENL=2:RETURNELSEIFB="GRENADE"ORB="BOMB"THE
NL=3:RETURN
1170 IFB="CARD"ORB="PLASTIC"THENL=4:RETURNELSEIFB="RAT"ORB="ALGA
RIAN"THENL=5:RETURNELSENEXTK:IFJ<29THEN270ELSEGOTO220
1180 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFLEFT$(B,4)="TECH"ORLEFT
$(B,4)="COMP"THENL=0:RETURNELSEIFB="GUARD"THENL=1:RETURNELSEIFB=
"RAT"ORB="ALGARIAN"THENL=2:RETURNELSEIFLEFT$(B,4)="BARB"THENL=3:
RETURN
1190 IFB="DOOR"THENL=8:RETURNELSEIFLEFT$(B,4)="CHAM"ORB="MAN"THE
NL=4:RETURNELSEIFB="TANK"ORB="ROBOT"THENL=5:RETURNELSENEXTK:GOTO
200
1200 GOSUB1160:IFL>4THEN1210ELSEIFO(L)<100THEN220ELSEO(L)=PL:GOT
O1220
1210 IFLF(2)<300THEN220ELSEYS(ND,0)=2:YS(ND,1)=PL:LF(2)=100:ND=ND
+1
1220 PRINT"YOU HAVE NOW DROPPED THE ";B;".":GOTO60
1230 DATA JANANANBNBNBNBNBNBICKAOAOAOBOBOBOBOBMCODODODOELELELE
LEOEMCKDODODMEJGIGJLDLKEMCKDODODOEOGMGFKIJKEMCKDODODMEFGLGNHEIKE
MCKDODODMEBNHNLHDMKEMCKDODODOENENENENEOEMCKFKFOFOFOFOFOFOPMCFF
LFLFLFLFLFLFLFLFEC
1240 DATAN,W,S,E,NORTH,WEST,SOUTH,EAST,OPEN,ON,LIGHT,OFF,UNLIGHT
,SHOOT,FIRE,KILL,ATTACK,ASK,TALK,SAY,SEARCH,EXAMINE,L,LOOK,INVEN
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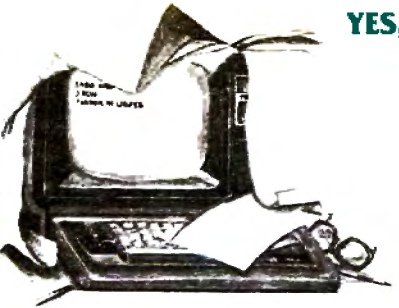
NADE,PLASTIC CARD
1270 DATA1637,882647,184858,854657,15265738,354526,
1280 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFB="GRENADE"ORB="BOMB"TH
EN1290ELSENEXTK:GOTO1200
1290 IFO(3)<100THEN220
1300 FORJ=KTOX:B=C1(J):IFB="TANK"THEN1310ELSEIFB="GUARD"THEN1330
ELSEIFB="DOOR"THEN1340ELSENEXTJ:B="AT":GOTO250
1310 IFLF(5)<>PLTHEN260ELSEL=5:X=4:GOTO1320
1320 O(3)=200:PRINT"YOU THROW THE ";CO(3);" AT THE ";CC(L):IFRND
(12)>XTHENPRINT"AND IT EXPLODES! VAPORIZING THE ";CC(L):LF(L)=10
0:GOTO60ELSEPRINT"BUT IT DIDN'T DETONATE!":O(3)=PL:IFRND(12)>XTH
EN790ELSEGOTO60
1330 IFLF(1)<>PLTHEN260ELSEL=1:X=5:GOTO1320
1340 IFPL<>43THEN260ELSEO(3)=200:PRINT"YOU TOSS THE ";CO(3);" AT
 THE MASSIVE FRONT DOOR.":IFRND(12)>6THENPRINT"AND IT BLOWS IT W
IDE OPEN!":AC=1:GOTO60ELSEPRINT"BUT IT DIDN'T DETONATE!":O(3)=PL
:GOTO60
1350 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFB="RAT"ORB="ALGARIAN"TH
EN1360ELSENEXTK:GOTO270
1360 IFLF(2)<300THEN220ELSEPRINT"YUM YUM <SIC> YUCK! WELL AT LEA
ST IT HELPED YOUR STRENGTH!":FS=FS+20:LF(2)=500+PL:ER=1:GOTO60
1370 IFX=0THEN250ELSEFORK=ITOX:B=C1(K):IFB="CARD"ORB="PLASTIC"TH
EN1380ELSENEXTK:GOTO200
1380 IFO(4)<100THEN220ELSEIFPL<>43THEN230ELSEO(4)=200:PRINT"YOU
INSERT THE ";CO(4);" INTO THE SMALL SLOT...":EP=EP+3:GOTO60
1390 IFX=0THEN250ELSEFORK=ITOX:IFC1(K)="LEVER"THEN1400ELSENEXTK:
GOTO200
1400 IFPL<>43THEN230ELSEPRINT"YOU PULL THE LEVER.":IFO(4)<>200TH
ENPRINT"BUT NOTHING HAPPENS.":GOTO60
1410 IFRND(50)>40PRINT"A WIERD SOUND STARTS COMING FROM WITHIN."
ELSEPRINT"THE MASSIVE DOOR SLOWLY RISES BEFORE YOU!":AC=1:EP=EP+
2:GOTO60
1420 IFLF(5)=PLTHENPRINT"THE TANKS CANNON SPINS RAPIDLY AROUND A
ND FIRES A BLAST AT YOU.":PRINT"WHICH VAPORIZES YOU!":GOTO1430
1430 FORI=1TO1000:NEXTI:PRINT"YOU LOSE...":PL=96:GOTO1460
1440 PRINT"YOU HAD";FS;"STRENGTH POINT AND";EP;"EXPERIENCE POINT
S":PRINT"DO YOU WISH TO PLAY AGAIN <Y/N>"
1450 Y$=INKEY$:IFY$=""THEN1450ELSEIFY$="Y"THENRUNELSEIFY$="N"THE
NENDELSEGOTO1450
1460 FORI=1TO1000:NEXTI:PRINT:A$="FROM OUT OF THE HEAVENS YOU SE
E YOUR ROBOT SHIP'S FIERY TRAIL ASIT STOPS NEAR YOU. A SPARODIC
ROBOT EMERGES FROM THE SHIP AND  DELIVERS A MESSAGE TO YOU :":G
OSUB1470:GOTO1480
1470 FORI=1TOLEN(A$):PRINTMID$(A$,I,1);:FORJ=1TO5:NEXTJ,I:PRINT:
RETURN
1480 FORI=1TO500:NEXTI:PRINT"  ";Q;"YOU HAVE BEEN GIVEN ANOTHER
CHANCE. DO NOT FAIL AGAIN!";Q:PRINT:RESTORE:READD1:GOTO40
1490 FORI=1TO800:NEXTI:A$="YOUR SURGICAL IMPLANT BEEPS IN YOUR H
EAD! LOOKING UP YOU SEE A":GOSUB1470:A$="FIERY TRAIL AS YOUR SHI
P PREPARES TO LAND.":GOSUB1470:IFLF(1)=PLANDRND(12)=4THENPRINT"B
UT THE ";CC(1);" HAS OTHER PLANS!":L=1:GOTO790
1500 A$="LOOKING BACK AT "+Q+"MEMORY ALPHA"+Q+" YOU FEEL PROUD T
HAT YOU":GOSUB1470:A$="CONQUERED SUCH A FORMIDABLE OBJECT.":GOSU
B1470:A$="SHAKING YOUR HEAD YOU REALIZE THAT THE KLAXONS MUST RE
ALLY BE":GOSUB1470
1510 A$="TAKING CONTROL OF YOUR MIND....,":GOSUB1470:FORI=1TO500
:NEXTI:GOTO1440
1520 FORI=1TO500:NEXTI:A$="YOU ARE SUDDENLY TRANSPORTED TO SOMEP
LACE DARK.":GOSUB1470:A$="SOMEPLACE VERY COLD.":GOSUB1470:A$="SO
MEPLACE THAT IS COMPLETELY SILENT!":GOSUB1470:FORI=1TO1000:NEXTI

1530 CLS:PRINT:PRINT:PRINTCHR$(23);A$="S P A C E ! !":GOSUB1470:
FORI=1TO600:NEXTI:CLS:GOTO1430
```



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Publisher, *80 Micro*

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Space fun for the Models I and III, and Color Computer.

Space Duel

Dave Edick
15938 Gramercy Drive
San Leandro, CA 94578

I wrote Space Duel for my dad's Model I. I recently bought a TRS-80 Color Computer and rewrote Space Duel for it.

Space Duel is a real-time arcade type game with one smart ship which permits a fast pace.

Although I tried to make the Model I and Color versions similar I made some concessions. First was the graphics. The Model I version features smaller ships and barriers but lacks sound. It ran too slow with a machine language sound routine. Rather than sacrifice speed I removed the sound routine. Other than these two differences, the versions are nearly identical. On both versions pressing the left or right arrow keys moves the ship one space. Pressing the @ key fires your laser.

Principles of Operation

As you can see from the flowchart (Fig. 1), Space Duel crams a lot into a small amount of memory space or it would not fit into a 4K Color Computer. Space Duel is mostly subroutines. Some of the variables need explanation.

Variable	Description
A	Timer
A$	Keyboard scan
CC	Player's fire delay
E$	String of blank graphic blocks
HI	Direct hits
I	Computer's fire flag
P	Barrier position
PO	Player's ship position
Q	Hit display timer
S	Number of shots taken
SHIP$	Player's ship
T	Timer
TAR	Computer's ship position
TAR$	Computer's ship
V	Number of ships remaining
X	Missile position horizontal
Y	Missile position vertical

Table 1. Variable Table

First is the INKEY$ function for the keyboard scan. The keyboard can be accessed directly by PEEKing a certain memory location. However, when most people play the game with the repeat key capability, they spend more time running than dueling. Second is the use of the fire delay variable (CC). This eliminates repeat firing. Repeat firing results in a boring Space Duel game. Last is variable I, the computer fire flag. With this the player can move his ship while the computer's missile is moving down the screen by returning to the main loop only long enough for the player to move away, then returning to the fire routine.

Program Listing 1 is for Model I and Program Listing 2 is the Color Computer version. The flowchart and variable table (Table 1) apply for both versions. Both use the same line numbers. The Model I version will work on a Model III without change. The Color Computer version, written for a 4K machine, uses rather crude graphic routines and low resolution graphics. In other words, both versions can be improved. ■

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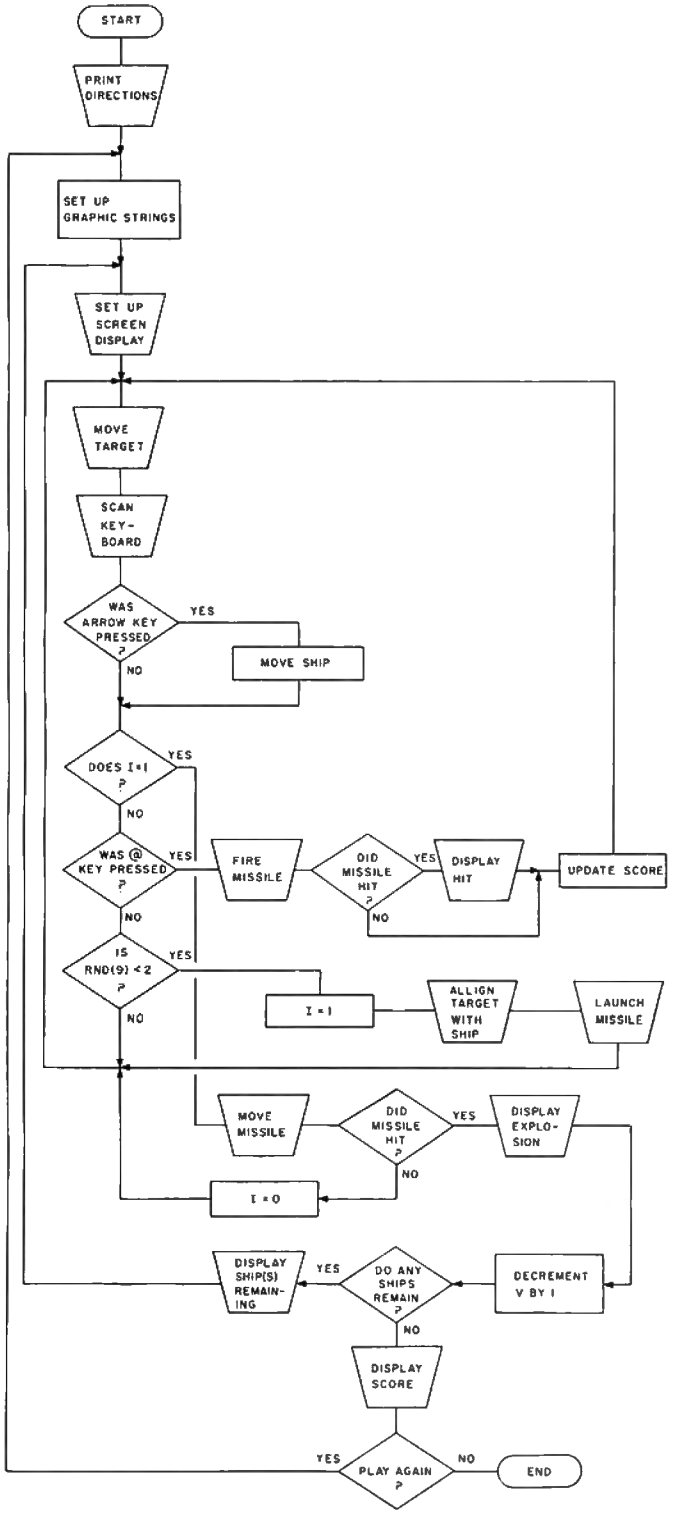

Fig. 1. Flowchart

Program Listing 1. Model I Version

```
0 CLS:DEFINT A-Z:PRINTTAB(25);"*** SPACE DUEL ***"
1 PRINT:PRINT"THE OBJECT OF THIS GAME IS TO HIT THE SPACE FIGHTE
R AT THE TOP  OF THE SCREEN AS MANY TIMES AS POSSIBLE BEFORE IT
HITS YOU 3 TIMES."
2 PRINT"TO STEER YOUR SHIP USE THE LEFT AND RIGHT ARROW KEYS.
3 PRINT"TO FIRE USE THE @ KEY"
4 PRINT:PRINT"PRESS ENTER TO BEGIN"
5 IF INKEY$="" THEN 5
```

Program continues

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6-SEARCH — FINDS PHONE NUMBER OF PERSON
7-NUMBER CHANGE — CHANGE PHONE NUMBER NUMBERS IN FILE
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9-MANUAL DIAL — DIALS NUMBER FROM KEYBOARD
10-END — GAMES ENTERED AND END PROGRAM

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Program continued

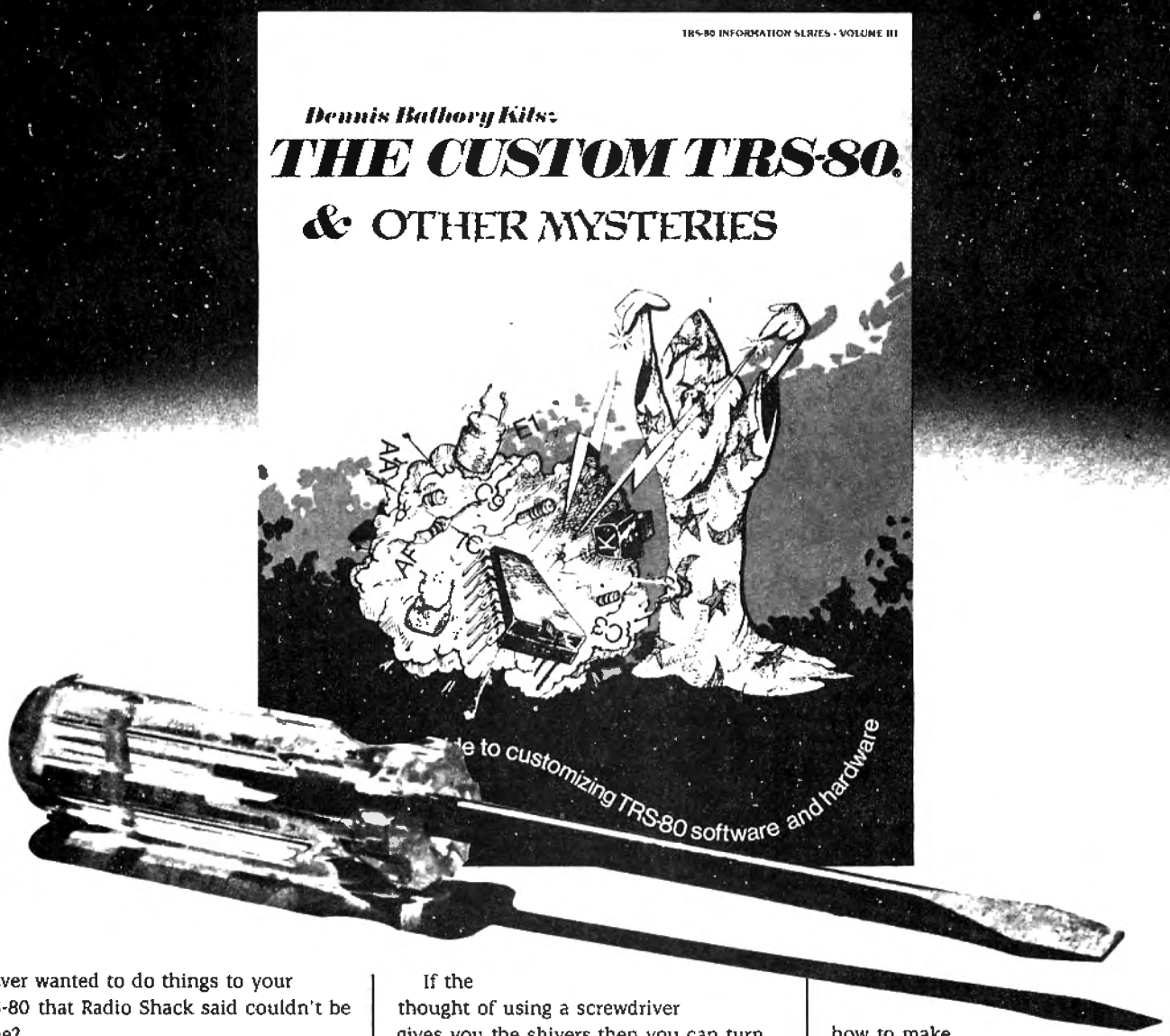
```
6 'SET UP GRAPHIC STRINGS
7 CLEAR 320:E$=STRING$(64,128):V=3:SHIP$=CHR$(142)+CHR$(141):TAR
$=CHR$(130)+CHR$(134)
9 'SET UP SCREEN DISPLAY
10 CLS:GOSUB 5000:PO=835+RND(55)
50 'SET UP BARIERS
60 FOR P=264 TO 310 STEP 11
63 PRINT@P,STRING$(4,143);:PRINT@P+512,STRING$(4,143);
66 NEXT
75 'ERASE AND REPOSITION TARGET
76 PRINT@192,E$;:IF I=0 THEN TAR=(PO-640)+(3-RND(6))
80 PRINT@TAR,TAR$;:GOTO 92
90 GOTO 76
91 'MAIN CONTROL LOOP
92 A$=INKEY$:CC=CC+1:PRINT@832,E$;
100 IF A$=CHR$(8) THEN PO=PO-1
110 IF A$=CHR$(9) THEN PO=PO+1
112 PRINT@PO,SHIP$;
115 IF I=1 THEN 10050
123 IF A$="@" AND CC<2 THEN 1000
125 IF RND(9)<2 THEN 10000 ELSE 76
999 'PLAYER'S FIRE ROUTINE
1000 X=(PO-832)*2+2:CC=0:FORY=38 TO 12 STEP-2:RESET(X,Y+2)
1030 IF POINT(X,37) THEN 90 ELSE SET(X,Y):NEXT
1040 IF POINT(X,10) THEN 2000
1065 S=S+1:GOSUB5000:I=0:RESET(X,Y+2):GOTO 76
1999 'HIT COMPUTER'S SHIP ROUTINE
2000 RESET(X,Y+2):FORQ=1TO25:PRINT@TAR,CHR$(166)+CHR$(166);:PRIN
T@TAR,CHR$(153)+CHR$(153);:NEXT:S=S+1:HI=HI+1:GOSUB 5000:GOTO80
4999 'PRINT SCORE
5000 PRINT@0,"SHOTS="S,,"HITS="HI:RETURN
9999 'COMPUTER'S FIRE ROUTINE
10000 TAR=PO-640:X=(TAR-192)*2+1:I=1:IFPOINT(X,12)THENI=0:GOTO76

10020 FORY=12 TO 38 STEP 4:SET(X,Y):IFRND(9)<4THEN76
10050 RESET(X,Y):NEXT:I=0
10060 IF POINT(X,40) THEN 20000 ELSE RESET(X,Y-4):GOTO 76
19999 'HIT PLAYER'S SHIP ROUTINE
20000 CLS:FOR A=1 TO 30:PRINTSTRING$(64,191);:NEXT:I=0:V=V-1
20017 IF V=0 THEN 50000
20020 CLS:PRINT@530,"YOU HAVE BEEN HIT.":PRINT TAB(11);"YOU HAVE
 "V" SHIPS REMAINING."
20030 FOR T=1 TO 500:NEXT:GOTO 10
50000 CLS:PRINT@540,"GAME OVER":PRINTTAB(15);"TOTAL SHOTS="S,"TO
TAL HITS="HI:PRINT:PRINT"DO YOU WANT TO PLAY AGAIN?":T$=INKEY$
50010 A$=INKEY$:IF A$="" THEN 50010 ELSE IF A$="Y" THEN RUN 7
```

```
0 CLS
1 PRINTTAB(10);"SPACE DUEL"
2 PRINT:PRINT"THE OBJECT OF THIS GAME IS TO "
3 PRINT"HIT THE SPACE FIGHTER AT THE TOPOF THE SCREEN AS MANY TI
MES AS  POSSIBLE BEFORE IT HITS YOU 3   TIMES."
4 PRINT"TO STEER YOUR SHIP USE THE LEFT AND RIGHT ARROW KEYS.":P
RINT"TO FIRE USE THE @ KEY.":PRINT:PRINT"PRESS ENTER TO BEGIN."
5 IF INKEY$="" THEN 5
6 REM SET UP GRAPHIC STRINGS
7 FORA=1TO30:E$=E$+CHR$(128):NEXT:V=3:SHIP$=CHR$(183)+CHR$(187):
TAR$=CHR$(249)+CHR$(248)
9 REM SET UP SCREEN DISPLAY
10 CLS0:GOSUB5000:POS=450+RND(23)
50 REM SET UP BARIERS
60 DATA 131,141,151,387,397,407
70 FOR T=1 TO 6:READ X
72 FOR A=1 TO 3:PRINT@X+A,CHR$(207);:NEXT A,T
75 REM ERASE AND REPOSITION TARGET
76 PRINT@64,E$;:IF I=0 THEN TAR=(POS-384)+(3-RND(6))
80 PRINT@TAR,TAR$;:GOTO 92
90 GOTO 76
91 REM MAIN CONTROL LOOP
92 A$=INKEY$:CC=CC+1:PRINT@448,E$;
100 IF A$=CHR$(8) THEN POS=POS-1
110 IF A$=CHR$(9) THEN POS=POS+1
112 PRINT@POS,SHIP$;
115 IF I=1 THEN 10050
123 IF A$="@" AND CC>2 THEN 1000
125 IF RND(9)<2 THEN 10000 ELSE 76
999 REM PLAYER'S FIRE ROUTINE
1000 TAR=POS-384:X=(TAR-64)*2+1:CC=0:FOR Y=25 TO 5 STEP -4:SOUND
 Y*2,1:RESET(X,Y+4)
1030 IF POINT(X,Y)=8 THEN 2000
1040 IF POINT(X,Y-1)=0 THEN SET(X,Y,3):NEXT
1065 S=S+1:GOSUB 5000:I=0:RESET(X,Y+4):GOTO 90
1999 REM HIT COMPUTER'S SHIP ROUTINE
2000 RESET(X,Y):PRINT@TAR,CHR$(173);CHR$(173);:FOR T=60 TO 150 S
TEP 10:SOUND T,1:NEXT:S=S+1:HI=HI+1:GOSUB 5000:GOTO 80
4999 REM PRINT SCORE ROUTINE
5000 PRINT@0,"SHOTS="S,"HITS="HI:RETURN
9999 REM COMPUTER'S FIRE ROUTINE
10000 TAR=POS-384:X=(TAR-64)*2+1:I=1:IFPOINT(X,9)THENI=0:GOTO90
10020 FORY=5TO24STEP4:SOUND(30-Y)*4,1:SET(X,Y,1)
10040 IF RND(9)>3 THEN 90
10050 RESET(X,Y):NEXT:I=0
10060 IF POINT(X,29)=4 THEN 20000 ELSE RESET(X,Y-4):GOTO90
19999 REM HIT PLAYER'S SHIP ROUTINE
20000 FORA=1TO8:CLSA:SOUND(10-A)*10,1:NEXT:I=0:V=V-1
20017 IF V=0 THEN 50000
20020 CLS:PRINT@256,"YOU HAVE BEEN HIT.":PRINT"YOU HAVE "V" SHIP
S REMAINING."
20030 RESTORE:FORT=1TO500:NEXT:GOTO10
50000 CLS:PRINT@235,"GAME OVER":PRINT"TOTAL SHOTS="S,"TOTAL HITS
="HI:FORT=1TO500:NEXT:PRINT:PRINT"DO YOU WANT TO PLAY AGAIN?"
50010 T$=INKEY$
50030 A$=INKEY$:IFA$=""THEN50030ELSEIFA$="Y"THENRUN7
```

Program Listing 2. Color Computer Version

TUNE-UP YOUR TRS-80®



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Square Game

Chuck Kanach
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The object of Square Game (adapted from Merlin) is to light up all of the dots in the outside cubes keeping the center cube dot off. Each cube is numbered. Selecting the corresponding key not only turns that cube's dot on or off, but it also affects surrounding cubes.

Square Game will run on the TRS-80 4K Color Computer if the remark statements are deleted. I added the remarks after upgrading my system to 16K. I sent Dave McGlumphy (see "Simon," *80 Micro*, August 1981) a listing of Square Game and he got it to work on his Model I, Level II system by leaving out the color and sound statements.

Program Listing

```
10 REM *****SQUARE GAME*****
20 REM ** ADAPTED FROM MERLIN**
30 REM BY CHUCK KANACH
40 REM PSC#1 BOX28749
50 REM APO SF 96230
60 REM WRITTEN ON TRS-80 COLOR         COMPUTER 4K SYSTEM
70 '
80 CLS0
90 B=8:REM COLOR OF GRID LINES
100 C=2:REM COLOR OF DOTS
110 '
120 REM  NUMBER EACH SQUARE
130 '
140 PRINT@170,"1";:PRINT@178,"2";:PRINT@186,"3";
150 PRINT@298,"4";:PRINT@306,"5";:PRINT@314,"6";
160 PRINT@426,"7";:PRINT@434,"8";:PRINT@442,"9";
170 PRINT@42," ENTER (1-9) ";
180 '
190 '
200 REM DRAW HORIZONTAL LINES
210 '
220 FOR X=8TO56
230 FOR Y=5TO29STEP8
240 SET(X,Y,B)
250 NEXTY
260 NEXTX
270 '
280 '
290 REM DRAW VERTICAL LINES
300 '
310 FOR X=8TO56STEP16
320 FOR Y=6TO28
330 SET(X,Y,B)
340 NEXTY
```

Program continues

Color

The CLS0 statement in line 80 establishes a black background. Lines 90 and 100 select the color for the grid lines and dots, respectively. You can change the color variables using the color codes in your owner's manual.

Color Computer SET statements, lines 240 and 330, require a third variable to determine the color. SET (32,16,8) would produce an orange dot in the center of the screen.

Reset statements do not require a color variable. RESET

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(32,16) will remove the orange dot. The point function can be used to check and change the dots' set color.

```
IF POINT (X,Y)=3 THEN
```

This checks for a blue dot at position (X,Y). I instructed the Point function to check for an off or on condition.

```
IF POINT (X,Y)=0 THEN
```

Any number, other than zero, would indicate the point is on. Checking for a zero allowed me to experiment with different grid line and dot color combinations without having to change the Point functions throughout the program every time I changed a color variable.

Lines and Dots

Lines 200-350 draw the horizontal and vertical grid lines using a pair of For...Next and a single SET statement. The dots were a bit more involved. I wanted each game to begin differently. The RND function in line 420 made this possible. It's like flipping a coin; if R equals one the dot stays off (reset) and if R equals two the dot is turned on (set). The For...Next statements, lines 400 and 410, ensure that all nine dots are set or reset.

INKEY$

Entering a number from one to nine and pressing the Enter key each time becomes a chore, so INKEY$ to the rescue. Every time the desired number key is pressed certain dots are set or reset immediately (lines 660-990). All nine dots are checked after each move by lines 1000-1080 to determine if you have won.

Sound

Each time a proper key is pressed line 500 produces a tone. When you figure out the proper sequence the computer declares you a winner and lines 1110-1180 produce a celebration array of sounds and colors. Then it's back to business; the screen is cleared, the grid lines redrawn, the dots repositioned and you are ready to play again. ■

Program continued

```
350 NEXTX
360 '
370 '
380 REM RANDOMLY SELECTS THE             DOTS
390 '
400 FOR PX=16TO48STEP16
410 FOR PY=9TO25STEP8
420 R=RND(2)
430 IF R=1THEN460
440 SET(PX,PY,C)
450 GOTO470
460 RESET(PX,PY)
470 NEXTPY:NEXTPX
480 '
490 '
500 SOUND125,1:REMSOUND
510 '
520 REM PLAYER SELECTS #1-9.
530 REM DEPENDING ON NUMBER, THE         DOTS WILL SET OR RESET.
540 '
550 A$=INKEY$
560 IFA$="1"THEN660
570 IFA$="2"THEN700
580 IFA$="3"THEN730
590 IFA$="4"THEN770
600 IFA$="5"THEN800
610 IFA$="6"THEN860
620 IFA$="7"THEN890
630 IFA$="8"THEN930
640 IFA$="9"THEN960
650 GOTO 1000
660 FOR X=16TO32STEP16
670 IFPOINT(X,9)=0THENSET(X,9,C)ELSERESET(X,9)
680 IFPOINT(X,17)=0THENSET(X,17,C)ELSERESET(X,17)
690 NEXTX:GOTO500
700 FOR X=16TO48STEP16
710 IFPOINT(X,9)=0THENSET(X,9,C)ELSERESET(X,9)
720 NEXTX:GOTO500
730 FOR X=32TO48STEP16
740 IFPOINT(X,9)=0THENSET(X,9,C)ELSERESET(X,9)
750 IFPOINT(X,17)=0THENSET(X,17,C)ELSERESET(X,17)
760 NEXTX:GOTO500
770 FOR Y=9TO25STEP8
780 IFPOINT(16,Y)=0THENSET(16,Y,C)ELSERESET(16,Y)
790 NEXTY:GOTO500
800 FOR X=16TO48STEP16
810 IFPOINT(X,17)=0THENSET(X,17,C)ELSERESET(X,17)
820 NEXTX
830 FOR Y=9TO25STEP16
840 IFPOINT(32,Y)=0THENSET(32,Y,C)ELSERESET(32,Y)
850 NEXTY:GOTO500
860 FOR Y=9TO25STEP8
870 IFPOINT(48,Y)=0THENSET(48,Y,C)ELSERESET(48,Y)
880 NEXTY:GOTO500
890 FOR X=16TO32STEP16
900 IFPOINT(X,17)=0THENSET(X,17,C)ELSERESET(X,17)
910 IFPOINT(X,25)=0THENSET(X,25,C)ELSERESET(X,25)
920 NEXTX:GOTO500
930 FOR X=16TO48STEP16
940 IFPOINT(X,25)=0THENSET(X,25,C)ELSERESET(X,25)
950 NEXT:GOTO500
960 FOR X=32TO48STEP16
970 IFPOINT(X,17)=0THENSET(X,17,C)ELSERESET(X,17)
980 IFPOINT(X,25)=0THENSET(X,25,C)ELSERESET(X,25)
990 NEXTX:GOTO500
1000 IFPOINT(32,17)=0THEN1010ELSE550
1010 IFPOINT(16,9)<>0THEN1020ELSE550
1020 IFPOINT(32,9)<>0THEN1030ELSE550
1030 IFPOINT(48,9)<>0THEN1040ELSE550
1040 IFPOINT(16,17)<>0THEN1050ELSE550
1050 IFPOINT(16,25)<>0THEN1060ELSE550
1060 IFPOINT(48,17)<>0THEN1070ELSE550
1070 IFPOINT(32,25)<>0THEN1080ELSE550
1080 IFPOINT(48,25)<>0THEN1130ELSE550
1090 '
1100 '
1110 REM DECLARES THAT YOU ARE A         WINNER!!
1120 '
1130 FOR C=8TO0STEP-1
1140 FOR S=150TO200STEP10
1150 SOUNDS,1
1160 CLS(C)
1170 PRINT@198,">>>** WINNER!! **<<<";
1180 NEXTS,C
1190 CLS0
1200 GOTO80:REM STARTS THE GAME      OVER AGAIN.
```

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One-on-one hockey simulation.

Color Breakaway

Mitchell Grossbach
5 Bradford Road
Plainview, NY 11803

Color Breakaway recreates that rare occasion in hockey when a lone offensive player goes one-on-one against the opposing goalie. Each player, the goalie and offensive player, has certain advantages and limitations.

The game is set in a rectangular rink, with a goal on the left and a blue line to the right. The shooter can maneuver anywhere in the rink. The goalie can come out of the net or stay back and cover the goal. Pressing the button on the shooter's joystick launches a puck toward the rink's left boundary.

The shooter can control the puck's vertical position up to the blue line. The goalie makes a save by getting in the puck's way. This requires some practice.

The game is played against a running time clock.

Program Parts

The program begins by requesting a game duration input. The shooter is awarded one point for each goal, and the goalie one point for each save. This continues until time runs out. Then, the final score is displayed and you have the option to play again.

Aha! you say. What if the shooter scores a goal and then freezes the puck until time runs out? That would give him an unfair advantage. Yes it would, but we don't let that happen. At the end of the game program line 6005 checks to see that the offensive man has taken at least 10 shots (this can be changed to any number you desire). If he hasn't, the goalie wins.

The program has different sounds for goals scored, saves and missed shots.

In several places a zero is POKEd to address 65495. If your computer contains the 2MHz version of the 6809E microprocessor this will nearly double the game's speed.

The resulting dual-rate clock depends on the address accessed. The Sound command uses a PIA in the high clock address range which probably cannot run at the increased speed. The program restores the original contents of 65495 before calling for sounds.

This speed-up feature will probably make life harder for the goalie. You might want to remove it if he complains too much.■

Mitchell Grossbach is a ninth grade student at JFK High School in Plainview, NY. His hobbies include rock guitar, baseball and programming.

The Key Box

Color Basic
Color Computer
4K RAM
Joysticks

LP—Duration of game
L—Goalie's score
D—Shooter's score
T—Determines if shot is taken
WR—Number of shots taken
MM—Minutes
SS—Seconds

Table 1. Variable List

Program Listing

```
70 REM' ... COLOR BREAKAWAY...'
80 REM'...  BY MITCHELL GROSSBACH...'
85 REM'... COPYRIGHT(C) 1982...'
90 INPUT"TIME OF GAME(1-10)";LP
95 IF LP>10 OR LP<1 THEN 90
100 POKE 65495,0
110 L=0:D=0:Q=0:T=0:WR=0:MM=0:SS=0:DF=0
120 CLS(0)
130 IF L>1 OR D>1 THEN Q=2
140 PRINT@0,"SAVES:";L;PRINT@23,"GOALS:"D;
145 PRINT@500,"SHOTS:";WR;
150 GOTO 1000
160 REM ... ROUTINE TO MOVE GOALIE
165 H=JOYSTK(0):Y=JOYSTK(1)
170 IF T=1 THEN R=5 ELSE R=40
175 Y=Y/2
180 IF H>11 THEN H=11
185 IF Y>20 THEN Y=20
190 IF Y<13 THEN Y=13
195 IF H<5 THEN H=5
200 SET(H,Y,8):FOR W=1 TO R:NEXT:RESET(H,Y)
210 IF T=1 THEN RETURN
220 GOSUB 230:SS=SS+1:IF SS>59 THEN 2000
225 GOTO 160
230 REM... ROUTINE TO MOVE SHOOTER
235 G=JOYSTK(0):J=JOYSTK(2):K=JOYSTK(3)
240 K=K/2
250 PRINT@43,MM":"SS;
255 IF J>60 THEN J=60
260 IF J<17 THEN J=17
265 IF K>30 THEN K=30
270 IF K<5 THEN K=5
275 GOSUB 400
280 SET(J,K,7):SET(J,K+1,7)
285 FOR P=1 TO 10:NEXT
290 RESET(J,K):RESET(J,K+1)
300 RETURN
400 P=PEEK(65280):IF P=125 OR P=253 THEN GOSUB 500 ELSE 410
410 RETURN
500 REM... FIRE ROUTINE
510 WR=WR+1:REM' SHOT COUNTER'
520 FOR A=J TO 4 STEP -1
530 GOSUB 600
535 IF A<17 THEN 545
540 Q=JOYSTK(0):S=JOYSTK(3)
545 SET(A,S/2,5):FOR P=1 TO 2:NEXT P
550 RESET(A,S/2)
555 T=1:GOSUB 165:NEXT A
560 POKE 65495,126:SOUND 1,5
```

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7493	.42
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74157	.60
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74LS13	.43
74LS14	.71
74LS15	.30
74LS20	.26
74LS21	.30
74LS27	.30
74LS30	.26
74LS32	.37
74LS42	.65
74LS74	.39
74LS86	.41
74LS93	.70
74LS123	.92
74LS124	1.35
74LS132	.72
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```
570 GOTO 130
600 IF INT(A)=INT(H) THEN 602 ELSE 610
602 IF INT(S/2)=INT(Y) THEN 700
610 IF A<5 AND S/2>13 THEN 615 ELSE 620
615 IF S/2<20 THEN 750
620 RETURN
700 REM... SOUND ROUTINE AFTER SAVE
710 FOR T=1 TO 50 STEP 2
715 POKE 65495,126
720 SOUND T,1:NEXT T
730 L=L+1
735 PRINT@0,"SAVES:"L
740 POKE 65495,0
745 GOTO 130
750 POKE 65495,126:REM...SOUND AFTER GOAL SCORED
755 SOUND 89,7:SOUND 89,3:SOUND 133,10
760 D=D+1:PRINT@20,"GOALS:"D
765 POKE 65495,0
770 GOTO 130
1000 REM...SET UP GRAPHICS
1005 FOR T=13 TO 20
1010 SET(2,T,4)
1020 NEXT T
1030 FOR T=2 TO 5
1040 SET(T,13,4):SET(T,20,4)
1050 NEXT T
1055 FOR P=3 TO 4:SET(17,P,3):NEXT P
1057 FOR P=30 TO 31:SET(17,P,3):NEXT P
1060 GOTO 160
2000 SS=0:DF=DF+1
2020 MM=DF:IF DF=LP THEN 5000
2030 GOTO 225
5000 CLS(3)
6000 PRINT@269,"SAVES:";L;"GOALS:";D
6005 IF WR<15 THEN 6080:REM... THIS CAN BE CHANGED!
6010 IF L>D THEN 6060
6020 IF D>L THEN 6050
6022 IF D=L THEN 6025
6025 PRINT@394,"CONGRATULATIONS"
6030 PRINT@423,"YOU BOTH TIED!!"
6033 GOTO 6055
6035 CLS(3):PRINT"PLAY AGAIN(Y/N)?"
6040 A$=INKEY$:IF A$="Y" THEN 90
6045 IF A$="N" THEN END
6047 IF A$<>"Y" AND A$<>"N" THEN 6040
6050 PRINT@394,"THE SHOOTER WINS"
6055 FOR I=1 TO 2000:NEXT I:GOTO 6035
6060 PRINT@394,"THE GOALIE WINS"
6070 GOTO 6055
6080 PRINT@394,"THE SHOOTER ONLY TOOK";WR;"SHOTS!"
6085 PRINT@424,"... SO THE GOALIE WINS"
6090 GOTO 6055
```


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A draw poker variation: three pair takes all.

Pitty Pat

Lynard Barnes
320 South Whipple Street
Chicago, IL 60612

In human versus human Pitty Pat, each player is dealt five cards from a fifty-two card deck. The object is to form three pairs using your original five cards, the draw and discard pile. Each time a player draws a card from the deck that matches one in his hand, he must discard a card. The first player to make three pairs wins the game.

In Pitty Pat chance operates on two levels: how far down in the deck is a matching card for one held by a player, and are some, or all, of the matching cards needed by one player held in the hand of the other?

Programmed to Cheat

Beating your TRS-80 in computerized Pitty Pat will be especially gratifying. The computer keeps track of which cards have been discarded and also keeps track of what cards you need. It accomplishes this by peeking at your hand (program lines 1000 and 1010). The advantage gained is not all that great—but it prevents your computer from giving you a winning card from its own hand. Winning a game is not everything. In Pitty Pat the real war is over points!

Game, Set, Match

At the beginning of each set (from 5 to 20 games), each card within the four suits is assigned a point value. As cards are dealt, their values decline according to how often the suit has been dealt. Your strategy for capturing points is to draw cards from suits with higher point values and to weigh judiciously the value of the cards you discard.

You are excluded from capturing points from a particular suit if you are not dealt a card from that suit in your first hand. Though not a disastrous predicament, it does lessen your chances of winning the point war. It is hard, but you can still win more games than the computer and stop it from winning the set. On the other hand, you can get trounced trying.

The computer has no strategy for capturing points. It is at the mercy of chance and your skill. The better you are at capturing points, the worse off it is. In essence, the computer manipulates chance by peeking at your cards, and you manipulate chance by failing to match cards when you should, or by discarding one suit rather than another or by losing a game. The ultimate object is to win the set and as many games as possible. Pursuing a set winning strategy can be nerve rattling, but also, more satisfying. ■

Among other activities, Lynard Barnes teaches a course on micros at the Chicago Public Library.

The Key Box

Basic Level II
Model I
16K RAM

Program Listing

```
0 '*************************************************************
1 '*     TITLE:          PITTY PAT - POKER VARIATION           *
  *     PURPOSE:        SUIT MANIPULATION FOR POINTS          *
  *                                                           *
2 '*     AUTHOR:         LYNARD BARNES                         *
  *                     320 SOUTH WHIPPLE ST                  *
  *                     CHICAGO, ILLINOIS 60612               *
3 '*                    SEPTEMBER, 1981                       *
  *************************************************************

10 CLEAR75:CLS:PRINTCHR$(23):M=64:C$="********     ********";
   PRINT@130,STRING$(28,131);:PRINT@834,STRING$(28,176);:
   FORJ=1TO12:M=M+64:PRINT@M,CHR$(170);:PRINT@M+58,CHR$(149);:
   NEXT:PRINT@264,C$;:PRINT@398,"POKER GAME VARIATION - II";
20 PRINT@650,CHR$(197);"PITTY PAT";:PRINT@520,C$;:B=1500:
   GOSUB140
100 CLEAR120:DEFINTA-Z:DEFSTRC:CT=STRING$(10,131):CD=CHR$(191):
   CH="HEART":CC="CLUB":CS="SPADE":CI="DIA'":CO=CHR$(197):
   CJ="JACK":CQ="QUEEN":CE="ACE":CK="KING":CB="BUSINESS":
   CP="PLAY GAME":DEFSNGS,H,L,B,A,P:RANDOM:T$="###.##":CM="2"
110 RANDOM:DIMD(53),P(12,2),C(11,2):GOTO490:

SUB-ROUTINES
120 IFCY=CC,PD=1ELSEIFCY=CH,PD=2ELSEIFCY=CS,PD=3ELSE
   IFCY=CI,PD=4
130 RETURN
140 FORY=0TOB:NEXT:RETURN:REM

LOAD 52 CARDS
150 P=RND(2):U1=P(5,0):PO=0:L=1:G=1:G1=27:Q=1:PRINT@629
   ,"SHUFFLING",
160 IFL<=52THENONPGOTO170,180ELSEL=0:RETURN
170 D(L)=G:L=L+1:G=G+1:IFP=2,P=1:GOTO160ELSEIFP=1,P=2:GOTO160
180 D(L)=G1:L=L+1:G1=G1+1:IFP=2,P=1:GOTO160ELSEIFP=1,P=2:GOTO160

190 PRINT@629,"* STOCK *  ";:RETURN:REM

CLEAR ALL CARDS
200 FOFJ=0TO11:FORM=0TO1:PRINT@P(J,M),CO;:NEXT:NEXT:RETURN:REM

CLEAR BUSINESS AREA
210 R$=CHR$(224):PRINT@400,R$;:PRINT@464,R$;:PRINT@528,R$;:
   PRINT@591,R$;:PRINT@692,CO;:RETURN:REM

CLEAR ONE CARD
220 PRINT@650,R$;:PRINT@653,R$;:RETURN
230 PRINT@P(X,0),CO;:PRINT@P(X,1),CO;:RETURN:REM

POINTS SCORED
240 IFAP=0,RETURNELSEPRINT@400,"CAPTIVE :";A4;": TO WIN:";:
  PRINTUSINGT$;AC;:PRINT":";:PRINT@464,"YOUR.....";:
  PRINT@528,"SHARE: ";:PRINTUSINGT$;PE;:PRINT@592,"HOUSE: ";:
  PRINTUSINGT$;HP;
250 PRINT@400,"MY.....";:PRINT@544,"SHARE: ";:PRINTUSINGT$;HE
  ;:PRINT@608,"HOUSE: ";:PRINTUSINGT$;HG;:PRINT@663,"COMBINED:"
  ;:PRINTUSINGT$;AP;:GOSUB460:A5=(BP/PG)+(PG/BP):RETURN
260 PRINT@P(X,0),CV;:PRINT@P(X,1),CY;:RETURN:REM
MARK CARD MATCHES
270 C(V,0)="":PRINT@P(X,0),"::";:RETURN
280 PRINT@P(X,0)+5,"@";:RETURN
290 PRINT@P(X,0)+5,"*";:RETURN:REM

DEAL A CARD
300 D(P)=0:P=RND(52):IFD(P)=0THENGOTO300ELSEO=D(P)ELSEIFQ>=52
   ,RETURN
310 A2=A-V@:IFO<=13CZ=CC:PC=1:LL=(LX*A2)/PI:LX=LX-1:
  PO=LLELSEIFO>=14ANDO<=26CZ=CH:PC=2:D(P)=O-13:HT=(LT*A2)/PI:
  LT=LT-1:PO=HT
320 IFO>=27ANDO<=39CZ=CS:PC=3:D(P)=O-26:SP=(LP*A2)/PI:LP=LP-1:
  PO=SPELSEIFO>=40CZ=CI:PC=4:D(P)=O-39:SI=(LI*A2)/PI:LI=LI-1:PO=
SI
330 DC=D(P):CX=STR$(D(P)):IFD(P)=1CX=CEELSEIFD(P)=11CX=CJ
   ELSEIFD(P)=12CX=CQELSEIFD(P)=13CX=CK
340 AC=A5+((PG+BP)*.5):GOSUB1170:PI=PI-1:RETURN:REM

CHECK MATCHES
350 XF=5:FORXD=0TO4:F1=DL(XC):F2=PL(XP):FORXZ=0TO4:F3=DL(XZ):
   F4=PL(XZ+5):IFSC<=4,IFXZ<>XC,IFF1=F3,X=XC:GOSUB380:X=XZ:
   GOSUB380
360 IFXF<=9,IFXZ+5<>XF,IFF2=F4,J1=5:X=XF:GOSUB380:X=XZ+5:
   GOSUB380:J1=0
```

Program continues

Program continued

```
370 NEXT:XC=XC+1:XF=XF+1:NEXT:RETURN
380 IFJ1=5THENGOTO390ELSEE=E+1:GOSUB280:PRINT@P(X,0),C(X,0);:
    PRINT@P(X,1),C(X,1);:DL(X)=0: RETURN
390 E1=E1+1:PL(X)=0:GOSUB290:RETURN:REM

SET UP TABLE
400 K=0:Y=0:X=0:X1=192:X2=768:X3=960:C2=CD
410 PRINT@X+Y,CT;:PRINT@X1+Y,CT;:PRINT@X2+Y,CT;:PRINT@X3+Y,CT;:
    X4=X+Y:PRINT@X4,CD;:PRINT@X4+64,CD;:PRINT@X4+128,CD;:
    PRINT@X4+9,C2;:PRINT@X4+73,C2;:PRINT@X4+137,C2;:X4=X2+Y:
    PRINT@X4,CD;:PRINT@X4+64,CD;:PRINT@X4+128,CD;:PRINT@X4+9,C2
    ;
420 PRINT@X4+73,C2;:PRINT@X4+137,C2;:Y=Y+12:K=K+1:IFK=5,
    PRINT@374,CT;:PRINT@566,CT;:PRINT@373,C2;:PRINT@437,C2;:
    PRINT@501,C2;:PRINT@383,C2;:PRINT@447,C2;:PRINT@511,C2;:
    PRINT@565,CHR$(131);:GOTO430ELSEGOTO410
430 DATA 66,131,78,143,90,155,102,167,114,179,834,899,846,911,
        858,923,870,935,882,947,438,503,385,450:FORX=0TO11:
        FORY=0TO1:READP(X,Y):NEXT:NEXT:RESTORE:RETURN
440 PRINT@320,CT;:PRINT@512,CT;:PRINT@320,C2;:PRINT@384,C2;:
    PRINT@448,C2;:PRINT@329,C2;:PRINT@393,C2;:PRINT@457,C2;:
    PRINT@576,"* DISCARD *";:RETURN
450 PRINT@334,STRING$(35,130);:PRINT@718,STRING$(35,130);:
    FORM=1TO6:PRINT@334+N,CHR$(179);:PRINT@368+N,CHR$(179);:
    N=N+64:NEXT:N=0:RETURN:REM

KEY SCAN
460 IK$=INKEY$:PRINT@722,R$;:PRINT@692,"<KEY>";:GOSUB450
470 Z$=INKEY$:IF2$=""THEN470ELSEZ=VAL(Z$):RETURN
480 M=351:FORH=1TO5:PRINT@M,CHR$(173);:M=M+64:NEXT:GOSUB1170:
  RETURN:REM

PROGRAM STARTS
490 CLS:PRINT@480,"DO YOU NEED INSTRUCTIONS <Y/N>";:GOSUB470:
  IF2$="Y"THENGOTO1220ELSEPRINT@278,CB;:GOSUB210:GOSUB450:
  GOSUB210:GOSUB480:GOSUB150:PRINT@480,"SELECT BY LETTER...";

500 P=53:A=0:PRINT@529,"NUMBER OF GAMES IN THIS SET:";:
  PRINT@594," A      B      C      D";:
  PRINT@658," 5      10     15     20";:GOSUB470:
  IF2$="A",A=5ELSEIF2$="B",A=10ELSEIF2$="C",A=15
  ELSEIF2$="D",A=20ELSEGOTO500
510 XA=RND(2):PI=52*A:LX=13*A:LT=LX:LP=LX:LI=LX:A4=PI*.3:A3=0
520 IFXA=1,XA=2ELSEIFXA=2,XA=1
530 PRINT@692,CO;:GOSUB210:GOSUB450:GOSUB240:GOSUB210:GOSUB440:
  PRINT @270,CP;V0+1;:GOSUB220:GOSUB150:GOSUB190:PRINT@654
  ,STRING$(35,130);:ONXAGOTO540,580:REM

COMPUTER DEALT
540 V=0:X=0:PRINT@640,CHR$(205);:PRINT@256,"COMPUTER...";
550 GOSUB300:CV=CX:CY=CZ:GOSUB1060:GOSUB270:X=X+1:C(V,0)=CV:
  C(V,1)=CY:DL(V)=D(P):V=V+1:IFAP=0,SH(V-1)=PC:HG=HG+PO
560 IFV=5THEN570ELSE550
570 IFXA=2THEN620:REM

PLAYER DEALTH
580 X=5:V=5:PRINT@256,R$;:PRINT@704,"YOU.....";
590 GOSUB300:CV=CX:CY=CZ:GOSUB860:GOSUB260:X=X+1:C(V,0)=CV:
  C(V,1)=CY:PL(V)=D(P):V=V+1:IFAP=0,LH(V-6)=PC:HP=HP+PO
600 IFV=10THEN610ELSE590
610 Q=10:IFXA=2THENGOTO540:REM

DEALTH CARD MATCHES ?
620 G1=0:GOSUB350:PRINT@256,CHR$(204);:PRINT@704,CHR$(204);:
  XC=0:XP=0:IFE>=22THENGOTO1040
630 IFE1>=24THENGOTO810ELSEX=10:GOSUB230:CV=C(10,0):CY=C(10,1):
  GOSUB260:REM

DIVIDE BUSINESS AREA
640 A3=5:GOSUB480:PRINT@270,CP;V0+1;"OF";A;
650 IFXA=3THENGOTO920
660 X=10:GOSUB230:GOSUB300:CY=CZ:CV=CX:X=10:GOSUB260:Q=Q+1:
  ONXAGOTO670,920:REM

PLAYER PULLS CARD
670 PRINT@528,"YOUR DRAW....";:U=PEEK(14368):IFUAND8,XA=3:
  DD=0:GOTO650ELSEIFU=128THENGOSUB210:GOSUB1130:GOSUB460:
  GOSUB210:PRINT@654,STRING$(35,130);:PRINT@692,CHR$(254);:
  GOSUB480:GOTO670ELSEIFU<>0THENGOTO700
680 U1=U1+1:IFU1>=10,U1=5
690 GOSUB740:FORY=1TO100:NEXT:GOSUB750:GOTO670
700 U=PEEK(14368):IFUAND16THENGOSUB750:IFU1<=5,U1=5:
  GOSUB740ELSEU1=U1-1:GOSUB740
710 IFUAND64THENGOSUB750:IFU1+1>=10,U1=9:GOSUB750ELSE
  U1=U1+1:GOSUB740
720 IFUAND8,XA=3:DD=0:GOTO650ELSEIFU<>8ANDU<>16ANDU<>64
  ,PRINT@528,"KEYS:< > +";:GOSUB750:B=1500:GOSUB140:GOTO670
730 GOSUB470:IF2$="S",XW=1:GOTO760ELSEIF2$="D",XW=2:
  GOTO760ELSEIF2$=CHR$(13),XA=2:DD=0:GOTO920ELSE700
740 PRINT@P(U1,0)-128,CHR$(92);:RETURN
750 PRINT@P(U1,0)-128," ";:RETURN
760 PRINT@528,"YOU TAKE....";:IPPL(U1)=0,PRINT@704
  ,"PENALTY: .5 POINT";:BU(U1-5)=BU(U1-5)-.5:PRINT@P(U1,0)+5," "
;:
  GOSUB140:PRINT@704,CHR$(212);:GOTO920ELSEX=U1:GOSUB290:
  GOSUB820:ONXWGOTO770,780,920:REM
PLAYER-STOCK
770 GOSUB1170:D(P)=0:DD=PL(U1):X=11:GOSUB230:X=U1:GOSUB230:X=11
  :CV=C(U1,0):CY=C(U1,1):GOSUB900:GOSUB260:C(11,0)=CV:C(11,1)
  =CY:PL(U1)=0:X=U1:CY=CZ:GOSUB860:CV=CX:GOSUB260:DC=0:GOTO810:
REM
PLAYER-DRAW DISCARD
780 GOSUB1170:DD=PL(U1):X=11:GOSUB230:X=U1:GOSUB230:CV=C(11,0):
  CY=C(11,1):GOSUB860:X=U1:GOSUB260:CV=C(U1,0):CY=C(U1,1):X=11:
  GOSUB900:GOSUB260:PL(U1)=0:GOTO810:REM

CHECK PLAYER WIN
790 E1=0:FORY=5TO9:IFPL(Y)=0,E1=E1+1:NEXTELSENEXT
800 RETURN
810 GOSUB790:IFE1>=5PRINT@528,"PRESS ANY KEY";:
  PRINT@704,"YOU WIN....";:GOSUB470:PZ=PZ+1:GOTO1120
  ELSE:XA=1:GOTO920
820 FORJ=5TO9:IFDC=PL(J)ANDZ$<>"D",DC=0:PL(J)=0:GOSUB1170:
  X=J:GOSUB290:RETURN
830 IFDD>=1ANDDD=PL(J),PL(J)=0:GOSUB1170:X=J:GOSUB290:RETURN
840 NEXT
850 BU(U1-5)=BU(U1-5)-.25:PRINT@704,"PENALTY: .25 POINT";:
    B=900:GOSUB140:PRINT@704,CHR$(212);:PRINT@P(U1,0)+5," ";:
    XW=3:RETURN:REM

SUITS-PLAYER
860 IFA3=0THENGOTO880ELSEFORY=0TO4:IFLH(Y)=PCTHENGOTO880ELSENEXT

870 RETURN
880 IFCY=CC,BU(0)=BU(0)+LLELSEIFCY=CH,BU(1)=BU(1)+HTELSEIF
  CY=CS,BU(2)=BU(2)+SPELSEIFCY=CI,BU(3)=BU(3)+SI
890 PE=0:BP=0:FORY=0TO3:BP=BP+BU(Y):NEXT:PE=BP:RETURN
900 GOSUB790:IFE1>=4,RETURNELSEGOSUB120:FORY=0TO4:IFLH(Y)<>PD,
  NEXTELSEIFCY=CC,BU(0)=BU(0)-LLELSEIFCY=CH,BU(1)=BU(1)-HTELSE
  IFCY=CS,BU(2)=BU(2)-SPELSEIFCY=CI,BU(3)=BU(3)-SI
910 GOTO890:REM

COMPUTER PULLS
920 PRINT@528,CHR$(205);:PRINT@545,"MY DRAW..";:IFDD=0THENGOTO
  940ELSEFORJ=0TO4:IFDL(J)=DDTHENX=J:GOSUB230:GOSUB280:DL(J)
  =0:CV=C(J,0):CY=C(J,1):GOSUB260:GOSUB970:CV=C0:CY=C9:GOSUB
  1060:GOSUB260:GOSUB1170:XC=5:GOTO1040
930 NEXT:DD=0
940 IFDC=0THENXA=2:XC=9:GOTO660
950 FORJ=0TO4:IFDL(J)=DCTHENX=J:GOSUB230:GOSUB280:CV=C(J,0):
  CY=C(J,1):GOSUB260:D(P)=0:DL(J)=0:GOSUB970:CV=CX:CY=CZ:
  GOSUB1060:GOSUB1170:X=I:GOSUB260:GOSUB280:X=10:GOSUB230:
  GOSUB300:Q=Q+1:CY=CZ:CV=CX:GOSUB260:GOTO1040
960 NEXT:B=300:GOSUB140:PRINT@545,CHR$(202);:IFXC=9,XC=0:
  GOTO670ELSEIFXA=2,XA=1:GOTO670ELSEIFXA=3,XA=1:GOTO660ELSE
  GOTO660
970 IFJ>=5THENGOTO920ELSEPRINT@545,"I TAKE...";:FORI=4TO0STEP
  -1:IFDL(I)=0THENGU=GU+1:GOTO990ELSEGOTO1000
980 IFGX<>1ANDGU<6THENX=11:GOSUB230:CV=C(I,0):CY=C(I,1):GOSUB
  1100:GOSUB260:C0=C(11,0):C9=C(11,1):X=I:GOSUB
  230:GOSUB280:C(11,0)=C(I,0):C(11,1)=C(I,1):DD=DL(I):DL(I)=0:
  GX=0:GU=0:RETURN
990 NEXT:GX=0:GU=0:IFI<0THENFORI=1TO3:IFDL(I)<>0THENGX=0:GU=0
  :GOTO980ELSENEXTELSEGX=0:GU=0:GOTO980
1000 GX=0:FORJX=5TO9:UC=PL(JX):IFUC>0ANDUC=DL(I),GX=GX+1
1010 NEXT:GOTO980:REM
CHECK COMPUTER WIN
```

Program continues

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Program continued

```
1020 G=0:FORJ=0TO4:IFDL(J)=0,G=G+1:NEXTELSENEXT
1030 RETURN
1040 GOSUB1020:PRINT@545,CHR$(205);:IFG=5
  PRINT@545,"PRESS ANY KEY";:PRINT@256,"I WIN....";:GOSUB470:
  GOSUB470:WW=WW+1:GOTO1120
1050 IFXC=0THENGOTO670ELSEIFXC=5THENXC=0:GOTO660ELSE
  XC=0:GOTO670ELSEIFXA=2THENGOTO670:REM

SUITS - COMPUTER
1060 IFA3=0THENGOTO1080ELSEFORY=0TO4:IFSH(Y)=PCTHENGOTO1080ELSEN
EXT
1070 RETURN
1080 IFCY=CC,SU(0)=SU(0)+LLELSEIFCY=CH,SU(1)=SU(1)+HTELSEIF
   CY=CS,SU(2)=SU(2)+SPELSEIFCY=CI,SU(3)=SU(3)+SI
1090 HE=0:PG=0:FORY=0TO3:PG=PG+SU(Y):NEXT:HE=PG:RETURN
1100 GOSUB1020:IFG>=4,RETURNELSEGOSUB120:FORY=0TO4:IFSH(Y)<>PD,
   NEXTELSEIFCY=CC,SU(0)=SU(0)-LLELSEIFCY=CH,SU(1)=SU(1)-HTELSE
   IFCY=CS,SU(2)=SU(2)-SPELSEIFCY=CI,SU(3)=SU(3)-SI
1110 GOTO1090:REM

GAME STATUS
1120 U=0:V0=V0+1:E=0:E1=0:Q=0:XP=0:XC=0:GOSUB200:GOSUB210:GOSUB2
20:
GOSUB450:PRINT@485,"GAMES WON";:PRINT@468
,"YOU";:PRINT@477,"ME";:PRINT@532,PZ;:PRINT@541,WW;:GOSUB460:
GOSUB210:GOSUB1130:GOTO1150
1130 GOSUB220:GOSUB450:BP=0:PG=0:PE=0:HE=0:PRINT@483,CC";";:
PRINT@466,CH;":";:PRINT@530,CS;":";:PRINT@591,"DIAMONDS:";:
PRINT@657,"POWERS:";:
PRINT@668,"YOURS";:PRINT@679,"MINE";:M=411:M1=421
1140 FORY=0TO3:PRINT@M,USINGT$;BU(Y);:PRINT@M1,USINGT$;SU(Y);:
   M=M+64:M1=M1+64:BP=BU(Y)+BP:PG=SU(Y)+PG:NEXT:PE=PE+BP:
   HE=HE+PG:AP=PE+HE:RETURN
1150 GOSUB460:GOSUB210:GOSUB220:GOSUB1180:GOSUB190:IFV0+1<
=ATHENGOTO520
1160 LW=AC:IFPE>=LWORHE>=LWTHENC="SET ESTABLISHED:":GOTO1190
     ELSEC="NO SET:":GOTO1190:REM

PNTS IN HAND
1170 PRINT@408,"YOU:";:PRINTUSINGT$;BP;:PRINT@417,"ME:";:
 PRINTUSINGT$;PG;:RETURN:REM

CLEAR MARKERS
1180 FORY=0TO9:PRINT@P(Y,0)+5," ";:NEXT:RETURN:REM

END SET
1190 CLS:PRINTC;:GOSUB450:GOSUB240:GOSUB1350:CLS:PRINT@128,"";:
PRINT"WINNING POINTS:";AC:PRINT:
PRINT"YOUR POINTS:";BP;CHR$(210);"MY POINTS:";PG:PRINT:LW=AC:
IFPE>=LWTHENC="YOU "ELSEIFHE>=LWTHENC="I "ELSEC="YOU NOR I "
1200 PRINTC;"ACCUMULATED ENOUGH POINTS TO WIN THE SET.":
PRINT"OUT OF";A;" GAMES, YOU WON";PZ;" AND I WON";WW;".":
PRINT"A TOTAL OF";(52*A)-(PI+(13*A));"CARDS WERE DRAWN."
1210 X=13*A:PRINT:PRINT"CARDS DRAWN.....":
PRINT,CC;":";X-LX,CH;":";X-LT:PRINT,CS;":";X-LP,CI;":";X-LI:
PRINT:PRINT"DO YOU WANT TO PLAY AGAIN (Y/N) ?";:GOSUB470:
IFZ$="Y"THENGOTO100ELSEIFZ$="N"CLS:ENDELSEGOTO1190:REM
INSTRUCTIONS
1220 A=15:GOSUB1340:PRINT"OBJECTIVE:";:
PRINTTAB(A)"TO WIN AS MANY GAMES AND COLLECT AS MANY":
PRINTTAB(A)"POINTS AS POSSIBLE DURING ONE 'SET'.":PRINT
1230 PRINT"PROCEDURE";:
PRINTTAB(A)"GAME PLAY BEGINS WHEN EACH PLAYER (YOU":
PRINTTAB(A)"& COMPUTER) ARE DEALT 5 CARDS AND AT LEAST":
PRINTTAB(A)"ONE CARD IN YOUR RESPECTIVE HANDS DO NOT":
PRINTTAB(A)"MATCH THE FACE VALUE OF ONE OR MORE OF YOUR"
1240 PRINTTAB(A)"OTHER CARDS. FOR AN EXAMPLE, PRESS ANY KEY..":
GOSUB470:CN="4":
CF="PLAYER NEEDS A '2' TO END GAME AND WIN":GOSUB1330:B=1000:
GOSUB1350
1250 GOSUB1340:PRINT"PROCEDURE:";:
PRINTTAB(A)"YOU'LL PICK THE NUMBER OF GAMES TO BE PLAYED":
PRINTTAB(A)"IN THE 'SET'. A SET EXISTS WHEN EITHER PLAYER":
PRINTTAB(A)"CAPTURES ALL OR MORE OF THE 'TO WIN' POINTS.'
1260 PRINT:PRINT"SCORING:";:
PRINTTAB(A)"POINTS ARE CAPTURED BY INCREASING THE POWER OF A"
1270 PRINTTAB(A)"SUIT CONTAINED IN YOUR 'HOUSE'. SUITS DEALT IN"

:PRINTTAB(A)"YOUR FIRST HAND (HOUSE) DETERMINE WHICH SUITS"
:PRINTTAB(A)"YOU MUST DRAW TO INCREASE YOUR POINTS. DISCARD-"
1280 PRINTTAB(A)"ING A HOUSE SUIT DECREASES ITS POWER TO CAPTURE
"
:PRINTTAB(A)"POINTS. POINT VALUE IS DETERMINED ON A DESCEND-":
PRINTTAB(A)"ING PROABILITY SCALE.";:B=1000:GOSUB1350:GOSUB1340
1290 PRINT"PENALTIES:";:
PRINTTAB(A)"IF AN ATTEMPT IS MADE TO MATCH A CARD UNDER":
PRINTTAB(A)"THE FOLLOWING CONDITIONS, POINTS ARE DEDUCTED:"
:PRINTTAB(20)"CARD MARKED WITH '*'";
PRINTTAB(20)"HAND DOES NOT CONTAN POSSIBLE MATCH."
:PRINTTAB(20)"DRAW FROM ";
1300 PRINT"DISCARD AFTER LEGAL TURN.":PRINT:PRINT"PLAY:";:
PRINTTAB(A)"FOR PLAY OPERATIONS, PRESS ANY KEY":
GOSUB470:CLS:GOSUB480:GOSUB190:GOSUB440:PRINT@480
,"TO DRAW FROM STOCK OR DISCARD:";:PRINT@706,CHR$(92);:
PRINT@464,"POSITION ARROW OVER UN-MATCHED";
1310 PRINT@528,"CARD WITH: '<' TO MOVE LEFT";:
PRINT@592,CHR$(203);"'>' TO MOVE RIGHT";:
PRINT@656,"THEN TYPE 'S' OR 'D' TO TAKE.";:GOSUB460:GOSUB210:
PRINT@656,R$;:PRINT@480,"IF YOU DO NOT NEED THE CARD";:
PRINT@464,"IN STOCK, PRESS '+'.";
1320
PRINT@656,"* YOU DO NOT USE SHIFT-KEY *";:GOSUB460:GOSUB210:
PRINT@656,R$;:PRINT@480,"TO CHECK STATUS OF HOUSE,";:
PRINT@464,"PRESS '/' DURING YOUR DRAW.";:GOSUB460:CLS:GOTO490
1330 PRINT@785,CJ;CO;CJ;CO;CJ;CO;"  ";CH;CO;"  ";CH;:
PRINT@849,CC;CO;CS;CO;CI;CO;CC;CO;CH;:PRINT@960,"SIGNIFICANCE:";
:
PRINTTAB(15)CF;:RETURN
1340 CLS:PRINT"PITTY PAT";:PRINTCHR$(222);"POKER VARIATION II"
:PRINTSTRING$(64,131);:RETURN
1350 GOSUB140:B=300:PRINT@768,"PRESS";:PRINT@832,"ANY";:
PRINT@896,"KEY";
1360 GOSUB140:PRINT@704,CO;" ";:PRINT@768,CO;:PRINT@832,CO;:
PRINT@896,CO;:GOSUB140:IFINKEY$=""THEN1350ELSERETURN
1370 END
```

Poor Man's Floppy

HIGH SPEED CASSETTE SYSTEM

FOR TRS-80*

Now the widely acclaimed JPC Cassette System is available for your TRS-80* computer. The price is only $90.00

[Reprint of June 1980 Review, *80 Microcomputing*]

TC-8 Cassette System
JPC Products
Albuquerque, NM
Kit: $90
Assembled: $120

by Carl A. Kollar

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ × 11 papers stapled together. It is written in the nicest format I've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD"filename": Searches for and loads the specified file from cassette.
LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET?"filename": Same as LOAD? and LOAD?"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.
OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button. ■

ORDER NOW

To order your TC-8 kit, send your check or money order for $90.00 plus $3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales tax). Credit card orders accepted by phone or mail. Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cabinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.

For Mod I Level II only.

✓ 42
JPC PRODUCTS CO.
Phone (505) 294-4623
12021 Paisano Ct.
Albuquerque, N.M. 87112

✓See List of Advertisers on page 338

GAME

LOAD 80

Help the little buggers munch your CRT.

Termites

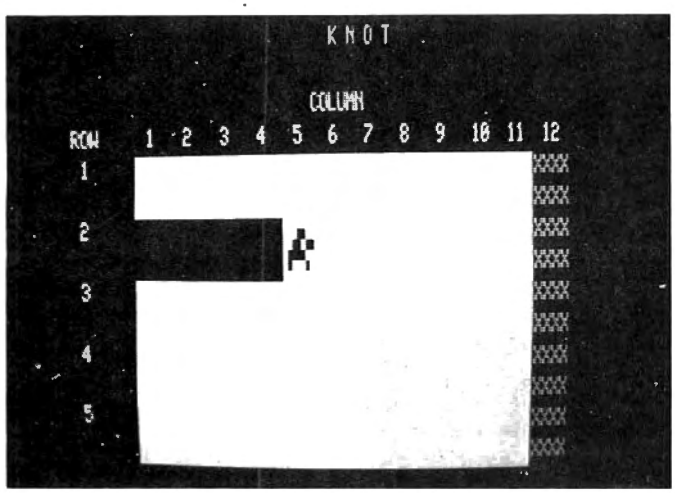

Photo 1. The termite has hit a knot in column five

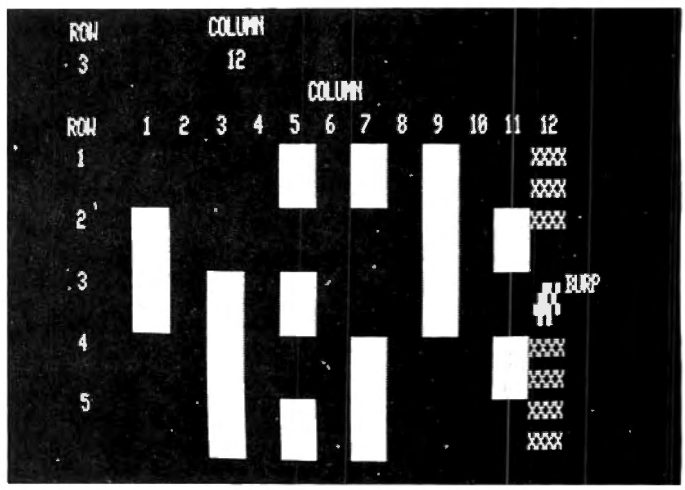

Photo 2. Here the termite has made it through the cherry wood treat (Xs) at a column 12

Charles Weindorf
2828 Legion Road
Erie, PA 16506

Termite is a one player, invisible maze game designed to improve your memory. The idea is to help a termite navigate a block of pine wood without hitting any knots. This program includes a sound routine of the termite chomping wood.

The knots in the wood are in odd columns only. There are one, two or three knots in each odd column. If the termite hits a knot, he goes back to start. If the termite reaches the twelfth column, you win.

Levels of Play

The game varies from level one, a fairly simple maze, to level four, a hair pulling course.

If a knot is hit in level one, the board is reset and the termite goes back to the start. When the termite hits a knot in level two, the board is reset and all knots in the one previous odd column move down one row. So, if the termite hits a knot in column five, the knots in column three, in rows one, four and five, move down into rows two, five and one.

In level three the knots move down in all odd columns. Level four will test your soul. If the termite hits a knot, all the knots in all odd columns move down, and all the odd columns move to the next odd column on the right, with the eleventh column moving to the first column. If the termite hits a knot, the knots in column seven, rows two, three and four move down and to the right. The knots will now be in column nine, rows three, four and five. I suggest keeping track on a piece of paper.

How to Play

After choosing a level of play, plot a path for the termite to take using the keys F (forward), U (up) and D (down). After plotting, the termite will start to chew his way through the wood. If a knot is hit, the board is reset, the termite goes back to the start and the knots are moved according to the particular level. If the termite reaches the end, he jumps for joy.

Strategy

Avoid moving up or down in the odd numbered columns. The most direct path between columns one and twelve is the easiest to remember. ■

The Key Box

Model I
Level II
16K RAM

Program Listing

```
1 CLEAR1000
2  CLS:INPUT"ENTER A NUMBER UP TO 1000";A:A=RND(A):A=0
3 RANDOM
4 T$(5)=CHR$(191)+CHR$(135)+CHR$(155)+CHR$(175)
5 T$(1)=" "+CHR$(184)+CHR$(164)+CHR$(144)
6 T$(2)=CHR$(138)+CHR$(131)+CHR$(137)+" "
7 T$(3)=" "+CHR$(184)+CHR$(164)+CHR$(132)
8 T$(4)=CHR$(130)+CHR$(135)+CHR$(133)+CHR$(129)
9 T$(6)=CHR$(181)+CHR$(188)+CHR$(182)+CHR$(191)
10 DIM KN(7,3),KR(6,5)
11 T=0:FOR X=1TO6:FORX1=1TO3
12 KN(X,X1)=RND(5)
13 NEXT:NEXT
20 GOSUB 1000
25 CLS:PRINT"WOULD YOU LIKE DIRECTIONS?"
26 K$=INKEY$:IFK$=""THEN26
27 IFK$="Y"GOSUB3000:GOTO28
28 CLS:INPUT"ENTER YOUR LEVEL  1 - 4";DI:IFDI<1ORDI>4THEN28
30 GOSUB 1500
35 M$="":P=515:H=515
40 PRINT@0,"PLOT THE TERMITE'S PATH. U = UP , D = DOWN , F = FOR
WARD.";
50 I$=INKEY$:IFI$<>"U"ANDI$<>"D"ANDI$<>"F"THEN50
70 M$=M$+I$
80 IFI$="F"THENP=P+4:GOTO95
90 IFI$="D"THENP=P+128ELSEP=P-128
95 PRINT@H,"    ";:PRINT@H+64,"    ";
100 IFP<256ORP>832THEN250
110 PRINT@P,T$(1);:PRINT@P+64,T$(2);
120 H=P
130 FORX=307TO819STEP128
140 IFP=XTHEN200
150 NEXT
199 GOTO40
200 PRINT@0,STRING$(60," ");:PRINT@0,"IS THIS PATH GOOD";
201 K$=INKEY$:IFK$=""THEN201
202 IFK$="N"THEN30
203 IFK$<>"Y"THEN201
204 T=T+1
205 FORL=1TO1000:NEXT
210 GOTO500
250 FORL1=1TO5:PRINT@0,"YOU HAVE GONE OFF THE BOARD. TRY AGAIN."
;
251 PRINT"                    ";
255 FORL=1TO300:NEXT
256 PRINT@0,"                                                  ";
257 FORL=1TO100:NEXT:NEXT
260 GOSUB1500:GOTO35
500 CLS:GOSUB1500:P=515:H=515
505 PRINT@0,"ROW            COLUMN";
510 FORZ=1TOLEN(M$)
520 IFMID$(M$,Z,1)="F"THENI=2:S1=20:S2=0:S3=0:S4=0:GOTO545
530 IFMID$(M$,Z,1)="U"THENI=-64:S1=5:S2=10:S3=10:S4=0:GOTO545
540 IFMID$(M$,Z,1)="D"THENI=64:S1=10:S2=0:S3=5:S4=10:GOTO545
545 PRINT@H,"    ";:PRINT@H+64,"    ";
546 P=P+I:H=P
550 PRINT@P,T$(3);:PRINT@P+64,T$(4);
565 GOSUB5000
570 PRINT@H,"    ";:PRINT@H+64,"    ";
575 P=P+I:H=P
576 R=INT(P/128)-1:CO=(P-((R+1)*128+3))/4
577 C1=CO/2+.5:PRINT@64,R,CO;
580 PRINT@P,T$(1);:PRINT@P+64,T$(2);
581 GOSUB5000
582 IFCO/2=INT(CO/2)THEN590
583 FORCH=1TO3:IFKN(C1,CH)=RTHENGOSUB2000:GOTO30
584 NEXT
590 NEXT
591 FOR X=1TO7:PRINT@P,"    ";:PRINT@P+64,"    ";
592 PRINT@P-64,T$(3);:PRINT@P,T$(4);
593 S1=5:S2=0:S3=5:S4=0:GOSUB5000:PRINT@P-64,"    ";:PRINT@P,"
  ";
594 PRINT@P,T$(1);:PRINT@P+64,T$(2);
595 S1=5:S2=10:S3=0:S4=10:GOSUB5000:NEXT:FORL=1TO100:NEXT
596 PRINT@P,T$(3)"BURP";:PRINT@P+64,T$(4);
597 S1=35:S2=20:S3=0:S4=20:GOSUB5000:GOSUB6995:GOTO4000
1000 CLS
1005 GOSUB6000
1010 PRINT@470,"T  E  R  M  I  T  E"
1020 TA$=T$(1):TB$=T$(2)
1030 K=1
1040 FORX=448TO492STEP2
1045 PRINT@X-2,"    ";:PRINT@X+62,"    ";
1050 PRINT@X,TA$;:PRINT@X+64,TB$;
1055 IFX<468ORX>486THENS1=4:S2=10ELSES1=10:S2=0
```

Program continues

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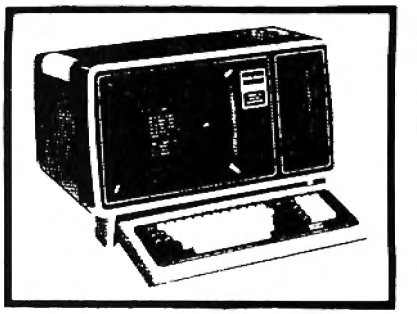

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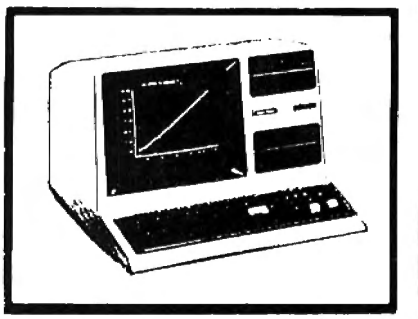

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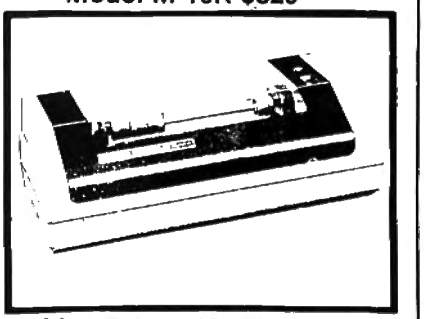

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Program continued

```
1056 GOSUB5000
1060 IFK=1THENK=3ELSEK=1
1070 TA$=T$(K):TB$=T$(K+1)
1075 FORL=1TO30:NEXT
1080 NEXT
1082 PRINT@492,T$(1);:PRINT@556,T$(2);
1083 FORL=1TO300:NEXT
1090 PRINT@492,T$(3)" BURP";:PRINT@556,T$(4);
1091 S1=20:S2=35:S3=0:S4=20:GOSUB5000
1092 PRINT@492,T$(1)"     ";:PRINT@556,T$(2);
1099 RETURN
1500 CLS:PRINT:PRINT
1502 PRINTTAB(26);"COLUMN"
1505 PRINT"ROW     1   2   3   4   5   6   7   8   9   10  11  1
2"
1510 FORL=1TO5.5STEP.5
1520 IFL=INT(L)THENPRINTL;ELSEPRINT"   ";
1530 PRINT"    "STRING$(44,CHR$(191));"XXXX"
1540 NEXT
1545 PRINT@515,T$(1);:PRINT@579,T$(2);
1550 RETURN
2000 FORA7=1TO4:PRINT@0,STRING$(120," ");:PRINT@28,"K N O T";
2005 FORY=1TO15
2010 PRINT@P,T$(1);:PRINT@P+64,T$(2);:FORX=1TO40:NEXT
2020 PRINT@P,T$(5);:PRINT@P+64,T$(6);:FORX=1TO40:NEXT
2030 NEXT
2054 S1=7:S2=0:S3=0:S4=0:FORA6=1TO22STEP3
2055 S2=A6:GOSUB5000:NEXT
2060 FORL=1TO2000:NEXT
2070 ONDIGOTO2499,2100,2200,2200
2100 REM DI=2
2105 IFC1=1THEN2150
2110 FORX=1TO3
2120 IFKN(C1-1,X)=5THENKN(C1-1,X)=1:GOTO2140
2130 KN(C1-1,X)=KN(C1-1,X)+1
2140 NEXT
2150 RETURN
2200 REM DI=3
2210 FORX1=1TO6:FORX=1TO3
2220 IFKN(X1,X)=5THENKN(X1,X)=1:GOTO2240
2230 KN(X1,X)=KN(X1,X)+1
2240 NEXT:NEXT
2245 IFDI=4THEN2300
2250 RETURN
2300 REM DI=4
2310 H1=KN(6,1):H2=KN(6,2):H3=KN(6,3)
2320 FORX1=5TO1STEP-1:FORX=1TO3
2330 KN(X1+1,X)=KN(X1,X)
2340 NEXT:NEXT:KN(1,1)=H1:KN(1,2)=H2:KN(1,3)=H3
2499 RETURN
3000 CLS:PRINT"  WELCOME TO TERMITE! TERMITE IS A GAME OF MEMORY
 AND"
3010 PRINT"(IN THE HIGHER LEVELS) TACTICS. YOU MUST HELP A TERMI
TE"
3020 PRINT"NAVIGATE A BLOCK OF PINE WOOD TO REACH A BLOCK OF CHE
RRY"
3030 PRINT"WOOD (YUMMY). THE GAME HAS 4 LEVELS OF PLAY, EACH DES
CRIBED"
3040 PRINT"BELOW. TERMITE WAS FOUNDED IN THE INTEREST OF PURE FU
N"
3050 PRINT"BUT IT HAS PROVED TO BE A TOOL FOR SHARPENING THE MEM
ORY."
3070 PRINT"TO KEEP BOTH YOUNG AND YOUNG-AT-HEART PLAYERS ENTERTA
INED,"
3080 PRINT"TERMITE HAS BOTH FINE GRAPHICS AND SOUND (THE SOUND C
OMES"
3090 PRINT"FROM THE AUXILIARY PLUG). HAPPY CHOMPING!"
3100 PRINT:PRINT"ANY KEY TO CONTINUE?"
3110 K$=INKEY$:IFK$=""THEN3110
3120 CLS:PRINTTAB(18);"GENERAL RULES FOR ALL LEVELS"
3130 PRINT:PRINT
3140 PRINT"1.  THE 'KNOTS' IN THE WOOD ARE IN ODD COLUMNS ONLY."

3150 PRINT"2.  IF THE TERMITE LANDS IN A SPACE WITH A KNOT, THE
"
3160 PRINTTAB(20);"TERMITE GOES BACK TO THE START."
3170 PRINT"3.  THERE ARE 1 TO 3 'KNOTS' IN EACH ODD COLUMN."
3180 PRINT"4.  IF THE TERMITE REACHES THE 12TH COLUMN, YOU WIN."

3190 PRINT:PRINT:PRINT"ANY KEY?"
3200 K$=INKEY$:IFK$=""THEN3200
3300 CLS:PRINT"LEVEL 1 : THE LEVEL 1 GAME IS DESIGNED TO HELP IM
PROVE"
3310 PRINT"         ANYONE'S MEMORY. IF YOUR TERMITE HITS A KNOT
 IN"
```

Program continues

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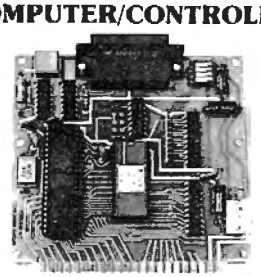

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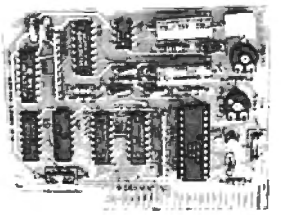

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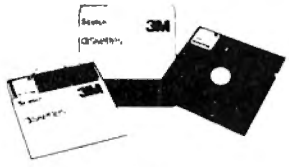

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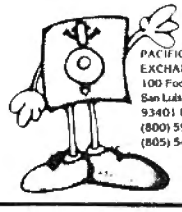

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```
3320 PRINT"          BOARD, THE BOARD IS RESET AND YOUR TERMITE G
OES"
3330 PRINT"          BACK TO THE STARTING POSITION. NONE OF THE"
3340 PRINT"          KNOTS MOVE AT THIS LEVEL."
3350 PRINT
3360 PRINT"LEVEL 2 : THE LEVEL 2 GAME IS DESIGNED TO ENTERTAIN T
HOSE"
3370 PRINT"          WHO BECOME BORED WITH THE LEVEL 1 GAME. IF Y
OUR"
3380 PRINT"          TERMITE HITS A KNOT IN THE BOARD, ALL THE KN
OTS IN"
3390 PRINT"          THE PREVIOUS ODD COLUMN MOVE 'DOWN' ONE ROW,
 WITH"
3400 PRINT"          THE BOTTOM ROW MOVING TO THE FIRST. EX: YOUR
 TERMITE"
3410 PRINT"          HAS JUST HIT A KNOT IN THE 5TH COLUMN. THE K
NOTS IN"
3420 PRINT"          COLUMN 3 (ROWS 1, 4 AND 5) WOULD BE CHANGED
TO ROWS"
3430 PRINT"          2, 5 AND 1."
3440 PRINT"ANY KEY?"
3450 K$=INKEY$:IFK$=""THEN3450
3460 CLS
3470 PRINT"LEVEL 3 : THE LEVEL 3 GAME IS A GOOD TEST FOR PATIENC
E."
3480 PRINT"          THIS LEVEL OPERATES MUCH LIKE THE LEVEL 2,"
3490 PRINT"          EXCEPT ALL THE KNOTS IN THE ODD COLUMNS MOVE
"
3500 PRINT"          DOWN WHEN A KNOT IS HIT IN ANY COLUMN."
3510 PRINT
3511 PRINT"ANY KEY?"
3512 K$=INKEY$:IFK$=""THEN3512
3513 CLS
3520 PRINT"LEVEL 4 : IF THE LEVEL 3 GAME IS A TEST OF PATIENCE,"

3530 PRINT"          THE LEVEL 4 GAME IS A TEST OF ONE'S SOUL."
3540 PRINT"          IT WOULD BE CHALLENGING FOR A CHESS MASTER"
3550 PRINT"          AND I SUGGEST THAT THE PLAYER KEEP TRACK OF"

3560 PRINT"          THE KNOTS ON A SHEET OF PAPER. THE RULES AT"

3570 PRINT"          THIS LEVEL ARE THE SAME AS LEVEL 3 WITH ONE"

3580 PRINT"          EXCEPTION, WHEN A KNOT IS HIT NOT ONLY DO"
3590 PRINT"          ALL THE KNOTS MOVE DOWN BUT ALL THE ODD"
3600 PRINT"          COLUMNS MOVE TO THE NEXT ODD COLUMN ON THE"
3610 PRINT"          RIGHT, WITH THE 11TH COLUMN MOVING TO THE"
3620 PRINT"          1ST COLUMN."
3630 PRINT
3640 PRINT"ANY KEY?"
3650 K$=INKEY$:IFK$=""THEN3650
3660 CLS
3999 RETURN
4000 REM
4100 CLS:PRINT"  CONGATULATIONS! YOU HAVE JUST WON THE LEVEL"DI"
GAME."
4105 ONDIGOTO4110,4200,4300,4400
4110 PRINT"THIS QUALIFIES YOU AS A 'JUNIOR CHOMPER.' IT TOOK YOU
"
4120 PRINTT" TURNS TO COMPLETE THE MAZE.":GOTO4990
4200 PRINT"THIS QUALIFIES YOU AS AN 'INTERMEDIATE CHOMPER.' IT T
OOK"
4210 PRINT"YOU "T" TURNS TO COMPLETE THE MAZE."
4260 GOTO4990
4300 PRINT"THIS QUALIFIES YOU AS AN 'EXPERIENCED CHOMPER.' IT TO
OK"
4310 PRINT"YOU "T" TURNS TO COMPLETE THE MAZE."
4360 GOTO4990
4400 PRINT"THIS QUALIFIES YOU AS A 'SUPER TERMITE.' IT TOOK YOU
"
4410 PRINTT" TURNS TO COMPLETE THE MAZE. GIVE YOURSELF A PAT ON"

4420 PRINT"THE BACK AND A PIECE OF SOFT WOOD TO THE TERMITE (HE'
S"
4430 PRINT"HAD A HARD DAY)."
4990 PRINT:PRINT"WOULD YOU LIKE TO TRY AGAIN?"
4991 K$=INKEY$:IFK$=""THEN4991
4992 IFK$="Y"THENGOSUB7500:GOTO11
4993 IFK$<>"N"THEN4991
4998 CLS:PRINTCHR$(23):PRINT@470,"CHICKEN!"
4999 GOTO4999
5000 FORL5=1TO5:FORL1=1TO1
5010 OUT255,1:OUT255,0
5020 FORL2=1TO2:NEXT
5030 NEXT
```

Program continues

Program continued

```
5040 FORL3=1TO3
5050 OUT255,1:OUT255,0
5060 FORL4=1TO4:NEXT
5070 NEXT
5080 NEXT
5090 RETURN
6000 Z$(1)="                              "+STRING$(12,CHR$(191))
6010 Z$(2)="                         "+STRING$(12,CHR$(191))+"       "
6015 Z$(2)=Z$(2)+STRING$(12,CHR$(191))
6020 Z$(3)="               "+STRING$(24,CHR$(191))
6030 Z$(4)="               "+STRING$(6,CHR$(191))+"
     "
6035 Z$(4)=Z$(4)+STRING$(6,CHR$(191))
6040 FORX=1TO3:FORY=1TO4:PRINTZ$(X):NEXT:NEXT
6050 PRINTZ$(4):PRINTZ$(4):PRINTZ$(4):PRINTZ$(4);
6055 PRINT@437,"TERMITE!";
6056 PRINT@498,"A MEMORY-MAZE";
6057 PRINT@567,"GAME.";
6060 FORX=1TO3000:NEXT:CLS:RETURN
6995 FORX=1TO6:FORY=1TO3:KR(X,KN(X,Y))=1:NEXT:NEXT
7000 PQ=263:FORX=1TO6:PP=PQ:FORY=1TO5
7010 IFKR(X,Y)=0PRINT@PP,"    ";:PRINT@PP+64,"    ";
7012 IFX<6PRINT@PP+4,"    ";:PRINT@PP+68,"    ";
7015 PP=PP+128
7020 NEXT:PQ=PQ+8:NEXT:FORX=1TO5000:NEXT:RETURN
7500 FORX=1TO6:FORY=1TO5:KR(X,Y)=0:NEXT:NEXT:RETURN
```


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GAME

LOAD 80

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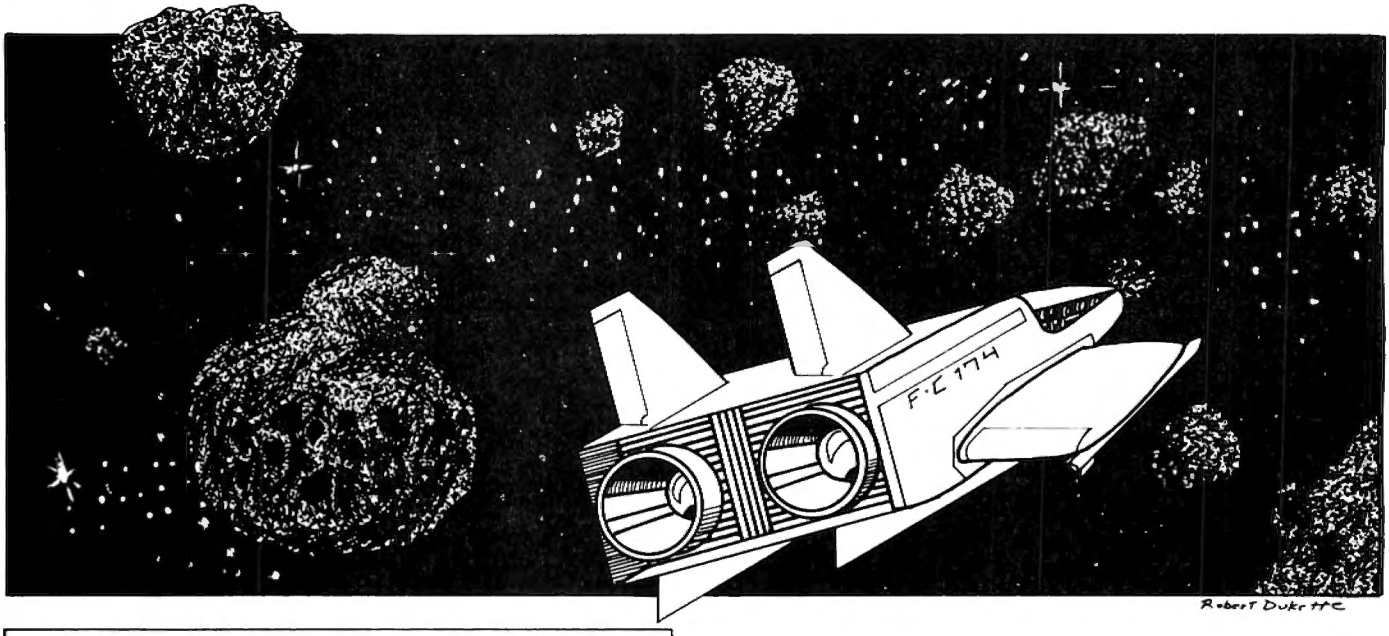
Thru the Asteriods



Joe D. Fugate
8979 Mandan Court
Boise, ID 83709

The October 1980 issue of *80 Micro* included a great little game, Asteroid Adventure, by Greg Perry and Richard Taylor. Their format was so simple I couldn't resist doing a little tinkering.

I call my version Thru the Asteroids. It is a real-time program with sound. I also included a performance rating routine based on the number of successful trips made through the asteroid field versus the number of crashes.

To start the game choose an experience level (zero to nine, with zero as beginner). The experience level determines the rate at which the game proceeds and the density of the asteroid field.

Little rewards await the player for each successful traversing of the asteroid field. After three successes the player is upgraded to the next experience level. A special reward is displayed for the player who successfully maneuvers through a level nine asteroid field.

Adding Sound

I tried several machine language subroutines from back issues of *80 Micro* for a good explosion sound and found Sound X in the July 1980 issue.

I think you will find Thru the Asteroids to be an addicting little game. ■

Joe Fugate, a programmer analyst, enjoys building models, science-fiction games, and fiddling with his micro.

The Key Box

Model I or III
16K RAM
Cassette Basic

```
 REM************************************************************
*************
2 S=PEEK(16548)+256*PEEK(16549)+5
3 FOR J=1 TO 72
4 READ X
5 POKE S+J-1,X
6 NEXT J
7 DATA 205,127,10,203,124,40,4,34,28,65,201,34,30,65
8 DATA 219,255,31,31,31,47,230,248,95,58,57,65,254,4,32,2
9 DATA 171,95,58,32,65,87,237,75,28,65,43,124,181,40,6
10 DATA 221,227,221,227,24,12,42,30,65,122,7,7,87,230,3,179
11 DATA 211,255,3,120,177,32,228,123,211,255,201
```

Program Listing 1

Program Listing 2. The first line of this program contains a REM statement with packed machine code. Because of this, keying in this program requires a preliminary step to pack the machine code into line 1. To pack the machine code into line 1, key in and run Listing 1. Next, delete lines 2–11, leaving only line 1. (Line 1 when listed will cause the video screen to behave strangely.) Program Listing 2 may then be keyed in as normal.

```
1 REM ** USE PROGRAM LISTING 1 TO GENERATE PACKED MACHINE CODE I
N LINE 1.  THEN KEY IN THE REST OF THIS LISTING **
2 DEFINTA-Z:RANDOM:DIMV(9):S=256*PEEK(16549)+PEEK(16548)+5
10 DEFINTA-Z:S=256*PEEK(16549)+PEEK(16548)+5:CLS:PRINT:S1=S/256:
S2=S-(S1*256):POKE16527,S1:POKE16526,S2:POKE16672,5:GOSUB700
20 PRINT"YOU ARE THE PILOT OF A HYPERLIGHT CORSAIR ON A ROUTINE
MISSION":GOSUB700:GOSUB700:GOSUB700
30 PRINT"TO A REMOTE PLANET ON THE EDGE OF THE GALAXY.  ALL APPE
ARS":GOSUB700:GOSUB700:GOSUB700
40 PRINT"NORMAL AS YOUR STARLIKE DESTINATION BEGINS TO RAPIDLY W
IDEN":GOSUB700:GOSUB700:GOSUB700
50 PRINT"INTO AN ENLARGING DISK, WHEN, TO YOUR HORROR AN UNCHART
ED":GOSUB710
60 PRINT"ASTEROID FIELD SUDDENLY APPEARS THROUGH YOUR COCKPIT WI
NDOW.":GOSUB710:GOSUB710:PRINT
```

Program continues

Program continued

```
70 PRINT"ITS TOO LATE TO AVOID IT...YOU TAKE A DEEP BREATH...GRI
P":GOSUB720
80 PRINT"YOUR CONTROL STICK TIGHTLY...BECAUSE YOU ARE GOING--":G
OSUB720
90 GOSUB630
100 PRINT"
THE UP AND DOWN ARROW KEYS WILL MANEUVER"
110 PRINT"YOUR CORSAIR AROUND THE ASTEROIDS.

  PRESS ENTER TO BEGIN."
115 A$=INKEY$:IF A$="" THEN GOTO 115
116 IF ASC(A$)<>13 GOTO 115
120 A=USR(-3000):A=USR(30):X=15872:Z=0:CLS:GOSUB390:GOSUB430:POK
EX+1,32:POKEX,62:FORW=1TO250:NEXTW:A=USR(30):POKEX,32:POKE16672,
5
190 LETY=PEEK(14400):IFY=8THENLETX=X-65:IFX<15360THENLETX=X+65:G
OTO250
200 IFY=16THENLETX=X+63:IFX>16317THENLETX=X-63:GOTO250
230 LETX=X+1:IFPEEK(X)<>32GOTO310
250 POKEX,62:POKEZ,32:LETZ=X:FORW=1TOE:NEXT
310 IFPEEK(X)=42GOTO530ELSEIFPEEK(X)>128GOTO550ELSEGOTO190
390 CR=15360
395 IF E>8 THEN NN=30
396 IF E<9 NN=20
397 IF E<4 NN=15
398 IF EL=9 NN=12
400 R=RND(NN)+2:CR=CR+R:IFCR>16379RETURNELSEPOKECR,42:GOTO400
430 W=63:FORI=1TO8:PRINT@W,STRING$(I,CHR$(191));:W=W+63:NEXT:W=W
+1:FORI=8TO2STEP-1:PRINT@W,STRING$(I,CHR$(191));:W=W+65:NEXT
510 FORY=45TO47:FORW=126TO127:SET(W,Y):NEXTW,Y:RETURN
530 CB=1:POKE16672,6:POKEX,191:POKEX+1,140:POKEX-1,140:POKEX-64,
176:POKEX+64,131:A=USR(-190):A=USR(15):A=USR(-2000):A=USR(90)
540 POKEX,166:POKEX+1,136:POKEX-1,132:POKEX-64,164:POKEX+64,137:
A=USR(-900):A=USR(100):A=USR(-1000):A=USR(300):A=USR(-100):A=USR
(200)
545 POKEX.132:POKEX+1,128:POKEX-1,128:POKEX-64,128:POKEX+64,128:
A=USR(-1000):A=USR(200):POKEX,128:A=USR(-5000):A=USR(200):CLS:CC
=CC+1:GOTO690
550 CB=0:CLS:PRINTCHR$(23):FORI=1TO5:PRINT@256,"SUCCESSFUL LANDI
NG":A=USR(8000):A=USR(50):PRINT@192,"
":FORJ=1TO100:NEXTJ,I
560 PRINT@272,CHR$(30):FOR P1=1 TO 50:NEXT:CLS:LL=LL+1:GOTO690
630 CLS:PRINTCHR$(23):PRINT@448,"    THRU THE ASTEROIDS"
640 FORI=80TO20STEP-1:A=USR(-200):A=USR(I):NEXTI:FORI=19TO1STEP-
1:A=USR(-500):A=USR(I):NEXTI
650 CLS:PRINT:PRINT"(C)1981 BY JOE D. FUGATE";:PRINT:PRINT:PRINT
"WHAT IS YOUR EXPERIENCE LEVEL?"
660 PRINT"<1:NOVICE TO 9:ACE>";
665 E$=INKEY$:IF E$=""GOTO665
666 A=USR(-3000):A=USR(30):EL=ASC(E$)-48:PRINT EL:E=10-EL
670 IF E<1 OR E>10 THEN CLS:PRINT:PRINT:GOTO 660
680 RETURN
690 GOSUB800:A=USR(-3000):A=USR(25):GOTO120
700 FORI=1TO5:A=USR(-3000):A=USR(80):FORJ=1TO30:NEXTJ,I:RETURN
710 FORI=1TO10:A=USR(-2000):A=USR(10):A=USR(-3000):A=USR(80):FOR
J=1TO30:NEXTJ,I:RETURN
720 FORI=1TO10:FORJ=1TO20:A=USR(-100):A=USR(J):NEXTJ,I:RETURN
800 CLS:A=USR(-3000):A=USR(30):PRINT"
LEVEL ";EL:IFCC=0THENCR=1ELSECR=CC
801 IFCB=0THENSC%=SC%+(LL/CR*100)*EL
802 PRINT"
RATING ";SC%;"

  LANDINGS-----> ";LL;"
  CRASHES------> ";CC
805 FORI=1TO1000:NEXTI
810 IFLL=0AND(CC=30RCC=60RCC=90RCC=120RCC>15)PRINT"
WHY DON'T YOU JUST GIVE UP AND COME BACK LATER?":FORI=1TO200:NEX
TI
820 IFLL<3GOTO890ELSEPRINT"
3 SUCCESSFUL LANDINGS AT THIS LEVEL!!":FORI=1TOEL:A=USR(-2000):A
=USR(20):A=USR(15):A=USR(20):A=USR(-5500):A=USR(15):NEXTI:EL=EL+
1:E=E-1:IFEL<10PRINT"
UPGRADING TO LEVEL ";EL:LL=0:CC=0:SC%=0
829 IFEL=10THENR=15360:SW=-1:CLS:PRINTCHR$(23):PRINT@466,"H O O
O R A Y!":GOTO838
830 POKE16772,182:A=USR(-10000):A=USR(20):A=USR(13):A=USR(-3000)
:FORI=1TO2:A=USR(15):A=USR(-1000):A=USR(16):A=USR(-3000):A=USR(1
8):A=USR(-10000):A=USR(10):A=USR(13):A=USR(-3000):NEXTI:A=USR(-3
000):A=USR(15):A=USR(16):A=USR(15):A=USR(-30000):A=USR(18)
831 RETURN
838 C1=22:GOSUB840:C1=18:GOSUB840:C1=15:GOSUB840:C1=12:GOSUB845:
C1=10:GOSUB845:A=USR(9):FORI=1TO100:NEXTI:PORK=1TO2:GOSUB830:NEX
TK:A=USR(-500):CLS
839 IFCC<10PRINT"
          YOU HAVE BEEN AWARDED--
   THE HIGHEST HONORS BESTOWED A HYPERLIGHT CORSAIR PILOT...

      ......GALACTIC MASTER HYPERLIGHT PILOT !!":FORI=48TO1
STEP-1:A=USR(I):NEXTI:ENDELSEEND
840 A=USR(-10000):GOSUB900:A=USR(C1):GOSUB900:A=USR(-2700):GOSUB
900:A=USR(C1):GOSUB900:A=USR(C1):GOSUB900:A=USR(-10000):GOSUB900
:A=USR(C1):GOSUB900:A=USR(-2700):GOSUB900:A=USR(C1):GOSUB900:A=U
SR(C1):GOSUB900:A=USR(-6000):GOSUB900:A=USR(C1)
841 GOSUB900:A=USR(-8000):GOSUB900:A=USR(C1):GOSUB900:A=USR(C1):
GOSUB900:A=USR(-2700):A=USR(C1):A=A:A=USR(C1):A=A:A=USR(C1):RETU
RN
845 GOSUB900:A=USR(-22000):GOSUB900:A=USR(C1):GOSUB900:A=USR(-27
00):GOSUB900:A=USR(C1):GOSUB900:A=USR(C1):GOSUB900:A=USR(C1):GOS
UB900:RETURN
890 FORI=1TO500:NEXTI:RETURN
900 OUT255,0:SW=SW*-1:R=15360+RND(1000):POKER,48:S=15360+(RND(50
0)*2):POKES,48:IFSW>0PRINT@466,"H O O O R A Y !";:OUT255,15:RETU
RN
910 PRINT@466,"              ";:OUT255,15:RETURN
```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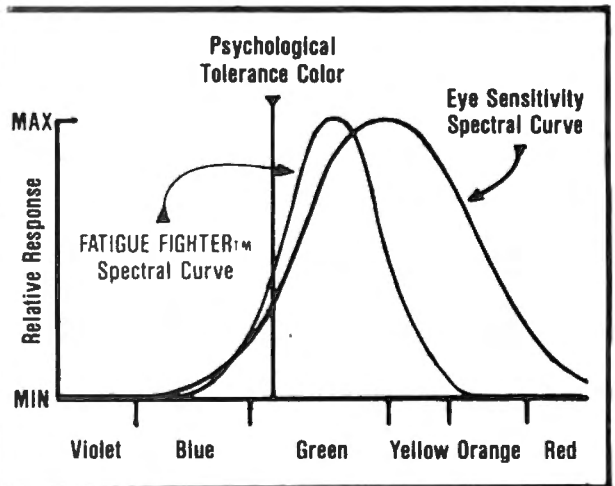

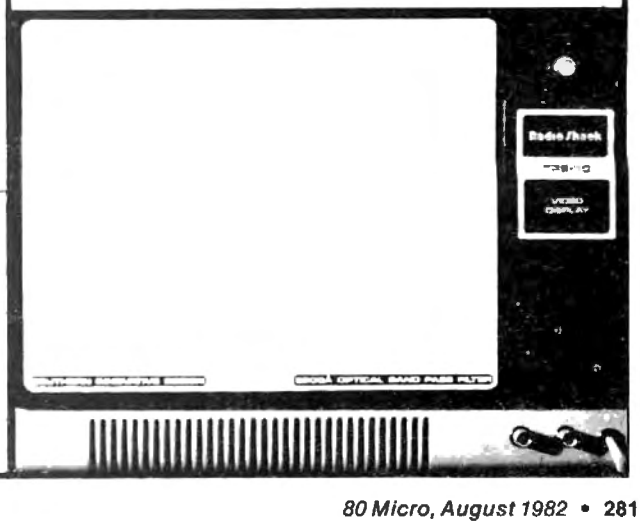

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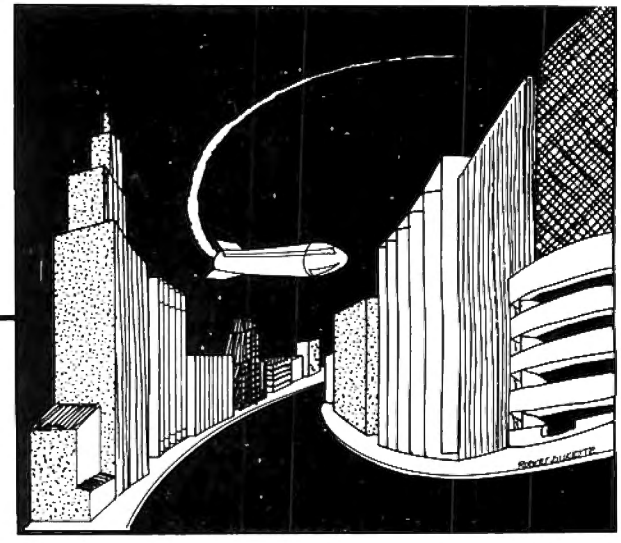
The cities' survival is up to you.

Alien Attack



Larry F. Perry
920 Baldwin Street
Denton, TX 76210

Do you like adventure and fast action? Well, here's another one of those space games.

How to Play

Begin by selecting the level at which you wish to play. A blinking cursor shows the position of your right joystick on the screen. Your bunker is at the bottom, and the cities you must protect are to the left and right of your bunker. Three missile trails will come down the screen. Using the joystick, put the cursor as near as you can to the front of the missile trail, and push the firing button to destroy the missile. You normally get 10 points for each missile destroyed, but extra points are added for some hits.

After you manage to get 300 points, the game speeds up. After reaching 500 points, look out for an alien. You must hit the alien in the orange spot to destroy it. If you succeed, you are given 100 extra points, and any destroyed cities are rebuilt. (Your cities will only be rebuilt twice.) If all of your cities are destroyed, the game ends.

How It Works

Line 480 checks the score to see if aliens can appear. S2 is the hundreds column in your score, and S3 the thousands. VX is a random number—whenever it equals 50, an alien attacks. You can change the number to which S2 is compared to any number between zero and nine (right now it is four). You can also change the size of the random number selection to change the probability of an alien attack.

Eliminate lines 1550–1570 if you don't want the game to speed up automatically. In line 1690, LC equals the number of times your cities will normally be replaced. You can increase or decrease this to any number.

In the firing sequence you can speed up the explosion by using the Draw command. I chose the Circle command to give the player a slight breather. One interesting note: In lines 690–710 I used the variable CO to set the explosion's color.

The Key Box

Extended Color Basic
Color Computer
16K RAM

Program Listing

```
10 REM  INTRODUCTION
20 GOSUB1860
30 CLS:PMODE1,1:PCLS
40 CLEAR700
50 REM SOUND FOR GAME
60 P1$="V30L25O3ABABL10O4CL25O4DEL10DADA":P2$="V10L25O4AG":P3$=
"V10L25O3ABCABCABCABC":P4$="V30L15O1PA":P5$="V15L15O1PA":P6$=
P5$:P7$="V30O3L35BDBBDEBDEBDEBDEL50ABABABABABAB"
70 P8$="V30O3L100FGACFGACFGACFGACFGACFGACFGACFGACFGAC
80 REM GAME CHOICES
90 PRINT"WHAT LEVEL DO YOU WISH TO PLAY?":PRINT" 1) NOVICE
                2) SEMI-PRO                    3) PRO
                4) MASOCHIST
100 PRINT"ENTER 1, 2, 3, OR 4
110 LC=0
120 PRINT" TO GET OUT OF THE GAME PRESS   <O>. NOTE: THE GAME IS
 OVER WHENALL OF YOUR CITIES ARE GONE,    BUNKER PENETRATION, OR
 YOU GIVE UP. THE OBJECT IS TO GET AS MANYPOINTS AS YOU CAN. THE
 MISSILES NEVER STOP COMING.
130 PO$=INKEY$:IFPO$=""THEN130
140 REM  SET SPEED OF GAME AND SOUND FOR MISSILE ADVANCE
150 IFPO$="1" THEN P5$=P2$:L1=2:L2=1:GOTO210
160 IFPO$="2" THEN L1=4:L2=2:GOTO210
170 IFPO$="3"THEN L1=6:L2=3:GOTO210
180 IFPO$="4"THEN L1=8:L2=4:GOTO210
190 GOTO130
200 REM  FIRST ATTACK POSITIONS
210 BB=24:CC=156:DD=94
220 COLOR2,1
230 REM  FIRST ANGLE OF ATTACK
240 C=2:G=-1:J=-1
250 REM  START LINES 15 SPACES DOWN FROM TOP OF SCREEN
260 BA=15:CA=15:DA=15
270 REM  SET UP START SCORE
280 GOSUB1130:GOSUB1160
290 COLOR2,1:GOSUB320
300 GOTO450
310 REM  DRAW CITIES & BUNKER
320 COLOR 2,1:LINE(0,186)-(256,191),PSET,BF
330 LINE(105,181)-(147,186),PSET,BF
340 LINE(110,176)-(142,181),PSET,BF:LINE(115,171)-(137,176),PSET
,BF:LINE(120,166)-(132,171),PSET,BF
350 AA$="L3U5R2U5R2U8R2U3R3D3R2D8R2D5R2D5L15"
360 FOR UU=14TO74STEP30
370 DRAW"C4;BM"+STR$(UU)+",184;"+AA$
380 PAINT(UU+5,180),4
390 NEXTUU
400 FOR UU=234TO164STEP-30
410 DRAW"C4;BM"+STR$(UU)+",184;"+AA$
420 PAINT(UU+5,180),4
430 NEXT UU
440 RETURN
450 COLOR4,1:SCREEN1,1
460 REM  BASIC GAME LOOP
470 AA=JOYSTK(0)*4:AB=JOYSTK(1)*4:OU$=INKEY$:IFOU$="O"THEN1730
480 IFS2>4OR S3>0THEN C=C:VX=RND(100):IFVX=50THEN2050
490 IFBA+D>190OR CA+F>190OR DA+I>190GOTO1960
500 Q=PPOINT(BB+B+2,BA+D+2):R=PPOINT(CC+E+2,CA+F+2):S=PPOINT(DD+
B+2,DA+I+2)
510 IFAB>150THEN AB=150
520 IFAB<20THEN AB=20
530 IFD>148THEN C=C:IFQ=8OR Q=6THEN GOSUB930
540 IFF>148THEN C=C:IFR=8OR R=6THEN GOSUB1800
550 IFI>148THEN C=C:IFS=8OR S=6THEN GOSUB1860
560 REM  INCREMENT LINE POSITIONS AND DISPLAY
570 D=D+L1:B=B+C*L2:F=F+L1:E=E+G*L2:I=I+L1:H=H+J*L2
580 LINE(AA,AB)-(AA+5,AB+1),PSET,B:COLOR4,1:LINE(BB,BA)-(BB+B,BA
+D),PSET:COLOR3,1:LINE(CC,CA)-(CC+E,CA+F),PSET:COLOR2,1:LINE(DD,
DA)-(DD+E,DA+I),PSET:COLOR4,1:LINE(AA,AB)-(AA+5,AB+1),PRESET
590 REM  CHECK FIRE BUTTON
600 POKE65494,0:PLAY P5$:P=PEEK(65280):POKE65495,0:IFP=126OR P=2
54THEN640
610 GOTO 470
620 REM  END OF BASIC GAME LOOP
630 REM LASER FIRE ROUTINE
640 G1=PPOINT(AA+2,AB-1):G2=PPOINT(AA+2,AB-2):G3=PPOINT(AA+1,AB-
1):G4=PPOINT(AA+1,AB-2):G5=PPOINT(AA+3,AB-1):G6=PPOINT(AA+3,AB-2
):G7=PPOINT(AA,AB-1):G8=PPOINT(AA+4,AB-1)
650 LINE(126,164)-(AA+2,AB),PSET
660 POKE65494,0:PLAY P3$:POKE65495,0
670 LINE(126,164)-(AA+2,AB),PRESET
680 CO=6
690 IFG1=8OR G2=8OR G3=8OR G4=8OR G5=8OR G6=8OR G7=8OR G8=8THENC
O=8:K1=1:GOTO730
700 IFG1=7OR G2=7OR G3=7OR G4=7OR G5=7OR G6=7OR G7=7OR G8=7THENC
```

Listing continues

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The explosion for the cities and bunker, starting at line 930, can also be changed to the Draw command. Using the Draw command along with the Size command, you can simulate a growing mushroom cloud. (When you are stuck with Basic, the simpler the task, the faster it can be done.)

The animation in the alien attack loop (lines 2140–2270) was accomplished using three variables—one for the main body of the alien, the other two used alternately to simulate flapping wings and moving legs or arms. This neat little task is accomplished using two lines (2180 and 2190). These lines switch the variables back and forth while the loop is running. If you want more advanced animation, you could draw several figures and use the Get and Put statements for animation sequences.

One of the reasons this game executes rapidly is that I increased the speed of the microprocessor by POKEing a zero into the address 65495. Those of you with early TRS-80 models may be unable to do this. To test your computer, POKE 65495,0. If the cursor flashes twice as fast as normal, your computer will operate at the higher speed. If your computer locks up, or nothing appears to happen, take out the command.

You will notice the statement POKE 65494,0 in several places. This brings the computer back to its normal speed while reading the joysticks and during sound routines. If it is not there while reading a joystick the computer will improperly perceive the joystick fire button. If the computer is in the fast mode while executing sound, it will occasionally lock up. Not all components of the computer are capable of a doubled response time.

Good luck—you'll need it!■

Larry Perry's interests include astronomy, electronics and motorcycles as well as his Color Computer.

Listing continued

```
O=7:K2=1:GOTO730
710 IFG1=6OR G2=6OR G3=6OR G4=6OR G5=6OR G6=6OR G7=6OR G8=6THENC
O=6:K3=1:GOTO730
720 GOTO470
730 FORX=1TO6:CIRCLE(AA+2,AB+2),X,CO:NEXTX
740 FORX=6TO1STEP-1:CIRCLE(AA+2,AB+2),X,1:NEXTX
750 IF AB>5+D THEN BA=15:IFK1=1THEN K1=0:LINE(BB,BA)-(BB+B,BA+D)
,PRESET:D=0:B=0:C=0:READ BB,C:GOSUB840:GOTO470
760 IF AB>5+F THEN CA=15:IFK2=1THEN K2=0:LINE(CC,CA)-(CC+E,CA+F)
,PRESET:F=0:E=0:G=0:READ CC,G:GOSUB840:GOTO470
770 IF AB>5+I THEN DA=15:IFK3=1THEN K3=0:LINE(DD,DA)-(DD+H,DA+I)
,PRESET:H=0:I=0:J=0:READ DD,J:GOSUB840:GOTO470
780 K1=0:K2=0:K3=0:GOTO470
790 RR=RR+1
800 IFRR=35THEN RESTORE:RR=0
810 GOSUB1680
820 RETURN
830 REM  ADD EXTRA POINTS TO SCORE IF PERFECT HIT
840 RR=RR+1
850 IFRR=35THEN RESTORE:RR=0
860 POKE65494,0:IFG1=8THEN PLAY P8$:POKE65495,0:GOSUB1400:GOSUB1
400:GOSUB1400:GOSUB1400
870 IFG1=7THEN PLAY P7$:POKE65495,0:GOSUB1400
880 POKE65495,0:GOSUB1400
890 RETURN
900 REM  POSITIONS/ANGLES OF MISSILES
910 DATA 201,-2,131,1,161,1,94,-1,53,2,79,0,49,0,161,1,131,1,204
,0,24,2,124,-1,94,-1,156,-1,234,0,94,-1,124,-1,238,-2,161,1,53,2
,174,0,19,0,230,-2,161,1,99,1,201,-2,94,-1,161,1,79,0,174,0,131,
1,24,2,124,-1,204,0,19,0
920 REM  BLOW UP CITY/BUNKER
930 LINE(BB,BA)-(BB+B,BA+D),PRESET
940 FORXY=1TO16:CIRCLE(BB+B+2,BA+D+8),XY,4:POKE65494,0:PLAY P4$:
POKE65495,0:NEXTXY
950 FORYX=16TO1STEP-1:CIRCLE(BB+B+2,BA+D+8),YX,1:NEXTYX
960 REM RESET LINE/GET NEW COORDINATE
970 B=0:D=0:C=0:READ BB,C
980 GOSUB790
990 RETURN
1000 LINE(CC,CA)-(CC+E,CA+F),PRESET
1010 FORXY=1TO16:CIRCLE(CC+E+2,CA+F+8),XY,4:PLAY P4$:NEXTXY
1020 FORYX=16TO1STEP-1:CIRCLE(CC+E+2,CA+F+8),YX,1:NEXTYX
1030 E=0:F=0:G=0:READ CC,G
1040 GOSUB790
1050 RETURN
1060 LINE(DD,DA)-(DD+H,DA+I),PRESET
1070 FORXY=1TO16:CIRCLE(DD+H+2,DA+I+8),XY,4:PLAY P4$:NEXTXY
1080 FORYX=16TO1STEP-1:CIRCLE(DD+H+2,DA+I+8),YX,1:NEXTYX
1090 H=0:I=0:READ DD,J
1100 GOSUB790
1110 RETURN
```

Listing continues

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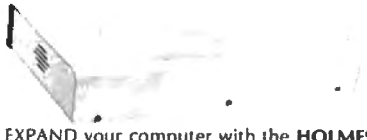

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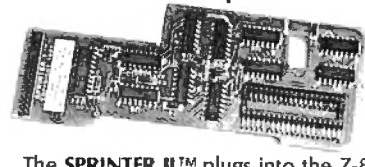

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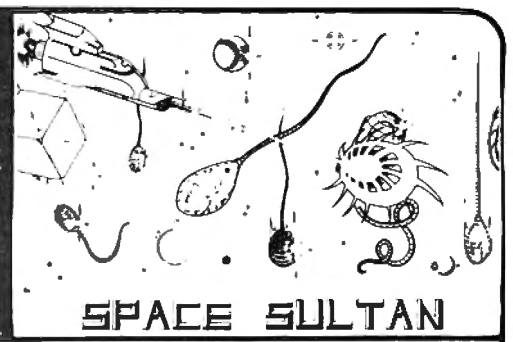
```
1120 REM  ZERO FOR SCORE
1130 BB$="BU2U6E2R3F2D6G2L3BR14
1140 RETURN
1150 REM  SET SCORE VARIABLES TO ZERO
1160 CC$=BB$:DD$=BB$:EE$=BB$:HH$=BB$
1170 REM  PUT SCORE ON SCREEN
1180 LINE(180,0)-(175,10),PRESET,BF:DRAW"C3;BM185,10;"+HH$+CC$+D
D$+EE$
1190 RETURN
1200 REM  NUMBERS FOR SCORE
1210 FF$="BR3NU10BR11
1220 RETURN
1230 FF$="BU8E2R3F2D2G2L3G2D2R7BR9
1240 RETURN
1250 FF$="BU8E2R3F2D1G2NL2F2D2G1L4NH2BR14
1260 RETURN
1270 FF$="BU4NE6R7BL1NU6D4BR10"
1280 RETURN
1290 FF$="BU10NR7D3F2R3F2D2G1L4NH2BR16"
1300 RETURN
1310 FF$="BU10BR5L3G2D6F2R3E2U2H1L3G1BD4BR16"
1320 RETURN
1330 FF$="BU9U1R7G6D4BR15"
1340 RETURN
1350 FF$="BU2U2BU2U2E2R3F2D2BD1BL2NL3F2D1G2L3BR16"
1360 RETURN
1370 FF$="BU7U1E2R3F2D3NL5D4G1L4NH2BR16"
1380 RETURN
1390 REM  SCORE ROUTINE
1400 S1=S1+1
1410 IFS1=10THENS1=0:FF$=BB$:GOTO1430
1420 ON S1 GOSUB1210,1230,1250,1270,1290,1310,1330,1350,1370,113
0
1430 DD$=FF$
1440 IFS1=0THEN S2=S2+1
1450 IFS2=10THEN S2=0:CC$=BB$:GOTO1480
1460 IFS2>0THEN C=C:ON S2 GOSUB1210,1230,1250,1270,1290,1310,133
0,1350,1370
1470 IFS1>0GOTO1530
1480 CC$=FF$
1490 IFS2=0THEN S3=S3+1
1500 IFS3>0THEN C=C:ON S3 GOSUB1210,1230,1250,1270,1290,1310,133
0,1350,1370
1510 IFS2>0THEN1530
1520 HH$=FF$
1530 GOSUB1180
1540 REM  INCREASE GAME SPEED IF RIGHT CONDITIONS ARE MET
1550 IFS2=3AND L1<4THEN L1=4:L2=2:P5$=P6$
1560 IFS3=1AND L1<6THEN L1=6:L2=3
1570 IFS3=2ANDL1<8THEN L1=8:L2=4
1580 RETURN
1590 REM  CHECK FOR 0 OF CITIES/END IF ZERO/IF ONE CITY LEFT AND
 SCORE OVER 90 SUBTRACT POINTS ADD CITIES-ONLY DO TWICE
1600 FORT=15TO75STEP3@
1610 Z=PPOINT(T+5,180)
1620 IF Z=0THEN W=W+1
1630 NEXT T
1640 FORT=230TO160STEP-30
1650 U=PPOINT(T+5,180)
1660 IF U=0THEN W=W+1
1670 NEXT T
1680 IF W=0THEN1730
1690 IF W=1THEN LC=LC+1:IFLC>2THEN1700ELSE C=C:GOSUB1800
1700 Z=0:W=0:T=0:U=0
1710 RETURN
1720 REM  FLASH SCREEN/SHOW SCORE/END GAME/START OVER
1730 FOR XP=1TO10:SCREEN1,0:SOUND100,1:SCREEN1,1:SOUND50,1:NEXTX
P:CLS:PRINT:PRINT:PRINT:PRINT:PRINTTAB(8)LO$;
1740 AW=S3*1000:AX=S2*100:AY=S1*10
1750 AU=AW+AX+AY
1760 PRINT:PRINT:PRINT:PRINT" YOUR SCORE:"AU;
1770 FOR HH=1TO2000:NEXT HH
1780 GOTO30
1790 REM  SUBTRACT POINTS IF POSSIBLE
1800 IFS1>0THEN S1=S1-9:GOSUB1400:GOSUB320:RETURN
1810 IFS2>0THEN S2=S2-1:IF S2=0THEN1840ELSE C=C:ON S2 GOSUB1210,
1230,1250,1270,1290,1310,1330,1350,1370:CC$=FF$:GOSUB1180:GOSUB3
20:RETURN
1820 IFS3>0THEN S3=S3-1:IFS3=0THEN1850ELSE C=C:ON S3GOSUB1000,11
00,1120,1140,1160,1180,1200,1220,1240:HH$=FF$:S2=8:S1=0:GOSUB144
0:GOSUB1180:GOSUB320:RETURN
1830 RETURN
1840 CC$=BB$:GOSUB1180:GOSUB320:RETURN
1850 HH$=BB$:GOSUB1180:S2=S2+8:S9=S1:S1=0:GOSUB1440:GOSUB320:S1=
S9:RETURN
1860 CLS:PRINT:PRINT" ********************************"
1870 PRINT:PRINT"          MISSILE ATTACK"
1880 PRINT:PRINT"                BY
1890 PRINT:PRINT"           L. F. PERRY":PRINT
1900 PRINT:PRINT"           VERSION 1.1":PRINT"          REQUIRES
16.5K "
1910 PRINT
1920 PRINT:PRINT" ********************************"
1930 FOR NJ=1TO2000:NEXT NJ
1940 GOTO30
1950 REM  END OF GAME REMARKS
1960 V=RND(5)
1970 ON V GOTO 1980,1990,2000,2010,2020
1980 LO$="YOU BLEW IT":GOTO1730
1990 LO$="YOU LOSE":GOTO1730
2000 LO$="TRY HARDER...?":GOTO1730
2010 LO$="BETTER LUCK NEXT TIME":GOTO1730
2020 LO$="TOUGH LUCK"
2030 GOTO1730
2040 REM RESET ALL LINES/GET POSITIONS   FOR NEXT ATTACK
2050 LINE(BB,BA)-(BB+B,BA+D),PRESET:LINE(CC,CA)-(CC+E,CA+F),PRES
ET:LINE(DD,DA)-(DD+H,DA+I),PRESET
2060 D=0:B=0:C=0:F=0:E=0:G=0:H=0:I=0:J=0:BA=15:CA=15:DA=15:READB
B,C:GOSUB2550:READCC,G:GOSUB2550:READDD,J:GOSUB2550
2070 GOSUB2290
2080 REM  PICK TYPE OF ALIEN FOR ATTACK
2090 BH=RND(4):IFBH=2THEN2480
2100 IFBH=3THEN2500
2110 IFBH=4THEN2520
2120 REM  DEFAULT ALIEN TYPE
2130 IN$="H6E6F6G6BU2":IO$="H4E4F4G4BU2BR2":IP$="H2E2F2G2":IQ$="
R4U8L8D8R4":IR$=IN$:IS$="C4":IT$="C4"
2140 REM  ALIEN ATTACK LOOP
2150 AA=JOYSTK(0)*4:AB=JOYSTK(1)*4:VA=VA+VC:VB=VB+VD
2160 IFAB>150THEN AB=150
2170 IFAB<20THEN AB=20
2180 IFNQ=1THEN IN$=IQ$:NQ=0:GOTO2210
2190 IFNQ=0THEN IN$=IR$:NQ=1
2200 PLAY"V30O4L40A
2210 COLOR4,1:LINE(AA,AB)-(AA+5,AB+1),PSET:DRAW"C2;BM"+STR$(VA)+
","+STR$(VB)+IN$+IS$+IO$+IT$+IP$
2220 LINE(AA,AB)-(AA+5,AB+1),PRESET
2230 IFVB>160THEN1960
2240 POKE65494,0:P=PEEK(65280):POKE65495,0:IFP=126OR P=254THEN23
70
2250 DRAW"C1;BM"+STR$(VA)+","+STR$(VB)+IN$+"C1;"+IO$+IP$
2260 GOTO2150
2270 REM  END OF ALIEN ATTACK LOOP
2280 REM  GET ALIEN ATTACK POSITION/ANGLE
2290 BS=RND(5):IFBS=0THEN2290
2300 ON BS GOTO2310,2320,2330,2340,2350
2310 VA=18:VB=30:VC=5:VD=6:RETURN
2320 VA=126:VB=30:VC=0:VD=4:RETURN
2330 VA=222:VB=30:VC=-4:VD=6:RETURN
2340 VA=60:VB=38:VC=2:VD=4:RETURN
2350 VA=190:VB=30:VC=-2:VD=4:RETURN
2360 REM  CHECK HIT ON ALIEN/ADD POINTS AND ELIMINATE ALIEN IF H
IT AND RETURN TO FIRST LOOP
2370 G1=PPOINT(AA+2,AB-1):G2=PPOINT(AA+2,AB-2)
2380 COLOR4,1:LINE(126,164)-(AA+2,AB),PSET
2390 POKE65494,0:PLAY P3$:POKE65495,0
2400 LINE(126,164)-(AA+2,AB),PRESET
2410 IFG1=8OR G2=8THEN2420ELSE2440
2420 COLOR4,1:FORX=1TO10:CIRCLE(AA+2,AB+2),X,4:NEXTX
2430 FORX=10TO1STEP-1:CIRCLE(AA+2,AB+2),X,1:NEXTX
2440 DRAW"C1;BM"+STR$(VA)+","+STR$(VB)+IN$+IO$+IP$
2450 IFG1=8OR G2=8THEN POKE65494,0:PLAY P1$:POKE65495,0:GOSUB320
:GOSUB1400:GOSUB1400:GOSUB1400:GOSUB1400:GOSUB1400:GOSUB1400:GOS
UB1400:GOSUB1400:GOSUB1400:GOSUB1400:GOTO470
2460 GOTO2150
2470 REM  ALIEN ANIMATION VARIABLES
2480 IO$="BL2BD1U4R4ND4U3NR2U4L2ND2NU2L2D3D3R2U2":IN$="NU4R13NU4
BL5D3BL2BD4":IQ$="ND4R13ND4BL5D3BL2BD4":IP$="BU3R2":IR$=IN$:IS$=
"C2":IT$="C4"
2490 GOTO2150
2500 IO$="BR10L14U2BR2R12BU2BL2L10BU2R10BU2BR2L14NG2BR14F2":IN$=
"E6H6L6G6F6BU14":IQ$="BL6U6H6L6G6D6BR6BU14":IP$="BL7BD4L2R4":IR$
=IN$:IS$="C2":IT$="C4"
2510 GOTO2150
2520 IO$="BL4NU4ND6R2NU4ND6":IN$="BU6G6D2E8BR8F6D2H8":IQ$="BU6H6
U2F8BR8E6U2G8":IP$="":IR$=IN$:IS$="C4"
2530 GOTO2150
2540 REM  CHECK FOR END OF DATA
2550 RR=RR+1:IFRR=35THEN RESTORE:RR=0
2560 RETURN
```

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Step up from Rubik's Cubes with Ridgway's Ovals.

Loco Motion

Dennis Ridgway
2160 Frisco Avenue
Terre Haute, IN 47805

This solitaire game requires concentration, dexterity and patience. The playing field consists of three concentric tracks, on which 12 units take turns relentlessly rotating. The units are identified as 1, 2, 3, 4, 5, 6, 7, 8, 9, X, Y and Z.

A normal move is an advance of two positions on the same track. Control keys are used to make units slow down (advance only one position) or speed up (advance three positions). Control keys also direct units to adjacent tracks.

The object of the game is to align the 12 units with a pre-established target pattern in as few moves as possible. The target pattern can be selected from eight preprogrammed patterns (Fig. 1) or, if you wish, custom-designed. Once a target pattern has been established it is continually displayed with a counter showing the number of moves.

During play, units may be moved to the inside of the innermost track (the infield). They can be returned to play on a subsequent turn. Units may also be moved to the outfield, the outside of the outermost track. From there, they cannot be returned to play.

When all 12 units match their corresponding target positions the display is frozen and the game is over. During play the screen can be frozen by the operator by pressing Shift@. The program includes complete playing instructions.■

Dennis Ridgway, a data processor, enjoys his micro, gardening and motorcycles.

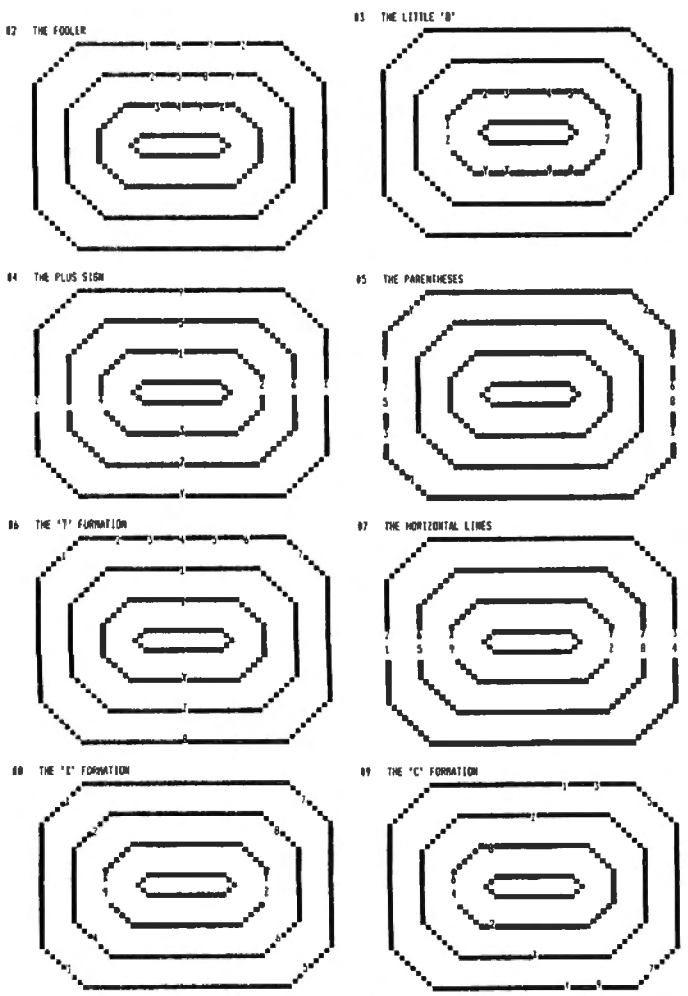


Fig. 1. Preprogrammed Target Patterns

The Key Box

Model I
16K RAM
Cassette Basic

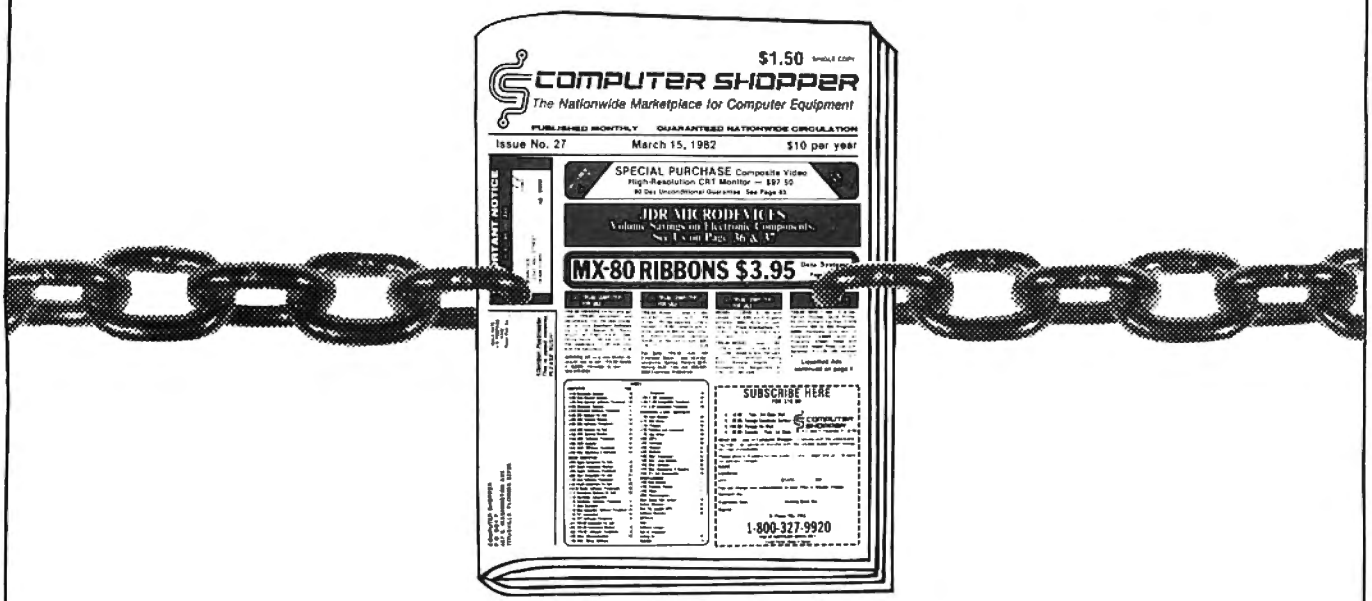
Program Listing

```
50 CLS:CLEAR15:DEFINTA-Z:M=15361:M$="HIT ENTER TO PROCEED"
60 DIMRA(5):RA(1)=15:RA(2)=15:RA(3)=19:RA(4)=23:RA(5)=23
70 DIMQR(4):DIMQU(4):DIMQT(4):DIMQS(4):DIMQK(4)
80 DIMTN(12):DIMSN(12):DIMHT(12):DIMHS(12)
150 GOSUB20000:GOSUB40000:PRINT@1000,M$;
220 IFINKEY$=""220
250 GOSUB21000:GOSUB40200:PRINT@1000,M$;
320 IFINKEY$=""320
350 GOSUB22000:GOSUB40500:PRINT@1000,M$;
370 IFINKEY$=""370
400 GOSUB23000:GOSUB40780:PRINT@1000,M$;
420 IFINKEY$=""420
600 GOSUB26015
700 GOSUB28000:GOSUB28200:PRINT@54,"COUNTER";:GOSUB1010
900 GOSUB3000:GOTO900
1010 NU=0:FORX=1TO12:TN(X)=T2(X):SN(X)=S2(X):NEXT
1070 TY=6:FORSK=1TO12:TX=TN(SK):SX=SN(SK):GOSUB11000
1080 NEXT:SK=0:PL=0:RETURN
3000 SK=SK+1:IFSK=13THENSK=1
3002 IFPL=1THENPL=2ELSEPL=1
3004 LE=0:RI=0:SL=0:FA=0
3010 IFPL=1THENGOSUB4100ELSEGOSUB5000
3020 P1=0:P2=0:P3=0
```

Program continues

YOU'VE JUST FOUND

THE MISSING LINK!



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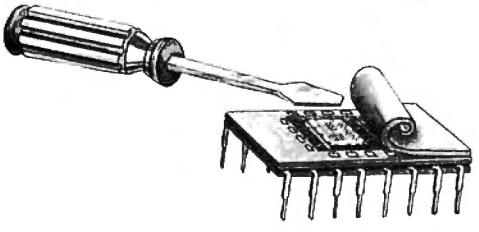
Program continued

```
3030 IFSL+FA=0ORSL+FA=2GOTO3050
3040 IFSL=1THEN3060ELSEP3=1
3050 P1=1
3060 IFLE+RI=0ORLE+RI=2THENP2=2:GOTO3080
3070 IFLE=1THENP2=1ELSEP2=3
3080 IFP2=1THENGOSUB6000ELSEGOTO3090
3085 GOSUB15000
3090 IFP2=2THENGOSUB8000ELSEGOTO3100
3095 GOSUB15000
3100 IFP2=3THENGOSUB9000ELSEGOTO3110
3105 GOSUB15000
3110 IFP1=1THENGOSUB8000ELSEGOTO3120
3115 GOSUB15000
3120 IFP3=1THENGOSUB8000ELSEGOTO3130
3125 GOSUB15000
3130 RETURN
4100 X=PEEK(14340)
4110 IF(XAND132)>0FA=1
4120 IF(XAND8)>0LE=1
4130 X=PEEK(14337)
4140 IF(XAND32)>0FA=1
4150 IF(XAND2)>0LE=1
4160 IF(XAND80)>0RI=1
4170 IF(XAND8)>0SL=1
4180 X=PEEK(14344)
4190 IF(XAND5)>0SL=1
4200 RETURN
5000 X=PEEK(14338)
5010 IF(XAND130)>0FA=1
5020 IF(XAND12)>0LE=1
5030 IF(XAND16)>0RI=1
5040 IF(XAND32)>0SL=1
5050 X=PEEK(14340)
5060 IF(XAND1)>0FA=1
5070 X=PEEK(14368)
5080 IF(XAND8)>0RI=1
5090 IF(XAND80)>0SL=1
5100 RETURN
6000 QC=1'LEFT
6010 TX=TN(SK):QR(QC)=TX:SX=SN(SK):QU(QC)=SX
6020 SX=SX+1:IFSX=RA(TX)THENSX=1
6030 ONTXGOTO6031,6032,6033,6034,6035
6031 RETURN
6032 GOTO6038
6033 SX=CI(SX):GOTO6038
6034 SX=DI(SX):GOTO6038
6035 RETURN
6038 TX=TX-1:QT(QC)=TX:QK(QC)=SK
6040 ONTXGOTO6041,6042,6043
6041 X=BI(SX):GOTO6090
6042 X=BT(SX):GOTO6090
6043 X=CT(SX)
6090 QS(QC)=SX
6095 X=PEEK(X)
6100 IFX>90ORX<49GOTO7000
6110 IFTX<>1GOTO6200
6120 SX=SX+1:IFSX=RA(TX+1)THENSX=1
6130 GOTO6040
6200 QC=QC+1:SK=X-48:IFSK>9THENSK=SK-30
6210 GOTO6010
7000 FORX3=QCTO1STEP-1
7010 SK=QK(X3):TX=QT(X3):TY=QR(X3):SX=QS(X3):SY=QU(X3)
7020 GOSUB11000
7025 TN(SK)=TX:SN(SK)=SX
7030 NEXT
7040 RETURN
8000 TX=TN(SK):SX=SN(SK)
8010 SX=SX+1:IFSX=RA(TX)THENSX=1
8020 ONTXGOTO8021,8022,8023,8024,8025
8021 RETURN
8022 X=BT(SX):GOTO8030
8023 X=CT(SX):GOTO8030
8024 X=DT(SX):GOTO8030
8025 RETURN
8030 IFPEEK(X)<>32RETURN
8040 TY=TN(SK):SY=SN(SK):TN(SK)=TX:SN(SK)=SX
8050 GOSUB11000
8060 RETURN
9000 QC=1'RIGHT
9010 TX=TN(SK):QR(QC)=TX:SX=SN(SK):QU(QC)=SX
9020 SX=SX+1:IFSX=RA(TX)THENSX=1
9030 ONTXGOTO9031,9032,9033,9034,9035
9031 GOTO9039'USE SX
9032 SX=BO(SX):GOTO9039
9033 SX=CO(SX):GOTO9039
9034 GOTO9039
9035 RETURN
9039 TX=TX+1:QT(QC)=TX:QK(QC)=SK
9040 ONTXGOTO9041,9042,9043,9044,9045
9041 END
9042 X=BT(SX):GOTO9050
9043 X=CT(SX):GOTO9050
9044 X=DT(SX):GOTO9050
9045 X=DO(SX)
9050 QS(QC)=SX:X=PEEK(X):IFX=32GOTO10000
9051 IFTX=2THENRETURN
9052 IFTX<>5THEN9100
9060 SX=SX+1:IFSX=RA(TX)THENSX=1
```

Program continues

Accessing the TRS-80* ROM...



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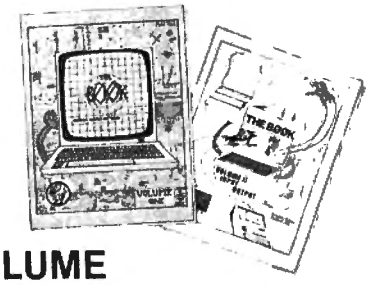

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Program continued

```
9870 GOTO9840
9100 QC=QC+1:SK=X-48:IFSK>9THENSK=SK-30
9110 GOTO9810
10000 FORX3=QCTO1STEP-1
10010 SK=QK(X3):TX=QT(X3):TY=QR(X3):SX=QS(X3):SY=QU(X3)
10020 GOSUB11000
10025 TN(SK)=TX:SN(SK)=SX
10030 NEXT
10040 RETURN
11000 ID=SK+48:IFID>57THENID=ID+30'DISPLAY UNITS
11010 ONTXGOTO11011,11012,11013,11014,11015
11011 X1=BI(SX):GOTO11031
11012 X1=BT(SX):GOTO11030
11013 X1=CT(SX):GOTO11030
11014 X1=DT(SX):GOTO11030
11015 X1=DO(SX)
11030 POKEX1-1,40:POKEX1+1,41
11031 POKEX1,ID
11060 ONTYGOTO11061,11062,11063,11064,11065,11100
11061 X2=BI(SY):GOTO11110
11062 X2=BT(SY):GOTO11070
11063 X2=CT(SY):GOTO11070
11064 X2=DT(SY):GOTO11070
11065 X2=DO(SY)
11070 POKEX2-1,32:POKEX2,32:POKEX2+1,32
11100 NU=NU+1:PRINT@119,NU;:RETURN
11110 POKEX2,RP(SY):RETURN
15000 'TEST
15010 FORX=1TO12
15020 IFSN(X)<>BS(X)THENRETURN
15030 IFTN(X)<>HT(X)THENRETURN
15040 NEXT
15050 PRINT@0,"CONGRATULATIONS - YOU DID IT";
15055 B$=INKEY$:PRINT@960,"TO REPEAT THIS PATTERN ENTER 'R'.TO P
ICK A NEW ONE ENTER 'N'";:A=1:GOSUB24000:IFB$="R"THEN700ELSE600
15060 GOTO15060
20000 CLS:PRINT@17,"- LOCO MOTION -"
20010 PRINT@133,"THE PLAYING FIELD CONSISTS OF THREE CONCENTRIC
TRACKS"
20020 PRINT@192,"ON WHICH 12 UNITS CONTINUALLY ROTATE."
20030 PRINT@261,"THE OBJECT OF THE GAME IS TO ALIGN THE 12 MOVIN
G UNITS"
20040 PRINT@320,"WITH A PRESELECTED TARGET PATTERN"
20050 PRINT@460,"PATTERN SELECTION METHODS"
20170 PRINT@576,"-  YOU CAN SELECT 1 OF 8 PREPROGRAMMED PATTERNS
"
20191 PRINT@704,"-  YOU CAN DESIGN THE PATTERN YOURSELF"
20200 PRINT@832,"-  YOU CAN REPEAT THE LAST COMPLETED PATTERN"
20999 RETURN
21000 CLS:PRINT@25,"CONTROL KEYS"
21010 PRINT`69,"THE 12 UNITS ARE NUMBERED AND MOVE IN THE ORDER
"
21020 PRINT@140," 1  2  3  4  5  6  7  8  9  X  Y  Z"
21025 PRINT@256,"CONTROL KEYS":PRINT@306,"CONTROL KEYS"
21030 PRINT@320,"FOR ODD UNITS":PRINT@370,"FOR EVEN UNITS"
21040 PRINT@384,"1,3,5,7,9,Y":PRINT@434,"2,4,6,8,X,Z"
21060 PRINT@512,"    W E R                    FAST - ADVANCE 3
    I O P"
21070 PRINT@576,"A S                         MOVE TO INSIDE
    J K"
21080 PRINT@650,"D F             MOVE TO OUTSIDE
   L ;"
21090 PRINT@708,"Z X C                  SLOW - ADVANCE 1
    M , ."
21100 PRINT@768,"   NO KEYS                  NORMAL - ADVANCE 2
      NO KEYS"
21999 RETURN
22000 CLS:PRINT@25,"MOVEMENT"
22010 PRINT@197,"TRACK MUST BE OPEN FOR UNITS TO MOVE STRAIGHT A
HEAD"
22020 PRINT@325,"UNITS MOVING TO THE INSIDE OR OUTSIDE WILL MOVE
 REGARDLESS"
22030 PRINT@384,"OF WHETHER OR NOT THE TRACK IS OPEN. IF THE WAY
 IS BLOCKED"
22040 PRINT@448,"THE BLOCKING UNIT WILL BE BUMPED OUT OF THE WAY
. IT MAY"
22050 PRINT@512,"IN TURN BUMP ANOTHER UNIT."
22060 PRINT@645,"THE DIAGONAL INSIDE OR OUTSIDE MOVE OCCURS PRIO
R TO THE"
22070 PRINT@704,"FORWARD ADVANCE PORTION OF THE MOVE."
22999 RETURN
23000 CLS:PRINT@25,"INFIELD"
23010 PRINT@133,"UNITS MOVED OR BUMPED INTO THE INFIELD IN THE C
ENTER OF"
23020 PRINT@192,"THE TRACKS CAN BE MOVED BACK ONTO THE PLAYING F
IELD BY"
23030 PRINT@256,"KEYING A 'MOVE TO OUTSIDE', HOWEVER THE ADJACEN
T POSITION"
23040 PRINT@320,"ON THE TRACK MUST BE OPEN."
23050 PRINT@537,"OUTFIELD"
23060 PRINT@645,"UNITS MOVED OR BUMPED TO THE OUTFIELD ARE OUT O
F PLAY AND"
23070 PRINT@704,"CANNOT BE RETURNED TO THE PLAYING FIELD"
23999 RETURN
24000 B$="":PRINTCHR$(14);
24010 A$=INKEY$:IFA$>""IFA$=CHR$(13)THENPRINTCHR$(15);:RETURNELS
EIFA$>CHR$(31)ANDLEN(B$)<ATHENPRINTA$;:B$=B$+A$ELSEIFB$>""IFA$=C
HR$(8)THENPRINTA$;:B$=LEFT$(B$,LEN(B$)-1)ELSEIFA$=CHR$(24)THENPR
```

Program continues

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Program continued

```
INTSTRING$(LEN(B$),8)::B$=""
24020 GOTO24010
26015 CLS:PRINT@18,"SELECT YOUR PATTERN"
26020 PRINT@138,"1  TO SPECIFY YOUR OWN PATTERN"
26030 PRINT@197,"THE FOLLOWING ARE PREPROGRAMMED PATTERNS"
26032 PRINT@266,"2  THE FOOLER"
26035 PRINT@330,"3  THE LITTLE 'O'"
26040 PRINT@394,"4  THE PLUS SIGN"
26045 PRINT@458,"5  THE PARENTHESES"
26050 PRINT@522,"6  THE 'T' FORMATION"
26055 PRINT@586,"7  HORIZONTAL LINES"
26060 PRINT@650,"8  THE 'X' FORMATION"
26065 PRINT@714,"9  THE 'C' FORMATION"
26070 PRINT@832,"ENTER CODE";:INPUTP
26120 IFP=1GOTO26500'DO IT YOURSELF
26130 IFP=2THENFORX=1TO12:HT(X)=T2(X):HS(X)=S2(X):NEXT:GOTO26250

26140 IFP=3THENFORX=1TO12:HT(X)=T3(X):HS(X)=S3(X):NEXT:GOTO26250

26150 IFP=4THENFORX=1TO12:HT(X)=T4(X):HS(X)=S4(X):NEXT:GOTO26250
26160 IFP=5THENFORX=1TO12:HT(X)=T5(X):HS(X)=S5(X):NEXT:GOTO26250

26170 IFP=6THENFORX=1TO12:HT(X)=T6(X):HS(X)=S6(X):NEXT:GOTO26250

26180 IFP=7THENFORX=1TO12:HT(X)=T7(X):HS(X)=S7(X):NEXT:GOTO26250

26190 IFP=8THENFORX=1TO12:HT(X)=T8(X):HS(X)=S8(X):NEXT:GOTO26250

26200 IFP=9THENFORX=1TO12:HT(X)=T9(X):HS(X)=S9(X):NEXT:GOTO26250

26240 GOTO26070
26250 GOSUB28000
26260 GOSUB28200
26270 PRINT@0,"ENTER Y TO PLAY THIS PATTERN. ENTER N TO SELECT A
NOTHER";:INPUTP$
26280 IFP$="N" GOTO26015
26310 RETURN
26500 GOSUB28000'DO IT
26510 GOSUB28500
26515 PRINT@0,"ENTER TARGET LOCATIONS FOR EACH UNIT AT BOTTOM OF
 SCREEN";
26525 PRINT@960,"1";CHR$(94);"Z";
26530 FORX=1TO12
26540 PRINT@964+(X-1)*5,"    ";
26545 PRINT@964+(X-1)*5,"?";
26550 A=3:GOSUB24000:IFB$=""GOTO26540
26570 HT(X)=ASC(LEFT$(B$,1))-63
26575 IFRIGHT$(B$,1)=" "THENY=1ELSEY=2
26580 P=VAL(MID$(B$,2,Y))
26590 LI=(HT(X)-2)*4+14

26600 IFHT(X)<2ORHT(X)>4THEN26540
26610 IFP<1ORP>LITHEN26540
26615 HS(X)=P
26620 X1=X+48:IFX1>57THENX1=X1+30
26630 ONHT(X)GOTO26640,26642,26643,26644
26640 STOP
26642 POKEPA(P),X1:GOTO26650
26643 POKEPB(P),X1:GOTO26650
26644 POKEPC(P),X1
26650 NEXT:GOTO26250
28000 CLS:FORX=15847TO15833STEP-1:POKEX,131:NEXT
28010 FORX=1TO3:POKEB1(X),C1(X):NEXT
28020 FORX=15897TO15911:POKEX,140:NEXT
28030 FORX=3TO1STEP-1:POKED1(X),C1(X):NEXT
28040 FORX=15722TO15702STEP-1:POKEX,131:NEXT
28050 FORX=1TO11:POKEB2(X),C2(X):NEXT
28060 FORX=16022TO16042:POKEX,140:NEXT
28070 FORX=11TO1STEP-1:POKED2(X),C2(X):NEXT
28080 FORX=15598TO15570STEP-1:POKEX,131:NEXT
28090 FORX=1TO18:POKEB3(X),C3(X):NEXT
28100 FORX=16146TO16174:POKEX,140:NEXT
28110 FORX=18TO1STEP-1:POKED3(X),C3(X):NEXT
28120 FORX=15475TO15437STEP-1:POKEX,131:NEXT
28130 FORX=1TO23:POKEB4(X),C4(X):NEXT
28140 FORX=16269TO16307:POKEX,140:NEXT
28150 FORX=23TO1STEP-1:POKED4(X),C4(X):NEXT
28160 RETURN
28200 FORX=1TO12
28210 SK=X+48:IFSK>57THENSK=SK+30
28220 Y=HS(X)
28230 ONHT(X)GOTO28240,28241,28242,28243
28240 STOP
28241 POKEPA(Y),SK:GOTO28250
28242 POKEPB(Y),SK:GOTO28250
28243 POKEPC(Y),SK
28250 NEXT
28260 RETURN
28500 FORX=1TO9:PRINT@BT(X)-M,"A";CHR$(X+48);:NEXT'TRK POS
28510 FORX=0TO4:PRINT@BT(X+10)-M,"A1";CHR$(X+48);:NEXT
28520 FORX=1TO9:PRINT@CT(X)-M,"B";CHR$(X+48);:NEXT
28530 FORX=0TO8:PRINT@CT(X+10)-M,"B1";CHR$(X+48);:NEXT
28540 FORX=1TO9:PRINT@DT(X)-M,"C";CHR$(X+48);:NEXT
28550 FORX=0TO9:PRINT@DT(X+10)-M,"C1";CHR$(X+48);:NEXT
28560 FORX=0TO2:PRINT@DT(X+20)-M,"C2";CHR$(X+48);:NEXT
28570 RETURN
40000 DATA15776,15772,15768,15828,15892,15960,15964,15968,15972,
15976,15916,15852,15784,15780
40010 DIMBT(14):FORX=1TO14:READBT(X):NEXT
40020 DATA15648,15643,15638,15696,15822,15886,16016,16086,16091,
16096,16101,16106,16048,15922,15858,15728,15658,15653
40030 DIMCT(18):FORX=1TO18:READCT(X):NEXT
```

Program continues

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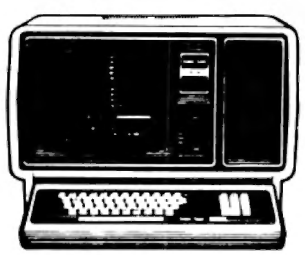

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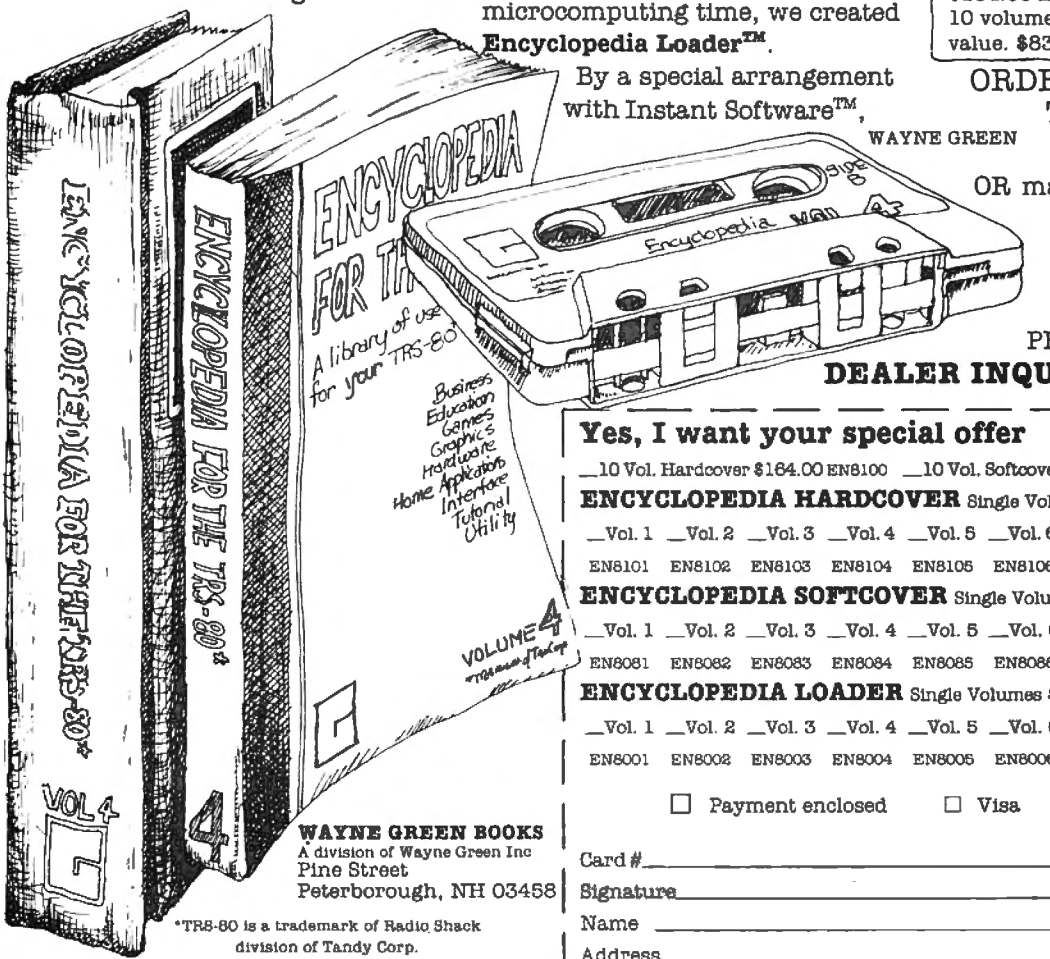

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Program continued

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40040 DATA15520,15514,15508,15564,15688,15816,15880,16008,16140,
16212,16218,16224,16230,16236,16180,16056,15928,15864,15736,1560
4,15532,15526
40050 DIMDT(22):FORX=1TO22:READDT(X):NEXT
40100 DATA15838,15836,15834,15898,15900,15902,15904,15906,15908,
15910,15846,15844,15842,15840
40110 DIMBI(14):FORX=1TO14:READBI(X):NEXT
40120 DATA2,3,4,4,5,6,6,7,8,9,10,11,11,12,13,13,14,1
40130 DIMCI(18):FORX=1TO18:READCI(X):NEXT
40140 DATA2,3,4,4,5,6,7,7,8,9,10,11,12,13,13,14,15,16,16,17,18,1

40150 DIMDI(22):FORX=1TO22:READDI(X):NEXT
40160 RETURN
40200 DATA2,3,4,6,7,9,10,11,12,13,15,16,18,1
40210 DIMBO(14):FORX=1TO14:READBO(X):NEXT
40220 DATA2,3,4,6,7,8,10,11,12,13,14,15,17,18,19,21,22,1
40230 DIMCO(18):FORX=1TO18:READCO(X):NEXT
40240 DATA15392,15386,15380,15493,15682,15810,15874,16002,16197,
16340,16346,16352,16358,16364,16251,16062,15934,15870,15742,1554
7,15404,15398
40250 DIMDO(22):FORX=1TO22:READDO(X):NEXT
40300 DATA15712,15708,15704,15825,15889,16024,16028,16032,16036,
16048,15919,15855,15720,15716
40310 DIMPA(14):FORX=1TO14:READPA(X):NEXT
40320 DATA15584,15579,15574,15631,15819,15883,16079,16150,16155,
16160,16165,16170,16113,15925,15861,15665,15594,15589
40330 DIMPB(18):FORX=1TO18:READPB(X):NEXT
40340 DATA15456,15450,15444,15498,15685,15813,15877,16005,16202,
16276,16282,16288,16294,16300,16246,16059,15931,15867,15739,1554
2,15468,15462
40350 DIMPC(22):FORX=1TO22:READPC(X):NEXT
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1
40400 DIMRP(14):FORX=1TO14:READRP(X):NEXT
40450 RETURN
40500 DATA15832,15831,15896
40510 DIMB1(3):FORX=1TO3:READB1(X):NEXT
40520 DATA140,176,131
40530 DIMC1(3):FORX=1TO3:READC1(X):NEXT
40540 DATA15848,15849,15912
40550 DIMD1(3):FORX=1TO3:READD1(X):NEXT
40560 DATA15701,15700,15763,15762,15761,15825,15889,15954,15955,
15956,16021
40570 DIMB2(11):FORX=1TO11:READB2(X):NEXT
40580 DATA140,176,131,140,176,191,191,131,140,176,131
40590 DIMC2(11):FORX=1TO11:READC2(X):NEXT
40600 DATA15723,15724,15789,15790,15791,15855,15919,15982,15981,
15980,16043
40610 DIMD2(11):FORX=1TO11:READD2(X):NEXT
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15883,15947,16011,16012,16013,16078,16079,16080,16145
40630 DIMB3(18):FORX=1TO18:READB3(X):NEXT
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6,131,140,176,131
40650 DIMC3(18):FORX=1TO18:READC3(X):NEXT
40660 DATA15599,15600,15665,15666,15667,15732,15733,15797,15861,
15925,15989,16053,16052,16051,16114,16113,16112,16175
40670 DIMD3(18):FORX=1TO18:READD3(X):NEXT
40680 DATA15436,15435,15498,15497,15496,15559,15558,15557,15621,
15685,15749,15813,15877,15941,16005,16069,16134,16135,16136,1620
1,16202,16203,16268
40690 DIMB4(23):FORX=1TO23:READB4(X):NEXT
40700 DATA140,176,131,140,176,131,140,176,191,191,191,191,191,19
1,191,191,131,140,176,131,140,176,131
40710 DIMC4(23):FORX=1TO23:READC4(X):NEXT
40720 DATA15476,15477,15542,15543,15544,15609,15610,15611,15675,
15739,15803,15867,15931,15995,16059,16123,16186,16185,16184,1624
7,16246,16245,16308
40730 DIMD4(23):FORX=1TO23:READD4(X):NEXT
40740 RETURN
40780 DATA4,3,2,2,3,4,4,3,2,2,3,4
40785 DIMT2(12):FORX=1TO12:READT2(X):NEXT
40790 DATA2,2,2,1,1,1,22,18,14,13,17,21
40795 DIMS2(12):FORX=1TO12:READS2(X):NEXT
40800 DATA2,2,2,2,2,2,2,2,2,2,2,2
40810 DIMT3(12):FORX=1TO12:READT3(X):NEXT
40820 DATA4,3,2,14,13,12,11,10,9,7,6,5
40830 DIMS3(12):FORX=1TO12:READS3(X):NEXT
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40850 DIMT4(12):FORX=1TO12:READT4(X):NEXT
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40870 DIMS4(12):FORX=1TO12:READS4(X):NEXT
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40890 DIMT5(12):FORX=1TO12:READT5(X):NEXT
40900 DATA9,20,8,19,7,18,6,17,5,16,4,15
40910 DIMS5(12):FORX=1TO12:READS5(X):NEXT
40920 DATA4,4,4,4,4,4,4,4,2,3,2,3
40930 DIMT6(12):FORX=1TO12:READT6(X):NEXT
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40950 DIMS6(12):FORX=1TO12:READS6(X):NEXT
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40970 DIMT7(12):FORX=1TO12:READT7(X):NEXT
40980 DATA7,6,18,17,6,5,15,14,5,4,12,11
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41010 DIMT8(12):FORX=1TO12:READT8(X):NEXT
41020 DATA4,4,9,7,15,13,20,16,5,4,12,11
41030 DIMS8(12):FORX=1TO12:READS8(X):NEXT
41300 DATA4,2,4,2,4,2,4,2,4,3,4,3
41310 DIMT9(12):FORX=1TO12:READT9(X):NEXT
41320 DATA22,6,21,5,20,4,15,3,14,10,13,1
41330 DIMS9(12):FORX=1TO12:READS9(X):NEXT
45000 RETURN
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LINE NUMBERS	FUNCTION
50-80	Initialize
150-220	1st screen & data read
250-320	2nd screen & data read
350-370	3rd screen & data read
400-420	4th screen & data read
600	Select pattern
700	Setup for play
900	Play
1010-1080	Start units
3000-3130	Mstr move ctl
3000	Add 1 to active unit
3002	Alternate odd and even
3004	Clear left, right, slow, and fast controls
3010	Odd or even key reads
3020	Clear movement phase controls
3030	Slow+fast or not slow+not fast=normal
3040	Fast P3+P1+P2=non 0
3050	Normal P1+P2=non 0
3060-3070	Left+right or not left+not right=straight
3080-3085	1st move phase(P2) a "1" = left(inside)
3090-3095	1st move phase(P2) a "2" = straight
3100-3105	1st move phase(P2) a "3" = right(outside)
3110-3115	2nd move phase(P1)a"1"=straight "0"=no move
3120-3130	3rd move phase(P3)a"1"=straight "0"=no move
4100-4200	Odd units key read
4110	W & R
4120	S
4140	E
4150	A
4160	D & F
4170	C
4190	Z & X
5000-5100	Even units key read
5010	I & O
5020	J & K
5030	L
5040	M
5060	P
5080	;
5090	, & .
6000-7040	Move left(inside)
6000	Set queue ctr
6010	Move old address into queue
6020	Increment position
6030	Old track branch vector
6031	Already in infield
6032	Moving to infield
6033	Moving middle to inside track
6034	Moving outside to middle track
6035	Inside move cannot be to outfield
6038	Calc new track and store in queue
6040	New track branch vector
6041	Move to infield
6042	Move to inside
6043	Move to middle
6090-6095	Store new position address in queue
6100	Occupied? If no goto 7000
6110	If track not infield goto 6200
6120-6130	Go till an open infield position is found
6200	Increment queue cntr & identify bumped unit
6210	Loop back with new unit
7000-7010	Go backward through queue moving each unit
7020-7040	Advance unit routine
8000-8060	Move straight
8010	Increment position number
8020	Track branch vector
8021	In infield
8022	Inside track
8023	Middle track
8024	Outside track
8025	In outfield
8030	No advance if blocked
8040	Prepare for advance
8050-8060	Advance unit
9000-10040	Move right (outside)
9000	Set queue counter
9010	Store old address in queue
9020	Increment position number
9030	Old track branch vector
9031	Infield to inside track
9032	Inside to middle track
9033	Middle to outside track
9034	Outside to outfield
9035	Already in outfield
9039	Calc new track and store in queue
9040	New track branch vector
9041	Cannot move out to infield

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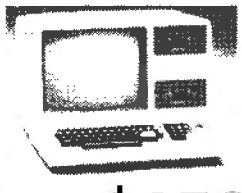

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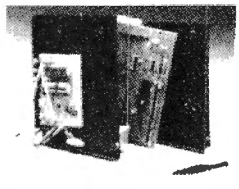

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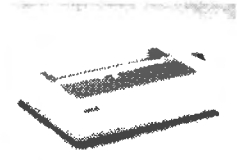

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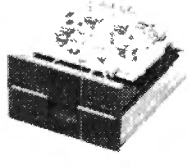

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9042          Move to inside track from infield
9043          Move to middle track from inside
9044          Move to outside track from middle
9045          Move to outfield from outside track
9050          Store new positions in queue
9051          Won't move from infield if position filled
9052          Test - track and not outfield
9060-9070     Go till an open outfield position is found
9100          Increment queue cntr & identify bumped unit
9110          Loop back with new unit
10000-10010   Go backwards thru queue moving units
10020-10040   Advance units
11000-11110   Advance units on screen
11010-11031   New display position
11011         Infield
11012         Inside
11013         Middle
11014         Outside
11015         Outfield
11030         Display left & right parentheses()
11031         Display unit number
11060-11110   Clear old display
11061         Infield
11062         Inside
11063         Middle
11064         Outside
11065         Outfield not cleared
11070         Clear 3 character unit display
11100         Increment score counter
11110         Repair infield
15000-15060   Test against target
20000-20999   Screen number one
21000-21999   Screen number two
22000-22999   Screen number three
23000-23999   Screen number four
24000-24020   Special inkey routine
26015-26120   Select pattern
26130-26240   Load patterns
26250         Draw borders routine
26260-26310   Draw target pattern
26500         Draw borders   Do it yourself
26510-26650   Show positions
28000-28160   Draw borders routine
28200-28260   Draw target patterns
28500-28570   Draw track map
40000-40001   Data arrays
40010-40021   Inside track addresses
40030-40041   Middle track addresses
40050-40101   Outside track addresses
40110-40120   Infield track addresses
40130-40140   Middle to inside transfer
40150-40200   Outside to middle transfer
40210-40220   Inside to middle transfer
40230-40241   Middle to outside transfer
40250-40301   Outfield addresses
40310-40321   Inside track pattern addresses
40330-40341   Middle track pattern addresses
40350-40390   Outside track pattern addresses
40400-40500   Infield repair characters
40510-40520   Left infield border addresses
40530-40540   Infield border characters
40550-40560   Right infield border addresses
40570-40580   Left inside border addresses
40590-40600   Inside border characters
40610-40621   Right inside border addresses
40630-40641   Left middle border addresses
40650-40661   Middle border characters
40670-40681   Right middle border addresses
40690-40701   Left outside border addresses
40710-40721   Outside border characters
40730         Right outside border addresses
40740-40780   Pattern track and positions
40785-40790   Pattern 2 track
40795-40800   Pattern 2 position
40810-40820   Pattern 3 track
40830-40840   Pattern 3 position
40850-40860   Pattern 4 track
40870-40880   Pattern 4 position
40890-40900   Pattern 5 track
40910-40920   Pattern 5 position
40930-40940   Pattern 6 track
40950-40960   Pattern 6 position
40970-40980   Pattern 7 track
40990-41000   Pattern 7 position
41010-41020   Pattern 8 track
41030-41300   Pattern 8 position
41310-41320   Pattern 9 track
41330-45000   Pattern 9 position
```


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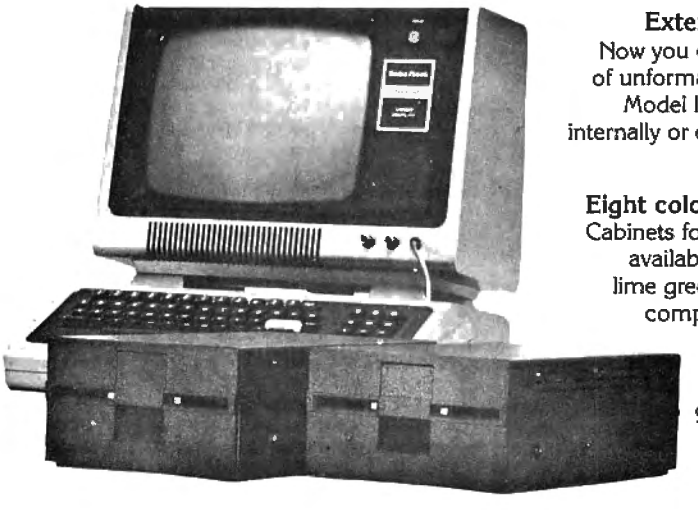

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With many simulation games it's hard for the operator to identify in a visual and tactile way with the action of the game. Some programs, in fact, provide little involvement of the senses at all, and the simulation is more an exercise in mathematics. These games can be challenging, but how about those times when we like to "get in on the action?"

Rammer is a short program written to show the other end of the spectrum—a fast-moving action game that combines animated graphics with natural motor responses.

Running The Program

Written for a 16K Level II TRS-80, Rammer includes a 12 byte machine language routine. To protect it from being overwritten by Basic, answer the memory size prompt with 32754. If you are running under Disk Basic with 32K, change lines 100, 180, and 320 to read:

```
100 DEFUSR0=&HBFF4
180 X=USR0(X)
320 B=&HBFF4:FOR X=B TO B+11
```

and answer the memory size question with 49140.

When the program is run, the Rammer (character A) appears in the center of the screen. At the same time, the enemy squadron appears at the top of the screen and begins to move down towards the Rammer. The object of the game is to intercept and ram as many enemy ships as possible, using the left and right arrow keys for control.

Any time the Rammer is being moved, a trail is left behind it. When a hit is made, the enemy ship disintegrates and its debris scrolls down the screen while the operator goes after the next likely target. Occasionally, a group of enemy ships will line up diagonally as they approach. It's really exciting to "wipe out" three or four of these at a time, and equally frustrating when you zip too far to the left or right and miss them all.

Each hit reduces the size of the enemy fleet so that fewer ships approach. During the action, the number of hits and misses is continuously displayed at the bottom of the screen.

Programming Features

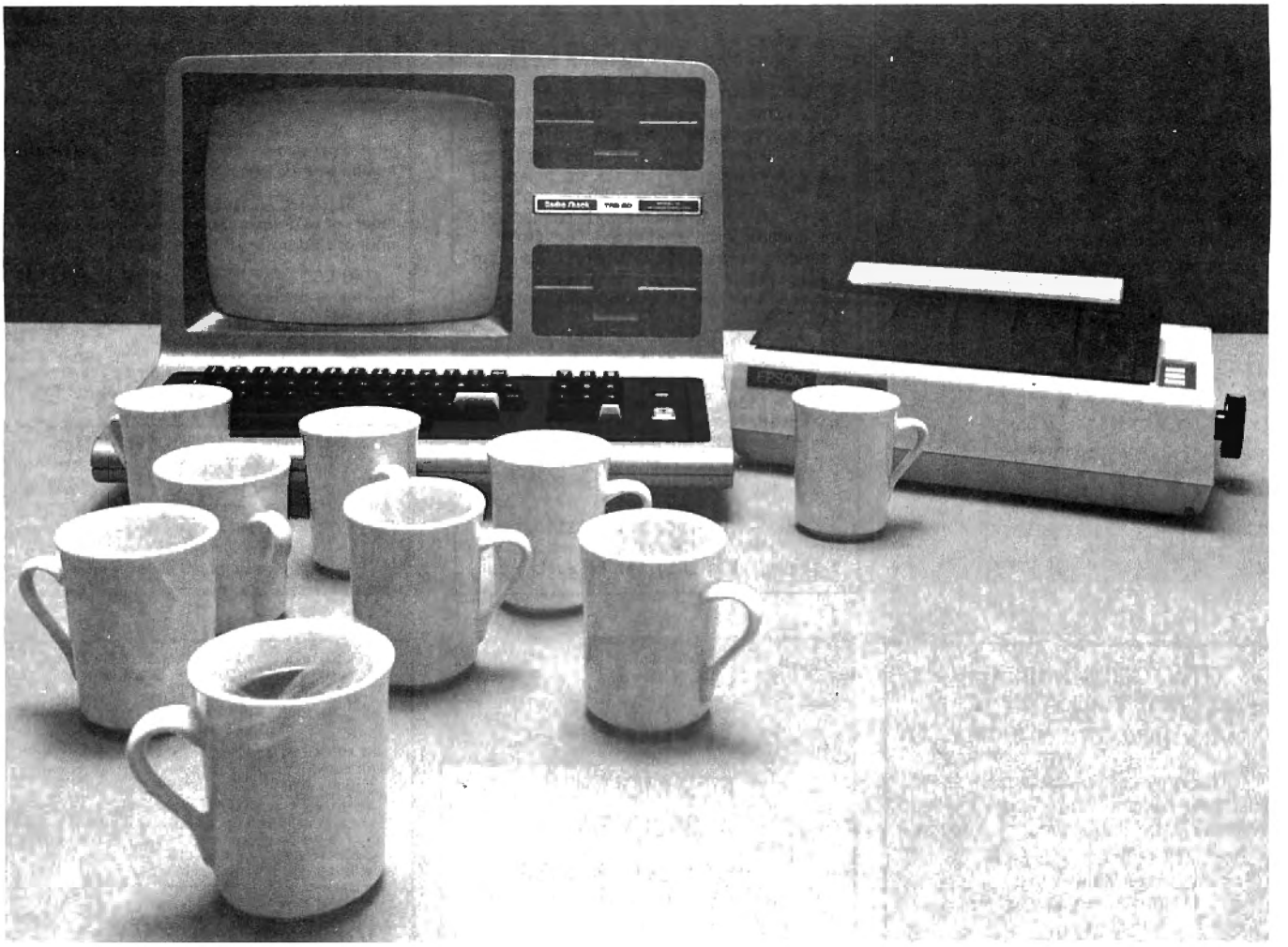
Since Rammer is a real-time action sequence, the program is optimized for speed. This is done in several ways: first, all variables are defined as integers, and most of the values needed by the program are assigned to variable names early, even if they remain constant during running. This increases

Variable Name	Initial Value	Purpose
H	0	Current total number of collisions (hits).
HM	0	Home position on screen, used in line 130.
KB	14400	Keyboard address where left and right-arrow keys are PEEKed.
LE	15938	Left Edge: Leftmost screen position allowed for the Rammer
LT	32	Used in comparison with the value found at KB in line 250 to determine if left arrow is being pressed.
M	0	Number of Misses: Incremented in line 150 each time a new enemy ship is created. Decremented only in line 300 following a hit. Displayed by line 130.
N	63	Used as a base number for random statement in line 150. Incremented by line 300 following a hit. As N grows, it becomes less likely that RND(N)-1 will return a valid position on the top line of the screen. This thins out the enemy fleet.
P	0	Position for next enemy ship to be displayed.
R	65	The Rammer. ASCII code 65 is character "A". It is POKEd to Rammer Position, RP, by line 280.
RE	15996	Right Edge: rightmost screen position allowed for Rammer.
RP	15968	Rammer Position: starts at address 15968 (middle of screen) and may be increased or decreased by lines 220 or 250. Immediately following a scroll, line 280 checks for a space at RP. If a space is present, there has been no collision.
RT	64	Same use as LT, except for right-arrow pressed.
TR	46	Trail left behind Rammer. 46 is ASCII code for a period.
X	0	Defined in line 60 to speed up execution of USR statement in line 180.
CD$		Collision Debris String: placed on screen by line 300 as replacement for enemy ship following collision.
CL$		Clear Line String: used in line 130 to clear top screen line before creating next enemy ship.
ES$		Enemy Ship String: consists of character "Y" surrounded by quotes.

Table 1. Variables

The Key Box

Basic Level II
Model I
16K RAM



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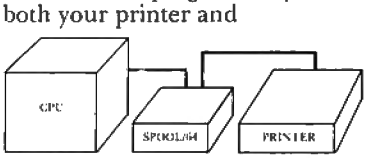

computer, accepts input from parallel centronics cables (serial RS-232 available soon), and its user programming feature allows you to download your own programs so SPOOL/64 can handle sophisticated print routines. And SPOOL/64, used with your software spooler, can give you the highest performance spooling available.

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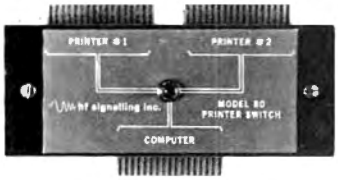

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execution speed, because Basic can look up a value in its variable table faster than it can interpret a constant value each time it encounters one.

The second speed feature is a short machine language routine (Program Listing 1) that does a reverse scroll of the screen. That is, all characters move *down* one line instead of the normal upward scroll seen while Listing a Basic program. Reverse scrolling allows the Rammer's environment to move past it from the top to the bottom of the screen, giving the operator a natural illusion of motion. The bottom line, used for scoring, is not scrolled.

Liberal use is made of POKE, rather than PRINT@ statements to display objects on the screen. Keyboard scanning for operator input is done with PEEK instead of INKEY$. This makes it unnecessary to hit the same key repeatedly for continued movement in one direction (a popular but distracting characteristic of some games). As long as the right-arrow key is depressed, the Rammer will continue to move to the right. Releasing the key stops the Rammer's movement. It's like a "poor man's joystick." For an excellent article on keyboard scanning with PEEK, see "Keyboard Interrogation"; *80 Microcomputing*, June 1980.

Of course, there is a price tag on any optimization for speed; the program listing is not as easy to analyze. For easier tracking of the variables used in Rammer, refer to Table 1. The program is heavily commented also and the remark lines contain the algorithm for the action (see Program Listing 2).

Customizing Ideas

Rammer can be used as is, but with a little imagination, you can do more with it. Here is some food for thought:

- Have the program occasionally generate a super enemy ship which can damage or destroy the Rammer with a hit.
- Incorporate other keys in the keyboard scan. For example, use the up-arrow to fire a missile.
- The scoring routine is intentionally primitive and can be altered. For example, scoring could be weighted according to the amount of maneuvering done by the operator, with penalties for failure to move the Rammer.
- If you have a fairly fast sound-generating routine, some noise could accompany a hit.
- Use the entire program as a subroutine in your favorite version of Startrek to provide an occasional change of pace in the action.
- If the addition of features causes speed to become critically slow, take out all remarks, initialize all constants as variables at the beginning of the program, and use multiple-statement lines wherever possible.

Even Mikie Likes It

Because Rammer's visual orientation is natural and the responses to keyboard input are immediate, the program allows good hand/eye coordination. Even small children can use it right away, once you show them the left- and right-arrow keys (be prepared to forfeit your rights to the computer for a while, mom and dad). Younger ones may find it easier to *evade* as many enemy ships as possible, instead of attacking. It's just as much fun.

Probably because we are raised with motion pictures and television, we have become a generation accustomed to realistic visual illusions, but displaying simulated motion on a computer screen is tricky business. Rammer illustrates at least one fairly simple alternative. ■

```
10 'RAMMER        M. KELLER   (505) 294-4966    JANUARY 1981
20 '
30 CLS:GOSUB 320   'POKE MACHINE LANGUAGE SCROLL ROUTINE
40 '------------------ INITIALIZE VARIABLES -------------------
50 CLEAR200:DEFINTA-Z:R=65:P=0:KB=14400:LT=32:RT=64:HM=0:TR=46
60 M=0:H=0:X=0:RP=15960:N=63:LE=15938:RE=15996:CL$=CHR$(30)
70 ES$=CHR$(34)+"Y"+CHR$(34)   'ENEMY SHIP
80 CD$=":* *:"   'COLLISION DEBRIS
90 'DEFINE ENTRY POINT FOR USR CALL (REVERSE SCROLL)
100 POKE 16526,243: POKE 16527,127
110 PRINT@965,"ENEMY SHIPS HIT:          ENEMY SHIPS MISSED:";
120 '---------- SHOW NEXT ENEMY SHIP AND SCROLL DOWN ----------
130 PRINT@HM,CL$;:PRINT@1014,M;   'CLEAR THE TOP LINE
140 'IF RND(N)-1 IS ON TOP LINE, PRINT AN ENEMY SHIP THERE
150 P=RND(N)-1:IFP>60THEN 170 ELSE PRINT@P,ES$;:M=M+1
160 'ERASE RAMMER SO IT WON'T SCROLL DOWN WITH REST OF SCREEN
170 POKE RP,32
180 X=USR(X)    'MOVE SCREEN DOWN 1 LINE
190 '---------------------- SCAN KEYBOARD -----------------------
200 ' IF RIGHT ARROW PRESSED AND RIGHT SCREEN EDGE NOT REACHED,
210 ' THEN SHIFT RAMMER POSITION 2 SPACES RIGHT & LEAVE TRAIL
220 IFPEEK(KB)=RT AND RP<RE THEN RP=RP+2:POKERP+63,TR
230 ' IF LEFT ARROW PRESSED AND LEFT SCREEN EDGE NOT REACHED,
240 ' THEN SHIFT RAMMER POSITION 2 SPACES LEFT & LEAVE TRAIL
250 IFPEEK(KB)=LT AND RP>LE THEN RP=RP-2:POKERP+65,TR
260 '----------------- COLLISION PROCESSING -----------------
270 'IF THERE'S NO COLLISICN, RESTORE RAMMER AND CONTINUE
280 IFPEEK(RP)=32 THEN POKE RP,R:GOTO130
290 'COLLISION!   DISPLAY DEBRIS BEHIND THE RAMMER AND CONTINUE
300 H=H+1:M=M-1:N=N+1:PRINT@RP-15362,CD$;:PRINT@981,H;:GOTO130
310 '------------- MACHINE CODE FOR REVERSE SCROLL ------------
320 FORX=32755 TO 32766
330 READ Y:POKE X,Y:NEXT X:RETURN
340 DATA 17,191,63,33,127,63,1,128,3,237,184,201
```

Program Listing. Rammer

```
                00420 ; DOES REVERSE SCROLL OF SCREEN. LEAVES LINE 16
                00425 ; INTACT. THIS ROUTINE IS BUILT INTO THE BASIC PRO-
                00427 ; GRAM, AND IS SHOWN HERE FOR CLARIFICATION.
                00428 ;
0000 11BF3F     00430   LD      DE,16319  ;DEST. = LAST OF LINE 15
0003 217F3F     00440   LD      HL,16255  ;SOURCE = LAST OF LINE 14
0006 018003     00450   LD      BC,896    ;NO. OF CHAR'S TO MOVE
0009 EDB8       00460   LDDR              ;REVERSE SCROLL 1 LINE !
000B C9         00465   RET               ;BACK TO BASIC
0000            00470   END
00000 TOTAL ERRORS
```

Program Listing 1

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Stanley

Program Listing

```
1 REM     STARE DOWN   WITH   STANLEY
2 REM     By   Dave and Keith Black
3 REM          1965 Sequoia Dr.
4 REM          Idaho Falls, ID.  83401
10 CLEAR600:B$=CHR$(24):A$=CHR$(25):D$=CHR$(26)
:U$=CHR$(27)
20 F$(1)=A$+CHR$(176)+CHR$(140)+CHR$(134)
+STRING$(3,131)+U$+STRING$(21,176)+D$+STRING$(3,131)
+CHR$(137)+CHR$(140)+CHR$(176)+D$+CHR$(149)+D$+B$
+CHR$(130)+CHR$(148)+D$+B$+CHR$(149)+D$+B$+CHR$(133)
+B$+B$+CHR$(160)+D$+B$+CHR$(149)+D$+B$+CHR$(129)
30 F$(1)=F$(1)+B$+B$+CHR$(152)+D$+B$+B$+CHR$(134)+B$
+B$+CHR$(176)+D$+B$+B$+CHR$(131)+B$+B$+CHR$(140)+B$
+B$+CHR$(176)+D$+B$+B$+CHR$(131)+B$+B$+CHR$(140)
40 F$(2)=D$+CHR$(170)+D$+B$+B$+CHR$(168)+CHR$(129)+D$
+B$+B$+CHR$(170)+D$+B$+CHR$(138)+CHR$(144)+D$+B$
+CHR$(170)+D$+B$+CHR$(130)+CHR$(164)+D$+CHR$(137)
+CHR$(176)+D$+CHR$(131)+CHR$(140)+CHR$(176)+D$
+CHR$(131)+CHR$(140)
50 F$(2)=F$(2)+STRING$(7,176)+D$+STRING$(3,131)+U$
+STRING$(7,176)
60 F$(3)=STRING$(4,D$)+STRING$(17,A$)+CHR$(191)+D$
+B$+CHR$(191)+D$+B$+B$+CHR$(184)+CHR$(191)+CHR$(180)
+STRING$(5,A$)+D$+CHR$(176)+CHR$(132)+STRING$(17,B$)
+CHR$(136)+CHR$(176)+D$+STRING$(13,131)
70 PU$=CHR$(174)+CHR$(183)+CHR$(187)+CHR$(157)
80 E$(1)=STRING$(2,D$)+STRING$(5,A$)+STRING$(2,176)
+STRING$(5,140)+CHR$(164)+CHR$(176)+STRING$(12,B$)
+D$+CHR$(152)+CHR$(134)+CHR$(131)+STRING$(3,32)
+PU$+STRING$(2,32)+CHR$(169)+STRING$(13,B$)+D$
+CHR$(130)+CHR$(131)+CHR$(137)+STRING$(9,140)
+CHR$(129)
90 E$(2)=STRING$(2,D$)+STRING$(21,A$)+CHR$(176)
+CHR$(152)+STRING$(5,140)+STRING$(2,176)
+STRING$(10,B$)+D$+CHR$(150)+STRING$(2,32)+PU$
+STRING$(3,32)+CHR$(131)+CHR$(137)+CHR$(164)
+STRING$(13,B$)+D$+CHR$(130)+STRING$(9,140)
+CHR$(134)+CHR$(131)+CHR$(129)
100 E$(3)=STRING$(3,D$)+STRING$(2,A$)+STRING$(13,176)
:E$(4)=STRING$(3,D$)+STRING$(20,A$)+STRING$(13,176)
200 CLS:TT=0:WW=0:INPUT"ENTER NAME    ";N$
210 CLS:W=0
:INPUT"INSTRUCTIONS  (Q)UIT   (Y)ES   (N)O  ";Q$
:IFLEFT$(Q$,1)="Q"THEN910
220 TT=TT+1
:INPUT"DEGREE OF DIFFICULTY  (1)=EASY  (10)=HARD   ";D
230 CLS:FORI=1TO3:PRINT@76,F$(I);:NEXTI:GOSUB900
240 IFLEFT$(Q$,1)="N"THENGOSUB600  :GOTO290
250 M1$=STRING$(13,131):RESTORE
260 READM2$:IFM2$<>"END"THENM2$=M1$+M2$
:GOSUB800  :M1$=RIGHT$(M2$,13):GOTO260
270 FORI=1TO500:NEXT
280 PRINT@599,STRING$(13,131);
290 R=RND(6):FORI=1TOR:READC$:NEXTI
300 F=F+(F<>0):A$=INKEY$
:IFA$=""THENIFRND(200)<10THENR=RND(10*D)
:ONRGOSUB380  ,300  ,400  ,400  :GOTO300
310 IFA$="<"ORA$=","THENIFF>0THEN500  ELSE570
320 IFA$=">"ORA$="."THENIFF>0THEN560  ELSE570
330 IFA$=CHR$(13)THEN700
340 IFA$=""THEN300ELSE570
400 PRINT@76,E$(R);:PRINT@76,E$(R-2);
410 IFR=3THENE$="L"ELSEE$="R"
```

Program continues

Dave Black
1965 Sequoia Drive
Idaho Falls, ID 83401

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Stanley presents the simple rules of play.

He asks that you press Enter if you should blink during the game. Though he will not chasten you if you cheat, honesty means much to Stanley. Should the Champ blink one eye or the other, hit the < (less than) key for his left eye or the > (greater than) key for his right eye. There is a response time limit that decreases with increasing degrees of difficulty. Pressing a key unnecessarily or after the time limit has expired will invoke an encouraging comment; otherwise Stanley will admit to being caught and allow you to play again.

If you wish to quit, a scoreboard of sorts will be displayed. If someone else would then like to play, he is asked to enter his name.

Add more comments to Stanley's repertoire in the second block of Data statements at the end of the program (lines 1000 through 1160).

This game has been thoroughly tested on a team of two or three people chosen at random from every walk of life in our household. In every test the game performed flawlessly; many said they felt as refreshed from the experience as from an afternoon nap. ■

The Key Box

Basic Level II
Model I
16K RAM

Program continued

```
420 F=-D+15:W=W+1:WW=WW+1:RETURN
500 IFE$<>"L"THEN570
510 IFW=1THEN
PRINT@900,"YOU CAUGHT ME ON THE FIRST WINK";
520 IFW=2THEN
PRINT@900,"YOU CAUGHT ME ON THE SECOND WINK";
530 IFW=3THEN
PRINT@900,"YOU CAUGHT ME ON THE THIRD WINK";
540 IFW>3THEN
PRINT@900,"I WINKED"W-1"TIMES BEFORE YOU CAUGHT ME!";
550 FORI=1TO2000:NEXT:GOTO210
560 IFE$<>"R"THEN570  ELSE510
570 READC$:IFC$="END"THENGOSUB600  :GOTO570
580 PRINT@900,CHR$(30);C$;
590 A$=INKEY$:GOTO300
600 RESTORE
610 READC$:IFC$="END"THEN RETURN
620 GOTO 610
700 PRINT@900,
"SUCH HONESTY, SUCH INTEGRITY, SUCH STUPIDITY";
710 FORI=1TO2000:NEXT:GOTO210
800 Z=LEN(M2$)-13:FORX=1TOZ
:PRINT@599,MID$(M2$,X,13);" ";
:FORI=1TO50:NEXTI:NEXTX
810 RETURN
900 FORI=1TO2:PRINT@76,E$(I);:NEXTI:RETURN
910 CLS:PRINTCHR$(23);
920 PRINTN$:PRINT:PRINT"YOU PLAYED"TT"GAMES"
:PRINT:PRINT"OF WHICH i WINKED"WW;
:IFWW>1THENPRINT"TIMES."ELSEPRINT"TIME."
930 DF=WW-TT:PRINT
:IFDF=0THENPRINT"YOU CAUGHT ME EVERY TIME"
940 IFDF>0THENPRINT"YOU MISSED"DF;
:IFDF>1THENPRINT"WINKS!"ELSEPRINT"WINK!"
950 PRINT:PRINT:INPUT"ANOTHER GAME";Q$
:IFLEFT$(Q$,1)="Y"THEN200  ELSECLS:END
1000 DATA "OK...READ MY LIPS...I'M STANLEY "
1010 DATA "AND THIS IS A STARE DOWN.  "
1020 DATA "WHEN YOU BLINK....PRESS ENTER.    "
1030 DATA "IF YOU THINK YOU HAVE CAUGHT "
1040 DATA "ME WINKING...PRESS  < FOR THE LEFT EYE --- "
1050 DATA "OR  > FOR THE RIGHT EYE --- "
1060 DATA "BE QUICK -- THERE IS A TIME LIMIT.  "
1070 DATA " OK LET'S BEGIN!!"
1080 DATA "END"
1090 DATA "QUIT PLAYING WITH THE KEYBOARD"
1100 DATA "DON'T BLINK - YOU DIDN'T CATCH ME YET"
1110 DATA "TICKLING MY KEYBOARD WON'T MAKE ME WINK"
1120 DATA "LOOK OUT BEHIND YOU !!!!!"
1130 DATA "YOUR SHOE IS UNTIED"
1140 DATA "YOUR EYES LOOK VERY DRY"
1150 DATA "YOUR FLY IS DOWN"
1160 DATA "END"
```


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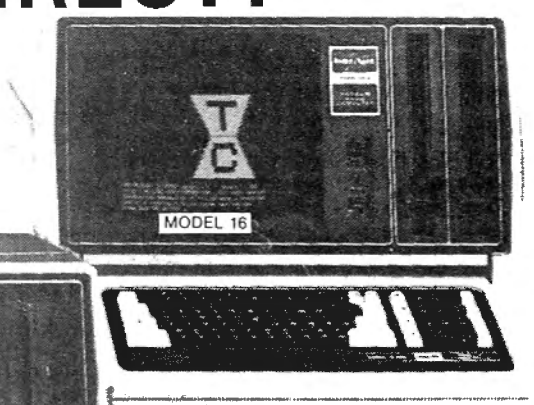

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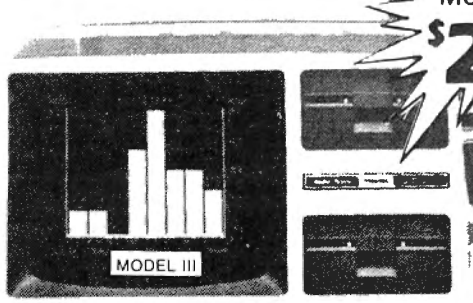

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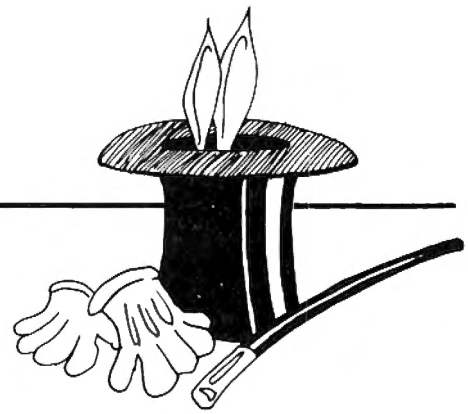

Amazing Cardoni II

Jon Mark O'Connor
56 Eustis Parkway
Waterville, ME 04901

A good magician never allows you to think he tricked you. For a card trick to leave a lasting impression it has to be thoroughly prepared.

For the Amazing Cardoni's Card Trick Number 2, the spectator shuffles the cards, does a little math, selects four cards; and then chooses one from the four. Then, through seemingly unbelievable odds, Cardoni names the card.

If you analyze the program, you probably will figure out how the trick works. Don't let that stop you from entering this program; the graphics are pretty good. Even when four or five lines are moved there is no pixel drag.

Qualifications

If your spectator's answer to the math problem is less than 1,000 then tell him that the first number is zero, since he will be selecting four cards. As indicated in the program, if any number is a zero then the spectator must choose a queen. This will become clearer once you have keyed in the program.■

The Key Box
Model I or III
Basic Level II

Program Listing

```
10 CLEAR3000:CLS:DEFSTRA-D,F,Z:DEFINTE,G-V,X,Y
20 DIMJJ%,T%,W1$,W$,TT%,G%,O%,Z$,AD$,X%,Q%,UL%,H%,XX%,U%,AA$,W!
30 DIMII%,I%,UP%,AC$,WW!,R$,K%,A7$,QL%,AE$,FF$,PZ%,AB$,AP$,AH$
40 DIMAZ$,AI$,QQ%,QI%,AJ$,C9$,C7$,C6$,AU$,C8$,JK%,A(13),B(19)
50 AZ="THE AMAZING CARDONI":GOSUB1150
60 CLS:QL=8:X=326:FORG=1TO8:PRINT@X,A(G);:X=X+64:NEXT:QI=6:PRINT
@22,AZTAB(60)"@ 2"
70 PRINT@837,CHR$(170)STRING$(5,183)CHR$(179)STRING$(5,187)AE
80 PRINT@902,CHR$(153)CHR$(166)CHR$(199)CHR$(153)CHR$(166)
90 PRINT@965,CHR$(154)AFCHR$(165)CHR$(197)CHR$(154)AFCHR$(165);:
X=288
100 PRINT@534," WRITE DOWN A 4 DIGIT NUMBER";:PRINT@602,"ON A PI
ECE OF PAPER.";
110 PRINT@666,FF;:GOSUB610:PRINT@533,"   ADD THE NUMBERS TOGETHE
R."CHR$(198);
120 PRINT@598,CHR$(200)"I CAN WAIT  !!!!"CHR$(200);:GOSUB610
130 PRINT@534,"  NOW SUBTRACT THIS NUMBER ";
140 PRINT@598,"  FROM YOUR 4 DIGIT NUMBER.";:GOSUB610
150 PRINT@534,"SHUFFLE CARDS. SELECT FOUR CARDS";
160 PRINT@599,"THAT MATCH THE NUMBERS IN YOUR";
170 PRINT@663,"ANSWER (ACE FOR 1 / QUEEN FOR 0).";
180 PRINT@728,"ALSO,  UTILIZE ALL FOUR SUITS.";:PRINT@795,FF;:GO
SUB610
190 FORG=534TO854STEP64:PRINT@G,CHR$(234);:NEXT
200 PRINT@534,"IF YOU HAVE YOUR FOUR CARDS,";
210 PRINT@598,"SELECT ONE OF THEM AND PLACE";
220 PRINT@662,"IT FACE DOWN ON THE TABLE.";:PRINT@730,FF;:GOSUB6
10
230 FORG=534TO726STEP64:PRINT@G,CHR$(230);:NEXT:H=3:FORG=430TO48
8STEP-11:GOSUB1100
240 PRINT@G,D(0);:PRINT@G+64,D(1);:PRINT@G+128,D(2);:PRINT@G+192
,D(1);
250 PRINT@G+256,D(3);:PRINT@G+324,H;:H=H-1:NEXT:X=474:I=1:JK=3
260 PRINT@792,"ACE - HIT <A>   QUEEN - HIT <Q>";:UL=999:PRINT@85
4,CHR$(230);
270 PRINT@854,CHR$(202)"WHAT IS CARD #"ICHR$(210);:FORT=1TO10:
280 GOSUB620:W$=INKEY$:IFW$="Q"ORW$="A"ORW$>CHR$(49)ANDW$<CHR$(5
8)THEN290ELSE280
290 PRINT@854,CHR$(204)W$" OF "CHR$(206);:IFW$="A"W=1:GOTO310ELS
EIFW$="Q"W=0:GOTO310
300 W=VAL(W$)
310 GOSUB620:Z=INKEY$:IFZ="S"ORZ="H"ORZ="D"ORZ="C"THEN320ELSE310
320 IFZ="S"Z=C9
330 IFZ="H"Z=C8
340 IFZ="D"Z=C7
350 IFZ="C"Z=C6
360 FORH=1TO4:IFZ=F(H)&(H)="":GOTO380ELSENEXT
370 PRINT@852,"   YOU MUST CHOOSE ALL FOUR SUITS.    ";:FORT=1T
O1500:NEXT:GOTO260
380 PRINT@854,CHR$(230);:WW=WW+W:FORG=XTOX+128STEP64:PRINT@G,CHR
$(198);:NEXT
390 PRINT@G-190,B(W);:PRINT@G-126,B(W+10);:PRINT@G-64,Z;:IFI=3TH
EN410ELSEI=I+1:X=X+11
400 UL=8:FORT=1TO20:GOSUB730:NEXT:UL=999:GOTO260
410 FORT=1TO20:GOSUB620:NEXT:UL=0:FORH=1TO4:IFF(H)=""NEXTELSEZ=F
(H)
420 IFWW<10PZ=9-WW:GOTO440ELSEIFWW<19PZ=18-WW:GOTO440ELSEIFWW<28
PZ=27-WW:GOTO440
430 IFWW<37PZ=36-WW
440 FORU=408TO856STEP64:PRINT@U,STRING$(32,191);:PRINT@U,CHR$(22
5);:NEXT
450 PRINT@218,D(4)D(5);:PRINT@282,D(6)D(7);:PRINT@346,D(6)D(7);:
PRINT@410,D(6)D(7);
460 PRINT@474,D(8)D(9);:PRINT@538,D(6)D(7);:PRINT@602,D(6)D(7);:
PRINT@666,D(6)D(7);
470 PRINT@730,D(4)D(5);:PRINT@788,"     FLIP OVER CARD ON TABLE"
;:PRINT@859,FF;
480 GOSUB620:R$=INKEY$:IFR$=CHR$(13)THEN490ELSE480
490 FORK=284TO668STEP64:PRINT@K,CHR$(207);:NEXT:PRINT@285,B(PZ);

500 PRINT@349,B(PZ+10);:PRINT@617,B(PZ);:PRINT@681,B(PZ+10);
510 IFLEFT$(Z,1)="D"Z="DIAMONDS":PRINT@488,Z;ELSEPRINT@481,Z;
520 PRINT@788,CHR$(230);:PRINT@854,CHR$(230);:FORT=1TO50:NEXT
530 PRINT@858,"PRETTY GOOD, HUH ?!!";:FORT=1TO50:GOSUB620:NEXT:
POKE15624,170
540 POKE15560,170:FORT=1TO90:NEXT:PRINT@266,AH;:FORT=1TO90:NEXT:
PRINT@202,AH;
550 PRINT@266,AI;:FORT=1TO90:NEXT:PRINT@138,AH;:PRINT@202,AI;:PR
INT@266,AJ;:QQ=20
560 QI=0:FORG=1TO50:POKE15566,144:POKE15630,129:FORT=1TO70:NEXT:
POKE15630,131
570 POKE15566,32:FORT=1TO80:NEXT:ONRND(7)GOSUB640,650,660,670,82
0,840,850:NEXT:QL=0
580 GOSUB880:FORQ=15951TO15523STEP-64:POKE15759,176:POKEQ,149:PO
KEQ+64,149
590 POKEQ+128,32:POKE15759,176:FORT=1TO50:NEXT:NEXT:FORT=1TO20:G
OSUB640:NEXT:GOSUB1000
600 GOSUB1510:GOTO60
610 POKE15360,32:POKE15360,32:GOSUB620:W1$=INKEY$:IFW1$=""THEN61
0ELSERETURN
620 FORT=1TORND(100)+300:NEXT:JJ=JJ+1:IFJJ=11JJ=0:RETURN
630 ONRND(JJ)GOTO720,640,650,660,670,720,680,690,700,710
640 PRINT@326,A(1);:PRINT@389,AD;A(2);:PRINT@454,A(3);:RETURN
650 PRINT@326,A(1);:PRINT@390,A(2);:PRINT@454,A(9);:RETURN
660 PRINT@326,A(12);:PRINT@390,A(13);:PRINT@454,A(10);:RETURN
670 PRINT@326,A(12);:PRINT@390,A(13);:PRINT@454,A(11);:RETURN
680 FORT=1TORND(5):GOSUB640:FORTT=1TO80:NEXT:GOSUB650:FORTT=1TO8
0:NEXT:NEXT:RETURN
690 FORT=1TORND(5):GOSUB660:FORTT=1TO80:NEXT:GOSUB670:FORTT=1TO8
0:NEXT:NEXT:RETURN
700 RETURN
710 FORT=1TORND(5):GOSUB680:FORTT=1TO80:NEXT:GOSUB640:FORTT=1TO8
0:NEXT:NEXT:RETURN
720 POKE15888,32:POKE15945,150:POKE16015,149:POKE15951,149:POKE1
6079,32
730 IFUL=999RETURNELSEFORT=1TORND(100)+300:NEXT
740 ONRND(11)GOTO820,830,840,850,880,930,1000,770,800,810
750 FORT=1TORND(10):POKE16140,141:FORTT=1TO60:NEXT:POKE16140,181
:FORTT=1TO60:NEXT
760 POKE16140,141:FORTT=1TO60:NEXT:POKE16140,181:FORT=1TO60:NEXT
:RETURN
770 FORT=1TORND(5)+5:POKE15951,32:POKE16015,144:POKE16015,32:POK
E16079,32
780 FORTT=1TO50:NEXT:POKE15951,32:POKE16015,149:POKE16079,149:FO
RTT=1TO50:NEXT
790 POKE15951,149:POKE16015,149:POKE16079,32:FORTT=1TO50:NEXT:NE
XT:RETURN
800 POKE15951,148:POKE16015,149:POKE16079,129:RETURN
810 POKE15951,144:POKE16015,149:POKE16079,133:RETURN
820 POKE16008,138:POKE16009,32:POKE16079,32:PRINT@581,AD;A(5);:I
I=0:RETURN
830 PRINT@646,A7;:RETURN
840 POKE16008,138:POKE16009,32:RETURN
850 PRINT@646,A7;:UP=RND(3):IFII=999RETURNELSEPOKE15951,32:PRINT
@655,AA;:FORT=1TO50
860 NEXT:PRINT@655,AECHR$(197);:POKE16079,149:II=999:IFUP=1THEN8
20ELSEIFUP=2THEN880
870 RETURN
880 POKE16008,138:POKE16009,32:POKE15951,32:POKE16079,149:FORT=1
TO50:NEXT
890 POKE16015,32:POKE16143,149:IFRND(8)=QLTHEN1060ELSEFORT=1TO50
:NEXT
```

Program continues

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Program continued

```
900 PRINT@780,CHR$(138)CHR$(176);:FORT=1TO50:NEXT
910 PRINT@780,CHR$(130)CHR$(164)CHR$(144);:POKE16143,32:PRINT@77
4,A(8)CHR$(198);
920 POKE16015,149:FORT=1TO50:NEXT:POKE16079,32:POKE15951,149:RET
URN
930 POKE16008,138:POKE16009,32:IPII=999RETURNELSEPORT=1TO2:POKE1
5951,32:POKE16015,32
940 PRINT@648,STRING$(2,140)CHR$(138)CHR$(191)CHR$(133)CHR$(140)
CHR$(133);
950 PORTY=1TO20:NEXT:POKE16013,32:PRINT@642,AACHR$(134)AD;:PORTT
=1TO20:NEXT
960 PRINT@642,CHR$(197)CHR$(170)CHR$(134)AD;:POKE15943,170:POKE1
5951,32
970 POKE16015,32:FORTTT=1TO20:NEXT:POKE16007,32:POKE15943,32:PRI
NT@655,AA;
980 FORTT=1TO40:NEXT:PRINT@655,CHR$(198);:POKE15951,149:POKE1601
4,137:POKE16015,149
990 FORTT=1TO40:NEXT:NEXT:RETURN
1000 IPRND(9)<QIRETURNELSEPRINT@647,ADCHR$(131)AD;:FORT=1TO20:NE
XT:PRINT@647,AF;
1010 PRINT@583,ADCHR$(164)CHR$(150);:FORT=1TO20:NEXT:PRINT@583,C
HR$(130)CHR$(164);
1020 FORT=1TO20:NEXT:PRINT@583,ADCHR$(165);:FORT=1TO20:NEXT
1030 PRINT@583,ADCHR$(128)CHR$(131);:POKE15880,171:FORTT=1TORND(
5)+QQ:POKE15880,165
1040 FORT=1TO50:NEXT:POKE15880,170:FORT=1TO50:NEXT:NEXT:POKE1588
0,32:POKE15945,150
1050 POKE16008,138:RETURN
1060 POKE16015,32:POKE16079,32:FORT=1TO5:PRINT@783,AC;:FORTT=1TO
20:NEXT
1070 PRINT@783,AA;:FORTT=1TO20:NEXT:NEXT:XX=783:FORG=1TO3:PRINT@
XX,AC;:PRINT@XX,AA;
1080 PRINT@XX,AB;:PRINT@XX,CHR$(198);:XX=XX-64:NEXT:POKE15951,14
9:POKE16015,149
1090 RETURN
1100 POKE16079,32:POKE16008,138:POKE16009,32:POKE15951,32:PRINT@
655,AA;
1110 PRINT@662,STRING$(9,140);:FORQ=16831TO16852-O:POKEQ,140:NEX
T:FORT=1TO5
1120 PRINT@662,STRING$(30-O,132);:PRINT@662,STRING$(30-O,136);
1130 PRINT@662,CHR$(224-O);:NEXT:O=O+11:PRINT@655,CHR$(198);:POK
E15951,149
1140 POKE16015,149:RETURN
1150 PRINT@470,AZ$:PRINT@536,"CARD TRICK # 2":PRINT@597,"BY  JON
 MARK O'CONNOR"
1160 A7=STRING$(3,32)+CHR$(137):AU=STRING$(9,191):AA=STRING$(6,1
40)

1170 AB=STRING$(6,131):AC=STRING$(6,176):AD=CHR$(32):AE=CHR$(149
):AF=STRING$(2,32)
1180 AH=CHR$(169)+CHR$(32)+CHR$(32)+CHR$(150)
1190 AI=CHR$(166)+CHR$(153)+CHR$(166)+CHR$(153)
1200 AJ=CHR$(160)+CHR$(190)+CHR$(189)+CHR$(152)+CHR$(137)
1210 FF="HIT ENTER WHEN READY !!"
1220 A(1)=STRING$(2,32)+CHR$(170)+STRING$(2,191)+CHR$(163)+CHR$(
187)+STRING$(2,191)+STRING$(2,32)
1230 A(2)=STRING$(2,176)+CHR$(186)+STRING$(2,191)+CHR$(178)+CHR$
(187)+STRING$(2,191)+STRING$(2,176)
1240 A(3)=CHR$(32)+CHR$(130)+CHR$(139)+CHR$(175)+CHR$(179)+CHR$(
143)+CHR$(179)+CHR$(159)+CHR$(135)+CHR$(129)+CHR$(32)
1250 A(4)=STRING$(4,32)+CHR$(130)+CHR$(191)+CHR$(129)+STRING$(4,
32)
1260 A(5)=STRING$(3,32)+CHR$(150)+CHR$(175)+CHR$(191)+CHR$(159)+
CHR$(169)+CHR$(32)+CHR$(149)+CHR$(32)
1270 A(6)=STRING$(2,32)+CHR$(134)+CHR$(32)+CHR$(138)+CHR$(191)+C
HR$(133)+CHR$(32)+CHR$(137)+CHR$(149)+CHR$(32)
1280 A(7)=STRING$(4,32)+CHR$(170)+CHR$(32)+CHR$(149)+STRING$(4,3
2)
1290 A(8)=STRING$(4,32)+CHR$(186)+CHR$(32)+CHR$(181)+STRING$(4,3
2)
1300 A(9)=STRING$(2,32)+CHR$(139)+CHR$(175)+CHR$(176)+CHR$(143)+
CHR$(176)+CHR$(159)+CHR$(135)+STRING$(2,32)
1310 A(10)=STRING$(2,32)+CHR$(139)+CHR$(175)+CHR$(181)+CHR$(154)
+CHR$(165)+CHR$(154)+CHR$(129)+STRING$(2,32)
1320 A(11)=STRING$(2,32)+CHR$(139)+CHR$(175)+CHR$(183)+CHR$(155)
+CHR$(167)+CHR$(155)+CHR$(129)+STRING$(2,32)
1330 A(12)=STRING$(2,32)+CHR$(170)+STRING$(2,191)+CHR$(151)+CHR$
(187)+CHR$(191)+CHR$(149)+STRING$(2,32)
1340 A(13)=STRING$(2,176)+CHR$(186)+STRING$(2,191)+CHR$(181)+CHR
$(187)+CHR$(191)+CHR$(181)+CHR$(176)+CHR$(32)
1350 B(0)=CHR$(151)+CHR$(171):B(1)=CHR$(182)+CHR$(185):B(2)=CHR$
(134)+CHR$(169)
1360 B(3)=B(2):B(4)=CHR$(152)+CHR$(129):B(5)=CHR$(183)+CHR$(179)

1370 B(6)=CHR$(152)+CHR$(129):B(7)=CHR$(131)+CHR$(171):B(8)=CHR$
(166)+CHR$(153)
1380 B(9)=CHR$(166)+CHR$(185):B(10)=CHR$(137)+CHR$(166):B(11)=CH
R$(149)+CHR$(170)
1390 B(12)=CHR$(182)+CHR$(177):B(13)=CHR$(164)+CHR$(153):B(14)=C
HR$(163)+CHR$(183)
1400 B(15)=CHR$(164)+CHR$(154):B(16)=CHR$(167)+CHR$(153):B(17)=C
HR$(152)+CHR$(129)
1410 B(18)=CHR$(183)+CHR$(187):B(19)=CHR$(160)+CHR$(134)
1420 D(0)=CHR$(191)+CHR$(159)+STRING$(6,179)+CHR$(175)+CHR$(191)

1430 D(1)=CHR$(191)+CHR$(178)+STRING$(3,153)+STRING$(3,166)+CHR$
(149)+CHR$(191)
1440 D(2)=CHR$(191)+CHR$(178)+STRING$(2,179)+CHR$(166)+CHR$(153)
+STRING$(2,179)+CHR$(149)+CHR$(191)
1450 D(3)=CHR$(191)+CHR$(189)+STRING$(6,179)+CHR$(190)+CHR$(191)

1460 D(4)=STRING$(2,191)+STRING$(8,179):D(5)=STRING$(8,179)+STRI
NG$(2,191)
1470 D(6)=STRING$(2,191)+CHR$(32)+CHR$(191)+STRING$(6,153)
1480 D(7)=STRING$(6,166)+CHR$(191)+CHR$(32)+STRING$(2,191)
1490 D(8)=STRING$(2,191)+CHR$(32)+STRING$(4,191)+STRING$(2,179)+
CHR$(191)
1500 D(9)=CHR$(191)+CHR$(179)+CHR$(179)+STRING$(4,191)+CHR$(32)+

STRING$(2,191)
1510 QQ=0:WW=0:O=0:P(1)="SPADES":P(2)="HEARTS":P(3)="DIAMDS":P(4
)="CLUBS":C9=P(1)
1520 C8=P(2):C7=P(3):C6=P(4):RETURN
```

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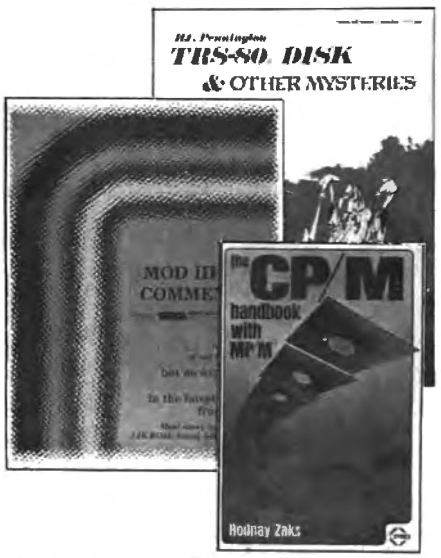

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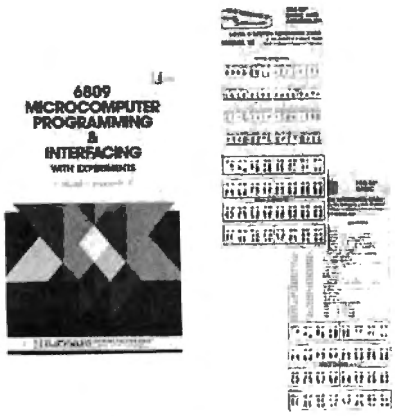

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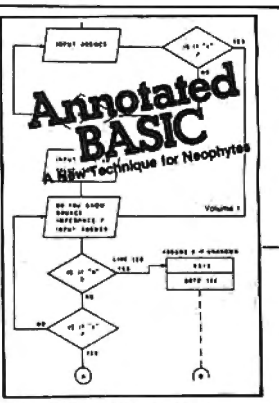

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80 NEWS

edited by John P. Mello Jr.

Data base bunko artist

UPS probing alleged scam on Compuserve

John P. Mello Jr.
80 Micro News Editor

Investigators at the United Parcel Service are probing complaints that a San Antonio, TX, man attempted to rip off Compuserve subscribers by getting them to respond to an electronic bulletin board notice advertising name-brand computer hardware at cut rate prices.

According to Alan C. Maskell, Jr., of Wallkill, NY, a notice appeared on the Compuserve bulletin board in April stating a David Bauer had computer wares for sale including two TRS-80 Model IIIs and software; Epson MX-80 printers; and a Diabolo printer.

Maskell ordered an MX-80 from Bauer through Compuserve's electronic mail. But as the package was being delivered in what appeared to be a factory-fresh carton to Maskell, UPS-Syracuse warned him it had been alerted by UPS-San Antonio complaints had been aired about Bauer's packages.

When the UPS driver opened the package for Maskell, he found the Epson box contained newspaper and two Coke bottles filled with syrup.

According to UPS officials, who wished not to be named because the firm was conducting an internal investigation of the matter, a person giving the name David Bauer shipped four packages—two to Tennessee, one to New York and one to Nevada—from San Antonio.

United Parcel received complaints from the Tennessee customers. One of them, a UPS official said, received a box containing newspaper and two bricks. The shipment to New York, Maskell's "printer," was intercepted in time. Apparently, the official added, the Nevada package was never delivered.

Once a customer pays cash on a COD, he or she must act quickly to stop the payment from reaching a seller. The time between putting the money in the UPS driver's hand and the carrier sending a check to the seller is about 24 hours. However, the San Antonio official said the Tennessee customers were refunded their money and UPS would attempt to recoup their losses through criminal prosecution.

Since being alerted of the alleged scam, Compuserve has suspended service to Bauer.

"We have reason to believe the address we have on file for this person [Bauer] is not accurate," said Lynne Gard, customer administration manager for Compuserve. "Plus there are some claims that he used our service in a fraudulent manner. So we have suspended his service until we clear up these matters."

Since he has been spreading the word on the apparent rip-off, his phone has "been ringing off the hook," said Maskell, whose Compuserve ID number is 70505,1123. He claimed the alleged scam could victimize as many as 10 percent of Compuserve's 23,000 subscribers. But Gard said, "To my knowledge, I know of less than five" complaints about Bauer. And a sampling by *80 Micro* of other San Antonio shipping outlets—the U.S. Post Office, Emory Express and Federal Express—unearthed no complaints connected to "David Bauer."

John Hanley of the FBI in San Antonio said no investigation of the matter had been opened yet, but he had been contacted by UPS officials and was awaiting more information from the carrier.

Gard of Compuserve warned the information utility's users to be careful when responding to mail order ads. She added: "We have a disclaimer up in the public bulletin board. We're going to enhance the wording so people understand it is their responsibility to check out who they are going to be purchasing from—much the same as a magazine ad or newspaper ad. The publisher is not responsible for the person who places the ad."

"I'd hate to have a situation give the bulletin board a bad reputation," she continued. "There are other people that post things on our bulletin board that are very reputable. We have not had any complaints about anybody else. I haven't run into this before and I've been with the firm since the beginning." ■

SAT takes umbrage with critic who hikes student test scores

Kerry Leichtman
80 Micro Staff

A critic of the College Board Scholastic Aptitude Tests—tests taken by every student wanting to enter an accredited American college or university—has miffed the originators of the tests, not by rapping them but by improving students' performances on the exams.

Until recently, students seeking an edge in the exams had two choices: thick study-guide books or classroom-style tutoring. Now there's a third: computer simulation. That approach has been very successful, according to an outspoken detractor of the SATs and chairman of the board at Krell Software Corporation of Stony Brook, NY, Dr. Edward Friedland. Friedland told *80 Micro* in a telephone interview: "The statistics compiled show roughly a 20-point score increase for students who have been tutored. Our studies show that students using our exam preparation series have score improvements that are much better than that."

Krell's advertisements boast a 70-point mean increase for students who used the initial preparation series. However an average increase of 140 points was reported in a limited survey of students at Hempstead High School, in Hempstead, NY. And more recently, an educator from a Detroit school district claimed one student's SAT scores jumped 250 points after being tutored by Krell Software.

It all sounds very impressive, but not everyone is happy. Friedland received a letter from the law firm representing the College Entrance Examination Board: "Our client has recently become aware that you are distributing a promotional brochure in which 'College Board' and 'SAT' marks are used to designate your 'Preparation Series'...Such use constitutes trademark infringement and unfair competition...The use is deceptive and misleading in that it creates the false impression that your organization and its products and services are affiliated with, or endorsed or sponsored by our client." Friedland was advised to refrain from further distribution of this brochure.

According to Russell Martin of the Examination Testing Service, the question is not over Krell's programs, but the relationship implied in the ads. When asked by *80 Micro* to comment on the dispute, Martin said, "I had sent a letter back to Dr. Friedland in March stating that his characterization of the relationship to ETS is inaccurate. . . as referred in an advertisement." When asked to elaborate Martin refused to comment further.

Friedland, on the other hand, said: "They are saying that I am misleading people into thinking that my preparatory series is somehow or another authored by them. I say, no person can read that ad and come out with that kind of conclusion. I make it abundantly clear that we are not the ETS or the College Board."

In an answer to the letter sent to Krell by the law firm—Greenbaum, Wolff & Ernst—Friedland wrote, ". . . we have no intention to misrepresent our product as being endorsed by or in any way emanating from your client. We will be glad to make this even clearer in our future advertising copy. . . . We utterly reject any suggestion that our present materials imply a relationship to your client's organization or that they misuse what you allege to be his trademarks. We believe instead, that you are attempting to suppress the distribution of our products."

"Part of their contention," Friedland said, "is that they own the word SAT and they own the word College Board, and nobody may take their name in vain. That I think is a little silly. . . . If I were to put an ad in a magazine to sell Cadillac hubcaps, to an extent General Motors owns the right to call a particular set of hubcaps Cadillac hubcaps. If I say I'm selling a hubcap for a Cadillac, it is very clear to everyone that I am not purporting to be the General Motors Corporation."

Despite his disagreement with ETS claims, Friedland changed his ads after the initial letter from Greenbaum, Wolff & Ernst. The ads now include a statement disclaiming any official ties between Krell and the College Board. But the statement wasn't good enough for the board. It said the attribution implied an unofficial connection.

The irony is Friedland has little desire to have any connection to the board or ETS: "I want the whole world to know that I have nothing whatsoever to do with the folks down there. I do not have a high regard for their product."

But what about other SAT peripheral businesses? How do they deal with the SAT and College Board trademarks?

The best known SAT preparatory text is *Barron's How to Prepare for College Entrance Examinations SAT*, a thick book rivaling the Manhattan Yellow Pages. No credits or disclaimers are given anywhere. Nor are they given in other SAT study guides.

Why does it appear Krell has been singled out? It might be because of Friedland's belief that he can write and administer a better standardized exam:

"The ETS has been taking an awful lot of flack from the academic community in several ways. One way, of course, is that nobody likes these standardized exams. They really don't test creativity of imagination, just booklearning and the like.

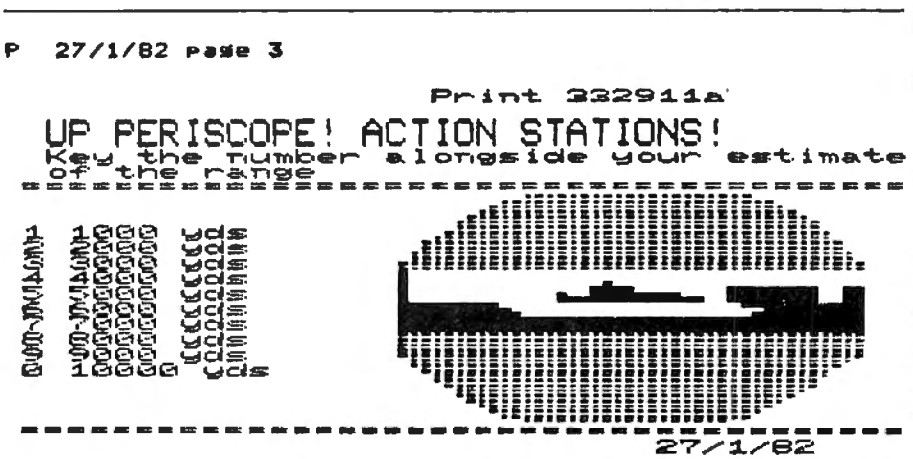
"I'm not too concerned with that because to be perfectly honest, I think I could do a better job than the ETS. . . . Usually after a test has been administered, there will be newspaper articles about their latest foul-up.

"I don't claim to be totally free of sloppiness, but I do claim that if I ran on a $100 million budget like they do, that I'd be a hell of a lot better than they are."

When reached by telephone for further comment, Martin neither confirmed nor denied the possibility of court action against Krell.

If it comes down to legitimate legal action Friedland said Krell will fight: "I think they're skating on very thin ice, trying to pretend to all sorts of rights which they, in fact, do not possess. [The] test certainly plays too large a role given the nature of the college boards. . . . I'd like to confront them directly and really let them have it. I would dearly like to meet them in a trial." ■

Video game on war in Falklands stirred up heated controversy in Britain



Early in the Falklands crisis last spring, videotext editor Gary Zabel found his electronic newspaper steeped in controversy—not over its coverage of the escalating confrontation between Great Britain and Argentina, but over a game called "Obliterate."

The game simulated a British submarine sinking the flagship of the Argentine navy.

Zabel, in a telephone interview with *80 Micro*, said Obliterate had been on the British data base service Prestel for nearly a year before the Falklands crisis. "When the situation began to brew up in the Falklands," he explained, "we changed the topic to become more up to date and topical. The user would assume the role of a British submarine commander with orders to destroy the flagship of the Argentine navy."

"It was very popular for a week," he continued, "but then it was criticized as possibly being in bad taste, in view of the delicate stage of negotiations."

He added: "The whole thing blew up because someone told an MP (Member of Parliament) about it and he described it as in bad taste. Then the whole press seemed to seize on the idea and it really blew up out of proportion."

Soon after the public questioning of the game's propriety, Obliterate was withdrawn from the system. "Our decision to withdraw the game," Zabel said in a statement, "caused great consternation among Prestel users—many of whom wrote us demanding it be brought back immediately."

In the phone interview with *80 Micro* Zabel, who originated the game with Bill Wadsworth, a friend and advertising salesman at the electronic newspaper, contended: "The game was designed to be fun and topical. We didn't want to give the impression that we were being mercenary in any way, trying to make money out of a delicate situation that was becoming worse every day."

Prestel, however, in a press release seems to be capitalizing on Obliterate's notoriety calling it "The game that made Prestel famous." And Zabel is quoted in the statement as saying, "I believe it [Obliterate] has gained more publicity for Prestel than any marketing campaign."

The editor of *Mercury 332*, the Prestel service of the St. Regis Newspapers in Bolton, UK, maintained the criticism of the game was unjustified. "There's a lot more happening in the world today to be critical of," he observed. "There are so many things on the market from war films to war games to comics about war. I don't feel guilty about the game at all."

Asked about the sinking of the Argentine cruiser Belgrano May 2—a real life fulfillment of the video game's scenario—Zabel replied: "It does feel spooky. I'm by no means a warmonger. The game was simply an idea. I think most people admit it was a brilliant idea to have a thing up to date and topical. It was good journalism, if you like, to bring your product to more people's attention by making it topical."■

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A robot that job shops

Computer and synthetic talk employed to aid job seekers

Job shopping? Let a robot sell you to a potential employer. How? Ask Joel Mannion.

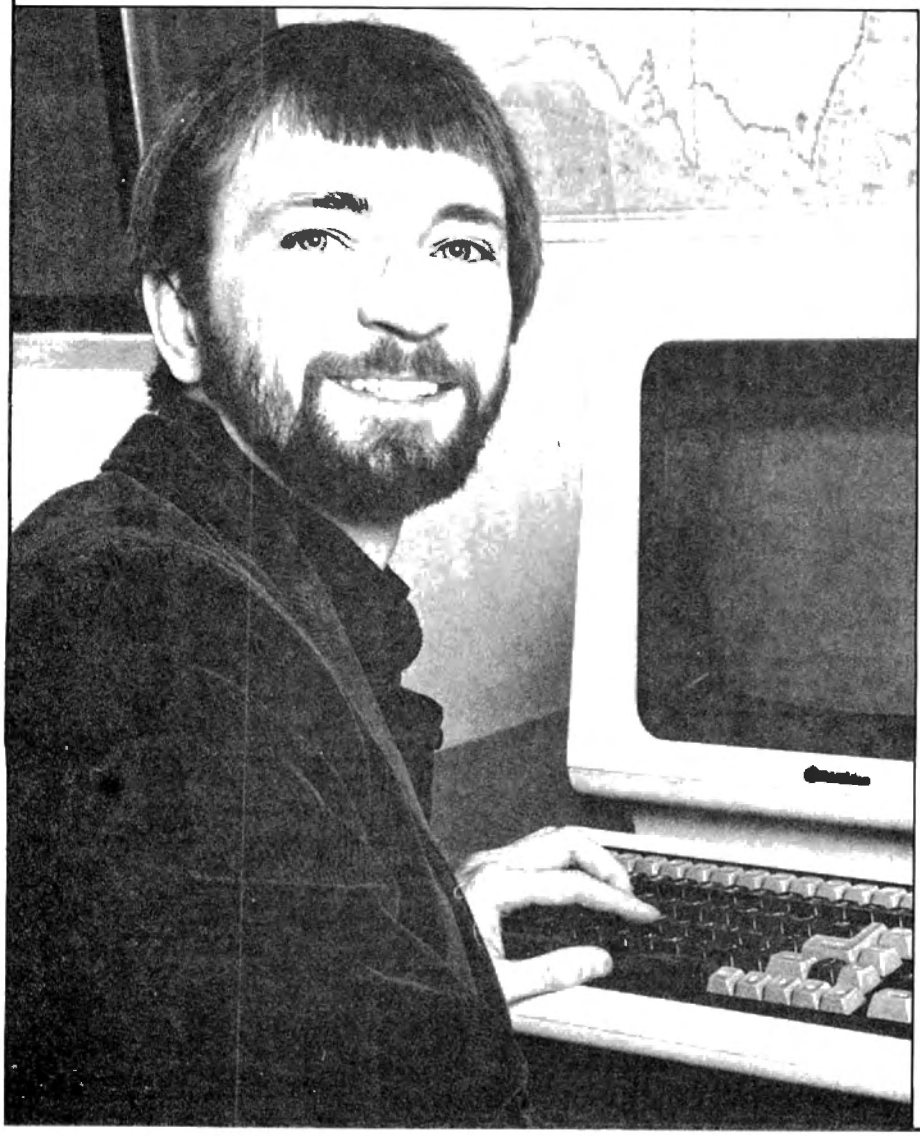
Mannion, who's been programming for 15 years, has set up a job referral service in Cambridge, MA, using a computer and voice synthesizer acting as a robot. According to the 30-year-old president of Softwork Voyce, the robot headhunter represents the first time large vocabulary synthetic speech technology has been used in a system accessible to the public.

During its first six weeks of operation, the robot received 1600 phone calls, mostly from the curious, said Mannion, who was a computer consultant in the Boston area before getting involved with Softwork. "That accounts for why we have only 125 resumes," he explained. "Some people call up to see if this is a joke or not."

One of the service's aims is to help men and women find career advancement or first-time jobs in the computer field, according to a statement from Softwork Voyce. It also spares job seekers the psychologically difficult step of writing their resumes and cover letters.

To use the service, which is free to the job seeker, a caller dials 617-497-2323 from any push-button phone. The robot, called "The Voyce," solicits information about the caller's career goals, education, salary requirements and experience with particular computers, languages, data bases and multi-tasking. The caller responds by pushing buttons on the phone. A resume is written by The Voyce from the information and stored in its files.

Mannion: No joke.



The Voyce also saves employers the hassle of sorting through piles of resumes, while helping them locate programmers, technical writers, computer operators and information system managers.

When employers contact the computer, they describe the combination of skills they need and the robot searches its files for qualified applicants and recites their resumes. The matching process considers such things as commuting distance, employee's interest in relocating, and willingness to work on military projects. Part-time, full-time, temporary and summer jobs also can be handled by the robot. Resumes selected are printed and mailed to the employer for $20 each.

"The employee can find out if his resume has been forwarded but he can't find out who it's been forwarded to until that employer calls and lets him know," Mannion said. "This is a considerable savings for employers over a situation where someone sends them a resume. Both parties know the resume has been sent and just out of a sense of common courtesy, there's expected to be some sort of reply and there's an expense involved in that."

Asked if people might be turned off by the impersonality of a robot, the graduate of Carnegie-Mellon University responded: "People have been quite enthusiastic about it. They've called to tell us this is truly an amazing thing. They really enjoyed the experience of dealing with it. I really don't see that as a problem and it hasn't been one."

He added in a statement, "People will find communicating with the robot to be simple, relaxed and rewarding—a way to eliminate a lot of the confusion involved in finding a job." ■

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High Tech High in Silicon Valley

by Kerry Leichtman
80 Micro Staff

Vocational training isn't what it used to be—at least in California's Silicon Valley. Paul Collins, superintendent of the Lost Gatos-Saratoga Joint Union High School District, had an idea: to expand its high schools' curriculum to include computer sciences and electronics.

Most schools offer computer study courses, but the courses Collins has in mind will be hard for other districts to duplicate. "I devised a two-track program. The lower track includes drafting, peripheral kinds of computer skills, repair work and a lower level of electronic training. For the upper level, meaning those who go in and get hands-on experience... would take courses that would lead to engineering and computer specialists."

To properly run these courses, which will be electives to the normal curriculum, the school will need computers: mainframes, minis and micros. They will need qualified instructors, and they will need intelligent kids able to take in the science, math and technical jargon that a person needs to know to survive in the Silicon Valley. According to Collins, the resources are available.

"We are 62 points above the scholastic aptitude mean national score," Collins told *80 Micro* during a telephone interview. "We have many national merit scholars, and on our own California competency testing program, we score in the 99 percentile in writing and in math, and about the 98th in reading and the 95th in spelling."

The type of machinery needed ordinarily would cost big bucks, more money than most school districts would be able to raise, especially in California's post-Prop 13 era. But, in the Silicon Valley, the checkbooks are open to Collins's high school. "We have people who have already written to us saying, whenever you need startup seed money we'll give it to you. They've already given us agreements saying whenever you need the mainframe we'll give you that. Others have said, don't you dare forget us, we want to be in this."

That takes care of the students and machinery; as for instructors, industrial cooperation is again the key. "They will do three things for us that would insure the product was what they wanted," Collins said. "They would either put on leave... people to teach in our schools... or would have people who are teaching in their in-service program teach some of our teachers, some of whom hold masters in computer science, and they would upgrade them to where they could be the teachers... Our teaching force would constitute about 40 percent and they would constitute about 60 percent."

Collins: Riding the wave of the future.

The benevolence Silicon Valley-based companies are bestowing upon Paul Collins and his school district is rooted as much in their own needs as in the students' needs for a meaningful curriculum. The Silicon Valley has become a very expensive place to live. As a result, it is becoming increasingly harder for businesses there to attract qualified employees. According to Collins, the average house costs $244,000. Industry's need for employees is so great that a few years ago they tried putting kids from the area's juvenile home into job entry positions. But, Collins said, their bad attitudes needed to be changed before they could learn computer skills.

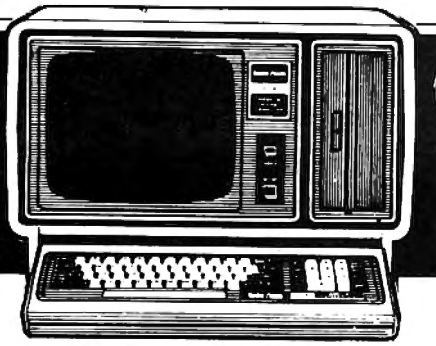
Where Collins's program is most radical in its departure from normal public school operating procedure is the extent it allows outside interests in. "The heart of the whole program is that industry will be a full-fledged partner from the very beginning," Collins said.

"They would be appointed to a five member board made up of one member from the Freemont school board and one from the Los Gatos board, an industrialist appointed by each board, and an industrialist appointed by the two boards."

The concept has met with some resistance from concerned people afraid students will find the computer more fascinating than other subjects and activities. That is one of the reasons Collins decided the hi-tech school should be separate and elective from the rest of the school: "This is a separate school that will not be a comprehensive high school; it will not offer English; it will not offer math; it will not offer foreign language, nor social studies or any other subjects. They will take those subjects at their home base, so the kids will have their ties to their home schools, and they will get the fine teaching they've been getting all along. This extra school will only help them attain another instrument to help them do a better job."

The name for the school has not yet been decided. One choice is Institute of Computer Technology. Collins doesn't like that one as well as Computer Academy. But he realizes the idea is no longer his baby. There are many people and dollars involved, and he's decided either name would be good.

The school's name is the smallest aspect of Collins's vision: "The wave of the future is computers and technology. And I think it's not only going to be in the Silicon Valley and Route 128, but I also think it's going to be all encompassing and going to revolutionize education throughout the entire curriculum, and not just in computer science." ■



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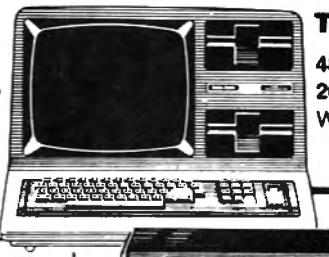

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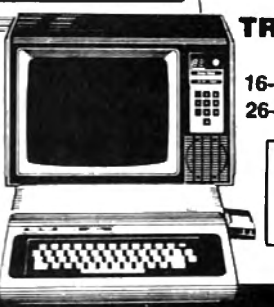

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10 REM          Beyond-BASIC In Action
20 GOSUB "CLEAR SCREEN"          ' See line 200
30 RESTORE 40 : DIM A(5) : MAT READ A
40 DATA  5,4,3,2,1               ' Data for array A
50 NU$="0123456789."             ' Allow digits only
60 INPUT LEN=3, USING NU$, "ACROSS";X
70 INPUT LEN=2, USING NU$, "DOWN";Y
80 PLOT (0,0)-(X,Y)              ' Draw a line
90 SHAPE$="PDPDPRPRPUPUPLP"      ' Define small square
100 INPUT USING NU$, "SCALE";A   ' 1=small, 4=large
110 INPUT USING NU$, "ROTATE";R  ' 0-360 degrees
120 PLOT (X,Y), S=A,R=R, SHAPE$  ' Draw the shape
130 DEF FNI (LO, HI, LOCAL N)    ' Define a function
140 INPUT "ENTER A NUMBER";N     '  to be this entire
150 IF N<LO OR N>HI THEN 140     '  subroutine
160 RETURN N : FNEND
170 PRINT FNI(1,10)+FNI(X,Y)     ' Input 2 nums, add
180 SORT A : PRINT "SORTED ARRAY: ";
190 MAT PRINT A; : DOS           ' Return to TRSDOS
200 'CLEAR SCREEN'               ' Named subroutine
210 CLS : POKE 3C00H, "BEYOND-BASIC DEMO"
220 MAT I                        ' Ignore A(0) in MAT
230 RETURN
240 END
```

At last, a truly complete **Extended BASIC** for the TRS-80!

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New micro by old name in business machines

Eye-catching graphics and unique disk formatting highlight Victor Business Products' first microcomputer, the Victor 9000.

At a recent press conference held in the plush Hotel Meridien in Boston, Victor officials modeled their new baby: a desktop micro with a 16-bit Intel 8088 microprocessor and 8-bit data path.

Victor Business Products President Edwin F. Carlson told reporters the firm's parent company, Kidde Inc., is grooming Victor to be "a significant force in business machines." That includes microcomputers and taking on the likes of IBM, Apple and Tandy, he added.

According to a statement from Victor, the 9000 compares favorably with its competition:

- Both the 9000 and IBM Personal Computer use 16-bit microprocessors;
- The 9000 RAM capacity—896K—is two times the capacity of the PC and Apple III and eight times the capacity of the TRS-80 Model II and Xerox 820;
- With its 1.2 megabyte capacity on two 5.25-inch floppy disks, the Victor machine has three times the capacity of the PC;
- While competitors offer only an 80 column spreadsheet, the 9000 offers 132-column format, which enables the spreadsheet to be read without horizontal scrolling; and
- The Victor micro's green phosphor CRT offers a resolution of 800 by 400, while the IBM's is 640 by 200.

Also, the 9000 has two RS232-C serial ports and a parallel port.

Software for the 9000 includes two operating systems (CP/M-86 and MSDOS) and six programming languages (C Basic, CIS Cobol, Pascal, Fortran, Basic and Cobol). Applications include packages for word processing (Victorwriter and Wordstar); financial planning (a Visicalc clone called Victorcalc); time management; accounting; installment lending; pharmacy management; and business equipment retailing.

The 9000, priced at $4,999, is aimed at businesses. According to the Yankee Group, a Cambridge, MA, consulting firm, annual shipment of microcomputers will reach 1.2 million in 1985 and 900,000 of them will be business computers. Of the 4.5 million micro-based systems in place by 1985, Yankee predicts, 3.5 million will be business systems. Observed Carlson: "The big market is not the hobbyist but the business market."

Because of its huge size, Victor contends, the small business market is more like the business machine market than the traditional computer market, or more like the application-driven market Victor is used to serving.

continued

MAKE & MODEL	Victor 9000	IBM PC	Xerox 820	Apple III	Radio Shack TRS-80 Model II
Processor Type	8088	8088	Z80A	6502	Z80A
Word Length	16 bits	16 bits	8 bits	8 bits	8 bits
Memory Size (Internal)	128-896KB	16-256KB	64KB	96-256KB	32-64KB
Storage Capacity on 2 Floppies	1200KB (5¼")	320KB (5¼")	184KB (5¼")	280KB (5¼")	960KB (8")
CRT DISPLAY					
Standard Format	80 × 25	80 × 25	80 × 24	80 × 24	80 × 24
Alternate Format	132 × 50	None	None	None	None
Gràphics Resolution	800 × 400	640 × 200	None	560 × 192	None
Communications					
Built-in Serial Ports at no extra cost	2	0	2	1	2
Built-in Parallel Ports at no extra cost	1	0	2	0	1
Human Factors					
Keys on Keyboards	94-104	83	96	74	76
Detached Keyboard	Yes	Yes	Yes	No	Yes
Tilting Display mechanism	Yes	No	No	No	No
Swivelling Display mechanism	Yes	No	No	No	No
Desk Area Required (Approx. Square In. with 2 floppy disks)	310	420	470	361	500
Operating System Supplied Standard	CP/M-86 MS-DOS	None	None	Apple DOS	TRSDOS

NOTE: Chart based on manufacturer's information and Dataquest, Inc. available as of April 4, 1982.

What Did You Buy Your TRS-80 Computer For?

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Why spend hours configuring your system to do the things Multidos does automatically?

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INTERPRETS	a single key stroke to get a directory from the 'DOS READY' mode.
READS	standard purchased copies of DBLDOS™, DOSPLUS, LDOS™, NEWDOS/80, and TRSDOS™. MODEL III and MODEL I - SINGLE and DOUBLE DENSITY
COMPENSATES	for CPU speeds of 1.77 MHz to 5.32 MHz even during DISK I/O.
DISPLAYS	the DIRECTORY (alphabetically) on the target diskette after a menu driven PURGE or COPY.
SENSES	the extra lowercase RAM chip and self-modifies to give you lowercase. (MODEL I)
CHECKS	for the same LRL before appending files.
EXECUTES	a machine language program under the control of DEBUG.
DETERMINES	if sufficient free space is present on the destination diskette before any writes are made during COPY.
CALCULATES	an effective TOPMEM for 100% complete DOS command execution from within BASIC.
MAINTAINS	the DATE on simple re-boots.
PREVENTS	a system hand — even without a diskette in drive zero.
DISABLES	interrupts when CLOAD, CSAVE, or SYSTEM is keyed in. (MODEL I)
TOTALS	the free space on all mounted diskettes.
DUMPS	graphics without any patches or system options.

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VICTOR*continued*

The firm has been doing business for 65 years and is well-known for adding machines, comptometers, electronic calculators, programmable calculators and cash registers. But will that reputation hurt Victor's image in the high tech marketplace? It thinks not. "There is hardly a business person who doesn't recognize the Victor name and identify quality office products," it said in a statement.

Victor said its standing as an existing distributor of business products has other advantages. It has in place one of the largest sales organizations covering the office market. To create such a distribution system from scratch would take years and cost millions, it argues. It also has established a large service network. One of the most common criticisms of any growing company in any market sector, it noted, is it fails to serve its customers.

"We also benefit from the many years of experience our company has in working with dealers," Carlson said. "We understand the level of support they require, and we know how to provide it."

Yankee Group reports GEISCO to offer e-mail to public this year

A major provider of electronic mail will offer its services to the public by the end of 1982, according to a statement by the Yankee Group.

The Cambridge, MA, consulting firm, announcing its latest issue of "Report on Electronic Mail," said the General Electric Information Service Company intends to convert its private, subscriber-based timesharing network to a public network for electronic mail and other data processing services.

Yankee forecasted spectacular growth for most electronic mail vendors over the next few years followed by a mid-decade shakeout by providers of the least functional and least user-friendly systems.

It estimated GEISCO, with 20,000 mailboxes, has 41 percent of the existing electronic mail market. Other firms holding a share of the e-mail market are Dialcom with 12,000 mailboxes and 25 percent of the market; Telemail with 8,000 mailboxes and 16 percent of the market; and Comet, Infoplex, and Ontyme II, each with 3,000 mailboxes and 6 percent of the market.

General Electric's competitors will be integrating their electronic mail and data base services, Yankee added. It said this year Computer Corporation of America will integrate in stages its Comet electronic mail and Model 204 data base management system into a new product called DBMS/OA (Data Base Management/Office Automation). Dialcom, Telemail and Ontyme II also plan electronic mail-data base integration moves, the consulting firm noted.

It maintained most of the electronic-mail firms support government standards allowing their systems to interface. Yankee predicted increased user interest in communication between systems.

General Electric doesn't entirely agree with Yankee. "We view our message systems as primarily private systems," observed Tom Bijou, program manager of GEISCO's electronic mail service. "We don't have any clamoring market demand to modify our system to meet a national standard."

He explained GEISCO's clients are mostly large corporations—Fortune 500 companies—that spend $50 to $100 a month on e-mail.

"We're not opposed to a standard," he said, "but we're not making any moves to incorporate that standard in our product. We are putting features in our product that our customers are telling us are important to them."

He added: "It's way too early to say we should follow standards or what the standards should be. The market is so immature."

Referring to the do-your-own-thing approach that has been one of the cornerstones of International Business Machine's success, Bijou noted: "I think Yankee would like to draw a parallel between GE's philosophy and IBM's. We're not trying to do that."

Yankee also said its report covers software interfaces between e-mail providers and users' computer systems. It noted some providers are ready to sell their e-mail software to clients who want to add an in-house system. "Comet already has some significant customers for its software," the company's statement said, "while Telemail will license its software to DEC and IBM users by late 1982."

"Report on Electronic Mail" is published quarterly by Yankee. Annual subscriptions cost $650.■

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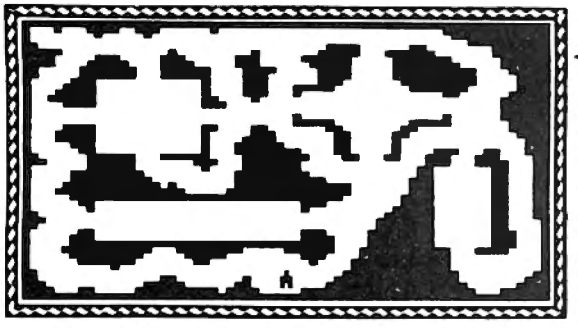

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With the PLATINUM WORKSAVER'S editor, there's no more counting the numbers of characters to delete or change, or wondering if you deleted too many or too few. You see the whole line as it's edited. Changes, deletes and inserts are automatic and the cursor can be moved anywhere on the screen.

FULL SCREEN EDITING OF NUMERIC AND STRING ARRAYS

But that's only the beginning! The editor (Written in machine language) also comes with a short, two line BASIC subroutine that will allow you to use the full screen editor on your numeric and string arrays. This is the springboard you need for developing your own VisiCalc™ or word processor.

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We've solved another Color Computer weakness. Press a control key and letters J, K, L, U, I, O, P become number keys 1-7. Numbers 8-0 remain in their normal positions. The key pad numbers are clearly labeled on the overlay.

SINGLE KEY ENTRIES OF BASIC WORDS

So, the PLATINUM WORKSAVER makes it easier to write useful programs and edit them, but that's not all! Entering programs is a breeze with single entry of over 90 basic words, on a beautifully designed KEYBOARD OVERLAY, color-keyed to function. No need to memorize or consult a conversion chart to find a word.

PROGRAM CHAINING AND DYNAMIC DEBUGGING

Now you can write, enter and change programs easily, but what about debugging? This is the frustrating, time consuming aspect of programming and frankly, the Color Computer doesn't help you much . . . you have to start the program over each time you make a change. But not with the PLATINUM WORKSAVER!! With it you can change, delete, add and rearrange or join lines. The special reserved key is excellent for copying or moving parts of lines to other lines . . . plus, you can even LOAD A WHOLE NEW PROGRAM without disturbing the data you've created.

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THE PLATINUM WORKSAVER INCLUDES:

- *Enhancement program, including a sample mini-word processor, on a high-quality Agfa Cassette.*
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- *Complete instructions*
- *Loads in seconds, takes less than 2K*

The PLATINUM WORKSAVER costs $30.00 plus $3.00 S&H (NY residents add 7% tax). To order write:

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**$30.00 plus $599 suggested price for 16K Color Computers (we do not sell the computers)

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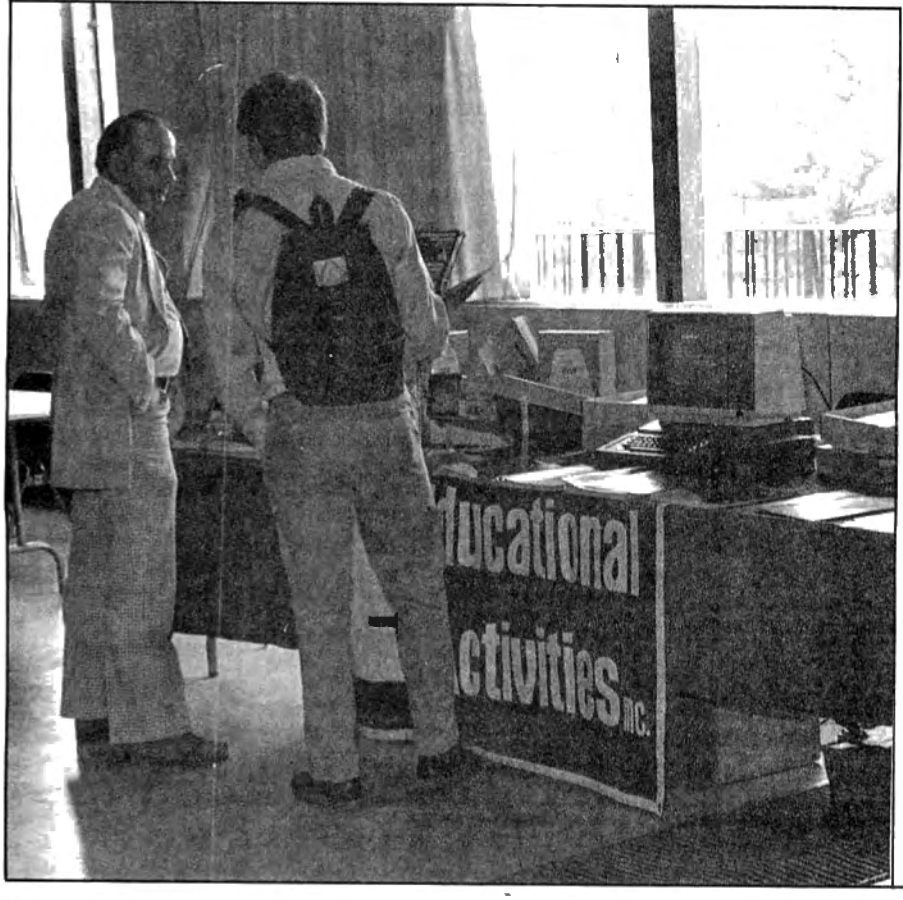
photos by Kerry Leichtman



Micro fair staged at NH school

Twenty-nine vendors—like the one from Educational Activities Inc. in the photo on the left—showed off their wares at the microcomputer fair held at the University of New Hampshire–Durham in May as part of the Granite State's Computer Education Week.

Among the vendors were Apple, Commodore, Atari and Digital. Although Tandy wasn't represented among the exhibitors, fairgoers, like the two in the photo below, could experience a TRS-80 in the hands-on workshop.

Teachers, administrators, students and computer enthusiasts were treated to lectures, seminars and panel discussions on Logo, Pascal, how to select software, networking, word processing, programs for young children and gifted students, and applications for specific subjects.

The fair was sponsored by the New Hampshire Association for Computer Education Statewide. ■

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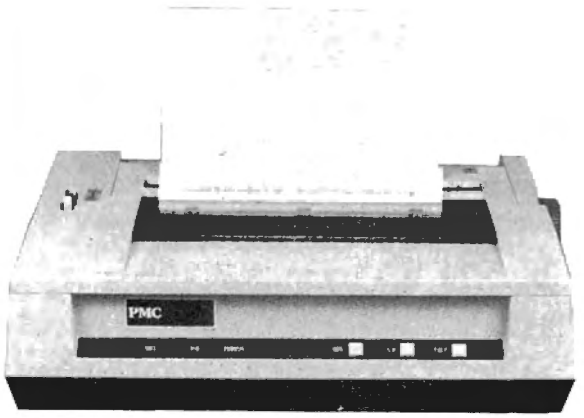

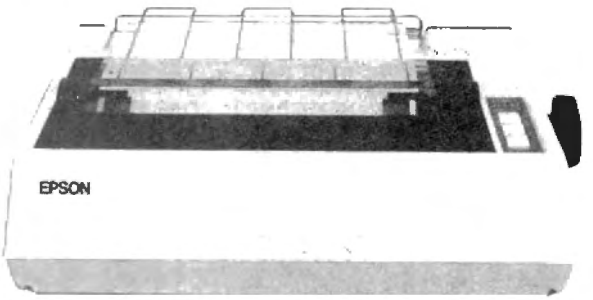

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- Mix fonts on any line
- Paper cut off 1" from last line
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- 6 channel VFU
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their MX-80

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PULSE TRAIN

Green light given Tandy on Memorex deal

After completion of an investigation lasting nearly six months, the Federal Trade Commission has okayed the Tandy Corporation's purchase of the Consumer Products Division of Memorex.

The commission began its investigation of the deal last October because of possible anti-trust implications. The original deadline for a commission ruling was Jan. 25, but no word came from the panel until the end of April. Then it said it had completed its investigation and planned no further action.

The deal makes Tandy the only domestic producer of video cassette tapes and for the first time, places it in the video cassette market, according to *Electronic News*. That newspaper added the transaction raises speculation Tandy, which has been unsuccessfully marketing a video disk player, will become an original equipment manufacturer of video cassette recorders.

According to a statement from Tandy, the acquisition has been made retroactive to April 1. The reason for that, EN reported, was to make the purchase coincide with Tandy's fiscal calendar.

Tandy's Director of Financial Planning Garland P. Asher told EN the Fort Worth, TX, corporation will immediately acquire the Memorex tape production plant in Santa Clara, CA, and will retain the nearly 800 employees who had been working for Memorex.

In Tandy's statement on the deal, it said international subsidiaries of the division will be acquired by Tandy as permission is received from the governments of Canada, United Kingdom, France, Germany and Italy.

"Basically," Asher told EN, "we're going to continue the Memorex business just as it has always been done."

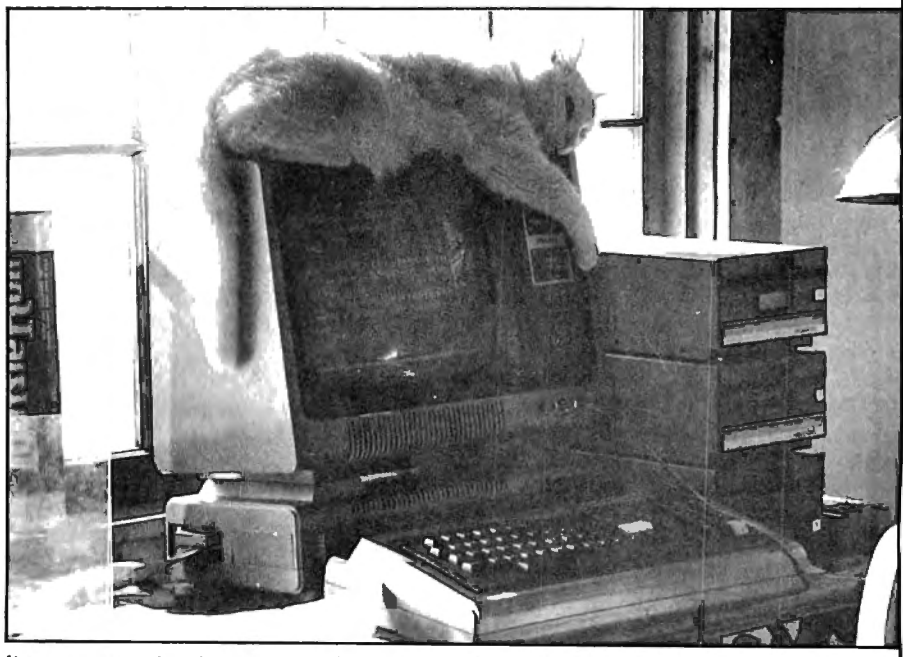
Flip in floppy prices

Pressure from Japanese disk-drive manufacturers should cause significant erosion in the price of 5.25-inch disk drives, according to *Electronic Buyers' News*.

The newspaper said the Japanese are selling boardless drives for as low as $55 and board versions for $100. Tandon, which does much of its production in India, it added, is expected to unveil a $50 floppy for the U.S. market by mid-year.

The Remex Corp. told EBN the price of the firm's double-sided, 48 tracks-per-inch RFD480, now selling for $225–$230, could drop to $200.

According to EBN, Robert Katzive, vice president of Gnostic Concepts' computer division, agreed the boardless drives were having an effect on the marketplace, but long-term floppy buyers will probably choose floppies with boards. He warned, "Adding arbitrary read-write electronics could get you into some trouble."



It seems more than just computerists are attracted to the TRS-80. Ask Kathy McMasters of Brattleboro, VT, who took this photo of her cat China White.

Choose publisher carefully, softwriters told

"Look for strong technical competence and marketing ability in a software publisher, or the computer program you hope to sell may never get off its floppy disk," according to Fred Pood, senior vice president of Micropro International Corporation, producers of Wordstar.

Speaking at the West Coast Computer Faire held in San Francisco in March, Pood added: "It's been our experience that authors all-too-often spend an inordinate amount of time perfecting a program, adding all sorts of bells and whistles, while others have brought out a product in simpler form and snatched away the market."

"Too many prospective authors," he said, "have come to us looking for a large percentage of a product's selling price. What they may not initially realize is that the technical and marketing abilities we bring to bear on a product can offer the chance of vastly greater sales and thus much more in royalties than if the author went it alone."

The man in charge of software acquisition at Micropro said programmers should expect as royalties 10 percent to 20 percent of a publisher's revenue from a program. In some cases, he added, that could make the programmer a millionaire.

Pood gave softwriters some tips in appraising a publisher:

- Look at the firm's track record in designing, developing and documenting its programs;
- Check its ability to produce detailed reference manuals and concise training guides for users;
- Determine the size of the company's sales force and number of sales support offices;
- See if it plans to give your software high visibility through a multifaceted

continued

PULSE TRAIN*continued*

marketing program, including research, pricing, packaging, public relations, advertising, trade show promotion and point of sale cooperative arrangements;

- Note if it offers strong legal protection to counteract software piracy and protect your interests; and
- Assess its manufacturing, shipping, distributing and accounting operations.

David Ferris, an industry consultant and entrepreneur, warned softwriters to polish their negotiating skills when readying themselves to deal with publishers and to spend $2,000 on a good software lawyer.

For softwriters thinking of self-publishing, Jackie Morby, a partner of TA Associates—the nation's largest venture capital firm—said an initial outlay of $25,000 was necessary before money began flowing back to a programmer.

Brits want home shopping

A market study of commercial videotext usage shows British consumers are eager to see classified and other advertising and are willing to pay for it, *Editor & Publisher* reported.

The newspaper trade journal said the study showed 60 percent of the videotext users regularly look up classifieds and more of them would like to see the ads expanded.

The study on Viewtel 202—the most popular supplier of information on Prestel, the British videotext system, and the world's first advertiser-supported electronic newspaper—also showed videotext users would like to do more shopping from their home terminals. Often-cited categories of merchandise consumers said they wanted to buy were electrical goods and books. There was also overwhelming support from users for buying goods with credit cards.

Gary H. Arlen, president of Arlen Communications Inc, the Washington, DC, firm distributing the Viewtel 202 report in the United States, told E & P: "The European findings are easily translatable to North American audiences. The report includes valuable ideas and interpretations about how to develop information and business services for potential videotext customers."

Michigan software house runs top games list

There's the *New York Times* bestseller list and the American Top 40 and now there's Gordon Monnier's Top 10 Games list.

Monnier, owner of the Computer Shack, a software house in Pontiac, MI, said he got the idea for his top 10 (published for the first time in the May issue of *80 Micro*) after seeing an Apple dealer do it in an issue of *Infoworld*. He thought it was a good idea "because a

COMPUTER SHOWCASE EXPO HELD IN BOSTON

Small-and medium-sized computers were displayed for three days at the Computer Showcase Expo held this spring in Boston. Here a crowd gathers around a drum filled with cards made out by thousands of expo vistors as a robot chooses Harold Solomon, M.D., of Boston as the winner of a $3,000 computer system. The expo was sponsored by The Interface group of Framingham, MA, the world's largest producer of expositions and conferences for the computer industry.

PULSE TRAIN *continued*

lot of people call me up and ask me what games I like and what's a good game."

Every month, Monnier and four other ardent game players make their choices and the top 10 are published in a Computer Shack ad.

Monnier said he is trying to get more of his customers to participate in his rating game. "It's hard to find guys who will sit down and send you a listing of their games," he noted. A lot of them say they'll do it and they never do. Anyone that buys a lot of stuff from us, I tell them if they'll send us a listing every month, we'll count them in."

Olivetti expects killing with 16-bit micro

Olivetti, known for its snazzily-designed typewriters, expects to make a killing in the European market as the first major Old World company to release a personal computer.

According to the *Providence Journal*, the Italian firm predicts it will sell 110,000 of its 16-bit M20 microcomputers in Europe by the end of 1983, substantially shaving Apple's and Commodore's share of the European market.

The M20 was developed at a cost of $5 million at the Olivetti Advanced Technology Center in Cupertino, CA. It has nine keyboards, making it as easy to use in Japan and France as in the United States. The M20's pricetag is between $3,000 and $10,000 and is designed for small businesses.

The *Journal* noted at least one of Olivetti's competitors is skeptical of the company's success claims. Said Fred Hoar of Apple, which owns 20 percent of the European personal computer market: "The idea of Olivetti suddenly jumping in and grabbing a large portion of our market share in Europe is very unlikely."

Computer used to stiff ad agency of $24 million

The nation's second largest advertising agency—J. Walter Thompson—miscounted $24 million in revenue because one of its divisions doctored computer entries to make it appear it was reaching its annual goals.

According to *The Wall Street Journal* starting in 1978, phony computer entries made it appear that the agency's barter syndication unit had met its goals. Higher goals were set for 1979. When the 1979 goals weren't met, more bogus revenue was booked, resulting in even higher goals for 1980. And so the cycle continued into 1981.

Barter syndication involves an agency buying tv programs from independent producers and swapping them for commercial time on a tv station. This builds up a "bank" of spots for the agency with the station. The agency then sells the spots to blue-chip clients, usually at a discount.

The newspaper reported former employees of the unit said its computerized accounting system was riddled with what appeared to be erroneous entries, so much so that the employees sometimes had to resort to keeping their own records.

During JWT's investigation of the unit, the agency received more than 200 responses from stations, the majority of them disclosing substantial discrepancies between station records and time-bank numbers stored in JWT's computer.

Former buyers for JWT interviewed by the *Journal* said when time banks mysteriously appeared in printouts as having been earned, New York shrugged off the discrepancies as computer failure and sometimes took the position that the shortfalls could easily be made up in the future with a little extra effort.

Officials at JWT said fictitious time banks were created and fictitious clients used in fictitious spots. To prevent unexplained paper—bills, receipts, checks—from being sent clients and stations, the perpetrators of the scheme used the computer's "test estimate" function.

Test estimate uses fictitious client codes to determine "what-if" situations in various markets. Through a complicated series of steps, the schemers got the computer to treat the test estimates as real accounts and rolled them forward month after month.

Agency officials told the *Journal* no money had been stolen and clients weren't improperly billed. But while the unit was exhibiting its glowing sales record, the company poured $30 million into it, buying tv shows like "The Osmonds at the Ohio State Fair" and "Vic Damone on Campus" to barter with stations. That money will never be recovered, the officials said.

Exec calls for empathetic interfaces

If computers are to penetrate the managerial and professional market, they must reflect the user's, not the machine's, point of view, according to Joseph Adler of Integrated Office Systems of San Jose, CA.

continued

For TRS-80 Models I and III

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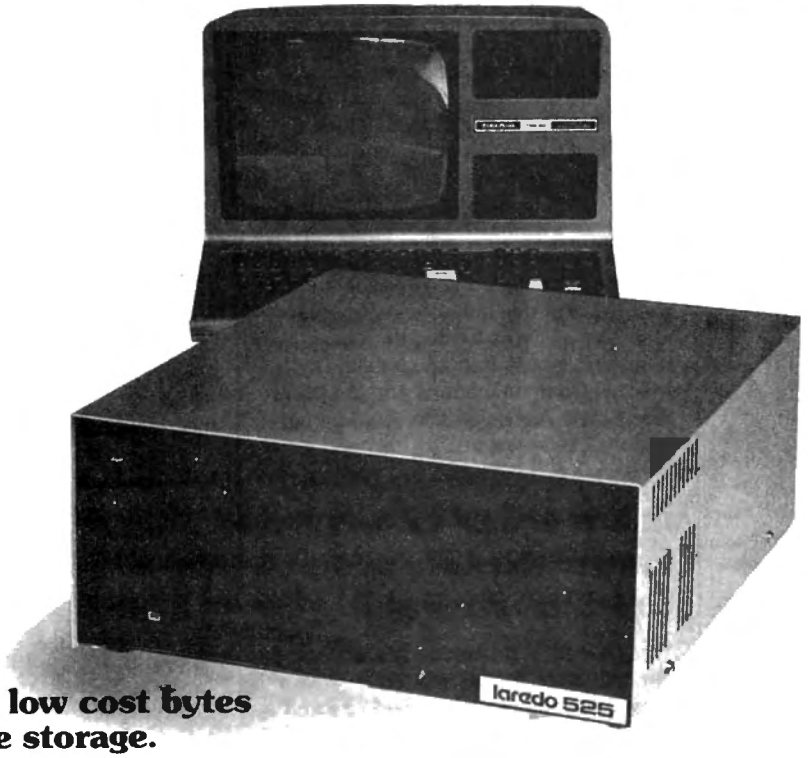

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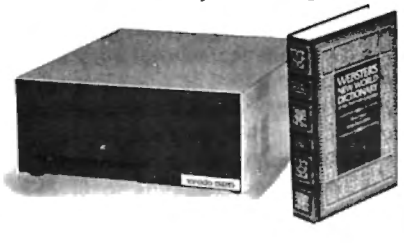

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PULSE TRAIN*continued*

Speaking at the Office Automation Conference held in April in San Francisco, the vice president for human systems said: "Professional working life is a dynamic process and a computer system which truly enhances effectiveness must respond to the user's environment and not constrain his behavior through the machine's own inherent limitations. A system meeting these requirements can be called empathetic because it reflects the world view of the user and responds accordingly."

"Achieving empathetic interfaces," he continued, "demands that system designers have a profound understanding of the needs, personality and work habits of the user. Pure functionality is no longer an adequate selling point as it was for technical and clerical users."

He added: "Executives are not in the habit of changing their ways for the sake of greater productivity. Although they strive for power and professional excellence, they are conservative in nature and do not employ the latest in office automation, choosing instead to use tools with which they are satisfied and comfortable."

To be attractive to management, he noted, new systems need three features: They must be useful immediately, speak the user's language, and "be packaged in such a way as to connote the appropriate status and symbolism."

Micro vitals in new directory

Vital information on the microcomputer industry will be included in *The Microcomputer Market Place* expected to be published next month by Dekotek Inc. of New York City.

The directory will contain key personnel, number of published software programs, application areas of interest, hardware served and a selection on how individuals can submit new programs for publication. It will also provide a list of magazines and newsletters serving micro owners, exhibits and shows, user groups by region, suppliers to the industry and associations.

The guide will retail for $145, but can be obtained for a special pre-publication price of $95 from Mike Hopkins, Dekotek, P.O. Box 1863, Grand Central Station, New York, NY 10022.

Records on the record

One of the most sophisticated record information systems in the world is up and running on Canada's Telidon videotext system.

The Canadian government expects to locate Telidon terminals in record stores, radio stations, libraries and educational institutions where people may access the catalog.

There are 80 information fields on each record in the data base including performers' biographies, labels, publishing rights and licenses and a host of distribution and management information. Also, because of Telidon's graphic capabilities, a person may call up color images of a record's jacket-cover and photos of recording artists.

The bilingual catalog contains more than 1,000 entries. It was prepared by the Canadian Independent Record Production Association and l'Association du Disque et de l'Industrie du Spectacle Quebecois. It was funded through matching grants from the federal Department of Communications and the Canadian Radio-Television and Telecommunications Commission.

Author of *Soul* garners Pulitzer and ABA, bids computers farewell

Tracy Kidder, who made high technology into a bestseller with his *Soul of a New Machine*, captured a Pulitzer Prize and American Book Award in April, but he appears far from enamored with computers.

In an interview with the *Boston Globe*, Kidder, whose book has sold more than 100,000 copies, opined: "I don't like the mystique about computers. The computer sociology [implied by] the word 'revolutionary' annoys me. I am glad to see them treated realistically. After all, they are just machines."

Soul (reviewed by Chris Brown in *80 Micro*, December 1981) received the Pulitzer and ABA in the general non-fiction category. The paperback rights sold for $250,000 and Avon Books expects to release the softcover version this month. Columbia Pictures has taken an option on the book to turn it into a movie.

Kidder, who lives in Williamsburg, MA, told the *Globe* he's not planning a *Soul II*: "I've bid the world of computers farewell. It has taken me six months to get it out of my system and I am ready to move on to something else."

Atari distributor chosen

The world's largest distributor of personal computer software, Softsel Computer Products Inc., has been chosen by Atari Inc. to be the first software-only distributor of the Warner Communications' firm computer programs.

Softsel will carry the entire line of software developed by Atari for its 400 and 800 home computers. The Inglewood, CA, company's 1500 dealers, which now provide 1200 personal computer programs, will provide a significant increase in distribution for Atari's growing catalog of programs in education, entertainment, home, office and personal management.

Paying for failing to connect

Call monitoring computers at two long-distance rivals of Ma Bell have a disconcerting habit, according to *The Wall Street Journal*: They charge for calls made but unanswered.

Officials from the two companies—MCI Communications Corp. and Southern Pacific Communication Co.'s Sprint—conceded to the *Journal* there are occasional billing errors, but blame it on AT&T.

They explained American Telephone and Telegraph's answer supervision system rarely makes a mistake because when a call is answered, an unambiguous signal goes directly to the computer that compiles the bills. The competitors' computers do not receive a direct signal, but monitor the ringing pattern of a call. That pattern can be disturbed by noise on the phone line and be interpreted by the computer as an answered call. The longer a caller lets an unanswered phone ring, the greater the chances he or she will be billed for the call.

Despite the problem, the competitors told the *Journal*, their billing systems work more often than not. They added the pending AT&T anti-trust settlement will require Ma Bell to provide its competitors with services identical to its own, including answer supervision.

Meanwhile, however, at least one customer said he's going back to Ma. "At least we have faith in their bills," he told the *Journal*.

Disk-controller firm wins trade secrets case

The largest independent producer of disk controllers in the nation has won a $1.4 million trade secrets lawsuit against two former employees.

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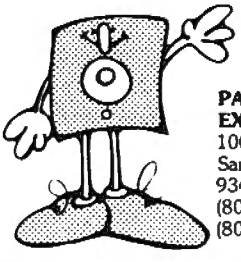

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PULSE TRAIN*continued*

According to David Goss, the attorney for Microcomputer Systems Corporation of Sunnyvale, CA, the case by a California Superior Court judge represents the first time a substantial judgment has been awarded in a high technology business confidences lawsuit.

Microcomputer Systems filed its suit against a firm, Data Technology Corporation, established by two former employees, David Tsang and Lloyd Ebisu. In a statement, Microcomputer Systems maintained Tsang and Ebisu used confidential information gained at the Sunnyvale company to construct their disk controller used to land a fat contract with Shugart Associates.

Microcomputer Systems Chief Executive Officer James S. Torenson noted: "The judgment is more than a victory for MSC. It is a landmark victory for all companies concerned with protecting their proprietary information."

Keeping the jerks off talk radio

Radio stations with talk shows are finding having a computer hobbyist on the staff can be useful.

Stations in Chicago and Phoenix have microcomputer set-ups designed by hobbyists and aimed at screening calls to their talk shows, according to the computer industry newspaper *Infoworld*. Some people at the stations have dubbed the programs "jerk-finders" because they allow talk show hosts to keep people they don't want to talk to off the air.

David Graves, general manager of WIND in Chicago, designed "Electronic Producer" for use on an Apple II Plus. The program facilitates communication between a talk show's host and producer. The host has a monitor tied into the Apple and messages can be conveyed to him by the producer. A display of how long each caller has been kept waiting and what he or she is calling about is also maintained by the computer.

If someone calls with a "dynamite comment," the producer can put a flashing cursor by the call. Other messages needing to go on the air immediately can also be sent to the host's monitor.

In Phoenix, KKLT-FM disk jockey Timothy Greer wrote "Talkscreen" to run on a Commodore VIC 20. Like Electronic Producer, the host has a monitor tied to the computer. The producer prioritizes calls and gives the host 22-character messages about waiting callers.

Bob Dunn, producer of several talk shows on the AM side of KKLT, told *Infoworld* Talkscreen was not unfair and was designed to get the most information on the air for listeners.

E-paper publishers not in it for the money—yet

"If you're out to make a quick buck, the alpha-numeric presentation of news on cable television is not necessarily the way to do it."

That's the opinion of Roger Galstad, sales manager for *Telecable*, the electronic publishing subsidiary of the *Leader Telegram* of Eau Claire, WI.

According to the newspaper trade journal *Editor & Publisher*, Galstad, speaking at a cable marketing seminar held in Port Chester, NY, observed, "Television commercials retailers understand, alpha-numeric, static advertising they do not."

Telecable is available to 70 percent of the Eau Claire market via cable tv. Galstad said the service lost money its first year—when it produced $90,000 in revenues—and is expected to lose money this year even though the company projects the service will earn $200,000 in 1982.

To boost income, *Telecable* has introduced a five-minute, live-anchored newscast and sells traditional 30-second spots for it. In a short time, Galstad said, the program has become the service's most saleable product.

Micros alter lives of pupils and teachers

The teacher-pupil hierarchy is being shaken by increasing use of computers in the classroom, according to *The New York Times*.

Schools having experimented with computers report that they can dramatically alter an institution's social climate, the *Times* said. However, many teachers, contrary to their expectations, found computers promote conversation and cooperation among students rather than isolation and introspection, especially if the machines are placed in clusters.

Patricia Mattingly, the head of the Lamplighter School in Dallas, told the newspaper computers have had a democratizing effect on classes: "No one is best at computers in the way that someone is often best at mathematics."

A widespread phenomenon in schools that use computers extensively is that students' knowledge of the machines soon outstrips the teacher's, the *Times* reported. This alters classroom relationships in a way that many teachers view as positive. "I work with third graders," one Lamplighter teacher said, "and most of them are already beyond me. I think it's nice at that age to tell an adult something and be right."

Lewis Stewart, a 14-year-old ninth grader at Joan of Arc Junior High School in Manhattan, would agree with that assessment, the *Times* opined. Stewart is said to be a year and a half below grade level in reading, but when it comes to computers, he is at the head of his class. He recently designed a complex electronic football game that involved 75 subprograms, and he finds faculty members often calling on him for help with computer problems.

But some experts fear there may be some negative spinoffs from computers in the classroom.

James Hoburg, a professor of electrical engineering at Carnegie-Mellon University in Pittsburgh, said computers create a danger of "reinforcing people who want quick, superficial answers."

Schools may start overemphasizing problems and ideas tending themselves to quantification, the *Times* noted. It was told by MIT professor Joseph Weizenbaum, "The danger is that we will end up thinking like a computer and that the only legitimate problems are those where quantification and calculation play a big role."

He added: "Abraham Maslow once said that to him who has only a hammer, the whole world looks like a nail. To him who has only a computer, the world looks like a computable domain."

Will Das Kapital become Die Auskunft?

For those who think computers may be the great social equalizer of the 20th century, think again, warned an artificial intelligence expert at the Massachusetts Institute of Technology in Boston.

In an interview published in the computer industry newspaper *Infoworld*, professor Joseph Weizenbaum said he saw future society splitting into information haves and have nots:

"My own feeling is that what is likely to happen is that there will be a partitioning of the population into fundamentally two classes: those who have access to computer-mediated activities in our society—banking, electronic mail and all that—and who think of that as a natural part of life. . . and those who don't. . ."

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PULSE TRAIN *continued*

The author of *Computer Power and Human Reason* added, "The division will be pretty much along class and race lines. As usual the poor will get poorer (in the sense of being information literacy-poor), and the well-off will continue to be well-off and continue to receive the tools that make it possible to be well-off."

Weizenbaum went on to say his most serious concern is that the two classes will diverge from each other sharply and be unable to communicate with one another, making the separation unbridgeable.

In video games, the myth's the thing

Why can teenagers with a miniscule attention span in school spend hours in front of a video game? According to a California psychologist, it's because society fails to provide youths with the mythic challenges they need.

David Van Nuys, who has worked as a consultant for Atari and is a member of the psychology department at Sonoma State University in Rohnert Park, CA, was quoted in the computer industry newspaper *Infoworld* as observing:

"Teenagers sit in school for years and years and they hunger for life-and-death kinds of challenges. There's a myth involved in playing an arcade game. It provides a framework that allows people to act out or role-play being a hero, and I think that's more important than the aggressive component" of the games.

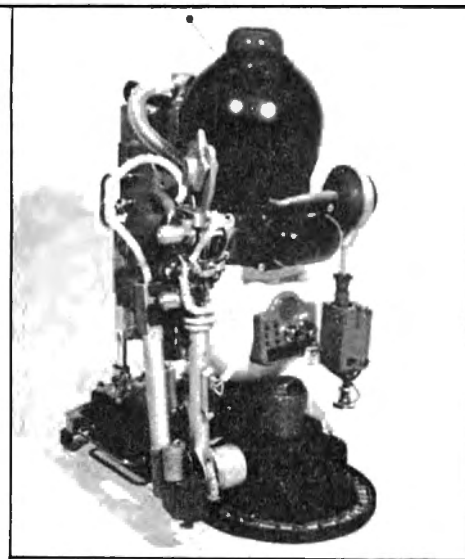
He added another reason the kids are attracted to the games is they're interactive: "They give you immediate response. For that reason alone they are a step up and out of the dark cave of television into the light of day. Instead of having a kid lost in a mind swamp of total passivity watching tv for hours on end, the kid is interacting with an environment that is pushing his horizons."

Will personal robot be next?

Now that the personal computer is here, can the personal robot be far behind?

That's a question posed in a report appearing in *The Wall Street Journal*.

According to that business daily, experts agree personal computers have paved the way for robots, but disagree on how soon droids will become consumer items. One consultant said robots today are where micros were seven years ago, while other experts contend widespread use of robots is 10 to 15 years away. James S. Albus, head of robotics research for the National Bureau of Standards, maintained household robots will be impractical until the 1990s, when they might be available for the price of a car.



Avatar: Will fetch someday.

Seven small companies are selling computer-controlled arms, bodies or complete robots ranging in price from $695 to $2,500. And Zenith's Heath Co., the nation's largest maker of electronics kits, plans to market a build-it-yourself robot—along the lines of Star Wars' R2D2—within two years.

The *Journal* report named several hobbyists who have created robots:

- Los Angeles engineer Glenn Hoffstatter who built "Ambulatron" for $400. It doesn't do much, he said, just roams around frightening secretaries.
- Dayton, OH, electronics and computer specialist Charles Balmer, Jr., who spent $2,000 on "Avatar." When Balmer finishes writing the programs for his robot, it will be able to keep its batteries charged and fetch Balmer's tools and slippers.
- H.R. Everett of Monterey, CA, spent $6,000 on Robart, which acts as a 5-foot, 4-inch electronic sentry for his home.

At present, though, robot sales are a marginal business, the *Journal* reported, yet robot builders persist. Jerome Hamlin, a former Yale University philosophy student and theatrical prop builder, constructed a robot butler, Comro. Featured in Neiman-Marcus's Christmas catalog, Hamlin sold three Comros at $15,000 each. Now he plans to introduce a "cute," computer-controlled assemble-it-yourself android selling for less than $2,000.

Hamlin's "cute" robot may be a sign of things to come. Observed Dallas consultant Portia Isaacson: "Take your cutest, most cuddly stuffed dog. Put wheels on its paws. Add sensors for noise and motion. Install an electronic chip that will bark, a computer that can recognize an owner's voice, and a motor to wag the tail. It would be great. You also wouldn't have to feed or housebreak it."

Bar codes for runners

They're on everything from groceries to magazines and now they're even on runners.

They're the ubiquitous bar codes and in runs like the Boston Marathon, Bonne Bell Race and Gasparilla Long Distance Classic, they're used to keep track of runners' times.

Since 1980, Honeywell Inc. has been the official timekeeper at those races and it uses bar codes—like the one on the cover of *80 Micro*—to keep tabs on runners. The bar codes are attached to the runners' numbers. After a runner finishes the race, the bar codes are collected, fed into a computer and within 20 minutes, race results begin to roll out of the machine.

Not only does the computer accurately peg a runner's time, but it can be programmed to break out a race into team scores, age divisions and different groups.

Tom Cusson, manager of Honeywell's technical support and computer operations, explained to the *Boston Globe*: "We know at the moment it happened who finished 12th in the women's over-40 group."

The Honeywell computer also provides each runner with a permanent record of his or her performance. A postcard is produced by the machine and mailed out by Honeywell 24 hours after a race. For a Jane Doe finishing the Boston Marathon, the postcard may look something like this:

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In the Boston race, Cusson told the *Globe*, postcards will be sent to some 7600 racers. Information on the marathon, he added, is still being mailed to runners three months after the finish.

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From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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FEEDBACK LOOP

by Terry Kepner

"I've noticed a lot of low-price printers coming into this country from Japan."

Send any questions or problems dealing with any area of TRS-80 microcomputers to Feedback Loop, 80 Micro, 80 Pine Street, Peterborough, NH 03458.

Wow! Has the price of printers come down! I've noticed a lot of low-price printers coming into this country from Japan. Are they any good?

M.P.
Del Mar, CA

Yes they are. It is unfortunate that American printer companies are having a difficult time competing with the Japanese. In fact, Radio Shack's Daisy Wheel II printer is built in Japan because Tandy could not find an American company that could make a daisy-wheel printer to match Radio Shack's specifications of durability and speed.

I bought a book that explains how to generate sound using my TRS-80. The author suggested purchasing a small amplifier/speaker from Radio Shack. I did but all I hear is a hum. Is something wrong with my computer?

M.M.
Newark, NJ

Not if you can still CSAVE and CLOAD tapes. If you can CSAVE and CLOAD tapes normally, but cannot get sound out of the Radio Shack unit, then your problem could be with the amplifier/speaker, with the routines you use to generate sound, or with the way you have the unit connected to your computer. To test the amplifier/speaker, insert the gray plug that normally goes to the auxiliary jack of your tape recorder into the amplifier/speaker instead. Then, turning both the computer and the amplifier/speaker on, type CSAVE"A" and press Enter. You should hear the computer's 256-byte synchronization signal coming from the speaker. This is normally recorded on the tape to allow time for the tape recorder motor to come up to speed.

If you do not hear this signal, I would suspect the amplifier/speaker is defective. If you do hear the signal, the unit is okay. Double check your sound code.

Alternately, connect your computer to your tape recorder as if you were going to save a program, except unplug the small gray plug from the remote jack. Press the play and record buttons on the tape recorder and begin using your sound-generating routines. If the routines work correctly, you will get a tape recording of their output. When you're finished, stop the tape, rewind it, unplug the earphone plug and play the tape. If you hear only static or a hum, the problem lies with the sound-generating routines you are using.

Both tests assume the cassette port of the computer, the cables and the tape recorder all function correctly. If you cannot get your computer to save or load cassette tapes, check the cable first. Borrow a friend's cable and tape recorder and see if you can save or load a tape. If you still have problems, take the computer to a repair center and have their technicians take a look at it.

I did it now. Somehow I wrote over my TRSDOS disk. Any advice?

S.K.
Jackson, MS

This is not a complete tragedy. Radio Shack sells TRSDOS disks with the full operating system for $16.95. Drop by the nearest store and buy two. As soon as you get home, put one in a safe place and make a back-up of the other disk.

Here's a suggestion for you: Whenever you buy a box of blank disks, immediately back up your DOS onto each new disk. Not only does this find bad disks, if any, it also means you will always have a formatted and ready-to-use disk on hand. It will also prevent you from destroying the only working copy of your DOS.

I recently started to receive the Radio Shack newsletter and I would like to get back copies of it. I have written to Radio Shack with no success. Do any of your readers have back issues for sale?

L.O.
Allentown, PA

You're in luck. Radio Shack has just released a compilation of the first 20 issues (December 1977 to December 1980). Its catalog number is 26-2115 and it retails for $4.95. If you want copies of more recent issues, ask your Radio Shack Computer Center; many have back issues.

I just started to use the POKE and PEEK functions on my TRS-80. Is there a map available to help me find correct ROM addresses? I am especially interested in video display addresses.

M.K.
Jacksonville, FL

Pathways Through the ROM, sold by Softside Publications, 6 South Street, Milford, NH 03055 ($19.95), has a map of the Level II ROM and Basic RAM locations. The map was originally published as *Roger Fuller's ROM Map.*

Video memory begins at memory location 15360 (3C00 H) and runs through the next 1023 locations to 16383 (3FFF H). If you want to make your own map, with the video locations all marked off, get the video graphics display map in your TRS-80 Basic handbook and label the very first location in the upper left corner as position 15360. Label the first position of the line below it 15424. Add 64 each time you go to a new line until all 16 lines are labelled.

I know microcomputers are expensive, but recently I saw a book of several long business programs to key in selling for over $30. This was a paperback. With any other title it would sell for $10. What is happening to the personal computer business?

S.F.
Richmond, VA

There are several reasons why the book costs so much. One is the expense in developing these programs. Since the publisher anticipates limited sales because of the narrow market of buyers, he has to ask a higher price for it than for a more popular book (the more books you print and sell, the cheaper it costs to print each book).

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Another reason is the scarcity of books on the subject. Unfortunately for the consumer, the personal computer market is a seller's market. The book is selling for $30 because the publisher knows people are going to buy it. Until the market is as large and competitive as the mass media market, you'll be seeing lots of overpriced computer books. (Actually, there are responsible publishers who do not take advantage of the current market position and sell their books for reasonable prices. I just wish that there were more of them.)

My friend and I both feel we have become expert programmers. We experts, however, have a difference of opinion. He claims the POKE statement draws illustrations fastest without going into machine language. I say the CHR$ statement is the fastest. Who's right?

M.A.
Baton Rouge, LA

The experts are wrong again! The fastest way to draw graphics is to put them into Print statements, or variables, and then print them. For example:

```
A$ = CHR$(129) + CHR$(130) + CHR$(131)
   + CHR$(181) + CHR$(184):PRINTA$
```

will put graphics on the screen faster than five POKE statements, or one Print statement with five CHR$(x)s in it. In the last two cases the Basic interpreter has to process each graphics block separately as it goes to the video. In the first case, all the work is finished before it goes to the video.

I own a small business and am considering using a microcomputer to do my accounting. Not knowing much about microcomputers, I was wondering if I have to purchase an existing accounting software package, or is it easy to develop my own program?

J.C.
Newport News, VA

Programming a computer is like writing a letter in a foreign language; if you know what you're doing, it's easy and fairly quick. If you don't know what you're doing, be prepared to take a long time and to make many mistakes before it's finished.

Since you say you don't know much about computers I have to conclude you also don't know very much about programming. Learning how to program takes months of steady work, quite similar to learning a foreign language. You not only have to memorize the vocabulary, you must also learn how to correctly use words in groups. Programming is learning the correct way to get the computer to do the things you want; there is no quick and easy way to bypass this learning procedure.

As a rule of thumb, any program worth writing will take a minimum of a month of solid work, not including the time required to write the documentation. If you're in no hurry to use your computer for your business, you can learn to program and then write programs for your needs. Otherwise I'd suggest you buy the programs you want to use in your business.

I am thinking about creating software for my business and then selling the package to others in the same business. I would hate to spend the time developing a program just to have someone else copy and resell it. Is there any protection for the microcomputer programmer?

C.P.
Stockton, CA

Welcome to the gray and mysterious land of copyright protection. Supposedly there is protection for the computer programmer, but getting it is likely to cost a lot of money in lawyer's fees. According to the copyright laws, if someone copies and sells your program without your permission, you have the right to seek monetary compensation. However, proving the program the pirate is selling is actually your work and not a genuine creative effort of the pirate is not easy, especially if the pirate has added enhancements to your program. This involves courts and lawyers and can get expensive.

Most companies rely upon the threat of court action, which usually works, to prevent people from stealing programs.

If you have the bad fortune to run into someone who doesn't believe you'll take him to court, or who isn't afraid of fighting you in court, then you're stuck. He'll continue to copy and sell your program until the court does something about it, which will cost both of you a lot of money. The pirate can still profit because he didn't have to pay for the cost of developing the program, paying royalties and supplying customer support.

The best way to prevent someone from taking your program is to make it too difficult for them to copy. There are two ways to do this: Make the program uncopyable either by using a non-standard format, or encode the program; or make the program very dependent upon the documentation, and make the documentation thick.

The problem with the first method, selling uncopyable programs, is that you antagonize customers wanting to make legitimate backup copies for their files. Besides, anything stored on tape or disk can be copied by an expert programmer. So this method will deter only the amateur from copying your program.

The second method is a bit better, but costs more money. For example, no one in their right mind would want a bootleg copy of LDOS. You have to have the documentation to use it. Since the documentation is hundreds of pages thick, copying it is no small problem. It would be cheaper to buy a legitimate copy than spend hours and dollars photocopying the documentation. From the producer's point of view, creating this volume of documentation is time-consuming and expensive. Copyright laws are clearer on the written word than they are on magnetically stored programs.

Many companies either price their products high enough to cover the revenues lost from bootleggers, or they price their products low enough to discourage the bootleggers from trying to make a profit.

I have tried, without a great deal of success, to find out from Radio Shack the effect of adding a lowercase kit to my Model I Level II. If I were to add a lowercase kit, what effect will it have on the keyboard (will lowercase characters be generated unless Shift is depressed?), video (will lowercase and uppercase be generated and displayed?), programs (what effect will it have on all those programs I have already typed in and will they run?).

If the lowercase kit is installed, but the driver program is not loaded, what happens?

R.H.
Berthoud, CO

Some background information is necessary before I can answer your questions. The TRS-80 Model I was originally designed as a hobby machine, and as a result lowercase capability was left out. Since they had no intention of adding lowercase, the designers of the computer decided to save money. Displaying uppercase letters, special characters and graphics characters does not require a full eight bits of memory for each video location. They saved $1.49 by making the video use only seven bits.

This means bit 6 of the video memory does not exist as a location. Everything sent to the video has bit 6 set. So when you send an "A" to the screen, what you're actually sending is a binary one (bit 6 is a binary 64 and is already set, permanently). The video display adds the 64 and 1 and gets 65, the ASCII code for an "A." If you send a lowercase "a," it is converted by the video display to an uppercase "A." By using only seven bits instead of eight when manipulating ASCII codes, the ROM

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routines were simplified, reducing development and hardware costs.

When the Radio Shack uppercase/lowercase kit is installed, the video character generator chip and the video memory chip are replaced. The new VCG contains the uppercase alphabet in the first 26 locations. The ROM routines sending the binary one to the video will still operate normally. It also contains the uppercase alphabet at positions 65-90 allowing the uppercase/lowercase driver to operate properly.

"They saved $1.49 by making the video screen use seven bits."

Now for your questions.

Keyboard—Unless you have the uppercase/lowercase driver in place and activated, the keyboard will operate as if there were no modification. Uppercase letters will be typed unless the shift key is depressed, in which case lowercase letters will be typed. As in the unmodified computer, the lowercase letters will be displayed as uppercase letters.

Video—Upper and lowercase letters will be displayed only if the uppercase/lowercase driver is in place and activated.

Programs—Most programs will operate normally, with or without the uppercase/lowercase driver activated. The only programs you will have trouble with are those that use the PEEK command to examine the video. These programs expect to see only valid ASCII numbers on the screen. With the uppercase/lowercase modification installed, these programs will see values in the range of 1-26 for the uppercase letters. The ASCII values in that range are control codes and will cause difficulties for the programs. For example, if you have uppercase/lowercase capability, which is not activated, and you have an uppercase "A" in video location 15360, typing PRINTPEEK(15360) will give you the ASCII value one. If your program has something like:

```
A=PEEK(15360):IF A="A"THENSTOP
```

the Stop will not be executed because the ASCII value of "A" is 65, not one. Similarly, if you are PEEKing the video and sending the results to your line printer, you will have problems because the codes 1-26 are printer control codes.

The solution to these problems is rather simple; test the value PEEKed from the screen for illegalities. If you get a value below 27, add 64 to it and let the program continue.

Driver—The presence, or absence, of the driver will only affect whether the lowercase letters are displayed as lower or uppercase.

I have a long math program using about 20 variables. Every time I run the program I get the error message ?/0. I checked and rechecked the program and the formulas don't call for such a calculation. Is it my TRS-80 or me?

R.T.
Tacoma, WA

I'm sorry to say the problem is you and the program. If your program doesn't have any division in the formulas you're using, the problem lies with the size of the program. If a program tries to use up more room than is available, you should get an out-of-memory error. This can accidentally be circumvented if you're using any POKEs or machine-language routines, in which case the program is stomping on the variable storage area and causing the problem.

On the other hand, if none of the formulas contain values that are supposed to be at zero, then somewhere in your program a variable is being set to zero when it shouldn't. The only way to find such a problem is to put a Print statement after each program line that does a calculation, printing out the values just calculated. In this way you'll quickly find out where the problem lies. Also, be sure to check that the variable names you're using do not accidentally repeat. You may be using two variable names that the computer is treating as one. (This usually occurs only if you're using variable names longer than two letters.)

I'm working on a problem which calls for the calculation of numbers in the millions. The problem is that my TRS-80 returns results in exponential numbers. What can I do to resolve this problem? I am easily confused by exponential numbers.

A.S.
San Antonio, TX

Use the PRINTUSING command to build a display for you:

```
PRINTUSING "$$########,###.##";123456789.12
```

will display as:

```
$123,456,789.12
```

instead of

```
$1.23456E+08
```

Additionally, you'll have to define all your numbers as double precision, since single precision will only calculate and display the first seven significant digits of your number, the rest being lost from the calculations (an error in the hundreds).

I have an idea for a video newsletter. I own a TRS-80 and would like to have other TRS-80 owners access the newsletter by computer. Can this be done? How do I get started?

Y.K.
Tampa, FL

If you want to establish a bulletin board for subscribers to call, give a password and then be able to read the newsletter, you can most certainly do this. You'll need a dedicated phone line, a direct-connect modem that will let your computer answer the phone, an RS-232 board for your computer, a bulletin board program to selectively screen incoming calls and a computer with sufficient memory and disk-drive space to hold the program and newsletter.

Radio Shack sells the D.C. Modem II for $249 and the RS-232 for $99. There are several sources of BBS programs, including:

B.T. Enterprises (516-981-8568), Connection-80, which works with DOSPLUS, NEWDOS80, and LDOS;
Lance Micklus (802-864-5899) who has a set of three, the Personal Bulletin Board System (16K LII tape-based $80), ST-80CC ($149), and Mouse-Net ($349), all of which will work under TRSDOS, LDOS, NEWDOS80 or DOSPLUS;
Small Business Systems Group (617-692-3800), Forum-80 ($350), which requires NEWDOS80.

If you just want to send a newsletter to subscribers, that too is easily done. All you need are: an RS-232 board, a modem and a communications program. I don't think you'll want to do it this way because of the money you'll spend making the phone calls to all of your subscribers.

The other choice available is to store the newsletter on cassettes as a data file or newsletter program, a la *CLOAD* or *Chromasette* magazines, which you would periodically mail to your subscribers. The advantage to this last system is that your subscribers don't have to buy any extra equipment (RS-232, modem and communications program) to subscribe to your newsletter. ■

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Notes from BENEATH the KEYBOARD

by Paul Wiener

Flash! There's a news bulletin at the end of this month's column. So if you're not interested in the bulk of the column, skip to the end for a quick micro-report on the results of the second North American Computer Othello Championship.

Now that the teaser's out of the way, let me apologize, in behalf of *80 Micro*, for the cutting room goblin's latest rampage. I hope you weren't too badly hampered by the transposition of text in May's column. Oh well...

Competitive Tree Searches

What do chess, reversi, checkers, and go programs all have in common? They all have a competitive tree searching algorithm. The nature of such algorithms has been treated in technical books and journals, but not too much has appeared in the popular press, so here goes Part I of Competitive Tree Searches.

I haven't made a formal study of the subject. Most of what I know was picked up in conversation with such leaders in the field as Charlie Heath, Bill Fink and Peter Frey. One book I did learn a lot from is the *Thinking Computer* (subtitled *Mind Under Matter*) by Raphael.

Several key concepts of the technique are listed below:

- Ply
- Evaluation algorithm
- Breadth-first search
- Depth-first search
- Minimax
- Alpha-beta pruning
- Presort
- Iterative search
- Killer Heuristic
- Windowing

Many of us are familiar with plies, the minimax algorithm and Alpha-beta pruning (or have at least heard of them), but the rest remains a fairly arcane field.

Since chess is a familiar game, I will use it for all my examples. As far as programmers are concerned, what chess players call a move really consists of two moves, one for white and one for black. Chess players sometimes refer to one player's move as a half-move. The term ply is used to eliminate this ambiguity. Ply refers to a single move by one player. A programmer's ply, then, equals a chess player's half move.

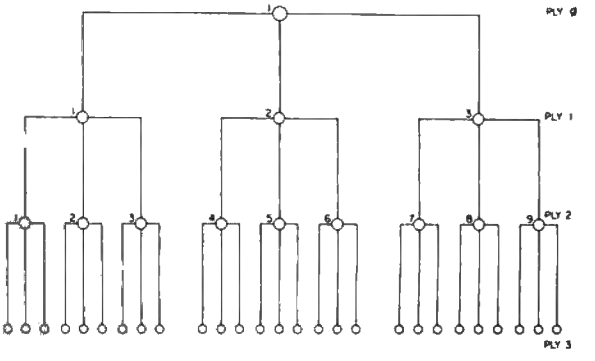

Fig. 1

Ply: The Tree's Seed

To some extent, a computer selects its move the same way a human selects his. It tries to look ahead as many moves as possible in an allotted time. A simple way of doing this requires the computer to generate the position resulting from each of its legal moves in the starting position, and to keep those new positions in memory. They are called successor positions. The computer then generates all the successor positions to the successor positions, and so on, for the number of ply to be included in the search. In doing all this, the computer builds up a tree in memory. If a computer searches from a given position to a depth-of-three ply, and there are three legal moves at each ply, the tree would be structured like the one in Fig. 1.

Searching for a good move in this fashion is called a breadth-first search, because each ply, or level of the tree, is generated in full before going on to the next level. As you will see, a breadth-first technique is not a very suitable one for a chess-like application.

Each level of the tree represents a ply. Every circle is a node, representing a possible position that can occur in the game at that ply. The root, which is at the top, is the current position and requires no look-ahead to generate. That's why I've labeled it ply zero. Level one represents all the positions generated in the first ply. This is what the computer sees when it looks ahead one move. Assuming it's the computer's turn to move, it will also be the computer's turn in all even-numbered plies. Odd numbered plies are the opponent's turn to play.

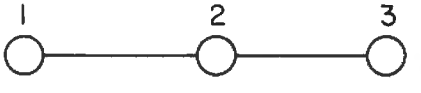

Fig. 2

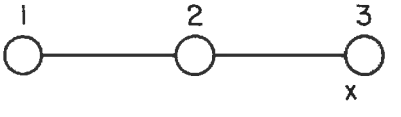

Fig. 3

The positions at the deepest ply of the tree are called terminal nodes. These represent the deepest level of look-ahead employed by the program. Hence, they are the key positions in the evaluation process.

When a program evaluates a position, it looks at a large number of terminal nodes resulting from different lines of play. A judgement must be made about the merits of each terminal position in order to choose the best line. This judgement, or evaluation, needs to be expressed as a numeric quantity which can be compared with the evaluations of other positions to determine which is best. A simple chess evaluation might be a piece count to see who's ahead in material. A more sophisticated evaluation would also take mobility and other positional considerations into account.

Notes from BENEATH the KEYBOARD

Obviously, the more comprehensive and well-designed the evaluation, the more accurately it will reflect a position's value. But a simpler evaluation might result in a stronger program. This is because of the time needed to complete a lengthy evaluation routine for every terminal position. As you can see from Fig. 1, the increase in nodes per ply is geometric.

Looking ahead only three ply with three options per position, the computer has 40 nodes to generate, 27 of which are terminal nodes in need of evaluation. Let's consider a more realistic chess situation. Suppose the computer is trying to look six ply ahead (that's only three chess moves, not very deep!), and there are an average of 25 legal moves per position in the tree. The number of terminal nodes would then be. . . Hmm, my word processor doesn't seem to have a number-crunching mode. I'll be right back, don't go away.

Hi there! Regards from Disk Basic. As I was saying, that would be 244,140,635. That's almost a quarter of a billion terminal nodes, but only three chess moves deep! So, in actual tournament competition, a quick and dirty evaluation often will prove superior to a smarter but slower one. A major part of the programmer's expertise consists of being able to choose an optimal trade-off between time and intelligence factors.

The tree's explosive growth rate also makes a breadth-first search too memory costly. The alternative is a depth-first search. When combined with alpha-beta pruning, a depth-first search not only requires a fraction of the memory, but also drastically reduces the number of terminal nodes evaluated. This frees up time for the CPU to look farther ahead, or to look just as deep but with a more elaborate terminal evaluation algorithm.

Wiener's Magic Cave

Let's play Adventure. I'll be your eyes, and you'll be my hands. We're in a room in a cave. Before us is a tree-like network of interconnecting tunnels. A sign on our left says "Egress Within Three Truths." We interpret this to mean we can reach the surface without having to make more than three correct turns. In other words, if only we knew the way, we wouldn't have to pass through more than three tunnel intersections.

An inventory of our possessions reveals that we have no map, but we do have a lit candle, a piece of chalk and a small chalkboard. We are determined to escape the cave, hopefully, before our candle burns down.

Here's a technique that would get us out—eventually. First use the chalk and board to draw a map. It won't be of the entire cave, or even of all the parts we explore. It will only show one stretch of tunnel with three intersections. It will, in fact, look like Fig. 2.

Start down the tunnel. Each time we come to a choice of directions, use the chalk to mark the passage we used to enter the intersection. That's the passage leading back to the precurser junction, and eventually to the starting point.

At each junction, take the leftmost turn available. Keep a tally of how many intersections we've passed through. When we reach the third intersection, take the leftmost branch as usual. Soon we reach another intersection, but are still in the cave and don't see daylight. Since we weren't supposed to have to make more than three correct choices, we know that somewhere we've taken a wrong turn. At any rate, the turn we made coming out of the last intersection definitely didn't lead us to light.

Node three on our map represents that last intersection. Make a little x on the map next to node three to indicate that the first way out is a failure. It should look like Fig. 3. Turn around and go back, until we're in junction three again.

Find the exit from this junction that has our chalk mark. This is where we originally came in from. Put our back to this exit so we'll be facing the same way we were on our first trip through. Now, consulting our map, a little x tells us that one path out of this junction has already been eliminated. This time we'll take the second leftmost tunnel out of the junction. If we eventually get to another junction without seeing daylight, we'll know we've blown it again, but at least we will have eliminated another false trail. Make a second x next to node three and back up again. This time we'll try the third leftmost exit out of junction three.

Suppose there are only three tunnels out of junction three (not counting the one we come in by). Also assume none of them lead to the egress. All three of them will now have proven useless to our quest. The next time we arrive in this junction, our map will have three x's, indicating the first three paths have been eliminated. But a glance shows us that there aren't any more exits from this crossing! What to do?

Now we know the leftmost path we've been taking out of junction two is wrong because it leads us to junction three, which has proven a total flop. So put another little x on the map, but this time next to node two. Then re-initialize node three by erasing all its x's.

Now back up to junction two, turn around, and get ready to leave it again. Our trusty map tells us not to take the leftmost choice, but the second leftmost. Doing so brings us to a section of the cave we've never seen before. When we reach the new third junction, a glance at our map's re-initialized node three reveals no

57	58	59	60	61	62	63	64
49	50	51	52	53	54	55	56
41	42	43	44	45	46	47	48
33	34	35	36	37	38	39	40
25	26	27	28	29	30	31	32
17	18	19	20	21	22	23	24
9	10	11	12	13	14	15	16
1	2	3	4	5	6	7	8

Fig. 4

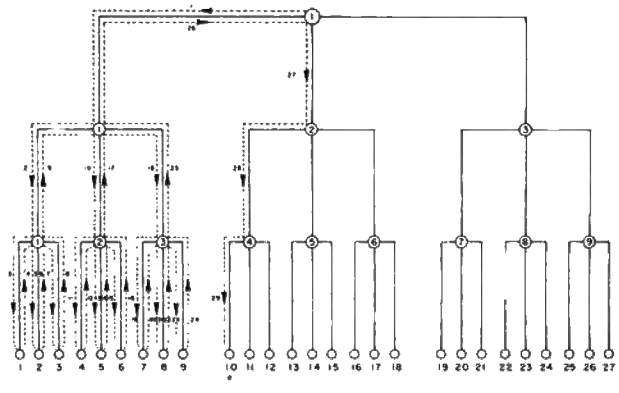

Fig. 5

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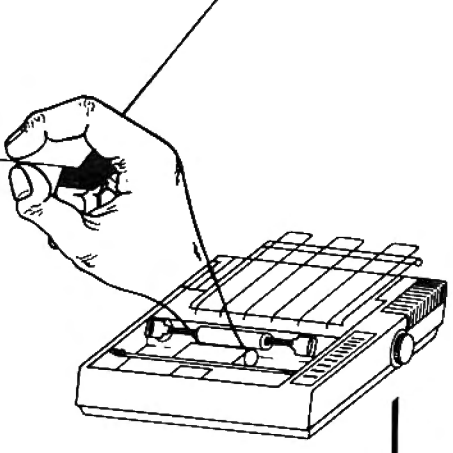

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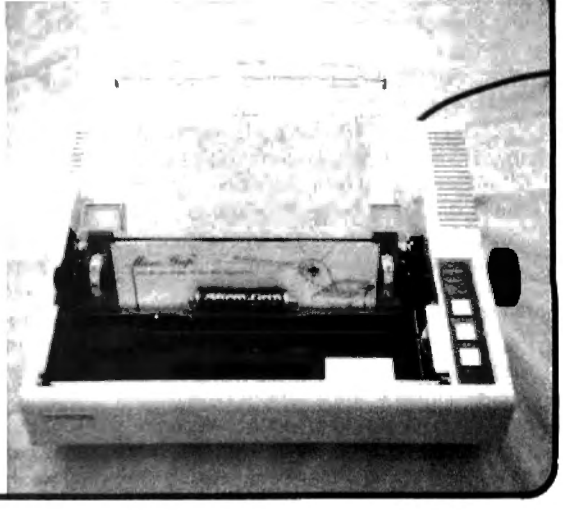

x's. This tells us to once again try the leftmost choice at this point.

And so it goes. After all the options have been eliminated at junction number two, we place an x near map node one and re-initialize node two. Then we back up to node one, our starting point.

One minor variation from our routine would occur if we were to encounter a dead end early in our search. Suppose that on our very first pass through the cave, we took the left most turn out of junction one and ran smack into a blank wall. All we'd have to do is put an x near node one on our map. This would ensure that we never pursued that fruitless first left turn again.

If there is truly an exit within our search range, this exhaustive method is guaranteed to find it. It might take a long time, but in a way, it's quite elegant. Regardless of how many zillions of tunnels were in need of exploration, we wouldn't need a big map or an exceptional memory to keep from going in circles. All we'd need would be a map with enough room for a little information about each level (or turn) generated.

In our case, we only needed room enough to draw three circles. We'd also need an unambiguous way of ordering our choices so that we could identify those branches as yet untried. In our chthonian exploit, the leftmost criterion provided a satisfactory method of ordering.

This may not come as a great surprise to you, but the procedure described above is analogous to a computer doing a three ply depth-first search. The computer has its own way of ordering legal moves. It might be an arbitrary method or a smart one. We'll consider the advantages of intelligent ordering in a little while. Let's first look at arbitrary ordering.

Ordered Move Generator

Start by numbering the squares from 1 to 64. See Fig. 4 for a numbered chess board. Once the square ordering has been established, start on square one. If square one is occupied by a piece belonging to the player whose turn it is to move, generate all the legal moves available to that piece. The move which would put the piece on the lowest numbered square is the first move. The move which puts it on the second is the second move, and so on.

When all the moves from square one have been catalogued, repeat the process for square two. Suppose the highest numbered move from square one was n. Then the lowest numbered move from square two will be numbered n plus 1. Repeat for all 64 squares and you'll have an ordered list of legal moves for the given position.

Let's see how this all works out with a tree like the one in Fig. 1. Notice that the tree has a total of 40 nodes: the starting node, three first-ply successor nodes, nine second-ply successor nodes, and 27 third-ply successor (and in this case terminal) nodes. With the help of our magic cave algorithm, the computer will be able to explore all this tree space without using much memory.

To start with, we'll need to store the number of x's at each ply. Since the computer can't make chalk marks pointing the way back, we will also have to save the game position at each ply. This will let us back up from false starts. Only three board positions (plus the starting position) need be stored in memory at one time. The stack may be conveniently used to store the current position at each level. When we go forward through the tree, we push the position we are leaving onto the stack. To back up, we pop the information for the previous ply off the stack.

Doubling the number of plies in the search only (roughly) doubles the amount of memory required, though the search time still mushrooms. That six-ply chess search we considered before could be accomplished with enough memory to buffer seven board positions (the starting position and six ply positions) and some additional data about each position. This is quite an improvement over needing to keep hundreds of millions of positions in memory at once!

Another necessity is a terminal node evaluation algorithm. For the great cave escape, you need only check for a visible exit. If there is one, assign that terminal node a one, otherwise, assign it a zero. Fig. 5 shows our tree again. This time an e has been put next to one of the terminal nodes to indicate that it contains the escape hatch, and our explorer's depth-first path through the cave has been indicated. If the search terminates when the egress is reached, the information currently saved for each ply will have drawn an implicit map pointing straight at the egress.

There are several differences between this search and one used by a computer playing chess. First of all, in a chess game there is no guarantee the search will terminate within a given number of ply. In that sense, our cave search is more analogous to solving a chess problem. A mate in two consists of three plies—I move, you move, I move, checkmate, too bad. So our underground adventure is somewhat analogous to solving a mate in two.

Another shortcoming of the analogy is that it doesn't take into account the fact that the opponent is trying to foil our plans. In the cave, we could take any turn we wanted. But in a chess game (or problem), the opponent will use his moves to steer the game away from our goals. What our cave analogy really depicts is a solution to what chess enthusiasts call a helpmate problem, one in which the opponent cooperates in picking the moves which bring about his demise.

Our cave trip involved a two-value terminal node evaluation algorithm—either we found an exit or we didn't. This is also fine for a help mate—either the final move checkmates, or it doesn't. But in a real game, two values wouldn't be enough to help select the most promising move.

We'll continue this look at the competitive tree searching algorithm, in more depth, next month. Now for the news...

The Second North American Computer Othello Championship

The tournament took place on May 15th and 16th near Chicago at Northwestern University, the home of former world champ, Chess 4.5. The list of 14 competitors was impressive: eight micros and six mainframes. The mainframes competed from remote locations via phone link. One was a CDC CYBER 170/730. Other mainframes competing were a Data General MV/8000, an IBM 3033, a MODCOMP XTL, a Hewlett-Packard 3000, and a DEC 20.

The list of competing micros contained two Model I TRS-80's running at 5.3 megahertz (with the help of Archbold modifications), a Commodore 8032, an *Apple II*, an Atari 800, a Heath 89, an Ohio Scientific CIP, and a Hewlett-Packard 9826. The latter is an impressive piece of hardware. It's got an 68000 running at eight megahertz with a 128K RAM minimum configuration. It costs about $10,000.

Four countries were represented. Most of the programs were written by American programmers. Programs were also sent from Switzerland, Holland and Norway.

Microcomputers dominated the event. More specifically, TRS-80s dominated the event. The best a mainframe did was tie for fifth through eighth prize (with two other mainframes). The winning program was an experimental one written by Charlie Heath, author of Instant Software's Master Reversi program. It ran on a triple-speed TRS-80—mine.

The Swiss program, by Ander Kleruif, came in second, running on a Commodore. The pretournament favorite, Peter Frey's Odin, came in third. It ran on the other TRS-80. All in all, it was a very exciting event, enjoyed by all present.■

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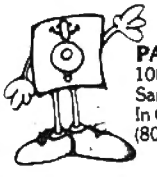

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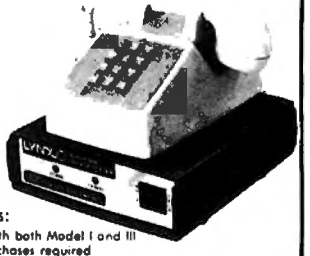

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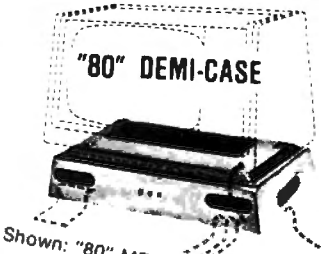

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80 APPLICATIONS

by Dennis Kitsz

Hi. I'm back with the exciting conclusion of the homebrew ROM pack project for the Color Computer, printed circuit layouts and all.

If you'll recall last time, (way back in March), I presented several techniques for decoding the ROM pack memory of the TRS-80 Color Computer, an open area that extends from $C000 to $FEFF (decimal 49152 to 65279). By the way, when speaking about the Color Computer, I'll use the format $0000 for hexadecimal numbers instead of 0000H, since the former is the standard method used for the 6809 central processing unit. Each decoding technique presented in March has advantages, such as construction simplicity or protection of the CPU from overexertion.

Such strain is serious on the Color Computer. I'll tell you what happened when I overextended the CPU in my Color Computer. . . silent death. In testing one of my ROM boards, I plugged it in upside down *and* with the power on. Real smart. Gone in two seconds it was. Unlike more rugged machines, the Color Computer has no electronics in between the 6809 CPU and the expansion connector. Additional integrated circuits to buffer the signal would have protected the computer user's pocketbook, since 6809s are $20 a pop.

But back to the main topic. Several techniques were presented specifically to protect the CPU from this expensive strain. For this month I have prepared a printed circuit layout incorporating some of the best features of all the methods—it accepts either four 2716 2K-byte EPROMs (erasable, programmable read-only-memories) or four 2732 4K-byte EPROMs, and it uses only a single integrated circuit to select the memories.

Figure 1 is the EPROM selection circuitry, a 74LS138 demultiplexer, together with a few jumpers. I want to describe the selection process slowly, because the use of a demultiplexer to do electronic acrobatics is very satisfying, but takes some getting used to.

Recalling the job of a demultiplexer: it accepts a group of input signals, and from that information creates a unique output signal. In the case of a 74LS138, there are four inputs—one selects the 74LS138 itself, and the other three are decoded into an appropriate output. This circuit turns on an output in simple binary sequence, as in Table 1.

This pattern is perfect for any job where selection must be done sequentially. Consider next the question: What is to be selected? The multiplexer can be used with a variety of signals, but for ROM packs the use will require choosing sequential addresses. To select individual addresses is simple—use the lowest three address lines (A0, A1 and A2). Using A1, A2 and A3 will select two-byte blocks; using A2, A3 and A4 will select four-byte blocks. A3, A4 and A5 used with the 74LS138 select eight-byte blocks.

If this isn't clear, then consider that any contiguous group of addresses is a kind of window looking out over the whole memory map. The higher the window, the more of the memory vista comes into view. Looking into addresses 0, 1 and 2 gives the most limited view (one-byte blocks). Looking at addresses 13, 14 and 15 gives the widest view (8,192-byte blocks).

Transfer this to the problem at hand. The 16,384 addresses $C000 to $FFFF must be decoded; actually, the range is allowed to include only up to $FEFF, but the CTS* signal we are using turns off the topmost block automatically and can be ignored. What bits do not change over this entire range? Well, $C000 converted to binary is 1100 0000 0000 0000 and the ROM

Decoding Pattern of a 74LS138 Circuit.
Chip is Selected
(Pins 4 and 5 are low, pin 6 is high)

Input Pattern C B A	Output Selected Number:	74LS138 Pin Number:
0 0 0	0	15
0 0 1	1	14
0 1 0	2	13
0 1 1	3	12
1 0 0	4	11
1 0 1	5	10
1 1 0	6	9
1 1 1	7	7

Table 1

$C000	(11)	00	0000	0000	0000
$C7FF	(11)	00	0111	1111	1111
Common:	(11)	00	0...	....	....
$C800	(11)	00	1000	0000	0000
$CFFF	(11)	00	1111	1111	1111
Common:	(11)	00	1...	....	....
$D000	(11)	01	0000	0000	0000
$D7FF	(11)	01	0111	1111	1111
Common:	(11)	01	0...	....	....
$D800	(11)	01	1000	0000	0000
$DFFF	(11)	01	1111	1111	1111
Common:	(11)	01	1...	....	....
$E000	(11)	10	0000	0000	0000
$E7FF	(11)	10	0111	1111	1111
Common:	(11)	10	0...	....	....
$E800	(11)	10	1000	0000	0000
$EFFF	(11)	10	1111	1111	1111
Common:	(11)	10	1...	....	....
$F000	(11)	11	0000	0000	0000
$F7FF	(11)	11	0111	1111	1111
Common:	(11)	11	0...	....	....
$F800	(11)	11	1000	0000	0000
$FFFF	(11)	11	1111	1111	1111
Common:	(11)	11	1...	....	....

Table 2

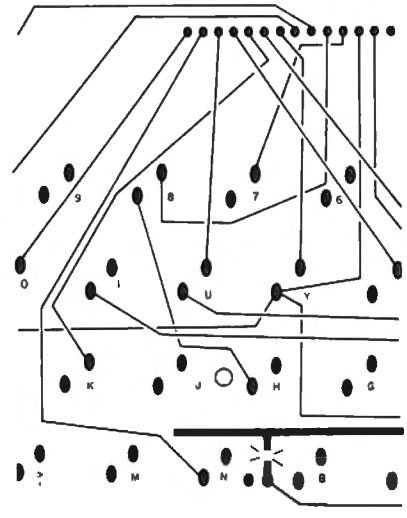

Figure 1

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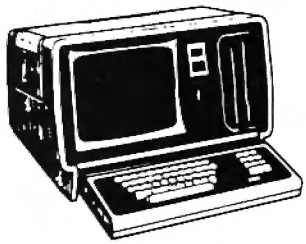

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pack memory area counts up to binary 1111 1111 1111 1111 ($FFFF). The only bits that remain the same over the range are the two highest bits (A15 and A14) which are both set to 1. CTS* takes care of this entire part of the decoding, and it is available to us at the Color Computer's edge connector.

Now with 16K of ROM pack memory available, how can it be broken up into appropriate blocks? If the blocks are 2,048 bytes in size, then there are eight blocks in all; they are: $C000-$C7FF, $C800-$CFFF, $D000-$D7FF, $D800-$DFFF, $E000-$E7FF, $E800-$EFFF, $F000-$F755, $F800-$FFFF. Take a few representative blocks and see what bits the individual blocks have in common (other than A15 and A14, which are already decoded by CTS*). See Table 2.

In the case of 2K-byte blocks, three bits (address bits A13, A12 and A11) identify the block. If you isolate these three-bit groups, you discover they neatly count upward from 000 to 111 in binary. Therefore, feeding these address bits to the 74LS138 demultiplexer will result in signals which can be used for decoding eight 2K-byte blocks of memory. Perfect for 2716 EPROMs, which have addresses bits A0 to A10. You just have to remember that, although eight EPROMs is a theoretical maximum, for safety only four can be hung directly on the Color Computer's CPU.

So how about decoding four 4K-byte blocks to use 2732 EPROMs? First, have a look at the blocks' addresses: $C000-$CFFF, $D000-$DFFF, $E000-$EFFF and $F000-$FFFF. And then take a look through the "window" at the common bits (see Table 3). This time, only bits A13 and A12 are in common in each block. But the 74LS138 requires *three* inputs, and the 2732 memory uses A11. How can this demultiplexer be used here?

A little imagination lets the 74LS138 do the job anyway. First of all, address line A11 can be disconnected from the 74LS138 and fed directly to the 2732, as it should be. A13 and A12 are fed to the 74LS138, exactly as they were before. And the first input to the 74LS138 is *held high*. What does that do? Look at Table 4.

Notice that input A is always a "one" (high). Since input A doesn't change, only four patterns can be produced when this is the case (instead of the eight patterns shown in Table 1). Therefore just four outputs will ever be used on the 74LS138, and these can be used to select one of four 2732 4K-byte memories.

Look again at Fig 1. To use 2716s, then, address 11 (marked Y) is connected to input A (marked X); pin 15 (marked V) is connected to EPROM A (marked U), pin 14 is connected to EPROM B, pin 13 (marked S) is connected to EPROM C (marked R), and pin 12 is connected to EPROM D. All EPROM programming pins (Vpp, marked Z) are held high by a 1K resistor.

To use 2732s, address 11 (marked Y) is connected to all 2732 A11s (marked Z); pin 14 is connected to EPROM A, pin 12 is connected to EPROM B, pin 10 (marked T) is connected to EPROM C (marked U), and pin 7 (marked Q) is connected to EPROM D (marked R). Input A of the 74LS138 is held high by a 1K resistor.

Building the Board

This is a double-sided, compact circuit design, and is not simple to construct. If it is your first project, don't. Boards—blank, with sockets, and/or in cases—are available from MSB Electronics, Drawer 766, Barre, Vermont 05641, (802) 476-7311.

If you decide to go ahead with the project, you'll need lots of patience and care. First of all, obtain sensitized double-sided printed circuit board, or sensitize your own. Sensitized board, sensitizing chemicals, developer and etchants can be obtained from Kepro Circuit Systems, 630 Axminister Drive, Fenton, MO 63026, or from Vector Electronics Company, 12460 Gladstone Avenue, Sylmar, CA 91342.

For details on producing printed circuit boards, refer to this column in *80 Micro*, December 1981. In addition, these hints will help you with the double sided boards, presented in Figs. 2 and 3:

1. Have a good negative made of these patterns using professional copying equipment. A local graphics shop or

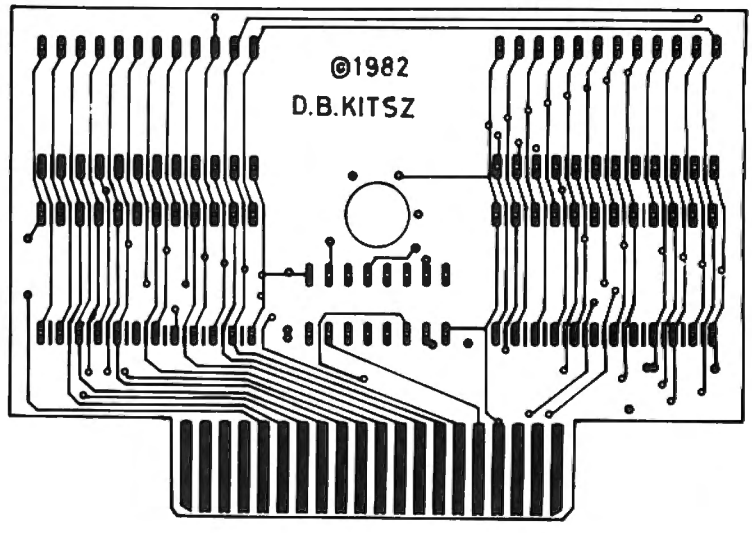

Figure 2

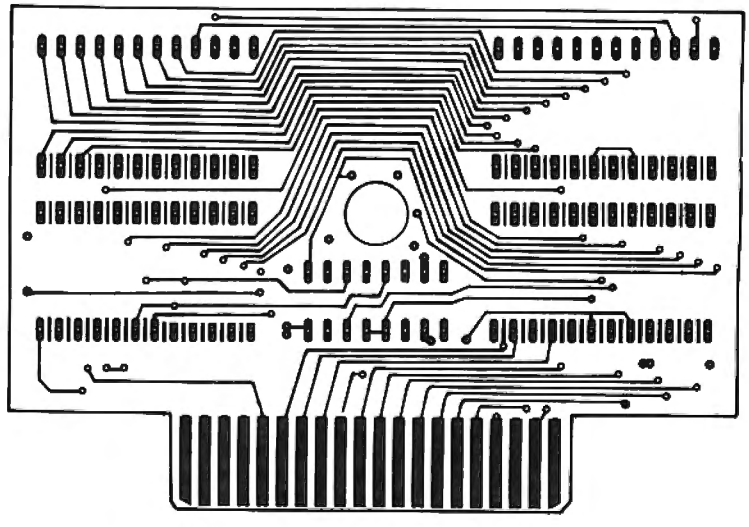

Figure 3

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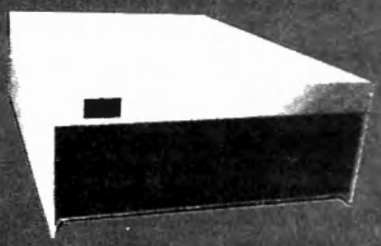

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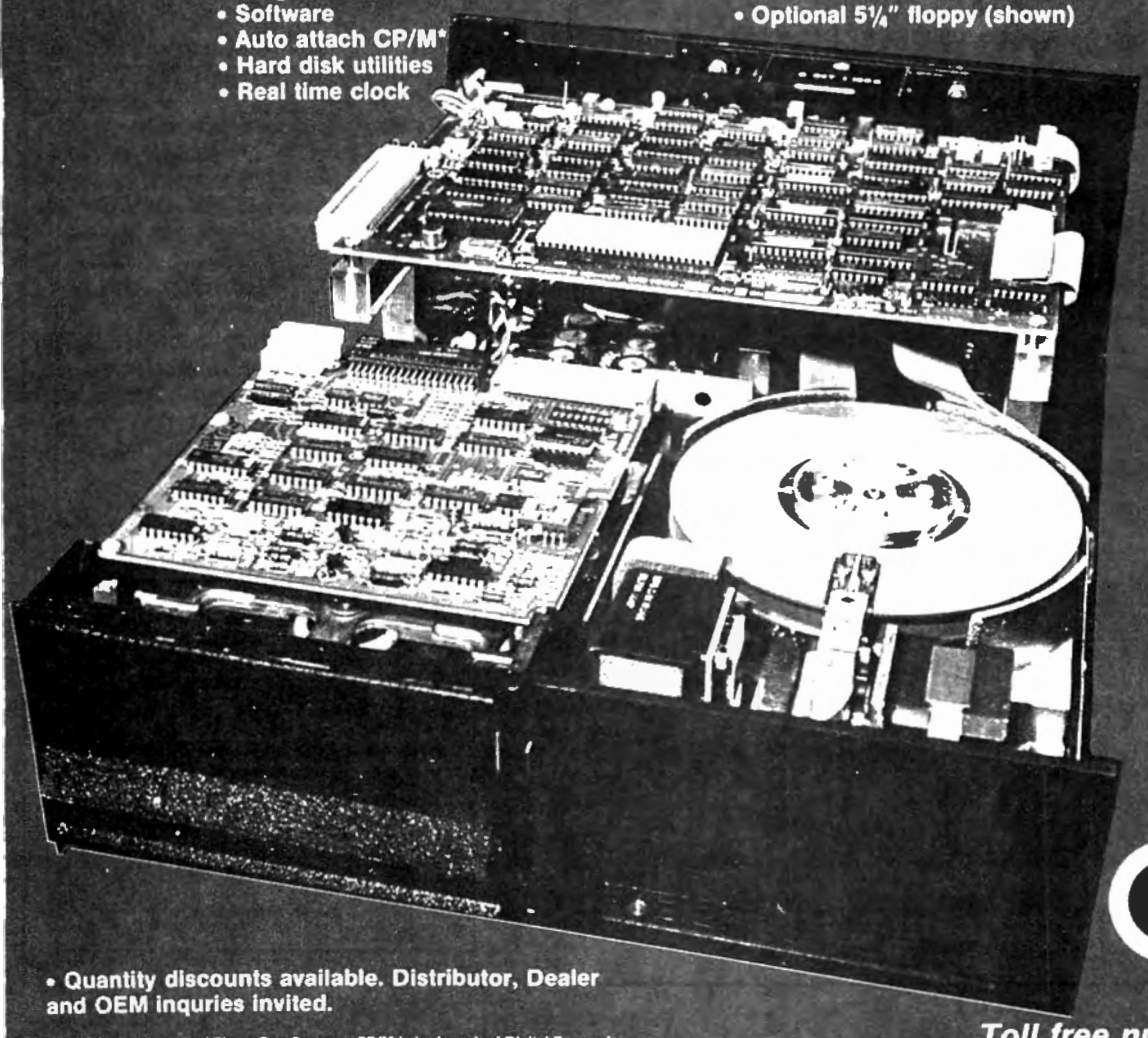

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newspaper can help out.

2. Line up the negatives and verify the alignment, then tape them together along two perpendicular sides. This forms a pocket into which the sensitized board can be inserted.

3. Use a vacuum table or high-quality photo proof frame for exposure, and use a carbon arc lamp if possible.

4. Make sure both your developer and etchant are at the proper temperature; cool etchant will leave solder hairs and warm etchant will remove the emulsion and break traces.

5. Use a #68 drill bit for integrated circuit pads and a #72 drill bit for through-holes.

6. Solder a wire very carefully to both sides of all through-holes. Solder sockets and the integrated circuit to both sides of all pads, as shown in Fig. 4.

7. Wash a light plating of solder across the edge connector contacts, and clean the flux off.

8. Test for shorts before inserting the cartridge for a test.

By the way, this board will fit inside Radio Shack's ROM pack cartridge shells if you cut out the center hole. In two months (see the end of the column), I'll present some software in ROM, four additional output ports using 6821 peripheral interface adapters (PIAs), and some other interesting items.

Misinformation and Silliness

In the past few months speculation and rumor about the Color Computer have proliferated. Misinformation and silliness have been perpetrated everywhere, and Color Computer users are the victims. I'd like to risk making some observations.

I'll start with publisher Wayne Green's "Remarks" in the January *80 Micro*. Now maybe Wayne is right when he says that Tandy Corporation might phase out the Color Computer; eventually, that's inevitable. He's certainly right when he says that whatever the situation, Fort Worth wouldn't acknowledge the whens and whys.

But when he bases his views about the popularity of the Color Computer on author submissions to *80 Micro* and Instant Software, the logic turns into hunch. Until recently, *80 Micro* simply hasn't been the place to look for Color Computer information, if I'm to believe Color Computer users with whom I've spoken. These people subscribe to *Color Computer News, The Rainbow, 68 Micro Journal,* and *Compute*. The latter magazine even expanded its coverage from 6502 systems to include 6809 systems in order to keep pace with the demand for information on the Color Computer—information that couldn't be found elsewhere.

No software? Just walk into any computer store, even those here in Vermont,

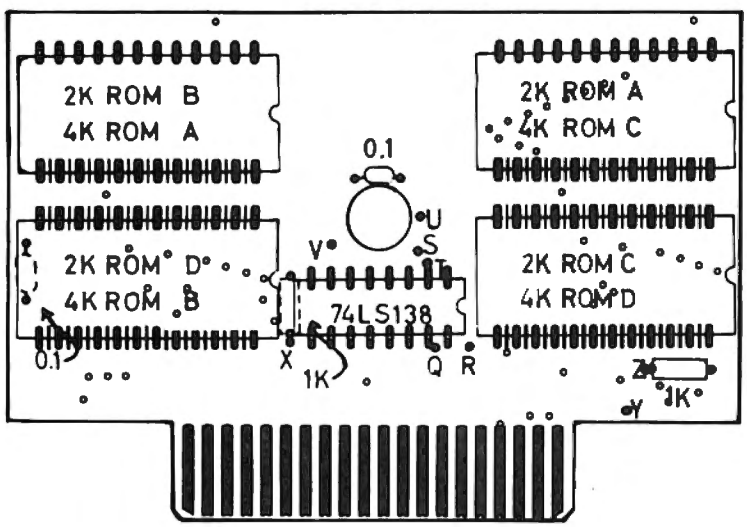

Figure 4

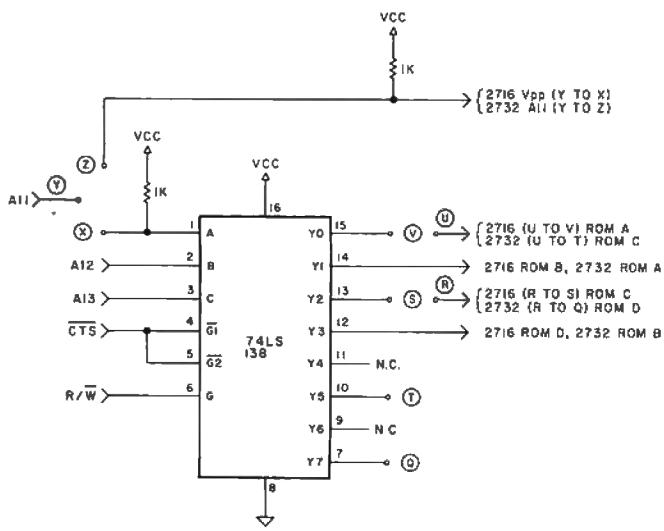

Figure 5

$C000	(11) 00 0000 0000 0000
$CFFF	(11) 00 1111 1111 1111
Common:	(11) 00 ....
$D000	(11) 01 0000 0000 0000
$DFFF	(11) 01 1111 1111 1111
Common:	(11) 01 ....
$E000	(11) 10 0000 0000 0000
$EFFF	(11) 10 1111 1111 1111
Common:	(11) 10 ....
$F000	(11) 11 0000 0000 0000
$FFFF	(11) 11 1111 1111 1111
Common:	(11) 11 ....

Table 3

Decoding Pattern of a 74LS138 Circuit.
Chip is Selected
(Pins 4 and 5 are low, pin 6 is high)
(Input A is held high)

Input Pattern C B A	Output Selected Number:	74LS138 Pin Number:
0 0 1	1	14
0 1 1	3	12
1 0 1	5	10
1 1 1	7	7

Table 4

whose total population is a fraction of just the work force in Silicon Valley. The walls are covered with Color Computer software—most of it far more sophisticated than what was available for the Model I at an equivalent stage of its existence.

Furthermore, Radio Shack's disk interface is here. It works and, with it, support from Fort Worth seems to be increasing. Exatron—home of the Stringy Floppy—has introduced disk interfaces and its own CCDOS; ROM packs are appearing from every direction. Hardware upgrades are being produced, and a full-blown Flex operating system ("the CP/M of the 6809") is being introduced as you read this. You can obtain assemblers, text editors, monitors, control packages, and software of every dimension.

Why is this? Probably because the Color Computer contains a 6809 processor—and most of the current generation of microprocessor programmers spent a lot of time learning what they know on its ancestor, the 6800. They're not Z80 graduates, so the "80" in *80 Micro* is a natural barrier to Color Computer article submissions.

If Radio Shack decides to phase out the Color Computer—perhaps because it plans to push its "Model 16," or whatever the new 16-bit, multi-processor personal monster is to be called—it isn't because the user base was missing. But then I have about as much inside information as Wayne does when it comes to Radio Shack marketing strategy... and I'm just guessing.

The little information I do have came from an enjoyable phone call with Jon Shirley, Vice President of computer marketing at Tandy. He was open and helpful, contrary to the picture painted of mysterious Tandy Towers. Yes, the intended market for the Color Computer was a popular one. Yes, the number of serious users was a surprise. Yes, these Color Computer users will receive Shack support, too. That news is more than welcome. I believe Jon Shirley.

But in December's *TRS-80 Microcomputing News*, one of Radio Shack's unnamed authors took a gratuitous slap at those who try to assist users with new approaches, fixes, and upgrades. Some of us happen to believe that the Shack—a relative latecomer to digital equipment—isn't the only font of hardware and software wisdom, nor necessarily of philosophical validity. So we get weary of Tandy Tower's suggestions that non-Shack peripherals, upgrades, modifications, and other enhancements are going to screw up users' machines. Because of the distinct information vacuum maintained by Radio Shack about its plans, you can expect other publications to support the machine. In the past, most of them have been right on the mark, even where Tandy folks were wrong or at best clandestine. We authors—regular columnists or occasional contributors—do a good job. We have to, or we'd get raked over the coals in print. The Tandy boys aren't going to publish self-criticism in their newsletter.

You think I'm blustering? You'd like a case in point? Let's get this one straight. There is no such thing as a 32K RAM chip, and the anonymous author of "Rumors, Rumors" (*TRS-80 Microcomputing News*, page 34) better shape up if he wants us to believe he's got better information than we "experts" do. Here's the real story, folks. Currently being produced are three

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major kinds of dynamic memories: 4K and 16K dynamics, and 64K dynamic/pseudo-static memories. Now, either Radio Shack is putting in top-of-the-line 64K memories and wasting half of them, or somebody gave them a deal on 64K "dropouts"—you know, where one bank of the memory inside the chip doesn't work, and you get them cheap from a supplier who would otherwise dump them into scrap barrels. Then you arrange to have them marked to your specifications, and zap!, instant 32K chips are invented.

Frankly, I don't believe that's what Tandy is doing, and recent units suggest that prime 64K chips are used throughout. I was skeptical about this, too, since it looks like dropouts are what the Tandy folks bought for the original character generator with a bum lowercase "a" in the Model I—until they got caught when users started installing their own lowercase. (If you want to read about Radio Shack getting caught with its hands in the cookie jar, read *Opinion 80,* #2, December 1981, published by The Alternate Source.) At first, funny RAMs probably explained why you find a "bank select" jumper in the E revision boards of the Color Computer; if both banks work on the 64K memories, why bother with the jumper? If you're the company that got the deal, you had better know which bank of your chips works and which doesn't, right? Let's quash that rumor now—as far as my sources can tell, all of those 64K RAMs are good in new units.

Yet as the Tandy writer says, I can't tell you "what standards or specifications those chips have to meet to be used" in TRS-80 machines. But who says those standards are higher or lower than off-the-shelf ones? If I were the Tandy engineers, and knew that the Color Computer only needed half of a 64K RAM, I'd probably be tempted to buy dropouts for just that reason. If I'm running a company that advertises a 32K RAM upgrade, that's all the buyer should expect to get; I can understand that viewpoint. But I think they should come clean with exactly what's inside their product, and not call these things "32K" RAMs when they aren't.

Frankly, the Shack writer's analogy that buyers don't need to know the weight of cardboard in record jackets and the color of the label is inappropriate and simplistic. I don't worry about plastic in the Color Computer case, or the color of the keycaps. The real, unclouded, indisputable issue is this: Exactly how much hard information am I allowed to have about a product on which I've spent hundreds of dollars? And how much has Tandy Towers told us?

The answer to the first question depends on whom you ask. No matter what I buy—amplifier, toaster, recording tape, car, bread, typewriter, water pump, garden seeds, photochemicals—I expect to be able to discover all the information necessary to use and maintain the product myself. If my big-boy tomatoes won't grow, I want to know why; if I want them bigger, I want to know how. I want my stereo manufacturer to tell me what to expect from my system, and I subscribe to audio magazines to tell me how to improve that system. I know that the formulas for my photo chemistry will be available if I ask for them. And since I drive an 18-year-old car, I have to have enough information to keep it going myself.

Here's my point stated another way. Perhaps America has become a throwaway culture; but where I live in New England, that unfortunate attitude hasn't caught on. The motto here is "use it up, wear it out...then use it for something else." I repair 20-year-old table radios for townfolks because they would rather pay for a repair than spend the same amount on a new radio. Model I owners still feel the same way, because—judging from my reader survey—they feel threatened by Radio Shack's abandonment of the product. So they're hungry to know everything they can.

But what has Tandy told us? Actually, they have revealed quite a bit. Their service and technical manuals are excellent examples of product support—far superior to anything you get from other manufacturers. Commodore, Apple, and all the rest hold the information close to their chest, but Radio Shack comes straight out with schematics, memory maps, technical descriptions, and detailed specifications. The Model II manual is a true star, with all the manufacturer spec sheets included.

The problem is not how they describe, but how they support the product. It's nothing new when manufacturers say "use only Squat brand whatsis in this fine Squat dingus." But the Squat salespeople usually can tell you if a non-Squat whatsis will work with a Squat dingus. Tandy not only doesn't want to tell you; it won't tell you, and most of its sales and service force can't tell you. Those who can will—on the side. But there are encouraging examples: A few managers were brazen enough to use the NEWDOS operating system in place of TRSDOS at a computer show, simply because NEWDOS wouldn't crash the software they were demonstrating. These salespeople had computers to sell, not paranoid philosophies to follow.

Okay, back to the main subject. The writer goes on to say that "there's nothing wrong with the 1.0 version (of the Color ROM) in the Color Computer." Maybe not, but that version did have to be patched to use their own line printer's graphics. There are changes in the joysticks, and doubtless a host of small changes (I wish they'd cure the need for spaces after variable names before keywords!). But most important is what the author left out: The 1.1 ROM has a different initialization routine to inform the synchronous address multiplexer (SAM) whether there are 64K RAMs installed in the computer!

The reason for Basic 1.1 can be pieced together from the evidence: The original Color Computer technical manual didn't have 32K upgrade circuitry, which suggests either they weren't planning an expansion, or were going to use a piggyback method, since the 1.0 ROM could support nothing but 4K or 16K memory chips. But the Shack had to make the upgrade easy and cheap for them and still justify the hundred bucks it cost the user. The answer evidently lay in the 64K chips, and new ROM support. In the process, some 1.0 inefficiencies were cleaned up—like not supporting their own line printer completely.

Oh yes. The newsletter author can't guarantee that the 32K piggyback will work with the 1.1 ROM. Well, it does work, and he's welcome to come see functioning units the next time he's in Vermont. With thousands of users going the piggyback route, it would do the Tandy people a world of good to take a look at it. But then, maybe they did look...and these are scary words to keep wavering users in the Shack flock.

Remember, we non-Tandy "experts"—whom Radio Shack's anonymous author derogates—are the same experts who brought users what they wanted: the first Model I and Color Computer lowercase; the first revelation of all the disk system mysteries; the first debugged disk operating systems; reliable faster CPU speeds in both Model I and Color; memory upgrades for all machines; working system expansions for Model I; almost everything that's an upgrade in the Model III; double-density disk systems; and more.

When you read the Tandy comments, remember that the non-Shack experts also told you what was really wrong when your memory crashed, or when your keyboard bounced or stuck, or when your tape wouldn't load. And told you how to fix the problems long before the Shack did. But we didn't do it Tandy's way—which means that when they eventually got around to it, their method was the so-

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called "standard." Now *their* 32K upgrade (*nine months* late) is the "standard." Curious how they insist on setting post facto standards.

I started this tirade by suggesting that misinformation and silliness was rampant. I think all of us could do well to re-examine our reactions. Radio Shack should loosen up and recognize printers like Epson, storage devices like the Stringy Floppy, and the host of significant non-Tandy peripherals. They can draw the line wherever they want to. Non-Shack suppliers should stop knocking a hierarchy-bound company for things it can't help, and encourage Tandy to come up front without worrying about being torn up by criticism.

"I took out my nippers and made the same cuts. . . . everything was perfect."

Reader Survey Results

What a change. Last year, two dozen people responded to the reader survey. This year, nearly 500 suggestions arrived. . . and the results were surprising. Color Computer, 68%; most of the rest Model I (one LNW user, and three Model III users demanding I buy one). Hardware and software split right down the middle for both computers.

Among the suggestions for the Color Computer: an EPROM programmer; lots of Assembly language utilities; real-world interfacing; a way to add more RAM, or bank-select blocks of it; 64- or 80-column screen (see last month's Exclusive Oracle for more on that topic); Atari-style joysticks (sounds good); speech input (see Bill Barden's article in the February issue of *Byte*); an external calculator keyboard; system diagnostics; a parallel printer interface; a bar code reader (not likely in this column, sorry); CPU speed-up (see updates below); a real-time clock; a light pen; and many more.

Although Model I owners had very few suggestions, they seem to have progressed since last year, with requests for double-density disk controllers (out of the range of this column); a Model III ROM upgrade for the Model I (perhaps); system reliability enhancements; more machine language utilities; a CP/M modification.

One reader expressed a list of Model I needs: a high-resolution color display, an EPROM bootup, a ROM pack for games, analog input, a faster processor. Model I owners, hear me! I've got a Model I, as you all know, and I love to use it. I'm writing this article using it. But I got a Color Computer precisely because I wanted what this reader wants. . . and instead of defending the Model I where it is basically indefensible, I joined those who added an inexpensive Color unit to increase computing power.

Color Computer High-Speed

Color Computer high speed: A gentleman whose letter I have misplaced (drop me a card so I can let the readers know who you are) wrote questioning my recommendations about Color Computer high speed problems. He asked, why replace the PIA's and/or RAM if they never run at high speed? He just cut a couple of capacitors and the computer worked fine. I had another look at my schematic; his cure was better, so here it is, with some explanations:

The four speed modes in the Color Computer are controlled by the synchronous address multiplexer (SAM). The memory map is divided into two sections, RAM and ports (hex 0000-7FFF and FF00 to FFFF) and ROMs 1 and 2 (hex 8000 to FEFF). When the computer is turned on, the "all slow" mode is selected. POKE 65495,X (X is any value; 65495 is FFD7 hex) turns on the "fast ROM" mode. That is, only the area from 8000 to FEFF (32768 to 65279) travels at double speed (1.8 MHz).

That means the RAM and the ports are still traveling at slow speed. So why replace them? My original answer was empirical—because it cured the problem. But this reader's solution was better. He noticed that two capacitors (C73 and C75) were placed right across the clock lines (E and Q*) to ground, and that pulling these out made things work. He wasn't sure why.

I took out my nippers and made the same cuts. Sure enough, everything was perfect. It seems the clock rise and fall time was being pulled so far out of spec that when the "address dependent" mode was invoked, the clock couldn't get itself straight fast enough to access the PIAs. Hence, the PIAs saw a fast clock and didn't have their data ready for the CPU. Same with the RAM, which was being accessed by a very messy clock, and had problems getting set up properly.

Then I tried "fast-fast" speed: POKE 65497,X. The screen went wild; I thought it was lost. But no. . . POKE 65496,X (typing blindly) brought everything back. ROM, RAM and ports were accessed successfully at 1.8 MHz. The screen went wild because the SAM register at 65497 (hex FFD9) kills transparent screen refresh, meaning the screen can't be accessed by the video display generator (VDG) and—here's the bummer—dynamic memory can't be refreshed. You can't use it for more than a second or two with great memory. So here are the rules for Color Computer high speed: 1. Cut capacitors C73 and C75. They may be replaced with 10-15 pF capacitors if necessary to keep noise down. 2. Test the system with POKE 65495,X. 3. If the computer locks up, replace the CPU with a 68A09 or preferably a 68B09. 4. Check the keyboard, MOTOR ON, and SOUND commands next. 5. If the computer locks up, replace the PIAs with 68A21 or 68B21 chips. 6. Enter this program:

```
10 CLS
20 PRINT"ENTERING ADDRESS DEPENDENCE"
30 POKE 65495,0
40 FOR N=0 TO 255 : POKE 1300,N : NEXT
50 PRINT"RE-ENTERING SLOW MODE"
60 POKE 65494,0
70 FOR N=0 TO 255 : POKE 1300,N : NEXT
80 GOTO 10
```

7. Remember never to CLOAD or CSAVE in the 65495 mode; always return to normal speed with 65494 from 65495.

POKE Value	RAM/Ports	ROM	Refresh
65494,x	slow	slow	on
65495,x	slow	fast	on
65496,x (no!)	fast	slow	off
65497,x (no!)	fast	fast	off

There's more to the story. Cutting the capacitors also reduced the heat generated by the SAM chip, meaning I could successfully remove the heat sink I had added (November Applications) for high-speed use.

Some Updates, Some Hints

As noted above, Color Computers can be upgraded to 32K RAM using 64K dynamic memory chips. You must have an E-revision board (the serial number's at the bottom right under the metal shield), and a 1.1 Basic ROM (the sign-on message tells you which version you have). If you have an E board, you probably have the ROM. Move all the jumpers from the 4K or 16K positions to the 32K positions, remove the 4K or 16K chips, insert the

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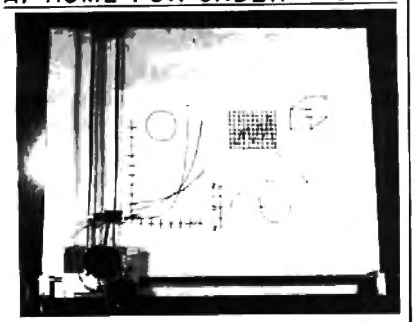

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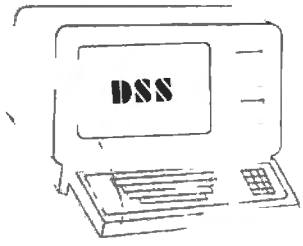

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80 APPLICATIONS

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Are you a disgruntled LNW system user? Many readers have written to say that support from LNW Research has not been forthcoming, with letters unanswered and phone calls ignored. My own requests for information have gone unanswered, so I can empathize with those complaints. I understand Harv Pennington (of *Disk and Other Mysteries* fame) is giving the LNW folks some essential lessons in customer relations and customer support, but until those lessons show signs of being learned, users might be relieved to know that an LNW-80 and LNW System Expansion support group is being formed by Steve Redmond of Burlington, Vermont. Steve says, "I don't know as much as I'd like to, but I hope what I can do is put users in touch with sources of help." He would like to hear from both LNW users with problems as well as LNW users who are familiar enough with the machine's operation to help others. I agree with Steve that the LNW-80 is a fine computer, and that it deserves an active nationwide user network. Write to Steve at 456 North St., Burlington, VT 05401.

Lately a publication called *The On-Line Computer Telephone Directory* has been dropping in my mailbox. It costs $9.95 a year, and two features make it well worth the price: a list of bulletin boards across the country (updated quarterly), and—best of all—information and "help" menus from many different systems. I always felt like I was stealing too much time from somebody else's bulletin board while I groped through the menus, but along came this publication. Write to J.A. Cambron Co. Inc., P.O. Box 10005, Kansas City, MO 64111-9990.

The Model I voice input/output installation (January Applications) contains a minor error. The correct trace to cut on the CPU board goes from pin 10 of Z4 to pin 9 of Z24. The orange wire also goes to pin 10 of Z4. The diagram was incorrectly marked Z4 pin 9, although it showed the correct trace. Thanks to many readers including M. Pollard of Soquel, California, for picking that up very quickly.

In the same article, the software had a small error, which does not affect its operation unless the voice input routines are used with other software. Line 500 (LD A,C) should appear after line 530. That resets port 255 correctly for 32-character mode.

Another small error crept into the Color Computer keyboard addition project (also January Applications). The keyboard wiring diagram omits a connection between the bottom pin on "H" to the bottom pin on "8". If you aren't getting your H or X keys, that's why. Both the photograph and the keyboard matrix are correct. A revised section of the diagram is shown below:

Brian Welch of Virginia Beach, Virginia, called to say that initially he had problems with the Model I destreakifyer modification (February). He traced the difficulty to a bad 2102 memory chip in his original circuit board. Because some fast switching is going on in this modification, marginal 2102 chips may produce "stuck" characters. Brian was the only reader who identified this problem, so it's probably an unlikely one.

Thanks to the many readers who wrote in with the solution to my request for a simple way to reseed the Color Computer's random number sequence. Shortly after I wrote the article, the information turned up in both *80 Micro* and *TRS-80 Microcomputing News*. The solution is to request a negative random number using an indeterminate base. The suggested process is very simple: X = RND (-TIMER) at the beginning of a program.

New fonts are available for the Color Computer Lowerkit (November Applications). These include Greek, Math Symbols, APL and Kata Kana. Hebrew, Arabic, and Cyrillic are in preparation as I am writing (February). Write to MSB Electronics, Drawer 766, Barre, VT 05641.

There is an inconsistency in the twisted-pair modification for early Model I expansion boxes (Exclusive Oracle, September). This modification works as presented for a single system. However, if you wish to switch expansion boxes or use your keyboard on other systems, you should know that Radio Shack uses the red/black wire for RAS, blue (or green)/black for CAS, and white/black for MUX.

Model I interrupts not working? Not sure? Try this one liner as a test from Level II. It will produce a continuous display:

```
10 A = 16402:POKEA,195:POKEA + 1,2:POKEA + 2,80:
FORX = 20480TO20509:READA:POKEX,A:NEXT:
POKE16526,0:POKE16527,80:M = USR(0):
DATA251,201,243,245,229,213,197,58,236,55,58,224,55,
33,17,1,17,38,60,1,26,0,237,176,193,209,225,241,251,201
```

Model I disk drives selecting incorrectly? Not sure? Try this one liner. It will select them in order:

```
10 X = 14304:POKEX,1:FORN = 1TO200:NEXT:POKEX,
2:FORN = 1TO200:NEXT:POKEX,4:FORN = 1TO200:
NEXT:POKEX,8:FORN = 1TO200:NEXT:GOTO10
```

Color Computer doesn't always turn on, or turns itself off in mid-program? Two resistors and two transistors handle a significant part of the 5-volt supply, and I've seen a couple units where the factory sol-

dering was unsatisfactory. Resolder all connections to R59, R66, Q2 (two are on the bottom of the board, as are the screw heads which should also be soldered) and Q3, and your power should be reliable once more.

The first Flex operating system for the Color Computer is here. I've been chomping at the proverbial bit for months to mention details, but the author of the system patches and documentation (Steve Odneal of Kansas City) has held me back. So now you can write to Data-Comp, South East Media, P.O. Box 794, Chattanooga, TN 37443 for details. The price of the basic Flex package is $150, with patches to the Exatron or Radio Shack operating systems priced at $49.95. If you are already a Flex owner, the patch system and documentation is $59.95 separately. It contains an Editor/Macro Assembler and full Flex utilities, and runs in a 64K RAM system and requires the 1.1 Basic ROM. Steve reports that a replacement 1.1 ROM can be obtained from Radio Shack National Parts distribution system for $36.30 with exchange of your old ROM. He also says that a very minor hardware modification is necessary to access all of the 64K RAM for standard Flex use—both banks of which have been working in later units, he reports. 32K Flex also works just fine. Good for Steve and the fine operating system, and good for Radio Shack for supplying those top quality memories.

If you have been following this column for the past two years, you know I purchased my early TRS-80 seeking to discover techniques of digital technology which might be useful in the preparation and performance of my music. The path was long and difficult for a composer with no previous knowledge of computer languages or digital electronics, and I allowed myself four years to achieve an understanding of those techniques. These are at last within my grasp, right on schedule.

That means that "80 Applications" will be going bimonthly, alternating with the "Exclusive Oracle." Occasionally but rarely I hope to contribute other meaningful ideas to the pages of *80 Micro*, and the editors have stashed away one or two of my articles for sometime later this year. However, aside from these miscellany, I am significantly reducing my presence in the world of personal computing. My thanks go to all those who have offered suggestions, ideas, improvements, and criticisms; without them these columns would truly have been an impossible task, since very little in my work is dramatically original.

By the time you read this, I will have returned primarily to musical composition, to its rewards, to its frustrations, and to its inevitable and unhappy anonymity in twentieth-century America.

We all have our teachers. Mine was Philip K. Hooper, much of whose thought guided the writing of these columns. I've mentioned Dr. Hooper's work often, as he was the inspiration for the economies in both my software and hardware. He abhorred excessive, affected software, liked minimal programming and operating systems, and loved challenges. He was the first—and probably the only—programmer to implement six-level multitasking on a KIM-1 computer with only 1K of memory. He founded the mythical Edible Bytes Corporation and worked under the appropriate title, The Codesmith. Phil, one of my closest friends, died in February. ■

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September

5-9 The European Association for Microprocessing and Microprogramming, Paris. **Euromicro '82** Haifa, Israel.

7-10 Management Science America, Inc., Atlanta, GA. **Interact I: A Convention Users of Cash Management Systems** Atlanta Hyatt Regency Hotel.

9-12 Personal Computer World, London, UK. **Fifth Personal Computer World Show** Barbican Center, London, UK.

11-12 Kengore Corporation, Franklin Park, NJ. **New Jersey Microcomputer Show and Fleamarket** Holiday Inn, North Passenger Terminal, Newark International Airport.

13 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Motorola Headquarters, Schaumburg, IL.

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21-24 Integrated Computer Systems, Santa Monica, CA. **Computer Graphics Course** Washington, DC.

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October

1 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Holiday Inn East, Wichita, KS.

1-3 Philadelphia Area Computer Society, Philadelphia, PA. **Philadelphia Area Computer Show** Philadelphia Center Hotel.

8-11 Northeast Expositions Inc., Chestnut Hill, MA. **Electronica: Personal Electronics and Home Entertainment Products** Hynes Auditorium, Boston, MA.

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24-26 Texas Association for Educational Data Systems, Austin, TX. **18th Annual Convention** Villa Capri Hotel, Austin, TX.

25-27 Association for Computing Machinery, New York, NY. **Annual Convention** Dallas Hilton Hotel.

30-2 The George Washington University, Office of Continuing Medical Education, Washington, DC. **Symposium on Computer Applications in Medical Care** Sheraton Washington Hotel, Washington, DC.

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Copernica Mathematica

by Bruce Douglass

"Few people are used to thinking in spatial terms."

This month we will discuss a different type of topic—spatially-oriented puzzles. The best known spatially-oriented puzzle is Fifteen, created by Sam Lloyd many years ago. A more popular one these days was invented in 1975 by a Hungarian mathematician with the name of Rubik. His puzzle is the infamous Rubik's Cube.

I wish to introduce three new puzzles that are based primarily on the Rubik's cube, but these are two-dimensional rather than three. They will be called Bruce's Squares.

Square One

All three puzzles are based on a large square made up of three smaller ones on each side (for a total of nine small squares in each large square). This is graphically depicted in Fig. 1.

The goal for all the problems is the same—to rearrange the small squares into a specific order. Allowable moves differ, depending on which game you are using.

Square One (Program Listing 1) allows only rotational moves of intermediate-sized squares. In Fig. 1 the smallest squares are labeled A through I, from left to right and from top to bottom. This is the goal state of the problem. The intermediate squares are made up of four small squares. Thus, one intermediate square in Fig. 1 would consist of small squares A,B,D,E; another would be B,C,E,F. The intermediate squares are labeled 1,2,3,4. Whenever I refer to a numbered square in this game, I will be speaking of an intermediate block; a lettered square will be a small block. Square 1 would consist of small squares A,B,D,E; square 2 would consist of small squares B,C,E,F; square 3 would be D,E,G,H; and square 4 would be E,F,H,I.

The legal moves in the first game are rotations (left or right) of an intermediate square. The game requires that you enter the square number to be moved, and then the rotation direction. L (left) is the same as counterclockwise, and R (right) is the same as clockwise.

The game randomly mixes the small squares and then displays the current orientation. It will also display the number of moves that you have made, and ask you for your next move. After you enter a move, the program will evaluate it and determine if the move is legal. If so, the program will make the move and determine whether you are at the goal state. If not, it will display the move, increment the number of moves by one and query you again. To give up, enter 9,C.

This is not as simple a problem as it first appears. Few people are used to thinking in abstract spatial terms. For example, suppose you have the situation in Fig. 2. How do you move the A into the upper left corner of the large square? Well, since it is at the lower right corner, you would have to enter the following short sequence of commands:

- 4, L—rotate counterclockwise medium square 4
- 4, L—repeat so A is also part of medium square 1
- 1, R—rotate square 1 clockwise
- 1, R—repeat so A is in the proper place.

Of course, if the overall problem was this simple, it would not be an interesting game at all! Suppose in Fig. 3 that we wish to orient A, B and C. How can we do that? The following seven-move sequence will do it:

- 4, R—produces Fig. 4
- 3, L—produces Fig. 5

Program Listing 1

```
10 CLS:PRINT"BACK TO SQUARE 1 - BY BRUCE POWEL DOUGLASS"
15 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
20 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
25 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
30 PRINT"YOU DO THIS BY ROTATING INNER SQUARES, EACH OF"
35 PRINT"WHOM CONTAIN 4 SQUARES. THESE MEDIUM-SIZED SQUARES"
40 PRINT"ARE INDICATED BY THE NUMBERS 1, 2, 3, OR 4."
45 PRINT"SQUARE 1 CONSISTS OF THE SMALL SQUARES 1, 2, 4, AND 5"
50 PRINT"AND SQUARE 2 CONSISTS OF SMALL SQUARES 2,3,5,6."
55 PRINT"SQUARE 3 CONSISTS OF SMALL SQUARES 4,5,6,7 AND"
60 PRINT"SQUARE 4 CONTAINS #'S 5,6,8,9"
65 INPUT"CONTINUE";A$
70 CLS:PRINT"YOU MAY ROTATE THE SQUARES CLOCKWISE (R) OR"
75 PRINT"COUNTER-CLOCKWISE (L): THE POSITIONS OF THE SQUARES"
80 PRINT"ARE ADJUSTED.  TO CONCEDE, ENTER 9,C. THE PROGRAM"
85 PRINT"WILL TELL YOU WHEN YOU WIN AND THE NUMBER OF MOVES"
90 PRINT"THAT IT TOOK - PRESS <ENTER> TO START"
```

Program Listing 1 Continues

A	B	C
D	E	F
G	H	I

Figure 1

- 1, R—produces Fig. 6
- 4, L—produces Fig. 7
- 4, L—produces Fig. 8
- 2, L—produces Fig. 9
- 1, R—produces Fig. 10

Of course, the ultimate goal is to put all the little squares in their rightful homes. To do this, it is most effective to think in terms of spatial transformations. The first example pointed to a simple type of two-dimensional rotational transformation. We achieved a diagonal linear transformation by using four rotational ones; that is, we moved the A square from the lower right corner to the upper left corner (a diagonal move) by rotating square 4 twice and then square 1 twice.

The transformation achieved in the second example is a bit more complex, but it is still easily thought of as a sum of several rotational transformations.

The basic goal is to travel from the initial state (Fig. 3) to the final state (Fig. 10). The conceptual process I went through divided the ultimate goal into two stages (although there are many other ways to achieve the same effect). First, I wanted to align A and B so I could rotate them in with a single move. I wanted to move C separately. Figure 6 came to mind as an intermediate goal state; from there I could easily solve the problem.

So the problem is divided into two pieces: how to achieve Fig. 6 and how to achieve Fig. 10 from Fig. 6. The first part required only three moves. The second part was easier conceptually, although it used four moves.

It is often easier to break up the main problem into subgoals and solve the subgoals one at a time. Thinking in spatial terms, though difficult at first, becomes easier with practice.

Square Two

The second game (Program Listing 2) uses only linear-spatial transformations. That is, you may only move squares in a straight line. In Fig. 11 you may move A two ways: horizontally or vertically. Both orientations have two directions. You can move A left or right horizontally, or up or

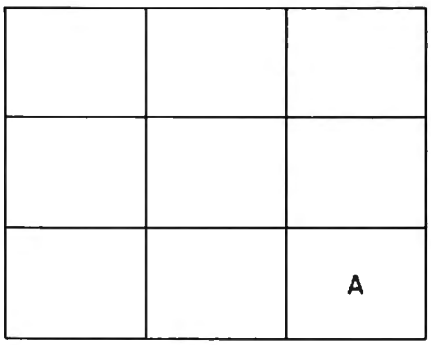

Figure 2

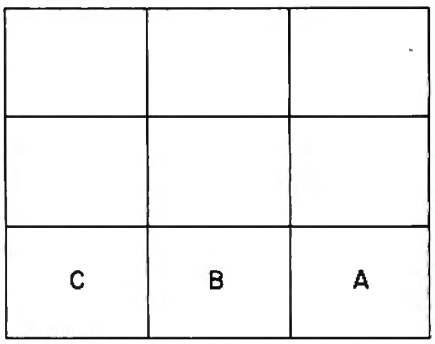

Figure 3

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Program Listing 1 Continued

```
 95 IF INKEY$="" THEN 95 ELSE CLS:PRINT@535,"JUST A SEC .....";
100 CLEAR 200:DEFSTRA-D:DEFINTI-K
110 K(1)=1:K(2)=2:K(3)=4:K(4)=5
120 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
130 A1=B+STRING$(5,C)+B
140 A3=B+STRING$(5,D)+B
150 FOR I=1 TO 9
160   J=RND(9):FOR K=1TOI:IF J=J(K) THEN 160 ELSE NEXT K
170 J(I)=J
180    A(I)=B+A+CHR$(J+64)+A+B:J=J+1
190 NEXT I
200 CLS:PRINTCHR$(23);
210 FOR I=1 TO 9:
220 J=1
230 PRINT A1;A;A1;A;A1
240 FOR I=J TO J+2
250   PRINT A(I);A;
260 NEXT I:PRINT
270 PRINT A3;A;A3;A;A3:PRINT
280 J=J+3:IF J>9 THEN 290 ELSE 230
290 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
360 PRINT@896,"";:INPUT"ENTER SQUARE, AND ROTATION";J,A9
365 IF J=9 AND A9="C" THEN 520
370 IF J>4 OR J<1 THEN 360 ELSE J=K(J) 'STARTING OF SQR
380 IF A9<>"R" THEN IF   A9<>"L" THEN 360
390 REM OK, NOW ROTATE THE SQUARES
400 REM K(J) CONTAINS THE POSITIONS FOR ROTATIONS
410 IF A9="L" THEN 440
420 A4=A(J):A(J)=A(J+3):A(J+3)=A(J+4):A(J+4)=A(J+1):A(J+1)=A4
430 GOTO 450
440 A4=A(J):A(J)=A(J+1):A(J+1)=A(J+4):A(J+4)=A(J+3):A(J+3)=A4
450 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
460 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 500
470 REM DISK PEOPLE USE "FOR I=1TO9:IF INSTR(A(I),CHR$(I+64))=0
THEN 380
480 NEXT I:PRINT@896,"DONE!! AND IN ONLY ";K9;" MOVES!"
490 INPUT"AGAIN";A9:IF A9="Y" OR "YES" THEN 100 ELSE END
500 REM NOT DONE YET!
510 K9=K9+1:GOTO 200 ' REDRAW SCREEN
520 PRINT@896,"QUITTER!! YOU TOOK ";K9;"MOVES      ";:END
560 NEXT I:PRINT@896,"DONE!! AND IN ONLY ";K9;" MOVES!"
570 INPUT"AGAIN";A9:IF A9="Y" OR A9$="YES" THEN 160 ELSE END
580 REM NOT DONE YET!
590 K9=K9+1:GOTO 260 ' REDRAW SCREEN
600 PRINT@896,"QUITTER!! YOU TOOK ";K9;"MOVES      ";:END
```

Program Listing 2

```
10 CLS:PRINT"   ON TO SQUARE 2 - BY BRUCE POWEL DOUGLASS"
20 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
30 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
40 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
50 PRINT"YOU DO THIS BY SHIFTING THE ROWS LEFT OR RIGHT"
60 PRINT"OR THE COLUMNS UP OR DOWN.  THIS SHIFT IS REALLY A"
70 PRINT"ROTATE, SINCE THE SQUARE THAT LEAVES THE BLOCKS WILL"
80 PRINT"REAPPEAR AT THE OTHER END OF THE ROW OR COLUMN."
90 PRINT"THE ROWS AND COLUMNS ARE BOTH NUMBERED 1 - 3"
100 PRINT"AND THE PROGRAM TELLS WHICH YOU MEAN BY THE PRESENCE"
110 PRINT"OF A ROW COMMAND (R OR L), OR A COLUMN COMMAND (U OR D
)"
120 PRINT"TO CONCEDE, ENTER 9,C. THE PROGRAM"
130 PRINT"WILL TELL YOU WHEN YOU WIN AND THE NUMBER OF MOVES"
140 PRINT"THAT IT TOOK - PRESS <ENTER> TO START"
150 IF INKEY$="" THEN 150 ELSE CLS:PRINT@535,"JUST A SEC .....";

160 CLEAR 200:DEFSTRA-D:DEFINTI-K
170 K(1)=1:K(2)=4:K(3)=7
180 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
190 A1=B+STRING$(5,C)+B
200 A3=B+STRING$(5,D)+B
210 FOR I=1 TO 9
220   J=RND(9):FOR K=1TOI:IF J=J(K) THEN 220 ELSE NEXT K
```

Program Listing 2 Continues

down vertically. If you move A across to the right, it will move into the middle square of the top row. If you move it left, it disappears off the left side and reappears at the top right corner. Alternately, if you move A down, it becomes the first square of the middle row; if you move it up, it becomes the first piece in the last row.

Specify moves by entering a row or column number (one is the top row or first column and three is the bottom row or last column), followed by a row or column direction (R,L,U and D stand for right, left, up and down). To move row 3 right one square, enter 3, R. To move column 2 down one square enter 2,D.

	B	
C	A	

Figure 4

B	A	
	C	

Figure 5

B		
A		
	C	

Figure 6

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This game seems easier to play, since most people are comfortable with linear movements. Moving A in Fig. 11 to any other position requires a simple concatenation of linear transformations. For example, to move A to the middle of the second row, just move A to the right and then down (the order of operations is reversible if no other pieces need be considered). Figure 12 shows a slightly more difficult problem, but it can easily be solved as well:

- 1, R—produces Fig. 13
- 2, D—produces Fig. 14
- 3, D—produces Fig. 15
- 2, R—produces Fig. 16

B		
A		
		C

Figure 7

B		
A		C

Figure 8

B		C
A		

Figure 9

Program Listing 2 Continues

```
230 J(I)=J
240    A(I)=B+A+CHR$(J+64)+A+B:J=J+1
250 NEXT I
260 CLS:PRINTCHR$(23);
270 FOR I=1 TO 9:
280 J=1
290 PRINT A1;A;A1;A;A1
300 FOR I=J TO J+2
310   PRINT A(I);A;
320 NEXT I:PRINT
330 PRINT A3;A;A3;A;A3:PRINT
340 J=J+3:IF J>9 THEN 350 ELSE 290
350 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
360 PRINT@896,"";:INPUT"ENTER SQUARE, AND SHIFT";J,A9
370 IF J=9 AND A9="C" THEN 600
380 IF J>3 OR J<1 THEN 360 ELSE IF A9="R" OR A9="L" THEN J=K(J)
'STARTING OF ROW
390 IF A9="R" OR A9="L" THEN 440
400 IF A9="U" OR A9="D" THEN 490
410 GOTO 360
420 REM OK, NOW SHIFT THE SQUARES
430 REM RIGHT OR LEFT
440 IF A9="L" THEN 470
450 A4=A(J+2):A(J+2)=A(J+1):A(J+1)=A(J):A(J)=A4
460 GOTO 530
470 A4=A(J):A(J)=A(J+1):A(J+1)=A(J+2):A(J+2)=A4
480 GOTO 530
490 IF A9="U" THEN 520
500 A4=A(J+6):A(J+6)=A(J+3):A(J+3)=A(J):A(J)=A4
510 GOTO 530
520 A4=A(J):A(J)=A(J+3):A(J+3)=A(J+6):A(J+6)=A4
530 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
540 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 580
550 REM DISK PEOPLE USE "FOR I=1TO9:IF INSTR(A(I),CHR$(I+64))=0
THEN 380
```

Program Listing 3

```
10 CLS:PRINT"  NOW TO SQUARE 3 - BY BRUCE POWEL DOUGLASS"
20 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
30 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
40 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
50 PRINT"YOU DO THIS BY EXCHANGING THE ROWS AND COLUMNS"
60 PRINT"THE ROWS AND COLUMNS ARE BOTH NUMBERED 1 - 3"
70 PRINT"SO, TO EXCHANGE ROW 1 WITH COLUMN 2, YOU WOULD ENTER"
80 PRINT" '1,2' AND THE PROGRAM WILL EXECUTE YOUR COMMAND"
90 PRINT"TO CONCEDE, ENTER 9,9"
100 PRINT"PART OF YOUR TASK IS TO DETERMINE  *EXACTLY*  HOW THE"

110 PRINT"SWITCHES MADE (SEE HINT BELOW) - PRESS <ENTER> TO STAR
T"
120 PRINT@832,"D";TAB(13);"(HINT)";TAB(32);"E";:PRINT@896,"E A F
";TAB(11);"SWITCHES TO";TAB(32);"A D H";:PRINT@960,"H";TAB(32);"
F";
130 IF INKEY$="" THEN 130 ELSE CLS:PRINT@535,"JUST A SEC .....";

140 CLEAR 200:DEFSTRA-D:DEFINTI-K
150 K(1)=1:K(2)=4:K(3)=7
160 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
170 A1=B+STRING$(5,C)+B
180 A3=B+STRING$(5,D)+B
190 FOR I=1 TO 9
200   J=RND(9):FOR K=1TOI:IF J=J(K) THEN 200 ELSE NEXT K
210 J(I)=J
220    A(I)=B+A+CHR$(J+64)+A+B:J=J+1
230 NEXT I
240 CLS:PRINTCHR$(23);
250 FOR I=1 TO 9:
260 J=1
270 PRINT A1;A;A1;A;A1
280 FOR I=J TO J+2
290   PRINT A(I);A;
300 NEXT I:PRINT
310 PRINT A3;A;A3;A;A3:PRINT
320 J=J+3:IF J>9 THEN 330 ELSE 270
```

Program Listing 3 Continues

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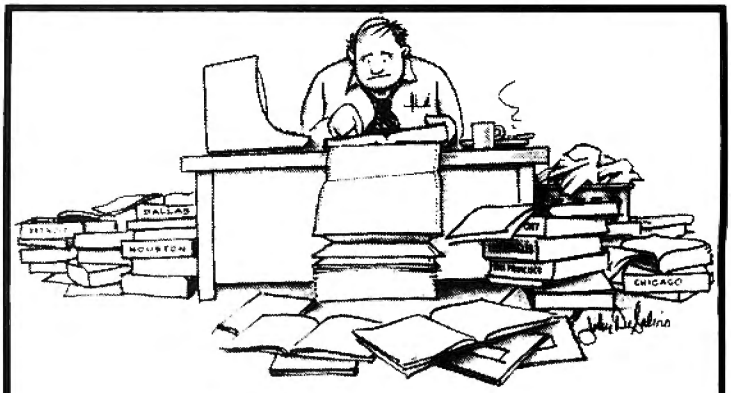

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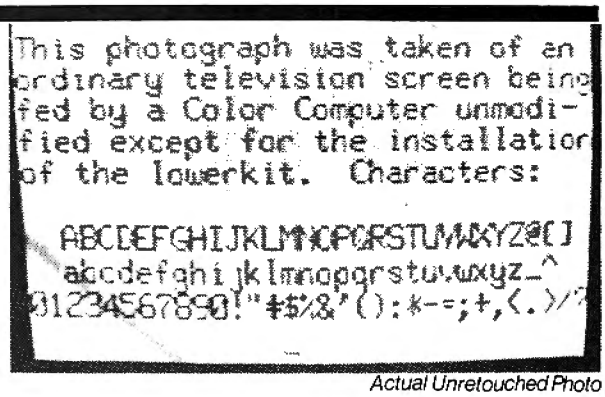

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Program Listing 3 Continued

```
330 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
340 PRINT@896,"";:INPUT"ENTER ROW, COLUMN TO SWITCH";J,L
350 IF J=9 AND L=9 THEN 470
360 IF J>3 OR J<1 OR L>3 OR L<1 THEN 340
370 IF J=2 THEN J=4 ELSE IF J=3 THEN J=7
380 FOR I=0 TO 6 STEP 3:A4=A(I/3+J):A(I/3+J)=A(I+L):A(I+L)=A4
390 NEXT I
400 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
410 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 450
420 REM DISK PEOPLE USE "FOR I=1TO9:IF INSTR(A(I),CHR$(I+64))=0
THEN 380
430 NEXT I:PRINT@896,"DONE!! AND IN ONLY ";K9;" MOVES!"
440 INPUT"AGAIN";A9:IF A9="Y" OR "YES" THEN 140 ELSE END
450 REM NOT DONE YET!
460 K9=K9+1:GOTO 240 ' REDRAW SCREEN
470 PRINT@896,"QUITTER!! YOU TOOK ";K9;"MOVES      ";:END
```

Program Listing 4

```
10 CLEAR 200:CLS:PRINT"SQUARE 1.1  -  BY BRUCE POWEL DOUGLASS"
20 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
30 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
40 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
50 PRINT"YOU DO THIS BY ROTATING INNER SQUARES, EACH OF"
60 PRINT"WHOM CONTAIN 4 SQUARES. THESE MEDIUM-SIZED SQUARES"
70 PRINT"ARE INDICATED BY THE NUMBERS 1, 2, 3, OR 4."
80 PRINT"SQUARE 1 CONSISTS OF THE SMALL SQUARES 1, 2, 4, AND 5"
90 PRINT"AND SQUARE 2 CONSISTS OF SMALL SQUARES 2,3,5,6."
100 PRINT"SQUARE 3 CONSISTS OF SMALL SQUARES 4,5,6,7 AND"
110 PRINT"SQUARE 4 CONTAINS #'S 5,6,8,9"
120 INPUT"CONTINUE";A$
130 CLS:PRINT"YOU MAY ROTATE THE SQUARES CLOCKWISE (R) OR"
140 PRINT"COUNTER-CLOCKWISE (L): THE POSITIONS OF THE SQUARES"
150 PRINT"ARE ADJUSTED.  TO CONCEDE, ENTER 9,C. THE PROGRAM"
160 PRINT"WILL MIX THE SQUARES UP USING THE NUMBER OF MOVES"
170 PRINT"THAT YOU GIVE IT, AND ALLOW YOU THAT PLUS 2 TO SOLVE T
HE PROBLEM"
180 PRINT"ENTER '0' AS THE NUMBER FOR A LINE PRINTER COPY"
190 PRINT"ENTER THE NUMBER OF MOVES FOR THE MIX";:INPUT Z9
200 DEFSTRA-D:DEFINTI-K
210 K(1)=1:K(2)=2:K(3)=4:K(4)=5
220 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
230 A1=B+STRING$(5,C)+B
240 A3=B+STRING$(5,D)+B
250 FOR I=1 TO 9
260    A(I)=B+A+CHR$(I+64)+A+B
270 NEXT I
280 FOR I=1 TO Z9 :REM   MIX 'EM UP
290   J=RND(4):K=RND(2)
300 IF K=1 THEN 330
310 A4=A(J):A(J)=A(J+3):A(J+3)=A(J+4):A(J+4)=A(J+1):A(J+1)=A4
320 GOTO 340
330 A4=A(J):A(J)=A(J+1):A(J+1)=A(J+4):A(J+4)=A(J+3):A(J+3)=A4
340 NEXT I
350 CLS:PRINTCHR$(23);
360 FOR I=1 TO 9
370 J=1
380 PRINT A1;A;A1;A;A1
390 FOR I=J TO J+2
400   PRINT A(I);A;
410 NEXT I:PRINT
420 PRINT A3;A;A3;A;A3:PRINT
430 J=J+3:IF J>9 THEN 440 ELSE 380
440 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
450 PRINT@896,"";:INPUT"ENTER SQUARE, AND ROTATION";J,A9
460 IF J=9 AND A9="C" THEN 620
470 IF J=0 THEN GOSUB 630:GOTO 350
480 IF J>4 OR J<1 THEN 450 ELSE J=K(J) 'STARTING OF SQR
490 IF A9<>"R" THEN IF A9<>"L" THEN 350
500 REM OK, NOW ROTATE THE SQUARES
510 REM K(J) CONTAINS THE POSITIONS FOR ROTATIONS
520 IF A9="L" THEN 550
530 A4=A(J):A(J)=A(J+3):A(J+3)=A(J+4):A(J+4)=A(J+1):A(J+1)=A4
540 GOTO 560
```

Program Listing 4 Continues

- 3, U—produces Fig. 17
- 2, R—produces Fig. 18
- 2, U—produces Fig. 19

Square Three

The last of the three games (Program Listing 3) uses a different move—exchanging a row and column. This game is more difficult to play than the other two because the transformations it uses are more alien to most of us.

Indicate the moves by entering the row and column number to be exchanged. To quit, enter 9,9. I'll let you figure out what pieces will end up where when you perform the exchange.

Another version of each game (Listings

A	B	C

Figure 10

A		

Figure 11

C	B	A

Figure 12

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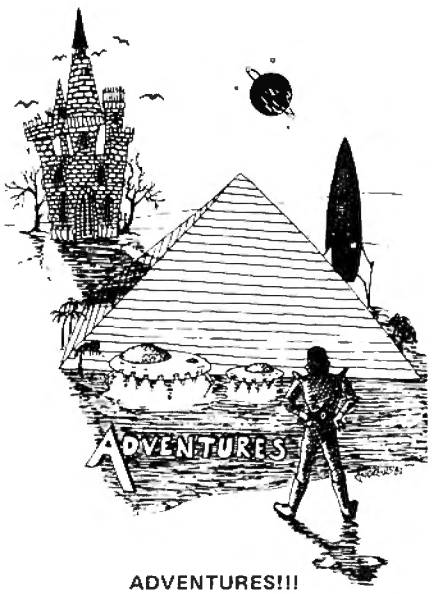

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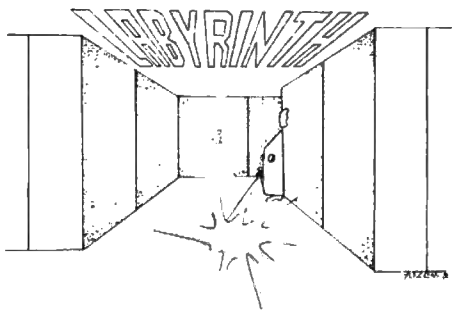

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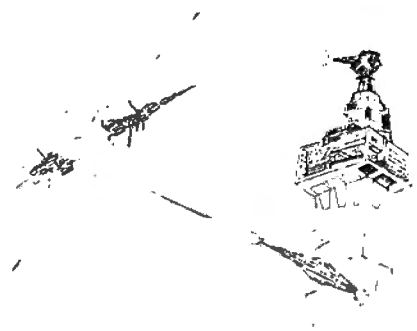

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Program Listing 4 Continued

```
550 A4=A(J):A(J)=A(J+1):A(J+1)=A(J+4):A(J+4)=A(J+3):A(J+3)=A4
560 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
570 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 600
580 NEXT I:PRINT@896,"DONE!! AND IN ONLY ";K9;" MOVES!"
590 INPUT"AGAIN";A9:IF A9="Y" OR "YES" THEN 200 ELSE END
600 REM NOT DONE YET!
610 K9=K9+1:IF K9<Z9+3 THEN GOTO 350 ' REDRAW SCREEN
620 PRINT@896,"TURKEY!! YOU TOOK TOO MANY MOVES!";:END
630 LPRINT"SQUARE 1.1  MOVE # ";K9
640 FOR I=0 TO 2:LPRINT"!.....!.....!.....!"
650   FOR J=1 TO 3
660     GOSUB 700 : LPRINT Q$;
670   NEXT J : LPRINT "!"
680 NEXT I
690 LPRINT"!.....!.....!.....!":LPRINT " :RETURN
700 Q$="!  "+MID$(A(I*3+J),4,1)+"  ":RETURN
```

Program Listing 5

```
10 CLEAR200:CLS:PRINT" SQUARE 2.1  -   BY BRUCE POWEL DOUGLASS"
20 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
30 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
40 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
50 PRINT"YOU DO THIS BY SHIFTING THE ROWS LEFT OR RIGHT"
60 PRINT"OR THE COLUMNS UP OR DOWN.  THIS SHIFT IS REALLY A"
70 PRINT"ROTATE, SINCE THE SQUARE THAT LEAVES THE BLOCKS WILL"
80 PRINT"REAPPEAR AT THE OTHER END OF THE ROW OR COLUMN."
90 INPUT"CONTINUE";A$:CLS
100 PRINT"THE ROWS AND COLUMNS ARE BOTH NUMBERED 1 - 3"
110 PRINT"AND THE PROGRAM TELLS WHICH YOU MEAN BY THE PRESENCE"
120 PRINT"OF A ROW COMMAND (R OR L), OR A COLUMN COMMAND (U OR D
)"
130 PRINT"TO CONCEDE, ENTER 9,C."
140 PRINT"TO SENT IT TO THE PRINTER, ENTER '0,X'.  THE PROGRAM"
150 PRINT"WILL MIX UP THE ORDER USING THE NUMBER OF MOVES"
160 PRINT"THAT YOU GIVE IT - ENTER THE NUMBER OF MOVES"
170 INPUT Z9
180 RANDOM:DEFSTRA-D:DEFINTI-K:Z8=0:K9=0
190 K(1)=1:K(2)=4:K(3)=7
200 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
210 A1=B+STRING$(5,C)+B
220 A3=B+STRING$(5,D)+B
230 FOR I=1 TO 9
240    A(I)=B+A+CHR$(I+64)+A+B
250 NEXT I:IF Z9=0 THEN 380
260 FOR I=1 TO Z9:K=RND(2):L=RND(2)
270 IF K=1 THEN 330
280 M=(RND(3)-1)*3+1:IF L=2 THEN 310
290 A4=A(M+2):A(M+2)=A(M+1):A(M+1)=A(M):A(M)=A4
300 GOTO 370
310 A4=A(M):A(M)=A(M+1):A(M+1)=A(M+2):A(M+2)=A4
320 GOTO 370
330 M=RND(3):IF L=1 THEN 360
340 A4=A(M+6):A(M+6)=A(M+3):A(M+3)=A(M):A(M)=A4
350 GOTO 370
360 A4=A(M):A(M)=A(M+3):A(M+3)=A(M+6):A(M+6)=A4
370 NEXT I
380 CLS:PRINTCHR$(23);
390 FOR I=1 TO 9
400 J=1
410 PRINT A1;A;A1;A;A1
420 FOR I=J TO J+2
430   PRINT A(I);A;
440 NEXT I:PRINT
450 PRINT A3;A;A3;A;A3:PRINT
460 J=J+3:IF J>9 THEN 470 ELSE 410
470 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
480 IF Z8=-1 THEN 700
490 PRINT@896,"";:INPUT"ENTER SQUARE, AND SHIFT";J,A9
500 IF J=0 THEN GOSUB 750:GOTO 380
510 IF J=9 AND A9="C" THEN 740
520 IF J>3 OR J<1 THEN 490 ELSE IF A9="R" OR A9="L" THEN J=K(J)
```

Program Listing 5 Continues

4-6) is presented as well. Rather than set the board up randomly, the game asks for the number of moves you want made. The program starts from the goal state position and makes that number of random moves. Your mission is to solve the problem in that number of moves plus two (you get to make one bad move and retract it). These programs also allow you to print the board at any time by entering zero as the first argument.

Parting Problem

There are two numbers between 1 and 100 (1 and 100 are excluded from the solution). Mr. P. knows the product of these two numbers, and Ms. S. knows their sum. Rather than exchange the infor-

A	C	B

Figure 13

A		B
	C	

Figure 14

A		
	C	B

Figure 15

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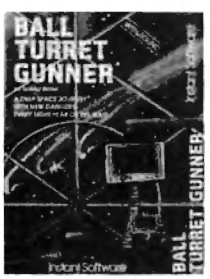

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Program Listing 5 Continued

```
'STARTING OF ROW
530 IF A9="R" OR A9="L" THEN 580
540 IF A9="U" OR A9="D" THEN 630
550 GOTO 380
560 REM OK, NOW SHIFT THE SQUARES
570 REM RIGHT OR LEFT
580 IF A9="L" THEN 610
590 A4=A(J+2):A(J+2)=A(J+1):A(J+1)=A(J):A(J)=A4
600 GOTO 670
610 A4=A(J):A(J)=A(J+1):A(J+1)=A(J+2):A(J+2)=A4
620 GOTO 670
630 IF A9="U" THEN 660
640 A4=A(J+6):A(J+6)=A(J+3):A(J+3)=A(J):A(J)=A4
650 GOTO 670
660 A4=A(J):A(J)=A(J+3):A(J+3)=A(J+6):A(J+6)=A4
670 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
680 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 720
690 NEXT I:Z8=-1:GOTO380
700 PRINT@896,"DONE!! AND IN ONLY ";K9+1;" MOVES!"
710 INPUT"AGAIN";A9:IF A9="Y" OR A9$="YES" THEN 130 ELSE END
720 REM NOT DONE YET!
730 K9=K9+1:IF K9>Z9+2 THEN 740 ELSE GOTO 380 ' REDRAW SCREEN
740 PRINT@768,"YOU TOOK TOO MANY MOVES!  ":END
750 LPRINT"SQUARE 2.2  MOVE # ";K9
760 FOR I=0 TO 2:LPRINT"..................."
770   FOR J=1 TO 3
780     GOSUB 820 : LPRINT Q$;
790   NEXT J : LPRINT "!"
800 NEXT I
810 LPRINT"!.....!.....!.....!":LPRINT" ":RETURN
820 Q$="!  "+MID$(A(I*3+J),4,1)+"  ":RETURN
```

Program Listing 6

```
10 CLEAR200:CLS:PRINT"        SQUARE 3.3  -  BY BRUCE POWEL DOUGL
ASS"
20 PRINT:PRINT"TO PLAY, YOU WILL BE SHOWN A SQUARE WITH"
30 PRINT"A NUMBER OF SMALLER SQUARES.  THE OBJECT IS TO"
40 PRINT"GET THE SQUARES IN LEFT - RIGHT ALPHABETICAL ORDER"
50 PRINT"YOU DO THIS BY EXCHANGING THE ROWS AND COLUMNS"
60 PRINT"THE ROWS AND COLUMNS ARE BOTH NUMBERED 1 - 3"
70 PRINT"SO, TO EXCHANGE ROW 1 WITH COLUMN 2, YOU WOULD ENTER"
80 PRINT" '1,2' AND THE PROGRAM WILL EXECUTE YOUR COMMAND"
90 PRINT"ENTERING A '0,1' WILL SEND THE CURRENT POSTION TO THE P
RINTER"
100 PRINT"TO CONCEDE, ENTER 9,9"
110 PRINTTAB(15);:INPUT"NEXT PAGE";A$:CLS
120 PRINT"PART OF YOUR TASK IS TO DETERMINE  *EXACTLY*  HOW THE"

130 PRINT"SWITCHES MADE (SEE HINT BELOW)"
140 PRINT@320,"D";TAB(13);"(HINT)";TAB(32);"E";:PRINT@384,"E A F
";TAB(11);"SWITCHES TO";TAB(32);"A D H";:PRINT@448,"H";TAB(32);"
F"
150 PRINT:PRINT"YOU WILL HAVE THE DEPTH OF MIX-UP+2 MOVES TO FIN
D THE SOLUTION":INPUT"ENTER THE DEPTH OF THE MIX-UP";Z9:CLS:PRIN
T@534,"JUST A SEC .....";
160 DEFSTR A-D:DEFINT I-K:Z8=0
170 K(1)=1:K(2)=4:K(3)=7
180 A="  ":B=CHR$(191):C=CHR$(131):D=CHR$(176)
190 A1=B+STRING$(5,C)+B
200 A3=B+STRING$(5,D)+B
210 FOR I=1 TO 9
220    A(I)=B+A+CHR$(I+64)+A+B
230 NEXT I:FOR K=1 TO Z9:J=RND(3):L=RND(3)
240 IF J=2 THEN J=4 ELSE IF J=3 THEN J=7
250 FOR I=0 TO 6 STEP 3:A4=A(I/3+J):A(I/3+J)=A(I+L):A(I+L)=A4
260 NEXT I,K
270 CLS:PRINTCHR$(23);
280 FOR I=1 TO 9:
290 J=1
300 PRINT A1;A;A1;A;A1
310 FOR I=J TO J+2
320   PRINT A(I);A;
```

mation directly, and being perfect logicians, they have the following conversation:

Mr. P.: I don't know what the numbers are.
Ms. S.: I knew you didn't. Neither do I.
Mr. P.: AHA! Now I know what they are!
Ms. S.: (smiling) Now I do too!

The question is, of course, what are the two numbers?

I'm not going to tell you what they are, but I will give you a hint. There are two methods for solving this problem. One involves brute force, and the other uses an analog computer (made of paper).

A		
B		C

Figure 16

A		C
B		

Figure 17

A		C
	B	

Figure 18

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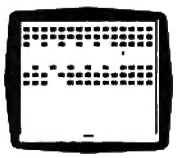

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A	B	C

Figure 19

Program Listing 6 continued

```
330 NEXT I:PRINT
340 PRINT A3;A;A3;A;A3:PRINT
350 J=J+3:IF J>9 THEN 360 ELSE 300
360 X(0)=64:X(1)=320:X(2)=576:PRINT@974,"MOVE ";K9;
365 IF K9>Z9+3 THEN 510 ELSE IF Z8=-1 THEN 470
370 PRINT@896,"";:INPUT"ENTER ROW, COLUMN TO SWITCH";J,L
380 IF J=0 THEN GOSUB 520:GOTO 270
390 IF J=9 AND L=9 THEN 510
400 IF J>3 OR J<1 OR L>3 OR L<1 THEN 370
410 IF J=2 THEN J=4 ELSE IF J=3 THEN J=7
420 FOR I=0 TO 6 STEP 3:A4=A(I/3+J):A(I/3+J)=A(I+L):A(I+L)=A4
430 NEXT I
440 REM NOW TEST TO SEE IF EVERYTHING IS CORRECT
450 FOR I=1 TO 9:A5=MID$(A(I),4,1):IF A5<>CHR$(I+64) THEN 490
460 NEXT I:Z8=-1:GOTO 270
470 PRINT@896,"DONE!! AND IN ONLY ";K9;" MOVES!"
480 INPUT"AGAIN";A9:IF A9="Y" OR A9="YES" THEN CLS:GOTO 150 ELSE
 END
490 REM NOT DONE YET!
500 K9=K9+1:GOTO 270 ' REDRAW SCREEN
510 PRINT@768,"YOU TOOK TOO MANY MOVES!!";:GOTO 480
520 LPRINT"SQUARE 3.3  MOVE # ";K9
530 FOR I=0 TO 2:LPRINT"....................."
540   FOR J=1 TO 3
550     GOSUB 590 : LPRINT Q$;
560   NEXT J : LPRINT "!"
570 NEXT I
580 LPRINT"!.....!.....!.....!":LPRINT" ":RETURN
590 Q$="!  "+MID$(A(I*3+J),4,1)+"  ":RETURN
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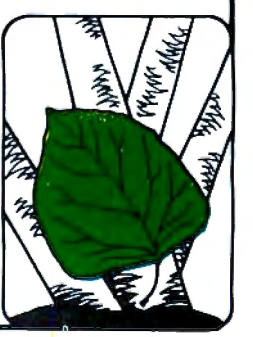

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EDUCATION 80

by Earl R. Savage

Let's take a look at microcomputer games. Do they have a legitimate place in the learning process?

To address this topic properly we must acknowledge the prevalence of learning games from very early ages on to adulthood. Countless elementary school students participate in classroom spelling bees and arithmetic contests; even graduate students set up and run fictitious corporations and model congresses.

These examples demonstrate that *some* games have a place in education. If games make learning fun, why, now that the computer is involved, does the question of their usefulness arise again? Is it because computer games are so much fun that learning seems to be missing? Or do teachers and parents still associate microcomputer games with those video-arcade games which have little educational merit other than developing fine eye-hand coordination?

In most classrooms, arcade games are useful only as entertaining rewards for the learning students acquire through some other means.

To be legitimate in school, a game must present some useful educational outcome. It is immaterial whether the computer version is more effective than a non-computer version—we are not trying to justify the computer but to evaluate the game. If at least one worthwhile learning objective is not found, the game is entertaining at best, and should be treated as such.

Education by Accident

While evaluating your software game library, keep in mind that learning can be direct or indirect in nature. A simple number guessing game may appear at first glance to be strictly entertaining (something like "Guess the secret number between one and 25"). If the computer simply responds with Right or Wrong to each guess, the game is entertainment (and boring at that). On the other hand, if the responses are "too high" or "too low," there is an opportunity for learning. In this case, rather than make random guesses, the successful player develops a strategy to maximize his chances. That process leads to a better understanding of the number line.

When played on a two-dimensional grid, guessing games can lead to further number conceptualization. If a third dimension is added (as in Depth Charge or Find the Sub), the benefits to an older pupil can be quite worthwhile.

The student playing a leader-type game can learn quite a lot. The purpose of the game may be to lead a wagon train to California or to govern an island or planetary kingdom. In a well-designed game of this type, the student can develop a good understanding for the interrelationships among factors which affect a community—taxation, food supply, mutual defense and resource management.

Lunar Lander and Human Cannonball help teach some simple science principles. In the latter, a student must understand how trajectory is affected by the angle of the cannon and the force of the propellant so the man lands in the net consistently.

The lunar lander will crash repeatedly until the player learns the relationships between mass, thrust, gravity and acceleration. Depending upon the version of the game played, the student may have to develop these relationships in mathematical terms.

So there you have the answer. The preceding examples were not designed as educational games. Students play the games because they are fun—and learn almost in spite of themselves.

Education by Design

Of much greater learning potential are those games specifically designed for educational purposes. A well-designed simulation can be quite valuable in the learning process. A few games with learning potential are: managing a campaign in a computer-run election, planning a ship's course on the basis of ocean currents and weather reports, handling a stock portfolio on the computer exchange, and establishing and maintaining a household budget.

On a more elementary level, we may include the wide variety af story-writing programs. These require the student to enter a given number of nouns and verbs to be used in a computer-written story.

In considering education and games, we must not overlook those designed specifically for instructional purposes. An example of this type is Math Duel, which pits one student against another in answering math problems at various levels of difficulty. Another is the Space Exploration-type in which the student identifies solar bodies by their characteristics.

Are all these games fun?—sure. Do they have teaching and learning potential?—certainly! Learning sometimes may be slow but it need not be always painful. Invariably, learning can be made pleasant especially when a microcomputer is available to control a great many variables and offer an infinite number of variations.

Final Thoughts

I'll conclude this overview of games in education with three observations. First, the instructional value of a computer game is not fixed. Just as with any instructional material, it must be matched to the level, readiness, and need of the student.

Second, if one has the programming ability and the time, a game designed for one level or ability may be adapted to another.

Finally, acquiring educational games is no different from acquiring any other type of software in one respect: caveat emptor—let the buyer beware.

We know the microcomputer can provide the *potential* for more effective learning. We take advantage of its value in better meeting the needs of the students by increasing the opportunity for individualizing instruction. We realize a good microcomputer program is self-prompting, immediately reinforcing, non-threatening, level-adjusting, and endlessly patient.

We must not overlook the fact that the microcomputer can also provide game/simulation learning experiences which are all but impossible by any other method. We must take advantage of this quality by interspersing our CAI lessons and tests with well-chosen games. ■

Educators—*80 Micro* is sponsoring a Young Programmer's Contest for all aspiring programmers 18 years old and younger.

Contestants will be divided into three age groups. One $300 Grand Prize, three $200 first prizes, three $100 second prizes, and three $50 third prizes will be offered. All winning entries will be published in *80 Micro's* February 1983 educational issue.

For more information see *80 Micro's* ad in this and coming issues.

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1. Final entries must be in by November 1.
2. All entries must be submitted on magnetic media and be accompanied by double-spaced, typewritten documentation.
3. You may submit as many entries as you like, but each must be submitted separately. Only one prize per person.
4. Entries must be original and unpublished.
5. All winning programs become the property of *80 Micro*.
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****

The *80 Micro* Young Programmer's Contest

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Street Address _____ Town _____

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Include this form with your entry and return to:
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See List of Advertisers on page 338

80 Medical Opinion

by Philip R. Mills, M.D.

"I like the simplicity and clarity of the daily and monthly journals."

This month we begin with suggestions for newcomers who are investigating automation of their clinic. It is always hazardous to give opinions, but for what it's worth...

The Model 16 with two disk drives should prove to be an excellent clinic computer. The medical clinic will benefit from the extra terminals, speed and memory the Model 16 provides. Early versions are bound to have hardware bugs. Model 16 TRSDOS will probably have software bugs as well. However, other operating systems will be developed. A full version of COSTAR (computer-stored ambulatory record), an excellent computer system developed at the Massachusetts General Hospital, is almost certain to become available for this computer within a short time.

Month-end statement printing is the most time-consuming operation the typical clinic computer performs. A printer with less speed than 200 cps is too slow for this function. A hardware spooling device is necessary. It will pay for itself by freeing the computer for other uses.

Eight-inch double-density disks provide a bare minimum of memory for patient billing systems. Most clinics will find a hard-disk drive a necessity. Radio Shack will be marketing a 50-megabyte disk drive in the near future according to my sources. Their current 8.5 megabyte drives are adequate for billing purposes, but larger storage is needed for complete medical records. The Model II's greatest need is in the area of utility software. Programs equivalent to Model I/III Superutility, Trakcess and good diagnostic packages will find a ready market.

Medical Office System
Windham Software, Inc.
29/31 Ivanhill St.
Willimantic, CT 06226
Model II
$499

The Medical Office System is very reasonably priced and a similar Dental Office System is available for the same amount. With the purchase of this software comes a coupon which gives 10 percent off on the purchase of a Model II computer system. In many cases this coupon actually makes the software free! A fully refundable demonstration disk is available for $100 and is recommended as a trial before purchasing the entire system.

The minimum hardware requirements for this package are the Model II with two external drives and a 132-column printer.

Windham Software is a new company. The writers of the program are not new to computers, however. The major author is Tom Price. He has written several programs marketed by Radio Shack.

The Medical Office System comes with very superior packaging. The documentation is clear and well written. My secretary was able to understand the instructions without difficulty.

A very good feature was the Operator's Prompt Card. This is a cue card which details start-up, formatting and back-up instructions. It is excellent and inexperienced operators will undoubtedly appreciate this help.

The manual is printed on very thick paper (almost cardboard), and is easy to read. A comprehensive index is included. The appendix gives a sample of the major printouts. The appendix also provides complete information for ordering statement forms, and so on.

The only part in the manual which I found confusing was the Sample Charge Slip which was included under Sample Reports in the appendix. I assumed it was a printout produced by the Medical Office System. Actually it is a copy of the charge slip Dr. Hayes, one of the authors, uses in his practice. It was typed using Scripsit. I would like to see an additional section added to the documentation detailing suggestions for initial implementation of the system. It could contain suggestions for clinics changing to computers gradually, and for those changing all at once. Computerization is initially difficult, as our clinic has learned repeatedly.

The program is written in Basic. Programs are easily enhanced by any programmer. Sorts and searches are done in machine language and are fast. PEEKs and POKEs are used freely. Break is disabled while the program is running. Several clever Basic programming features have been utilized to speed up the package, making it the finest Basic program I have seen to date for medical billing. Disks can be copied, and back-ups are encouraged.

To protect office records, passwords have been implemented. Three passwords are used. One password initializes the system, a second password gives access to the billing data. A third password, for updating the software, is used only by Windham Software and is not given to the purchaser. Although I was able to defeat the password protection in a short time, no one with merely a casual knowledge of computers could do it easily.

Setting up the data files is a time-consuming task. A full system with space for 3,500 patients (expandable to 15,000), takes nearly two hours just for the computer to allocate disk space for the patient information. Although the manual does not suggest it, keeping a copy of the blank disk produced at this time, and making back-ups of these disks each month saves more than 45 minutes during the time-consuming month-end routines.

During the original setup routines, the clinic address and physician information is entered. Entry is simple. Manual centering is possible by pressing the tab key, which moves all characters to the right. I suspect the tab key was chosen for one-key command simplicity.

When all setup chores are completed, diagnosis and procedure files are entered. The package allows a maximum of 500 procedures and 500 diagnoses to be entered. This will be adequate for most clinics. An irritation during data entry is the failure to provide the number of the last procedure or diagnosis entered. Furthermore, automatic numbering for speedy entry is not available as an option, nor is such an enhancement planned. Because string space is limited, most procedures and diagnoses must be abbreviated.

(One function that, to my knowledge, is provided on no micro medical package is

fun 'n' games

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80 Medical Opinion

the ability to differentiate left, right or bilateral; chronic or acute; mild, moderate or severe; or distal, middle or proximal without a different diagnosis for each. For example, it should be possible to give a diagnosis of left carpal tunnel syndrome, by tacking on the extension "left" after the diagnosis "carpal tunnel syndrome" is entered. Any suggestions, programmers?)

A very helpful feature is the ability to print complete procedure and diagnosis lists in alphabetic sequence as well as numeric sequence.

When procedure and diagnostic files have been completed, the package is ready for daily billing.

Patient account number entry is similar to diagnosis and procedure entry. It also has no method of auto recording the last account number entered nor automatic patient account number incrementing. The program was designed to allow the entry of the patient's clinic number as the account number. However, this is not practical for two reasons: First, family members have different clinic numbers, but usually only one account. Second, end-of-month sorting routines are much too slow on any floppy-disk system to tolerate more than one or two patient disks for a practical maximum of 7,000 patients. With the usual busy clinic, all inactive accounts must be routinely removed from the system for maximum efficiency.

Patient account numbers can be located by patient name if desired. This is an important feature since patients commonly misplace their account numbers, and a printout of all patients is a time-consuming task.

Once patient data is entered, daily transactions are very easily entered. A needed enhancement is a running total on the screen. I wrote a simple enhancement to my own copy of the program. (Incidentally, the place to modify for the enhancement is located in MOSA on lines 2680–2780 in my version.)

A superbill is not printed, but diagnoses, procedure charges, and payments can be printed out on an AMA-approved insurance form, and this can serve as a superbill. Personally, I would modify the printout for a superbill. This has the big advantage of requiring fewer paper form changes. (The personal information portion of the insurance form is not filled out by this system.)

Editing transactions is a simple process. Although transactions can be deleted by editing, inserting a transaction requires going through the daily transaction module.

I like the simplicity and clarity of the daily and monthly journals. They are easily understood, but the daily journal should be improved by showing the balance of each account transaction. This is particularly needed because the major deficiency of this program is its failure to provide the current account balance. (This deficiency is shared with Radio Shack's Model II medical package.) My billing clerk tells me that readily available current account balances are a must. The way editing is performed on this program to provide current balances would probably require a major rewrite. It would definitely reduce the maximum number of patients allowed. It would not affect the practical limitation of patient accounts, however.

Complete statements are printed each month. A copy of the record may be printed as well. There is no option to print out a portion of the statements for billing half of the patients at mid-month, and the other half at month's end.

A number of helpful statistics are provided. Most statistics are available for the entire practice or for the individual physician as well. Here are a few highlights:

- Procedure counts and diagnosis counts are available. All diagnosis statistics are provided only for the first diagnosis entered for each patient office visit, however.
- A morbidity index is available to locate all patients with any selected primary diagnosis. For example, you can identify all patients with a primary diagnosis diabetes mellitus. This should be very helpful for research.

Early this summer several important enhancements will be available. These enhancements include an interface with Scripsit, a referring physician file, recall and appointment scheduling, an expanded insurance file, installment billing, archiving to produce an itemized account for the entire year for income-tax purposes, and aged balances printed on statement forms. A final enhancement is a module to add interest charges to outstanding balances.

Although it is not perfect, the system is very useable, particularly when you consider the price. Video prompts are clear, the screen displays are clean and artistic. Support is excellent, and many improvements are forthcoming in response to users' requests. A year from now this program should be quite good. It is written by proven programmers and Windham Software is almost certain to be around for a long time. The company's long-term plans for a Model 16 Medical Office System for the clinic are very exciting.

If a clinic has fewer than 7,000 patients and is not considering a hard disk, the Medical Office System provides an economical software choice.

I am anxious to hear from other clinics. Any special topics you are interested in? Until next month . . . ■

COMPUTER BOOKS FOR BEGINNERS

Everything you need to know to get started programming your own computer. These handy books of programs and about programming are jammed with easy-to-understand info for beginners. They are crammed with hundreds of tips, tricks, secrets, hints, shortcuts and techniques plus hundreds of tested ready-to-run programs. Our full line includes program books and programming aids for eight of the most popular computers for beginners: TRS-80 Color Computer. APPLE II. IBM Personal Computer. TRS-80, Sharp and Casio pocket computers, including the new TRS-80 PC-2 and Sharp PC-1500

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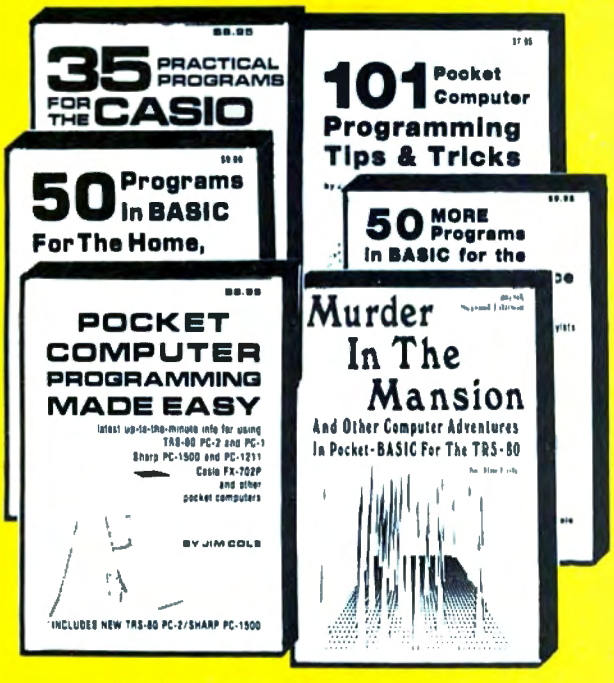

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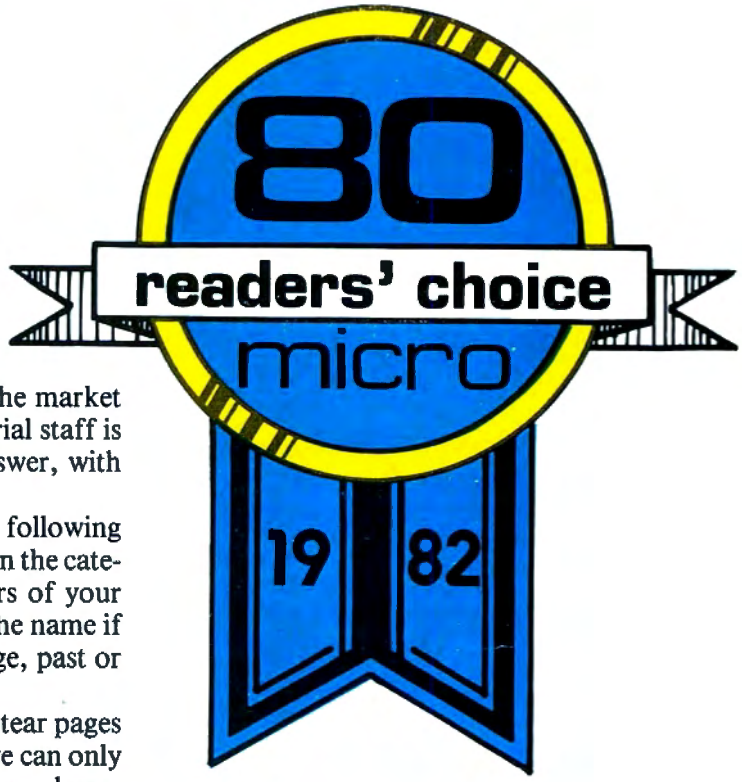

What's the most popular TRS-80 software on the market these days? It's a question the *80 Micro* editorial staff is asked frequently. So we decided to find out the answer, with our first annual *80 Micro* Readers' Choice Awards.

The object is simple. Read through the lists on the following pages, and pick out your favorite software packages in the categories that apply to you. Then write in the numbers of your choices on the ballot provided. Or you can write in the name if it's not on the list. Any commercial software package, past or present, is eligible.

One other thing. We know how much you hate to tear pages out of your magazine, but to avoid ballot-stuffing, we can only accept original ballots. In other words, no photocopies, please.

Oh, yes—the deadline for ballots is October 1. We'll publish the results in December.

Color Computer—Business

1. Business Analysis (Spectral Associates)
2. Check-Book (MPP Graphics)
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7. Word Drill (Tom Mix Software)

Color Computer—Games

1. Battlefleet (Aardvark-80)
2. Bible Quiz (Moses Software)
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5. Black Sanctum (Mark Data)
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6. CocoBug (Algorix)
7. CORES9 (Cer-Comp)
8. Editor/Assembler (Micro Works)
9. Editor/Assembler (Spectral Associates)
10. Humbug (Star-Kits)
11. Magic Box (Spectral Associates)
12. ML Rabbit (Tom Mix Software)
13. Monitor Tape/ROM (Micro Works)
14. SEACS (Data Soft)
15. Sigmon (Data Soft)
16. Source Generator (Micro Works)
17. Super Monitor (Spectral Associates)
18. Text Editor (Cer-Comp)
19. TRS-MON (Cer-Comp)

Color Computer—Word Processing

1. CCEDT9 (Cer-Comp)
2. CCWriter for Disk (Transtek)
3. CDTPRO (Cer-Comp)
4. Color Scripsit (Radio Shack)
5. Super Color Writer II (Nelson Software)
6. Telewriter (Cognitec)
7. Textpro (Cer-Comp)
8. Word CC7 (DSC Products)

I/III—Accounting

1. Accounts Payable (Plus Computer Technologies)
2. Accounts Payable (D.B. Software Co.)
3. Accounts Payable (Creative Software)
4. Accounts Payable (Data Automation Services)
5. Accounts Payable System (Nepenthe Programs)
6. Accounts Payable System (Radio Shack)
7. Accounts Payable System (Data Automation Services)
8. Accounts Payable System (North American Software)
9. Accounts Receivable (Plus Computer Technologies)
10. Accounts Receivable (D.B. Software Co.)
11. Accounts Receivable (Computronics)
12. Accounts Receivable (Creative Software)
13. Accounts Receivable System (Nepenthe Programs)
14. Accounts Receivable System (North American Software)
15. Accounts Receivable System (Data Automation Services)
16. Accounts Receivable, Invoices (Taranto & Associates Inc.)
17. Accounts Receivable, Overdue Notices (FCT Inc.)
18. Business Accounting System (Computer Generated Data)
19. Cash Disbursements System (FCT Inc.)
20. Check Writer-80 (Radio Shack)
21. Client Accounting (Computer Generated Data)
22. Client Billing For CPAs (Small Business Systems)
23. Coordinated Accounting Systems (D.B. Software Co.)
24. Doughflo (Alphanetics)
25. General Contractor Costing (Data Automation Services)
26. General Ledger (Computronics)
27. General Ledger (D.B. Software Co.)
28. General Ledger (Creative Software)
29. General Ledger (Plus Computer Tech)
30. General Ledger By Department (D.B. Software Co.)
31. General Ledger System (Data Automation Services)
32. General Ledger System (North American Software)
33. Jewelry Industry Factpac (Centex Data Systems Inc.)
34. Ledgerplus Accounts Receivable (Microsource)
35. Lynn's A/R System (Lynn Computer Service)
36. Minibiz System (Nepenthe Programs)
37. Order Entry (D.B. Software Co.)
38. Property Management System (Realty Software Co.)
39. Receipts (FCT Inc.)
40. Small Billing System (Business Data Control)
41. Time and Expense System (Computer Generated Data)
42. Versa Ledger (Computronics)
43. Visaccount (All Systems Software)

I/III—Business

1. Budget Management (Radio Shack)
2. EasyTrak (Plus Computer Technologies)
3. Easy Calc (Instant Software)
4. Fixed Assets (Plus Computer Technologies)
5. Incoprop (E-Z Software)
6. MailPak (Simplified Software)
7. Mailgram (Radio Shack)
8. Market Tracker (H&H Trading)
9. Project Manager (Radio Shack)
10. Real Estate I,II,III (Radio Shack)
11. Stock Tracker (H&H Trading Co.)
12. Stock Chart (Softbyte Computers)
13. StockPak (Radio Shack)
14. System III (Contract Services Association)
15. Trendex—Stock Trend Analysis (Radio Shack)

I/III—Data Base Management

1. Aids-III (Meta Technologies)
2. Autowriter (Midwest Data)
3. Business Database System (Charles Mann & Associates)
4. Business Information System (FCT Inc.)
5. Data Ace (Computer Software Design)
6. Data Manager II (Bottom Shelf Inc.)
7. Data Organizer (CMS Inc.)
8. Database Management System (Institute for Scientific Analysis)
9. Database Manager (Micro Architect)
10. DBM-1 (Autel Electronics)
11. FORM80/DATA80 (Alpha Data)
12. INFO 80 (Bluebird's Inc.)
13. Instant Sort/Search (Acorn Software)
14. Keyed File System (KFS80) (Racet Computes)
15. Magnum Data Management (Data Resources)
16. Maxi Manager (Adventure International)
17. MicroFiles (Radio Shack)
18. Profile (Radio Shack)
19. Profile III Plus (Radio Shack)
20. Smart Terminal (Micron Inc.)
21. STERM (Howe Software)
22. VersaFile (Radio Shack)
23. Docu-Mail (Nepenthe Programs)
24. Mail List Programs (Precision Prototypes)
25. MAIL-V (Micro Architect)
26. Maillist (Racet Computes)

I/III—Data Communications

1. Autospec (Stanley Rice)
2. Autocast (Stanley Rice)
3. Connection 80 (B.T. Enterprises)
4. Forum80 (Small Business Systems)
5. Modem 80 (Alternate Source)
6. Omni-Term (Lindbergh Systems)
7. Smart Terminal (STERM) (Computronics)
8. ST80 (Small Business Systems)
9. SuperTerm (Instant Software)
10. TELCOM (Mumford Micro Systems)
11. UNITERM 80 (Apparat Inc.)
12. Videotex Communications Package (Radio Shack)

I/III—Disk Operating Systems

1. DOSPLUS (Micro Systems Software)

2. LDOS (Logical Systems)
3. MULTIDOS (Cosmopolitan Electronics)
4. NEWDOS (Apparat)
5. NEWDOS80 (Apparat)
6. WOBOS I (Western Operations)
7. TRSDOS (Radio Shack)

I/III—Education

1. Acid-Base Chemistry Package (Queue Inc.)
2. Atomic Structure Package (Queue Inc.)
3. CAI Package (Resource Software)
4. CAIWARE (MicroGnome)
5. CAIWARE 2-D (MicroGnome)
6. Chemistry Equilibrium Package (Queue Inc.)
7. Chemistry With Computers (Queue Inc.)
8. Conduit Biology Package (Queue Inc.)
9. Conduit Physics Package (Queue Inc.)
10. Conduit Sociology Package (Queue Inc.)
11. Diascriptive Reading (Educational Activities)
12. Educational Package (Queue Inc.)
13. Essential Math Program (Radio Shack)
14. Euclid Geometry Tutor (Radio Shack)
15. EUX (3R Software)
16. Fundamental Chemistry Skills (Queue Inc.)
17. Geography Explorer (Instant Software)
18. High School Math (Queue Inc.)
19. J&S Chemistry Package (Queue Inc.)
20. K-8 Math With Student Management (Radio Shack)
21. Language Art (Milliken Publishing)
22. Math Paks 1,2,3 (Edu-Ware)
23. Milliken Math Sequences (Milliken Publishing)
24. Redcomp Chemistry (Queue Inc.)
25. Redcomp Physics (Queue Inc.)
26. Spark-80 Math (Precision People)
27. Student Scheduling (DownEast Digital)
28. Super CAI (MicroGnome)
29. Testrite (Class 1 Systems)
30. Typing Teacher (Instant Software)

I/III—Games

1. Adventure (MicroSoft)
2. Alien Attack Force (Instant Software)
3. Alien Defense (Soft Sector)
4. Armored Patrol (Adventure International)
5. Asylum (Med Systems)
6. Attack Force (Big Five)
7. Ball Turret Gunner (Instant Software)
8. Balrog (Adventure International)
9. Battleground (Instant Software)
10. Calixto Island (Mark Data)
11. Commbat (Adventure International)
12. Conquest Of Chestwood (Adventure International)
13. Cosmic Command (Big Five)
14. Cosmic Fighter (Big Five)
15. Danger In Orbit (Instant Software)
16. Death Dreadnaught (Programmer's Guild)
17. Defense Command (Big Five)
18. Domes Of Kilgari (Programmer's Guild)
19. Dragonquest (Programmer's Guild)
20. Dunzhin (Med Systems)
21. Escape From Mars (Aardvark-80)
22. Earthquake (Adventure International)
23. Eliminator (Adventure International)
24. Everest Explorer (Acorn Software)
25. Flight Simulator (Sub LOGIC)
26. Flying Saucers (Radio Shack)
27. Forbidden City (Fantastic Software)
28. Fortress (Soft Sector Marketing)
29. Galaxy Invasion (Big Five)
30. Gauntlet (Pro-Games)
31. Ghost Town (Adventure International)
32. Golden Voyage (Adventure International)
33. House Of 30 Gables (Instant Software)
34. Haunted House (Radio Shack)
35. Hypergate (Synware)
36. Hypergate Patrol (Synware)
37. Hyperlight Patrol (Fantastic Software)
38. Invasion Force (Radio Shack)
39. Jet Fighter Pilot (Instant Software)
40. Laser Defense (Med Systems)
41. Lost Colony (Acorn)
42. Lunar Lander (Adventure International)
43. Master Reversi (Instant Software)
44. Meteor Mission (Big Five)
45. Micro Movie (Radio Shack)
46. Mission Impossible (Adventure International)
47. Missle Attack (Adventure International)
48. Morton's Fork (Adventure International)
49. Penetrator (Melbourne House)
50. Planetoids (Adventure International)
51. Pyramid (Radio Shack)
52. Pyramid Of Doom (Adventure International)
53. Quest (Aardvark-80)
54. Raaka-Tu (Radio Shack)
55. RICOCHET (Auto Simulations)
56. Robot Attack (Big Five)
57. Santa Paravia and Fiumaccio (Instant Software)
58. Sargon II (chess) (Hayden)
59. Scarfman (Cornsoft Group)
60. Scott Adams' Adventure Package (Adventure International)
61. SFINKS 3.0 Chess (Fink Software)
62. Sky Warriors (Adventure International)
63. Space Castle (Cornsoft Group)
64. Space Intruders (Adventure International)
65. Space Warp (Radio Shack)
66. Space Shuttle (Instant Software)
67. Star Fighter (Adventure International)
68. Star Trek 3.5 (Adventure International)
69. Star Trek 4.0 (Programmer's Guild)
70. Stellar Escort (Big Five)
71. Stone of Sisyphus (Adventure International)
72. Strange Odyssey (Adventure International)
73. Super Nova (Big Five)
74. Swamp War (Instant Software)
75. Temple of Apshai (Automated Simulations)
76. Time Quest (Programmer's Guild)
77. Tower of Fear (Programmer's Guild)
78. Ultra Trek (Galactic Software)
79. Voodoo Castle (Adventure International)
80. Voyage of the Valkyrie (Advanced Operating Systems)

I/III—Spelling Checkers

1. Chextext (Apparat)
2. Electric Webster (Cornucopia)
3. Grammatik (Aspen Software)
4. Proof Edit (Aspen Software)
5. Proof Reader (Aspen Software)
6. Scripsit Dictionary (Radio Shack)
7. The Word (Oasis)

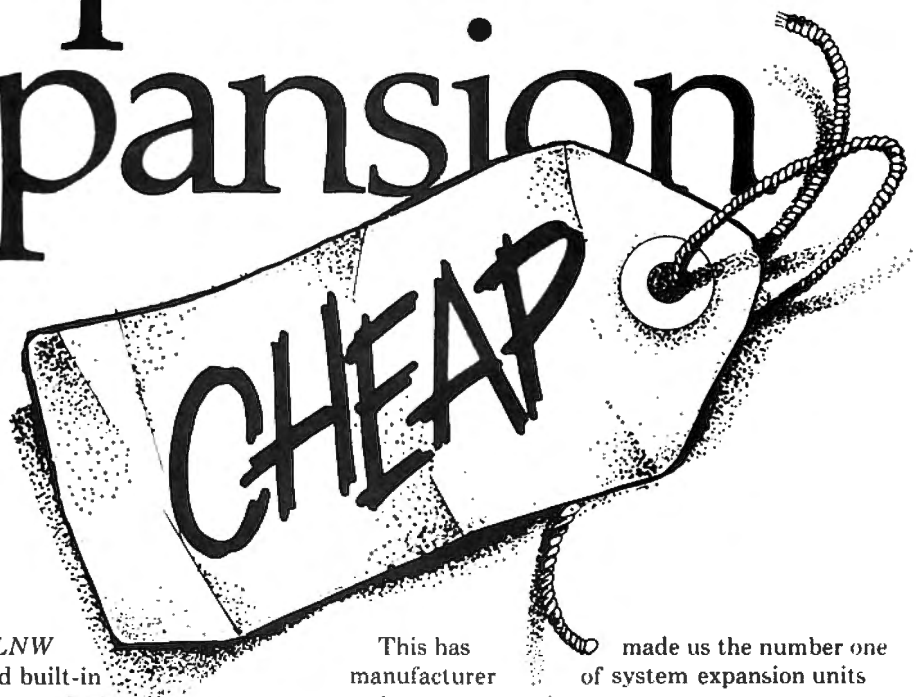
I/III—Utilities

1. Abe (Interpro)
2. Calcs IV (Meta Technologies)
3. CCEAD (Eigen Systems)
4. Clone (Mumford Micro)
5. Debug (Radio Shack)
6. Discat (Racet Computes)
7. DLDIS (Instant Software)
8. DUTL (MISO/SYS 80)
9. EDAS (MISO/SYS 80)
10. Edit (Algorix)
11. EDTASM (Radio Shack)
12. Extended Built in Functions (Snappware)
13. Full Screen Editor (DCS Software)
14. Global (Relational Systems)
15. Instant Assembler (Mumford Micro Systems)
16. Irv (Programmer's Guild)
17. KBE (Alternate Source)
18. Line Printer Spooler (Racet Computes)
19. M-Zal (Computer Applications)
20. Macro-Mon (Advanced Operating Systems)
21. Mon-3 and Mon-4 (Howe)
22. Quick Fix (Powersoft)
23. Quick Pro (Future Soft)
24. Quic-n-Easi (Standard Micro Systems)
25. SDS80C (Micro Works)
26. Step 80 (Mumford Micro Systems)
27. Stretch-Super Stretch (Algorix)
28. Super Keys (Advanced Operating Systems)
29. Super Utility (Breeze/QSD)
30. Super Utility Plus (Breeze/QSD)
31. System Diagnostics (Howe)
32. System Tape Duplicator (Small Systems Design)
33. Tasmon (Alternate Source)
34. T-Bug (Radio Shack)
35. TLDIS (Instant Software)
36. TSAVE (Algorix)
37. Tutil (MISO/SYS)
38. Ultra-Mon (Interpro)
39. Ultramon (Instant Software)
40. XBE (XEDIT) (Computer Applications)
41. XBUG (Computer Applications)

I/III—Word Processing

1. Appointment Management System (Data Automation Services)
2. Client/Bas Professional List System (Computer Generated Data)
3. Copyart (Simutek)
4. Custom (FCT Inc.)

Expensive Expansion



EXPENSIVE – The *LNW System Expansion II* and built-in comes with a full 32K of 200ns RAM. RS232c 20 MA current loop serial interface. That's for starters. Next, consider our heavy gauge steel case, power indicator lamp, gold-plated connectors, FR-2 glass epoxy circuit board with solder mask and silk screen legends. Then there is the parallel printer port, screen printer port, real time clock, and extra heavy duty onboard power supply with over current protection, over voltage protection and thermal shutdown. If that's not enough then there is the floppy disk controller, guaranteed operation at a 4MHz CPU speed and our 6 month warranty. Every one of these features is *STANDARD*. This is true system expansion. You get every 'expensive' feature without spending more.

CHEAP – Our price is $399.95. Any way you compare, features or price, LNW's *System Expansion II* is the clear winner. The LNW System has been field tested for over two years with thousands of users. It works with any DOS, is 100% TRS-80 Model I compatible and it works 'right out of the box'. If there is any doubt in your mind as to whether you should buy ours or the 'other guys', just ask an LNW owner!

WE ARE #1 – Number one in price, features, reliability, performance and delivery. LNW is committed to 'expensive' features and quality at reasonable prices. LNW is committed to support, thorough documentation, and reliability.

This has made us the number one manufacturer of system expansion units and accessories for the Model I computer.

EXPANSION OPTION – 8-inch drive capability is as easy as plugging in the *LNDoubler 5/8* option*. Now you can have any combination of single- or double-density, single- or double-sided, 8"* and/or 5" disks on-line! 8-inch disk storage increased to 591,360 bytes – 77-track single-sided, double-density or 1,182,720 bytes – 77-track double-density, double-sided.

The *LNDoubler's* unique 5/8 switch allows you to boot from 5- or 8-inch system disks and it's accessible from outside the interface. The $219.95 *LNDoubler 5/8* comes with a double-density disk operating system (DOS+ 3.3.9), *complete* with BASIC and utility programs... ready to run your software.

Each of your present 40-track, single-sided 5-inch drives will store up to 184,320 bytes (formatted storage) – that's an 80% increase in storage capacity for only half the cost of just one disk drive. With three 8-inch double-density, double-sided drives your Model I will have 3.75 Megabytes of online storage – that's more storage than a Model II or Model III!

LNW Research Corp.

2620 WALNUT Tustin, CA. 92680
(714) 641-8850 (714) 544-5744

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*8" drive operation requires special cable. 8" double-density requires 3.55MHz CPU speed up modification or LNW 80 4MHz computer

5. Electric Pencil (Michael Shrayer)
6. Hexspell (Hexagon)
7. Home I (Business Data Control System)
8. Lazy Writer (Soft Sector Marketing)
9. Micro Proof (Cornucopia)
10. Newscript (Prosoft)
11. Qwerty (Med Systems)
12. Scriplus (Powersoft)
13. Scripsit System I/III (Radio Shack)
14. Soft Screen (Aspen Software)
15. Soft Text (Aspen Software)
16. Special Delivery (Software Concepts)
17. Super Scripsit (Radio Shack)
18. Supertxt (Bluebird's Inc.)
19. Time Manager (Radio Shack)
20. Type & File (Bluebird's Inc.)
21. Ultimail/Bas (Computer Generated Data)
22. Word Processor (Word-V) (Micro Architect)

II—Accounting

1. Accounts Payable (Plus Computer Technologies)
2. Accounts Payable Purchase (Taranto & Associates)
3. Accounts System (Micro Architect)
4. Accounts Payable (North American Software)
5. Accounts Payable (Micro Architect)
6. Accounts Payable (Magnum Computer Products)
7. Accounts Receivable (Radio Shack)
8. Accounts Receivable (Plus Computer Technologies)
9. Accounts Receivable (Magnum Computer Products)
10. Accounts Receivable (Computronics)
11. ACCT-M2 (Micro Architect)
12. Accounts Payable and Receivable System (Construction Data Control)
13. Accounts Receivable, Balance Forward (Taranto & Associates)
14. Accounts Receivable, Invoices (Taranto & Associates)
15. Client Accounting/Posting (Peach Tree)
16. General Ledger (Computronics)
17. General Ledger (Instant Software)
18. General Ledger (Magnum Computer Products)
19. Time Accounting (Radio Shack)
20. Versa Ledger (Computronics)
21. Visaccount (All Systems Software)

II—Business

1. Calc Star (Micro Pro)
2. Construction Job Costing (Micro Business)
3. Electronic Broker (Radio Shack)
4. Easy Track (Plus Computer Technologies)
5. Fixed Assets (Plus Computer Technologies)
6. General Ledger (Graham Dorion)
7. General Ledger (Plus Computer Technologies)
8. General Ledger (Systems Plus)
9. Incoprop (EZ Software)
10. Inventory (Systems Plus)
11. Inventory Control (Magnum Computer Products)
12. Inventory Control System (Radio Shack)
13. Manufacturing Invoice System (ENM Development)
14. Market Tracker (H&H Trading)
15. Micro Tax (Microcomputer Tax Systems)
16. Option Investing (Options 80)
17. Order Entry/ICS (Radio Shack)
18. Payroll II (Graham Dorian)
19. Property Management (Peach Tree)
20. Property Management Systems (Micro Computer Sales)
21. Purchase Order Entry (Systems Plus)
22. Sales Analysis (Radio Shack)
23. Statistical Analysis (Radio Shack)
24. Visi File (VisiCorp)
25. Visi Calc (VisiCorp)
26. Visidex (VisiCorp)
27. Visi Plot (VisiCorp)
28. Visi Schedule (VisiCorp)
29. Visi Trend (VisiCorp)

II—Data Base Management

1. Aids-III (Meta Technologies)
2. Business Database (Charles Mann & Associates)
3. CCA (Personal Software)
4. Condor I (Condor Computer Corp.)
5. Condor II (Condor Computer Corp.)
6. Condor III (Condor Computer Corp.)
7. Data Ace (Computer Software Design)
8. Data View (Supersoft)
9. Database Estimating (Construction Data Control)
10. Database Management (Institute for Scientific Analysis)
11. DBase II (Ashton-Tate)
12. Indexing Scheme (Software Consulting Services)
13. Keyed File System (Racet Computes)
14. Magnum Data Management (Data Resources)
15. Profile II (Radio Shack)
16. Selector IV (Micro Applications)
17. Versafile (Radio Shack)

II—Data Communications

1. Binary Synchronous Communications (Radio Shack)
2. Business Information (FCT Inc.)
3. I-TERM (Info Soft)
4. Model II Videotex (Radio Shack)
5. Reformatter (Radio Shack)
6. Smart Terminal (Small Business Systems)

II—Disk Operating Systems

1. CP/M (Digital Research)
2. TRSDOS (Radio Shack)
3. TURBODOS (Data-Rx)

II—Education

1. Testrite (Class 1 Systems)
2. Microtyping (Hayden)

II—Games

1. Hypergate (Synware)
2. Hypergate Patrol (Synware)
3. Sargon II (chess) (Hayden)

II—Medical

1. Dental Billing (Small Business Systems)
2. Dental/Medical Patient (MICRO/SYS80)
3. FMS 80 (MICRO/SYS80)
4. Hospital Records (Agricultural Systems)
5. Medical Office Systems (Radio Shack)
6. Medical Control Information (Resource Software)
7. Medical Office Management (Charles Mann & Associates)
8. Patient Data Management (Micro Computer Sales)

II—Utilities

1. Automap (Snappware)
2. Autofile (Snappware)
3. Bootstrap (Eigen Systems)
4. BOSS-II (Soft Sector Marketing)
5. CALCS-II (Meta Technologies)
6. Compress (Snappware)
7. Cross Reference Utility (Racet Computes)
8. Development Package (Racet Computes)
9. DUMP (Snappware)
10. Extended Built in Functions (Snappware)
11. EDIT-80 (Microsoft)
12. I/SAL (Infosoft)
13. Macro Assembler (Programming Innovations)
14. Mince (Mark of the Unicorn)
15. MuMATH (Microsoft)
16. Program Editor (Radio Shack)
17. Quic-n-Easi (Standard Micro Systems)
18. Reformatter (Micro Technologies)
19. Renumber (Radio Shack)
20. RSMII (Small Systems Software)

II—Word Processing

1. Electric Pencil (Michael Shrayer)
2. Electric Webster (Cornucopia Software)
3. Magic Wand (Pickles & Trout)
4. Micro Proof (Cornucopia Software)
5. Palantir (Designer Software)
6. Perfect Writer (Computer Services Corp.)
7. Scripsit (Radio Shack)
8. Scripsit 2.0 (Radio Shack)
9. Scratch Pad (Supersoft)
10. Spell Binder (Lexisoft)
11. Spell Star (Micro Pro)
12. Super Text II (Muse)
13. Tickler File (Software Consulting)
14. Word Master (Micro Pro)
15. Word Processing II (Micro Architect)
16. Word Processing System (Construction Data Control)
17. WORD-5 (Micro Architect)
18. Word Search (Key Bits)
19. Wordstar (Micro Pro)
20. WP Daisy (Infosoft)

readers' choice

For each category, put down the number of the listed software package. If your choice is not on the list, write it in. Only one choice per category.

When you've made your selections, carefully cut this form out and mail it to: Readers' Choice Awards, *80 Micro*, Pine St., Peterborough, NH 03458.

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II—Education

II—Games

II—Medical

II—Utilities

II—Word Processing

CC—Business

CC—Data Communications

CC—Disk Operating Systems

CC—Education

CC—Games

CC—Graphics

CC—Utilities

CC—Word Processing

I/III—Accounting

I/III—Business

I/III—Data Base Management

I/III—Disk Communications

I/III—Disk Operating Systems

I/III—Education

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II—Accounting

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II—Data Base Management

II—Data Communications

awards

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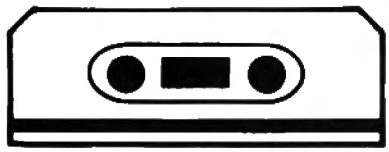

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In the April, 1981 issue of 80 Micro we introduced LOAD 80 to save you the time and trouble of typing our programs yourself. LOAD 80 cassette tapes contain dumps of the major program listings in 80 Micro.

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*Disks available from March 1982 to present

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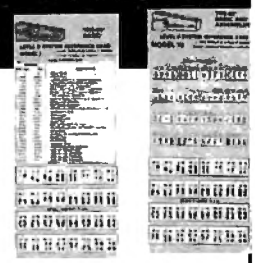

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For Models I, II, III and Color

At last! No more flipping through the pages of the Basic manual! No more working through the maze of machine language instructions! These cards completely summarize the Basic and Assembler manuals! FEATURES (on most cards):
memory map, eyeball graphics, math instructions, basic commands, store instructions, basic functions, load instructions, basic statements, move instructions, special keys, exchange instructions, print using examples, shift instructions, basic special characters, compare instructions, basic and assembler messages and codes, branch instructions, basic facts, data alteration instructions, reserved words, I/O instructions, ROM routines, complete character chart with graphics and space-compression codes, hex-dec chart, control code cross-reference, assembler instructions commands and operators, screen line layout, editor commands & subcommands, condition code easy access

Model I: BASIC only FC1001	$2.95
Model I: BASIC and Assembler FC1002	$4.95
Model II: BASIC and Assembler FC1005	$5.95
Model III: BASIC only FC1004	$3.95
Model III: BASIC and Assembler FC1003	$5.95
Color: BASIC and Extended FC1006	$4.95

NEW!

DOS RANDOM ACCESS & BASIC FILE HANDLING—By H.J. Muller. This book was written for the nonprogrammer. It is ideal for the businessman or professional who needs to solve and write special programs for in-house business problems, or the hobbyist who wants to go beyond the cassette recorder and into disk storage and file manipulation. It is written as a self-instruction tutorial and will provide anyone with some Level II experience with the ability to write special programs for inventories, mailing list, work scheduling, record keeping, research project data manipulation, etc. 150 pages. BK1236 $29.50

NEW!

FOR THE MODEL III

MOD III ROM COMMENTED —Soft-Sector marketing, 1981. This book is not an instruction course on machine language, but rather an information source that you can use time and time again for writing your own program or patching old Mod I machine language programs. It contains an explanation of ROMs in the latest machine from Tandy, with must every location of the 14K ROMs listed, with comments. BK1235 $22.50.

Prices do not include shipping and handling charges. Please include $1.50 for first book, $1.00 each additional book and $10.00 per book foreign airmail. Sorry no COD orders. Use the order card in this magazine to order. Allow 4-6 for delivery. Shipping and handling for cards only $1.00 per order.

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RELOAD 80

by Art Huston

Programs that go POKE in the night.

Load 80 has expanded to make room for this third annual Games Issue. We are offering two tapes and two disks this month, including everything from arcade games to card tricks.

Prices are higher this month only. The double-cassette package will cost $17.97, and the disks $29.97. Load 80 subscribers will receive the first disk or tape as usual with an option to purchase the second at reduced rates.

Move That Machine Language

Last month's RELOAD80 column began a discussion of program compatibility, or lack of it. A program designed for one machine might crash on a machine with a different memory capacity.

Having too little memory is obviously not good, but having more memory is no guarantee that a program will work correctly either. This occurs when running disks with a program designed for cassette-based systems.

Disk Basic programs load into higher memory than cassette-based Basic programs, because Disk Basic takes extra room in memory. A machine-language routine POKEd into memory locations above 31999, while above the top of a cassette Basic program, will actually overwrite the same program under Disk Basic.

Some Model I Level II programs take advantage of the free RAM in locations 16446-16511 (403EH-407FH) and 16722-16805 (4152H-41A5H). See The Freebie on page 304, December 1981 and Missiles From Mars on page 205, January 1982, which both use this technique. Disk Basic and the Model III use these addresses, so you may have to POKE the routine in elsewhere.

Here is a technique for moving the POKEs higher or lower. First, read the Key Box to see which system it was designed for. Determine the top of memory for that system and for yours. (The top of memory for 16K is 32767, for 32K 49151, and for 48K 65535.)

Now check the lines that actually POKE the routine in. Move the POKEs higher or lower depending on your system. This 16K Level II statement POKEs a routine into the top of 16K:

```
FOR ML = 32700 TO 32767:READ P:
POKE ML,P:NEXT
```

Here is the same statement moved 16K higher for 32K:

```
FOR ML = 49084 TO 49151:READ P:POKE
ML-65536,P:NEXT
```

and for 48K:

```
FOR ML = 65468 TO 65536:READ P:POKE
ML-65536,P:NEXT
```

Note that memory locations above 32767 are expressed as that location minus 65536. Memory address 65535 is expressed as 65535 minus 65536, or negative 1. Memory address 32768 is expressed as 32768 minus 65536, or negative 32768.

Moving the machine-language routine into the correct memory location is not enough; we must tell the Basic interpreter where that routine is located. Next month's column will discuss how to do this under cassette and Disk Basic, and how to switch from cassette to disk and back. It will also include a short program to help you handle hexadecimal, decimal and addresses above 32767. ■

Tape 1

Program	Title	Page	Comments
1	COPYRGHT	—	None
2	HFLYNN46	66	None
3	CUBE80	106	None
4	KALAH/SRC	132	Needs EDTASM
5	LUCKY13	156	None
6	ROUNDEND	156	None
7	STAR	156	None
8	DBLTRI	156	None
9	SLOTMACH	222	None
10	CRAM	234	None
11	MEMALPHA	254	None
12	TERMITES	274	None

Tape 2

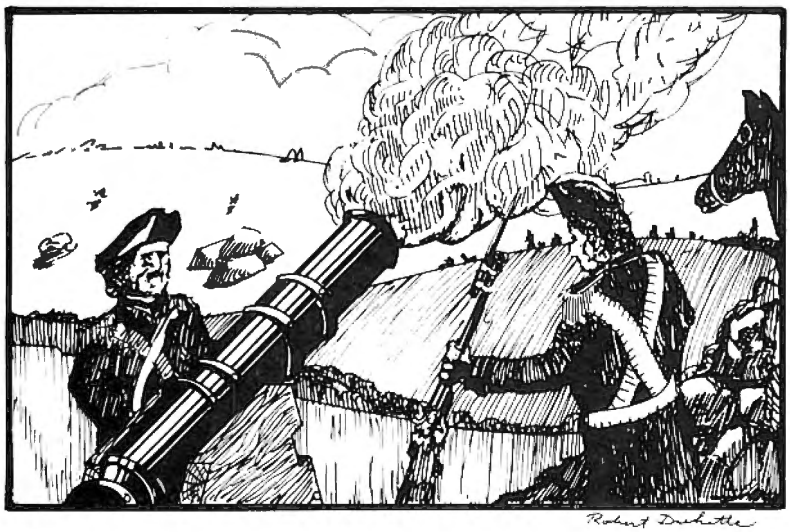
Program	Title	Page	Comments
13	SPY	80	None
14	SPYFIELD	80	None
15	TREK1	174	None
16	TREK2	174	None
17	SUBCHOP2	216	None
18	ACROSTIC	240	None
19	KUNGFU	248	None
20	PITTYPAT	270	None
21	THRUASTR	280	None
22	LOCO	286	None
23	CARDONI2	302	None

August Load 80 Directory

NEW PRODUCTS

Edited by Steven Frann

"Guns of Fort Defiance requires you to master the 'gunner's art' as practiced in the early 19th century."

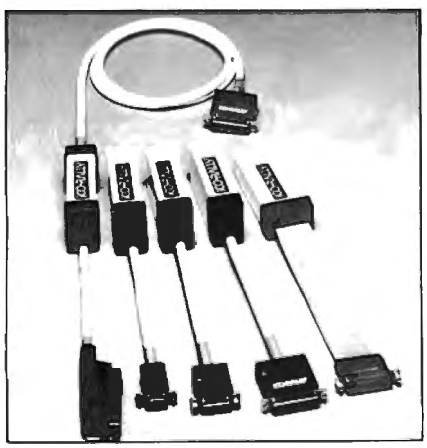


Do In the Enemy

Guns of Fort Defiance puts you in command of a Napoleonic era artillery piece and its crew attempting to repel a series of attacks by infantry, cavalry or artillery. This game requires you to master the "gunner's art" as practiced in the early 19th century. As your crew goes through the steps of the actual drill involved in loading and firing, you have to determine a type of ammunition appropriate for the target, the correct fuse length for shell or spherical case, the elevation adjustment corresponding to the range for direct or rolling fire, and the deflection needed to put each shot where it will do the most good.

This fast-paced strategy game for the Models I or III is available on cassette or disk for $20. For additional information contact Avalon Hill Microcomputer Division, 4517 Harford Road, Baltimore, MD 21214.

Reader Service ✓ 552



Match-Box cable system

Computer Cabling System

Match-Box enables computer and data processing equipment users to avoid long lead times when ordering customized cables for reconfigured systems or peripherals. With this product the user can pick up two applicable components, connect them, and simply program the cable to the computer, printer or other peripheral.

The system is built around two connectors—component A and component B. Component A is a connector with a one-foot-long section of cable attached to a Match-Box unit. Component B has a complementary Match-Box unit attached to a cable that can be as much as 100-feet long. To use the system simply connect the two components and program it by moving the pins within the Match-Box into the correct sockets.

Depending on the number of conductors used in the cable, Match-Box prices range from $19–$53. For more information contact Ico-Rally Corp., 2578 East Bayshore Road, Palo Alto, CA 94303, (415) 856-9900.

Reader Service ✓599

MicroMonitor Teleprocessor

You can update your present phone system with features that many PABX telephone switching systems don't offer by coupling the MicroMonitor into a telephone extension jack and monitoring all outgoing or in-coming traffic with your microcomputer. Features such as business call accounting, toll restricting, speed dialing, auto call-back, call intercepting, paging, and tone-to-pulse conversion are easily implemented.

This product has other applications as well. Salesmen in the field can use it for low volume numeric data entry without resorting to a modem. You can also use it for radio telephone paging applications, as part of a message retrieval system, or as part of a dial up security system that scans fire and entry sensors thus giving your home or business added protection.

Priced at $495, the MicroMonitor is available from MK Enterprises, 8911 Norwick Road, P.O. Box 29654, Richmond, VA 23229, (804) 740-8380.

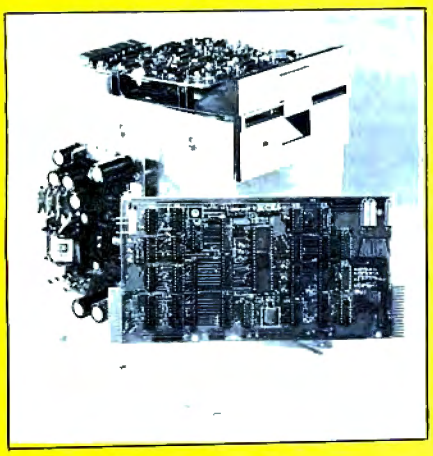
Reader Service ✓ 554

Tape Reproduction System

TRSDUM and TRSTUM facilitate the transfer of programs between disk and tape, disk and disk, and tape and tape. The Model III versions of these programs provide for the rewriting of existing tapes in the high speed mode. These programs read any tape or disk file that is in stan-

How to maximize your Model III:

You don't have to settle for standard equipment. Let MTI and Alpha Byte help you build the Model III you want.



MTI

MTI FLOPPY DISK ADD-ON KITS

Now you can upgrade your 16K level II Model III to a full 48K Disk System the easy way with MTI's Double Density Disk Controller and your choice of Disk Drives. You can choose 40 track, Double-Sided 40 track or Double-Sided 80 track Drives to supply your disk storage needs. Forty Track Drives store 175K, Double-sided 40 Track drives store 350K. Four Double-Sided 80 Track Drives provide up to 3 MEGABYTES of On-Line storage.

INTERNAL DISK DRIVE KITS

The first drive kit includes one Tandon Disk Drive, MTI Double Density Controller, Switching power supply, 32K of RAM, all mounting hardware, cables and Detailed Installation Instructions. The second internal drive kit includes a second drive and the necessary installation hardware.

40 TRACK DRIVE SYSTEM	
DRIVE NO. 1 KIT	649.00
DRIVE NO. 2 KIT	259.00
40 TRACK DUAL HEAD SYSTEM	
DRIVE NO. 1	729.00
DRIVE NO. 2	369.00
80 TRACK DUAL HEAD SYSTEM	
DRIVE NO. 1	889.00
DRIVE NO. 2	549.00

EXTERNAL DRIVE KITS

Two external drives can be attached to any dual drive Model III Computer.

40 TRACK EXTERNAL DRIVES	
DRIVE NO. 3	359.00
DRIVE NO. 4	339.00
DUAL HEAD 40 TRACK EXTERNAL DRIVES	
DRIVE NO. 3	479.00
DRIVE NO. 4	459.00
DUAL HEAD 80 TRACK EXTERNAL DRIVES	
DRIVE NO. 3	659.00
DRIVE NO. 4	639.00

FIVE MEGABYTE EXTERNAL WINCHESTER HARD DRIVE.....2795.00

Add the Ultimate in Fast High Capacity Disk Storage to any Model III Floppy Disk system. Reliable Winchester technology provides enough storage for the largest business files. Winchester disk drives have greatly increased data transfer rates and that means faster program and file loading. This is a complete self contained system that connects to a standard Model III Disk System in minutes without any modification to the computer.

MODEL III DIAGNOSTIC PROGRAM.....49.95

A complete diagnostic program for the Model III. Tests RAM and ROM, video display and all disk drives. Catch problems while they're small and be sure that your Model III is in perfect running condition.

MODEL III CP/M-80 NOW AVAILABLE!...799.00 CP/M® & 80 Column Kit.

Now you can run proven CP/M based software on your Model III, with standard 80-column display. A simple internal modification will transform your Model III into a NEW computer and allow you to run CP/M the industry-standard operating system and assure you of a large supply of fine software. Includes CP/M 2.2.

MODEL III SPEED-UP MOD.....149.00

Now you can run your Model III at 4 MEGAHERTZ, that's almost double the standard speed. This simple-to-install kit does require some soldering. (Requires DosPlus of CP/M 2.2)

MODEL III COOLING KIT.....44.95

Heat build up is a major cause of system failures and 'flakey' operation. This kit provides excellent cooling.

DOSPLUS OPERATING SYSTEMS FOR THE MODEL III

Solid BUG-FREE operating systems for the Model III. Supports different size drives on the same system and Basic Program Chaining with variables saved in memory.

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DOSPLUS 3.4 (80 TRACK)	119.00
DOSPLUS 4.0 (Supports Hard Disk)	129.00

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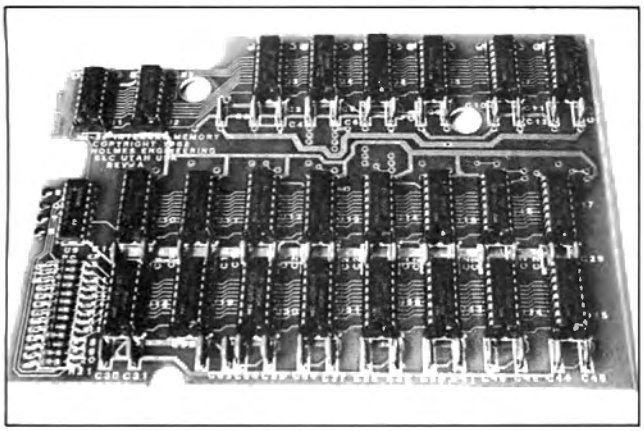


IM-2P internal memory

Model 140-RS interface

dard TRS-80 tape or disk protocol. The program that is to be transferred is loaded into internal buffers and converted to TRS-80 standard tape protocol.

These utilities automatically identify System, Basic and EDTASM formats from disk and tape sources and will produce files of the corresponding format on either disk or tape. These utilities display the name, length and format of all programs loaded.

For single drive Model I users, these utilities facilitate single disk drive copies of machine-language programs without the need for backup.

These utilities are implemented in high-speed machine language, are menu-driven, and provide full status displays at all times. They cannot defeat passwords on disk files or custom loaders on tapes.

TRSDUM, for 16K and larger disk systems with TRSDOS 2.3 or 1.3, is supplied on disk for $17.95. TRSTUM, for 16K tape-based systems, is supplied on cassette for $16.95. For more information contact CRB Microtools, 14835 N. First Ave., Phoenix, AZ 85023, (602) 993-3999.

Reader Service ↙ 555

Data Systems Security

Datalock I, a data system security device, prevents intruders from entering your data base system. This device features an encoding technique programmable by the data center manager, a data rate switch selectable to 9600 BPS, switch selectable word length, parity and stop bits, and standard EIA RS232-C connections.

Priced at $399 per unit, it is available from Terminal Brokers, 4265 Marina City Drive #411, Marina del Rey, CA 90291, (213) 822-3900.

Reader Service ↙ 591

Memory Expansion Without an Interface

The Internal Memory (IM) by Holmes Engineering expands your computer's memory capacity up to 48K without an expansion interface. The IM plugs into the RAM sockets inside the keyboard for easy installation without modifications. The unit runs reliably at high speeds, avoids reboots and data losses found in many memory systems, and does not overload power supplies.

This system comes in three models: the IM-1 ($86) for the Model I, the IM-2 ($139.50) for the Models I and III, and the IM-2P ($139.50) for the PMC-80/81. All kits upgrade your system from 16K to 48K. For more information contact Holmes Engineering, 3555 South 3200 West, Salt Lake City, UT 84119, (801) 967-2324.

Reader Service ↙ 564

Control a Random Access Projector

The Model 140-RS Interface drives a random access slide projector such as the Kodak RA-960 or Mast 137-S4 through the RS-232C port of your computer. Baud rate is 150-4800, field adjustable. The factory set level is 1200. Standard connectors are provided. Minimum memory and programming are required for the computer to control all functions of the projector including on/off and random slide retrieval. Any of 81 slides can be projected individually within 3.5 seconds. Average search for a selected slide is 1.5 seconds.

You can use the computer/random access projector system for programmable audio-visual presentations and interactive learning. You can easily create branching teaching programs using existing slide media.

The Model 140-RS Interface ($600) and random access projectors are available from Mast Development Co., 2212 E. 12th St., Davenport, IA 52803, (319) 326-0141.

Reader Service ↙ 557

Uninterruptible Power Supply System

The Series 2000 is a new line of small uninterruptible power supply (UPS) systems that provide low cost, full UPS protection.

The Series 2000 features a pre-assembled, pre-wired battery cabinet that combines with inverter and rectifier/charger cabinets to provide a compact system capable of being placed right in the computer room. A digitally-synthesized waveform offers faster response, better control and lower harmonic content on the output of the system.

The front panel with keyboard pushbuttons features independent LED displays for such conditions as circuit breaker status, individual power circuit status, rectifier on-off and inverter on-off.

The Series 2000 is available in 10 ratings from 5-30kW and 30 ratings from 15-45kW. For more information contact Exide Electronics, 2 Penn Center Plaza, Philadelphia, PA 19102, (215) 422-4015.

Reader Service ↙ 553

Color Computer Expansion Unit

The Color Computer Expansion Unit increases RAM to 64K, providing 61.5K of user RAM, continuous from zero. It includes a Z80A microprocessor which, along with the Color Computer's 6809 microprocessor, runs CP/M, FLEX and OS-9

Color Computer expansion unit

Cotton gin software

programs. The user can select via software between the Color Computer's built-in display and an 80 by 25 alphanumeric display, with reverse video, dual intensity, blinking/blanking, inverted and protected characters. A dual-density 5¼-inch disk controller supports four drives with up to 800K per disk for a total storage capacity of 3.2 megabytes.

Additional features include a Color Computer compatible RS-232 serial port, an optional IEEE-488/1980 controller for interfacing with numerous peripherals and laboratory instruments, an optional light pen, and two expansion busses for the addition of external circuitry. A built-in audio driver and speaker allow Color Computer audio output.

The unit plugs into the Color Computer cartridge port with no modification necessary and easily unplugs allowing stand-alone use of the Color Computer. Priced at $1585 without the IEEE controller and $1750 with the IEEE controller, it is available from George Associates, P.O. Box 960, Berkeley, CA 94701, (415) 843-3587.

Reader Service ✓ 563

Cotton Gin Software

Agri-Computer Services enhanced cotton gin software package files and accumulates information concerning individual bales of cotton. You can file the following information: gin bale number, warehouse bale number, gin weight, warehouse weight, owner's name and I.D. number, ASCS farm number, field number, price of seed, price of lint, grade and more. You can delete any of this information if it is not needed.

Using the filed bale data, the system will print various reports including ginning ticket, seed and ginning settlement sheets for gin customers, ASCS yield reports, bale ledger, daily gin summary, year to date gin summary, and others.

The program is available for the Models I, II, III, and 16. Agri-Computer Services will customize the program to the customer's operation. For additional information contact Summerville Enterprises, Agri-Computer Services, 104 Broad St., S.E., Aliceville, AL 35442, (205) 373-6383.

Reader Service ✓ 590

Doughflo

Doughflo aids home or business bookkeeping, tax preparation, cash flow analysis, and financial planning. The system features ease of data entry and can process large amounts of data (800 entries in memory with 48K machines). It yields many types of financial reports including grand totals, expenses as percent of total income or total expenses.

Entries can be made in any order while Doughflo organizes them by date, vendor code, name description, date of transaction, category or check/receipt number with fast machine language sorts. It automatically provides up to eight income accounts and 33 possible expense categories to group entries.

The package includes a summary subprogram that allows you to store the results of calculations in up to 24 files which are then available in any selected order. These stored results are available for automatic comparison to budget, each other or to averages.

The package requires a 32K or 48K, Model I or III. Priced at $98.95, it comes with detailed instructions and sample data files. For additional information contact Alphanetics, P.O. Box 597, Forestville, CA 95436, (707) 887-7237.

Reader Service ✓ 551

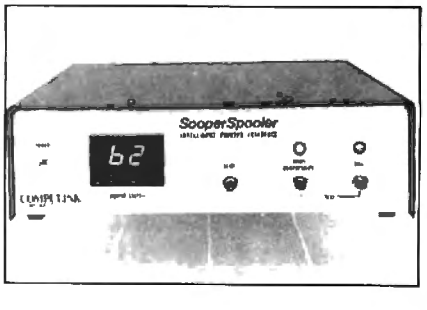
SuperSpooler

SuperSpooler is an intelligent printer interface. In addition to being a hardware buffer, many software-selectable formatting features are accessible with a simple Basic program.

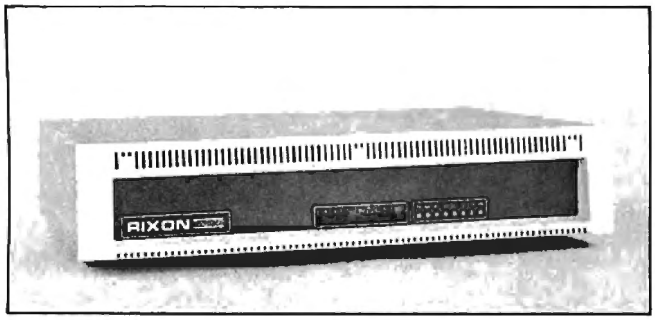
The base model ($349) includes a 16K byte memory and Centronics compatible I/O ports. Other standard features include a self-contained power supply, two digit LED display showing the amount of data stored in the buffer, and a brushed aluminum cabinet. Options include memory expansion to 62K ($159) and RS-232 serial I/O ports ($95) that can also be used for modem transmission and serial to parallel translation.

For additional information contact Compulink Corp., 1840 Industrial Circle, Longmont, CO 80501, (800) 525-6705.

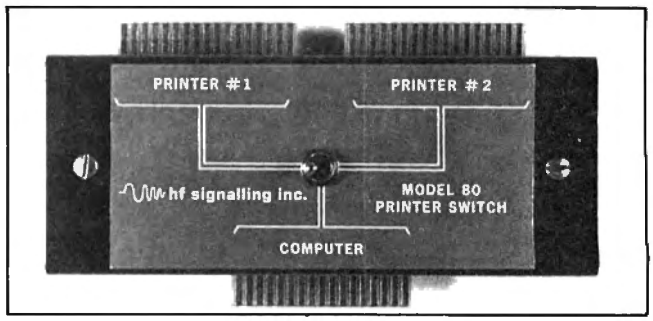
Reader Service ✓ 567



SuperSpooler



TA208A/B data modem



Model 80 printer switch

TA208A/B 4800 BPS Data Modem

The TA208A/B is an LSI (Large Scale Integration) Bell compatible 4800 bits per second data modem. You can configure it, as a switch selectable option, for two-wire DDD switched network operation (B mode) or four-wire private line operation (A mode).

Six pushbutton switches used in conjunction with eight LED visual indicators, located on the front panel, enable rapid isolation of a data communications system malfunction. Test features include analog loopback, digital loopback, and local end-to-end self testing.

The TA208A/B is compatible with Bell 208A and 208B, and Rixon T208A, T208B, and T208A/B data modems. It is available as a stand-alone desktop unit ($1895) or as a card modem ($1695). For additional information contact Rixon Inc., 2120 Industrial Parkway, Silver Spring, MD 20904, (301) 622-2121

Reader Service ✓ 596

Line Printer Switch

The Model 80 Line Printer Switch for the Models I and III allow you to have two separate line printers on line at all times. Selection of a printer is by means of a conveniently located switch, without changing interconnecting cables. The switch is a compact module that connects to the printer port of your Model I or III and provides an edge connector for each of your printers eliminating plugging and unplugging printer cables.

Priced at $55, it is available from HF Signalling Inc., P.O. Box 17510, Kansas City, MO 64130, (816) 931-4448.

Reader Service ✓ 574

Software Generates Unique Character Fonts

CHARGEN generates three different sizes of Script, Olde English, and Roman Bold characters on an Anadex DP-9000 series printer. This utility program can be used with existing word processing software for TRS-80 computers.

In operation you use the word processing program to generate a text file and then store it on disk. Then call CHARGEN. By selecting the appropriate print parameters, the printout is produced in the desired character font.

The program is written in machine language and requires at least 32K RAM and one disk drive. For more information on CHARGEN contact Joe King, 7342 Capistrano Ave., Canoga Park, CA 91307.

Reader Service ✓ 594

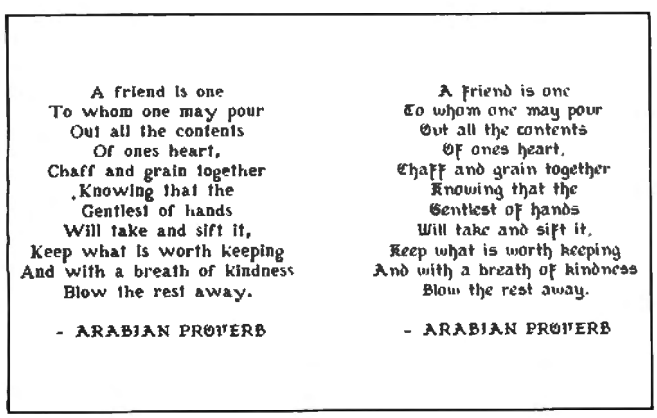
Stedi-Watt, Jr.

The Stedi-Watt, Jr. Model 718 offers immunity from the more complex causes of unwanted signals and electrical interference in computers and other sensitive circuitry. It features a seven-stage transient voltage and an RFI/EMI filter network and offers dual protection of 50 joules on both transverse and common modes.

Just plug it into a three-wire grounded 120 VAC outlet and turn on the lighted power switch. It includes a 15 amp circuit breaker and a green LED indicates all stages are functioning. It is ideal for hospitals, factories, lab technicians and other professionals.

Priced at $189.50, it is available from National Field Sales Inc., 2660 West Chester Pike, Broomall, PA 19008, (800) 543-3000 ext. 3443.

Reader Service ✓ 581



A friend is one
To whom one may pour
Out all the contents
Of ones heart,
Chaff and grain together
Knowing that the
Gentlest of hands
Will take and sift it,
Keep what is worth keeping
And with a breath of kindness
Blow the rest away.

- ARABIAN PROVERB

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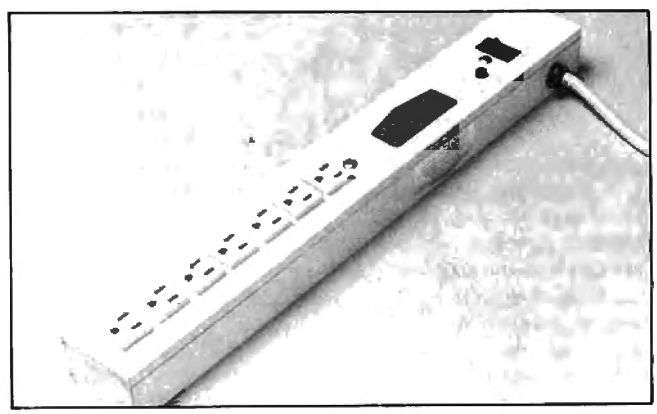
- ARABIAN PROVERB

CHARGEN print samples



Stedi-Watt, Jr.

M-ZAL™

Release Two Is Here!

Our Users asked for it, and we made the best TRS-80 disk assembler even better! Now M-ZAL has:

- Recursive MACROS with full symbolic parameter substitution
- Conditional assembly with unlimited nesting
- Text Editor warm-start/recovery option
- Support for all popular source file formats
- Load Module inspect/superzap using LINKER

and the features that made it famous:

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- Over 175 pages of documentation including Z-80 Technical Manual
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M-ZAL provides a modular, structured development environment that makes programming your TRS-80 a truly enjoyable experience. Order yours today. (Requires 32k, 2 disk system)

#1050-10	Mod 1	$149.00
#1250-10	Mod 3	$149.00

"We've been using M-ZAL heavily for over two months now, and it's been worth its weight in gold."
—Chuck Tesler
PROSOFT

"...well written software that is long overdue."
—Bruce Douglass
80 Microcomputing
BASIC Editor Review

"During the first 3 days of use, M-ZAL saved more money in programmers time than we had paid for the product."
—William Denman
Author of Asylum
MED SYSTEMS

"The editor has at least doubled my productive capacity...Having spent a good deal of money on so called 'utilities' that don't work, it's a delight to find one that not only lives up to its claims but surpasses the advertising."
—BASIC Editor user

Our choice for the best TRS-80 DOS:

DOSPLUS 3.4	Mod 1	$149.00
DOSPLUS 3.4	Mod 3	$149.00

CAU Development Software— The Professionals Choice:

Full Screen Text Editor for BASIC: we were the first to give the TRS-80 this indispensable ability! A must for every BASIC programmer:

#1010-20	Mod 1	$24.95
#1210-20	Mod 3	$29.95

T-ZAL: custom designed for the Model 3, this tape based assembler has many of M-ZAL's most desired features.

#1250-20	Mod 3 only	$49.95

XBUG: for machine language analysis and debugging—this tiny (2.5k) but powerful program lets you do it all!

#1020-10	Mod 1	$19.95
#1220-10	Mod 3	$19.95

FILEXFER: transfer any disk file between two TRS-80s. Use direct cable link or RS modems. Mod 1 and Mod 3 can be mixed. RS-232 and disk reqd.

#1040-10	Mod 1 and 3	$49.95

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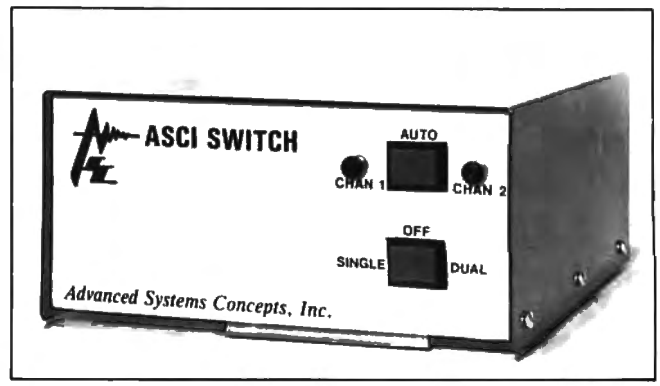
See List of Advertisers on page 338

Devoke Data Products' copper garland



ASCI switch

Copper Garlands Cut Printer Static

Devoke Data Products' tinsel-like garlands safely dissipate static generated by computer printers. Copper threads are woven into a base wire that hooks onto the printer housing and is held taut by springs at each end. As paper passes over the assembly, static is drained off so output paper stacks neatly. Garlands are 16-inches wide, with width adjustment made possible by repositioning mounting hooks. The units are available in packages of four garlands for $15.95. For more information contact Devoke Data Products, 3780 Fabian Way, Palo Alto, CA 94303, (415) 494-7511.

Reader Service ↙ 585

Construction Cost Management System

The Construction Cost Management System consists of job costing integrated with accounts payable, payroll and general ledger. The system accumulates costs by job and cost type and job phase and reports on those costs as compared to established budgets. Projected total costs may be determined either by percentage of completion or by units completed.

Job Cost reports include: job master listing, cost summary report, cost analysis by percent complete, cost analysis by units completed, labor cost report and month to date history report.

The accounts payable and payroll modules pass cost transactions to the job cost system as well as printing checks and providing basic accounting reports. Both modules provide automatic updating of the general ledger which prints standard financial reports.

The system runs on a Model III (or Model I with double density and the DOSPLUS operating system) with full memory and two standard disk drives. Larger disk configurations are supported including the hard disk for the Model III (with DOSPLUS 4.0).

The complete system is priced at $575, with the Job Cost alone priced at $350 and each accounting module $75 each. For additional information contact D.B. Software Co., 11840 NE Brazee, Portland, OR 97220, (503) 255-7735.

Reader Service ↙ 568

Lose Your Shirt and Walk Away Smiling

With an initial $5,000 you and your friends can speculate in shares of nine different corporations, or salt some of your money away in safe municipal bonds. Will you opt for slow but steady capital appreciation and the secure dividends of a public utility or mutual fund, or go for more spectacular growth (and a greater risk of loss) in the glamour industries of autos and real estate development? Perhaps the plunger in you craves the wild roller coaster of oil and uranium stocks? Whatever you choose, Computer Stocks and Bonds for the Models I and III stands ready as your loyal and unassuming broker.

This game allows you and up to three other players to summon stock analysis charts displaying not only the price history of the stock, but also detailed information on each player's performance with that company.

Priced at $20, it is available on disk or cassette from Avalon Hill Microcomputer Division, 4517 Harford Road, Baltimore, MD 21214.

Reader Service ↙ 565

Software Controllable Device For Computer Switching

The ASCI Switch allows users to have software controllable switching between any two peripherals using one computer port, or allows two computers to share the same peripheral by software switching of the peripheral between them.

Input and output ports of the ASCI Switch can be controlled by sending one of 128 user-selectable ASCII codes. The control code and baud rate are user selectable via switches located on the rear of the unit. In addition, there is no need for extra cabling or computer cards. The switch can be controlled by either data terminal equipment (DTE) or data communications equipment (DCE) without the need for a null modem.

The ASCI switch comes in two models. Model A10 switches 10 lines and Model A25 switches 24 lines of the RS-232 serial interface. The unit weighs two pounds and comes in a 3 by 5 by 7-inch metal enclosure. It can be powered by battery or an ac adapter. Priced at $295 for the A10 and $345 for the A25 it is available from Advanced Systems Concepts, P.O. Box Q, Altadena, CA 91001, (213) 684-5461.

Reader Service ↙ 573

Medical Office Manager

Medical Office Management I is a package for small medical office practice management. The latest version of the package allows use of a greater number of office procedures, a greater number of active insurance companies, and the use of up to four disk drives to increase the system's capacity and speed.

The package supports appointment scheduling, private patient billing, and

third party universal claims form preparation. The menu driven package comes with a new training and operations manual.

The system is for use with the Models I or III, requires 2-4 disk drives, 48K of memory, and a 130-column printer. It will operate on TRSDOS, NEWDOS or LDOS. The package is available from Charles Mann and Associates dealers for $795.95. A preview manual may be purchased separately for $50.

For additional information and dealer locations contact Charles Mann and Associates, Microcomputer Division, 55722 Santa Fe Trail, Yucca Valley, CA 92284, (714) 365-9718.

Reader Service ✓ 589

AMORT/BAS Produces Loan Schedule

The AMORT/BAS Loan amortization program for Model I and III computers with disk drives, minimum 32K RAM, and a printer computes the monthly loan payment given the loan amount, annual interest rate, and the term of the loan in months.

This product produces a loan schedule providing each month's payment number, interest payment, principal payment, loan balance, and fields for recording the date paid and check number of the payment. It prints subtotals for every year/part of year, giving the total interest, principal, and loan balance at the year end. After the monthly data is printed, a summary prints the total interest, total principal, the sum of the principal and interest, and the amount of the last payment.

Flashing cursors and operator prompts guide the operator through the program. One-key command entries and protected inputs eliminate operator error.

AMORT/BAS is supplied on a Model I TRSDOS 2.3 formatted disk and is priced at $34.95. For additional information contact Computer Generated Data, 5541 Parliament Drive, Virginia Beach, VA 23462, (804) 497-1165.

Reader Service ✓ 587

Procopy

Procopy is a fast disk-copy utility for the Model II which allows mass producing disks or backups. Each copy is a mirror image of the source disk and can be made in about 30 seconds on a preformatted disk. You can format and copy to a non-formatted disk in about 55 seconds. The verify option adds an additional 15 seconds.

Procopy works with from one to four disk drives and with most format versions. It requires all of memory from 2800H-E500H for its program and storage. It comes on a protected version 2.0 data disk and is executed from DOS Ready. Priced at $10, it is available from Pro-80 Systems, 3206 Center St., Cedar Falls, IA 50613, (319) 266-4262.

Reader Service ✓ 566

Dairy Diary

Dairy Diary is a dairy management package written by F.B.S. Systems Inc. that is designed to supplement DHIA records. This flexible program lets you input by code approximately 60 entries per animal per disk (200 animals/disk on the Model I and 300 on the Model III). The operator may add specific activity codes. This system produces reports on individual cow records; herd status and inventory; lists of lactating, dry, freshening, anticipated heat; and special reports on bulls and heifers.

The Model I and III versions require 48K and three or two disk drives respectively and are priced at $795. For additional information contact Paul P. Gutelius, Marathon Microsystems Inc., 2610 Grant St., Evanston, IL 60201, (312) 864-6289.

Reader Service ✓ 570

LemonAid Loader

An updated version of Lemons Tech Services' LemonAid Loader for improving Model I and low-speed Model III cassette loads is now available. The new model has a quick set-up switch for pre-recorded tapes and a separate loud output jack with screwdriver volume adjust. By plugging in an external speaker, audible monitoring of saves/loads and for pre-positioning tape is automatic. Game and other sound can be heard at room level without using a separate amplifier. Power is supplied automatically. The device is for use with Radio Shack CTR-80 or 80A, and other similar recorders.

The device retains all other features of the original LemonAid Loader. The new loader (model LLQ) is priced at $18.99. For more information contact Lemons Tech Services, 325 N. Hwy 65, P.O. Drawer 429, Buffalo, MO 65622, (417) 345-7643.

Reader Service ✓ 550

AUTHORIZED VR DATA DEALERS

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AR	Hot Springs	Microcomputer Systems
AR	Rogers	Computer Place, Inc
AZ	Tucson	Simutek Computer Products, Inc.
CA	Chino	Good-Lyddon Data Systems
CA	Oceanside	OK Electronics
CA	Pacific Palisades	Computer Management Consultants Inc.
CA	San Gabriel	MICRODOC
CA	Santa Clara	Desmar Electronics
CA	Santa Clara	B&C Compuvision
CA	Torrance	Booth Electronics
CA	Walnut	Computer Valley
CT	Bridgeport	Connecticut Information Systems Co.
CT	Danbury	Computer Services of Danbury
CT	Windsor	Command Performance
FL	Titusville	Computech
FL	Milton	Perry's Computer System
FL	Winter Garden	All Systems Go
FL	West Palm Beach	Computer Room
IA	Sioux City	Bytes and Nails
ID	Boise	Office Magic Computers
ID	Buhl	Idaho Microcomputers
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IN	Decatur	Solid-State Electronics/Radio Shack
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IA	Carroll	Wilkins Computer Service
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KS	Colby	T&W Electronics
MA	Tewksbury	Omnitek
MD	W. Hyattsville	Microcomputer Business Systems
MD	Baltimore	Microcomputer Business Services
MI	Milan	C&S Electronics
MN	Fergus Falls	Bob Fritz Electronics
NC	Hickory	Simplified Software
NE	Columbus	Columbus TV & Electronics
NH	Portsmouth	Portsmouth Computer Center
NJ	Three Bridges	Video Selection
NJ	Marlton	LCC Engineering
NY	Ashville	Wilson Typewriter Service
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NY	Woodhaven	Alpha Products
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OK	Tonkawa	Micro-Com Systems
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Canada, Cornwall (Ontario)—Helko Automated Products
Columbia, Cali—Microcomp del Occidente
Indonesia, Jakarta—Data Atlas
Italy, Florence—All 2000 Computer Systems
Philippines, Cebu City—Basic Instruments Phil, Inc.
South Africa, Durban—Braum Business Machines
South Africa, Johannesburg—Peter's Computer Discounts
West Germany, Dusseldorf—Uwe Markus Computer Systems
West Germany, Steinfurt—Fuessner Computer Systems
Singapore—Threshold Technology

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SPECIAL

TRS-80™ MOD III
48K—2 Drive—DISK III
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6.3 to 38 Meg
Winchester External
Hard Disk III
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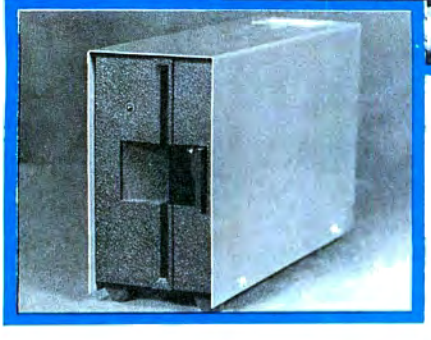

External Floppies
for MOD I or III
Fully compatible, 120 day warranty

$275.

80 TK or 2 sided **$419.**

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Optional HD III:

9.5 meg	$3695
19 meg	4295
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2 x 9.5 meg	5395
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CHECK THESE GREAT BUYS ON OTHER PRODUCTS:

Epson MX-80 w/graphtrax	$475.00	OKIDATA Microline 80	359.00	Verbatim 5¼" Diskettes	26.90
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MX-100 Ribbons	30.00	Lexicon Modem	125.00	Head Cleaning Kit 5¼"	14.95
Epson Graphtrax	75.00	Novation Cat Modem	175.00	Disk & Other Mysteries Book	19.95
C.ITOH F-10 40 cps	1,695.00	Novation D Cat Modem	199.00	Basic & Other Mysteries Book	27.50
Tractor	200.00	Percom Doubler II	169.00	NEC Ribbons (Min. 6)	5.95
C.ITOH & Diablo Ribbons	5.95	Percom Data Separator	29.95	Printer Cable	25.00
DC Hayes Smart Modem	259.00	Paper 9½ x 11 (Fanfold)	29.95	LDOS Operating Sys.	129.00
DC Hayes Micro Modem II	339.00	Paper 14⅞ x 11 (Green Bar)	34.95	DOSPLUS Operating Sys.	149.00

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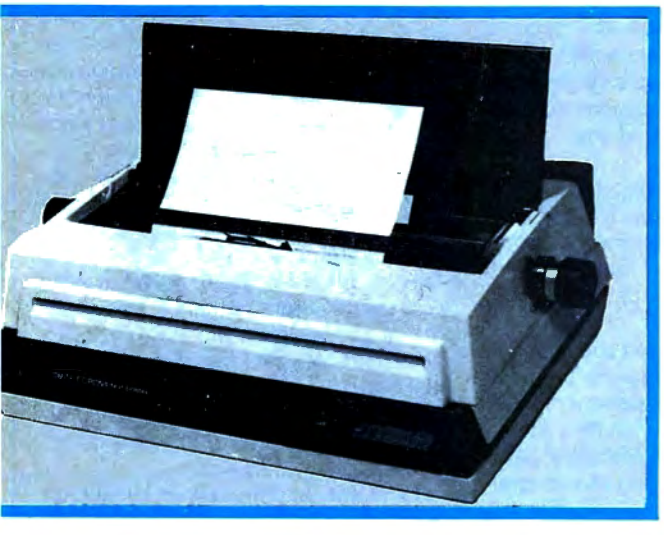

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NEW PRODUCTS

MVP printer

MVP Printer

The MVP selectable-mode printer offers three operator and computer-selectable print modes, or speeds. The dot density corresponding to each mode tailors the MVP for printing applications required in small office/multi-task operations, distributed data networks, and heavy-duty industrial uses.

Print speeds are 80 lines per minute (100 by 100 dots per inch) for correspondence and word processing applications; 150 lines per minute (60 by 72 dpi) for data processing output; and 200 lines per minute (66.7 by 66.7 dpi) for compressed character printing on reduced printout format.

The MVP's self-driven shuttle mechanism integrates a linear motor into the assembly assuring office quiet operation in a desktop size.

Its printing capabilities include six-part forms, business graphics, plotting, forms generation, labeling, OCR and bar codes. Other standard features are double-height printing, character printing, underlining, and electronic vertical formatting.

MVP options provide special and expanded character sets, multi-language output capability, a manual forms length selector, and an RS-232C interface. A printer pedestal, front entry paper feed, and a paper collecting basket also are offered.

For more information contact Printronix Inc., P.O. Box 19559, Irvine, CA 92713 (714) 549-7700.

Reader Service ✓ 562

Dental Practice Office Manager

The Dental Office Management application for the Model II handles appointment scheduling, claims form management and accounts receivable of a small to medium sized dental office. The system handles either single practitioners or small group clinics.

The appointment and registration elements work together to easily enter new patients and schedule appointments for old and new patients in real time and features an automatic patient recall system.

The system includes a full accounts receivable system allowing for the preparation of daily practice management reports and transactions reports. Monthly statements are prepared automatically with full aged accounts reporting and special collections management elements.

The package requires a 64K Model II with at least two disk drives and a 130-column printer. It operates under TRSDOS or any TRSDOS compatible operating system. Priced at $1,295.95, it is available from Charles Mann and Associates, Microcomputer Division, 55722 Santa Fe Trail, Yucca Valley, CA 92284, (714) 365-9718.

Reader Service ✓ 588

Linear Programming

LP-Disk solves any linear programming problem with up to 50 variables and 50 constraints (maximize, minimize, less than, greater than, or equal to). The simplex algorithm is in machine language for fast calculation.

The program supports full disk I/O features including save the problem on disk, change the problem data and save the last tableau on disk. It offers optional printing of the problem data and the tableaus. All printed output is in a readable format. The solution includes sensitivity analysis (price ranges and shadow prices) and maximum errror of solution.

LP-Disk runs on any microcomputer with CP/M, one disk drive and 48K of memory, or the Models I and III with one disk drive and 32K memory. Priced at $149.95 for the Model I and III versions and $199.95 for the CP/M version, it is available from Agricultural Software Consultants, 1706 Santa Fe, Kingsville, TX 78363, (512) 595-1937.

Reader Service ✓ 571

Value Line Averages Data

A 20-year record of the Value Line Stock Market Averages is now available on disks from D.B. Management Inc. With this data you can research your hedge or speculative trading strategy in preparation for trading the newest futures market innovation: the Kansas City board of Trade stock index futures contract (KCBT-VLA).

The package includes the Value Line Composite, Industrials, Rails, and Utilities Averages. Weekly closing averages are available from June 31, 1961 to the present for $35 while daily closing averages date from January 1, 1975 to the present and are priced at $65. If you purchase both data sets the price is $95. The daily KCBT-VLA futures prices are also recorded beginning with the opening day and are available free of charge with the purchase of any of the above.

The historical data base is compatible with the Models I, II and III. For additional information contact D.B. Management Inc., 16407 Evans Ave., South Holland, IL 60473, (312) 596-5755.

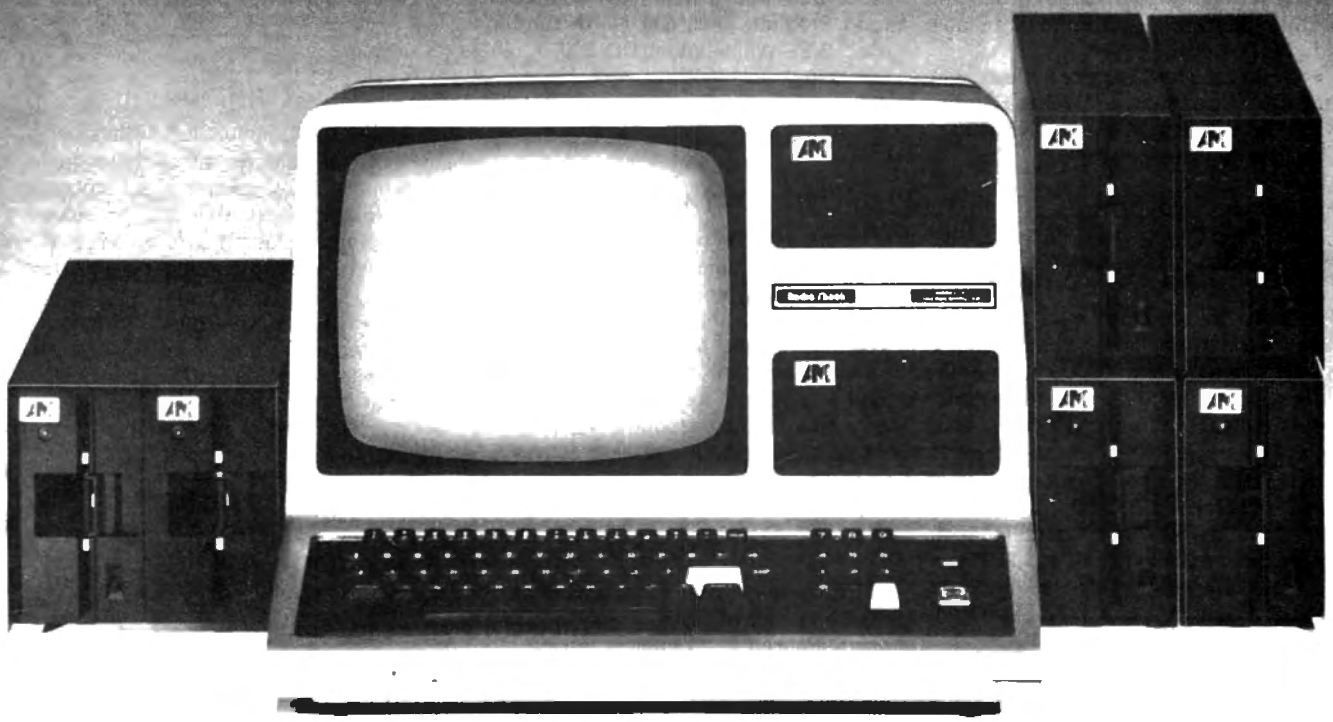
Reader Service ✓ 595

Conductive Floor Mat

The 9453 Static Control Floor Mat from 3M provides effective static control in locations where electronic systems are in use. It prevents time and money losses caused by equipment outages or data errors.

The earth-tone brown mat, which complements most office decorating

BORN TO RUN



Get your TRS-80™ up and running with special system & disk drive values like these . . .

Complete TRS-80 Model III microcomputer system with disk drives

A.M. Electronics Model III with 48K RAM, two Tandon 40-track double-density disk drives, A.M. Electronics controller board, DOS and manuals, complete and ready-to-run! $1895.00

Prepaid shipping when order is pre-paid.

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Tired of unreliable double density operation? With Multiplier, you can upgrade from a single-density without doubling your problems $99.95

Your Choice:
Teac or Tandon 5¼-inch disk drives, complete!

40-track single side disk drive with power supply, case and extender cables $250.00

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16K 200 nanosecond RAM chips ..... $2.00 each

New! Teac double-head 5¼-inch 40-track disk drive!

Complete with power supply, case and extender cables $340.00

New! Tandon "Thinline" 8-inch disk drive, complete!

For TRS-80 Model II, complete with dual case, power supply, and cables $695.00

New! Hard disk drives for Model III — Ready to plug in and run!

6.5 Megabyte drive $1995.00
9 Megabyte drive $2195.00
14 Megabyte drive $2395.00
(DOS extra)

TRS-80 Model III Commented

The definitive guidebook to Model III ROM . $15.00

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schemes, measures 4 by 5 feet and has a 30-inch lip to project under a desk or work station. Non-skid fastening strips on its back surface eliminate movement and curling. The mat has a 15-foot grounding cord to firmly connect it to a reliable ground.

The mat sells for $310. For additional information contact 3M, Department DR82-3, Box 33600, St. Paul, MN 55133.

Reader Service ✓ 592

New TRS-80 Compiler

Britain's Southern Software has just released Accel3, their latest Basic compiler for the Models I and III. Accel3 has the highest compatibility with source Basic and handles unstructured For...Next loops and arrays with adjustable bounds. It features quicker compilation and more compact compiled code (typically 10-35 percent larger than Basic source) than its predecessor Accel2. Priced at $99.95 ($50 to Accel2 owners) it is available from ALGORIX Software, Box 11721, San Francisco, CA 94101, (415) 387-3131.

Reader Service ✓ 558

New Information Providers

Two new information providers are now available on the CompuServe Information Service: Money Market Services and Small Business Reports.

Money Market Services, a corporation specializing in financial and economic research, uses weekly Federal Reserve data to forecast interest rate trends and their effect on the stocks, bonds, and commodities markets. A library of the firm's weekly financial newsletters is also available through CompuServe.

Small Business Reports provides current information on capital investment and savings plans, tax laws, insurance tips and services available to aid operators of small businesses.

Information from these new sources can be accessed for the standard fee of $5 per hour. For more information contact CompuServe, 5000 Arlington Centre Blvd., Columbus, OH 43220, (614) 457-8600.

Reader Service ✓ 559

System Savers

System Savers is now a two-program package for the Model III consisting of FLEXL and TDISK. FLEXL allows making backup copies of standard system format tapes. Disk owners can use TDISK to save system format tapes onto disk; TDISK even loads non-contiguous tapes. System Savers will not copy protected tapes.

Priced at $19.95 for Model I and III 16K cassette, it is available from Acorn Software Products Inc., 634 North Carolina Ave., S.E., Washington, DC 20003, (202) 544-4259.

Reader Service ✓ 560

Home Handy Hints

Home Handy Hints teaches you 50 ways to save time and money in areas such as energy costs, cooking, cleaning, childcare, and home maintenance. It is available for the Models I or III and requires at least 16K RAM. Priced at $13.83 (add $1 postage) for cassette, it is available from Nancy Modney, 4144 N. Via Villas, Tucson, AZ 85719, (602) 293-5186.

Starter Kit

The computer user's Starter Kit fills the start-up needs of 5½-inch and 8-inch disk users. Packed in a reusable box are a library case for disk storage, a head-cleaning disk with cleaning solution, disk labels, write protect labels, backup and archive labels, and mylar hub rings.

The kit also includes six plastic hard-copy binding posts and a nail clipper for trimming the posts, two floppy-disk writer pens, a No Smoking decal, lint-free cleaning cloth, six plastic wire ties, and two moist towelettes.

Priced at $29.95 for either the 5¼-inch or the 8-inch version, it is available from Ico-Rally Corp., 2575 East Bayshore Road, Palo Alto, CA 94303, (415) 856-9900.

Reader Service ✓ 579

Trade 80

Trade 80, a computer bulletin board system (CBBS) program, features chat mode, personal and general message sections, a local feature section supporting uploading and downloading, and a library section filled with programming tips and reviews.

It is written completely in Basic and is structured so anyone can make changes. It is available for the Models I or III with or without host. It runs under DOSPLUS or NEWDOS80 and can be modified to run under other operating systems.

Priced at $150 with host and $125 without host, it is available from Joe Agrella, 1226 N.W. Fourth Ave., Fort Lauderdale, FL 33311, (305) 525-1192.

Reader Service ✓ 593

MicroBev

The MicroBev Distribution System is a turnkey computer system designed strictly for small beer and soft-drink distributors. The software is designed for the Model II and runs on the TRSDOS operating system. MicroBev is written in Basic

Computer-user's starter kit

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WE SERVICE EVERYTHING WE SELL, WE'LL ALSO SERVICE YOUR MODIFIED EQUIPMENT (PROVIDED DOCUMENTATION IS AVAILABLE), AT REASONABLE SERVICE RATES.

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OLOR DRIVE 0 ASSEMBLY.....	$ 459.00
.P.I. OR TANDON DRIVES FOR COLOR, MOD I, MOD III, RAW (FROM $199.00) COMPLETE (FROM $259.00).....	$ CALL
.P.I. OR TANDON 8" DRIVES FOR MOD II, MOD 16, RAW (FROM $499.00) COMPLETE (FROM $649.00).....	$ CALL
RINTERS, R/S, EPSON, CITOH, MICROLINE, & OTHERS.....	$ CALL
INCHESTER DRIVES FOR MOD III, 6.4 meg, COMPLETE WITH DOS & INTERFACE, PLUG IT IN AND RUN.....	$1995.00
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TO HAVE THE R/S 90 DAY WARRANTY IN EFFECT, REQUIRES CONSTRUCTION FROM R/S SUPPLIED COMPONENTS, AT SLIGHTLY HIGHER PRICES.

EQUIPMENT CONSTRUCTED WITH COMPONENTS PURCHASED DIRECTLY FROM THE MANUFACTURER IS COVERED BY A SIX MONTH PARTS AND LABOR WARRANTY BY LEVEL IV PRODUCTS, INC.

YOU MUST SPECIFY WHEN ORDERING TO ASSURE THE LEVEL OF COVERAGE YOU REQUIRE.

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A CHARGE OF $10.00 WILL BE MADE FOR ALL RETURNED CHECKS.

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DOMESTIC SHIPMENTS OF ITEMS IN THE U.P.S. SIZE AND WEIGHT RANGE YOU MAY ADD 1.5% OF THE ORDER VALUE TO COVER CHARGES FOR SHIPPING, HANDLING, AND INSURANCE. (MINIMUM IS $2.50)

ADD $1.50 FOR ALL C.O.D. SHIPMENTS.

DEALER'S NOTE: Some key areas are still available for both re-sale and servicing dealerships, contact our Headquarters Division for Details.

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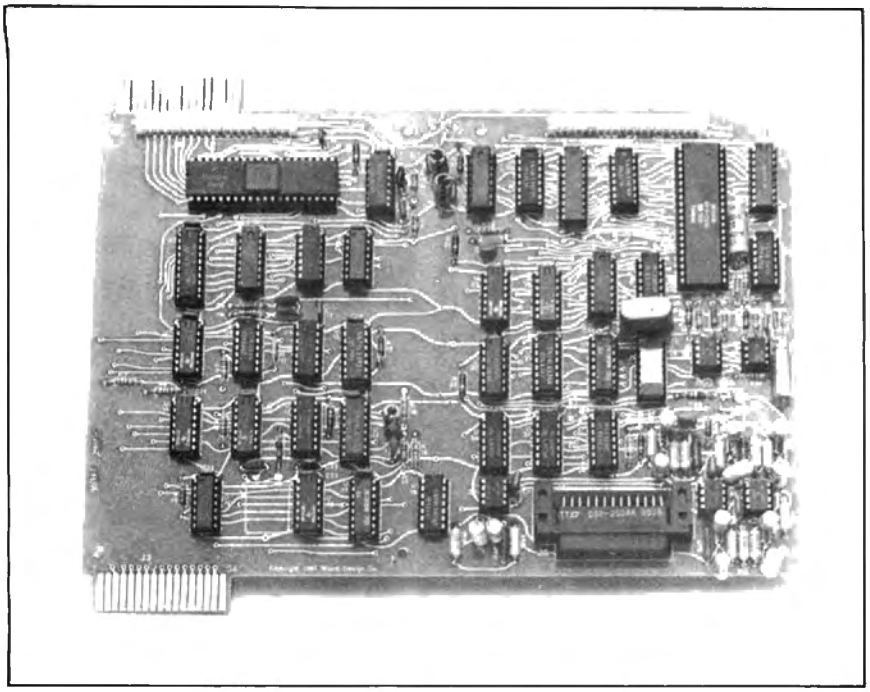

MDX-3 interface expansion board

and handles volumes of data using an assembler ISAM file access to speed up processing.

The system includes inventory control, invoice processing, purchase order preparation, customer control, and route processing.

For additional information contact Microcon Digital Systems Inc., 126 West Walnut St., Kokomo, IN 46901, (317) 457-6623.

Reader Service ↙ 556

Relocator to the Rescue

Now you can use those machine-language utilities you bought for your 16K machine on your upgraded 48K machine. Relocator rewrites and moves your existing machine-language programs so they use the memory locations you want them to use. Relocator will relocate itself to fit whatever memory you have from 16K up and combines several conflicting programs into one coordinated convenient module.

Priced at $16.95 for Level II tape systems, or $19.95 for disk systems it is available from Micro Pro Systems, Route 2 Box 533, Cumming, GA 30130, (404) 887-6814. Please include $2 for shipping.

Reader Service ↙ 580

Model III Expansion Board

The MDX-3 Interface Expansion Board mounts inside the Model III. It provides a dual density floppy disk controller and data separator, a 20ma and RS-232 serial port and a 300 baud direct-connect phone modem. The MDX-3 board is sold in kit form ($74.94) or as a finished product ($324.95). The User's Manual includes sections on board construction, circuit description, design overview and also includes data sheets on the MOS devices used.

For more information contact Micro-Design, P.O. Box 748, Manchaca, TX 78652.

Reader Service ↙ 584

Labor Distribution Module

International Micro Systems has expanded its payroll system, with a Labor Distribution module. Users can now assign an employee's salary or wage to as many as 30 different departments with each assignment made at differing rates. Complete reports are available by account or employee.

The IMS Payroll System allows small to medium sized businesses and accounting service bureaus to print payroll checks and registers as well as 941A and W-2 forms while keeping track of vacation and sick time for each employee.

The System permits up to eight user-definable deductions in addition to state and federal deductions. Posting is automatic to General Ledger, Job Accounting, or Fund Accounting systems available from IMS.

The Labor Distribution module features hard disk compatibility, a terminal configuration program, a fast machine language sort/merge utility, operator control through convenient screen menus, and full documentation.

IMS software requires CP/M or MP/M, CBasic II, 64K of memory, and a minimum of two disk drives of 500K per drive. For more information contact International Micro Systems, 6445 Metcalf, Shawnee Mission, KS 66202, (913) 677-1137.

Reader Service ↙ 561

Morse Code Communications

The Morse Code Communications program for the Models I and III provides the means to send and receive morse code. You can use it on the air or as an effective morse code instructor. The program generates perfect code at up to 40 wpm and can copy signals at over 100 wpm. Copy is obtained even when the speed varies up to 24 percent. Messages and CQs may be sent in response to a single key stroke.

The program uses cassette I/O and requires at least 16K of memory. It is available on cassette with a nine-page instruction booklet for $19.95 from ROGO Computer Products, 4752 DeBeers Drive, El Paso, TX 79924.

Reader Service ↙ 569

Graftrax-Plus

Graftrax-Plus, an advanced graphics capability for the Epson MX series of printers, is now standard in the MX series and is also available as retrofittable PROMs. The new graphics function offers a total of 66 different type fonts, including italics, subscript and superscript for small print and scientific notation, and international symbols for most Western languages. Graftrax-Plus can also underscore with one pass of the printhead instead of two.

Other features of Graftrax-Plus include programmable form length, horizontal tab

Circle 240 on Reader Service card.

Freedom Technology International

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EASY to install, plug-in boards; no wires or traces to cut; no soldering.

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and right margin, software printer reset, and true backspace. The function also produces high-resolution, bit-image graphics, with up to 120 dpi available horizontally, and 216 dpi available vertically.

For more information contact Epson America, 3415 Kashiwa St., Torrance, CA 90505, (213) 539-9140.

Reader Service ✓ 572

Ghost Gobbler

Ghost Gobbler is a maze-type game for the Color Computer. Four relentless ghosts intent on your destruction chase you around a maze. If you can make it to a power dot, the monsters turn blue and become edible. Then you can gobble the ghosts, but watch out, they flash on and off before becoming poisonous again. Eight different bonus shapes are available ranging in value from 100 to 500 points. Sixteen different skill levels provide hours of fun and enjoyment for the entire family.

Ghost Gobbler is written in machine language for fast action and features high-resolution graphics and sound. It requires 16K of RAM and joysticks. Priced at $21.95, it is available from Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466, (206) 565-8483.

Reader Service ✓ 575

Enumerator Line-Numbers Text Files

Enumerator automatically line-numbers text files created with MicroPro's WordStar. Line-numbered text aids proofreaders in pinpointing an author's typographical errors. By citing page and line numbers, rather than citing page, paragraph and line designations, a proofreader saves time and reduces the chance for compounding errors.

Enumerator offers users the opportunity to format every aspect of output. It also creates a new line-numbered file without changing or deleting the original file and allows lost, unnumbered text files to be restored from the numbered file. The menu-driven program automatically scrolls text onto the screen, allowing you to see what is being done and to quickly abort the program in the event of instruction error.

Enumerator is available on an 8-inch CP/M-formatted disk for $40. For further information contact The Orthocode Corporation, P.O. Box 6191, Albany, CA 94706.

Reader Service ✓ 577

Scott Adams Adventures For CP/M Users

Now CP/M users can enjoy Scott Adams Adventures.

Adventure International is now marketing all 12 of the adventures on a single-density, soft-sectored, 8-inch disk, compatible with any Z80 based computer running under CP/M.

Priced at $129.95, it is available from Adventure International, Dept. G, Box 3435, Longwood, FL 32750, (305) 862-6917.

Reader Service ✓ 576

Sixteen Focuses On Model 16

Sixteen is a new publication devoted exclusively to the new TRS-80 Model 16 microcomputer.

Sixteen will provide hints, tips, product reviews, program listings and general news and assistance. It will sell for an introductory price of $25 in the United States, $32 in Canada and Mexico. For ordering information contact *Sixteen*, 5803 Timber Ridge Drive, P.O. Box 209, Prospect, KY 40059, (502) 228-4492.

Reader Service ✓ 578

Report Writer

DeZoysa Enterprises' line-oriented word processor for the Models I and III permits up to 300 lines of text. It automatically stores text lines on disk and makes them available for subsequent use. It features six editing codes and 12 menu options (all on screen).

The program displays any part of text for review or correction. You can insert or remove lines of text, save all or part of text under different file names, append different text files to the one currently in the computer's memory, print all or part of the text, and print mailing labels for both sender and recipient in the case of a letter. A direct keyboard to printer output feature converts the keyboard to an electric typewriter. Unique on screen identification of uppercase letters for unmodified Model I keyboards is also featured.

The program is totally menu-driven and crash proof. It requires one disk drive, TRSDOS and 32K. Supplied on cassette only with instructions for easy transfer to disk, it is priced at $17.50 and is available from DeZoysa Enterprises, P.O. Box 170, Keyport, NJ 07735.

Reader Service ✓ 583

Software Evaluator's Guide

The *Evaluator's Guide for Microcomputer-Based Instructional Packages* includes a summary of MicroSIFT's evaluation process, glossary, a detailed explanation of all review components, two copies of the review form and sample reviews.

Preservice and inservice students, practitioners, software developers and users of software reviews will find it useful. Software authors can refer to it as they set their standards of quality. Adoption committees can follow it as they develop courseware recommendations. Professors of education can use the guide as their classes discuss advantages and limitations of typical instructional software packages.

Priced at $2.50 (US) prepaid, the guide is available from the International Council for Computers in Education, Department of Computer and Information Science, University of Oregon, Eugene, OR 97403, (503) 686-4414.

Reader Service ✓ 582

Dual Processor Option For the Model II

The 8086 Dual Processor Option (DPO) for the Model II transforms the Model II from an 8-bit to a 16-bit microcomputer. This unique dual-processor option allows the Model II to run the CP/M-86 operating system from Digital Research and MS-DOS from Microsoft, making available thousands of additional applications.

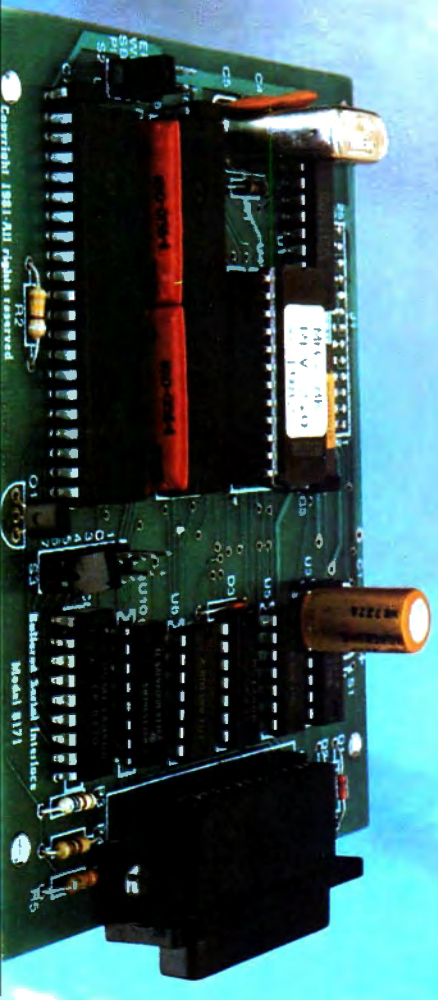
The DPO board comes with standard memory of 128K. This can be upgraded to 256K.

The Z80 microprocessor that is standard on the Model II is used as an I/O processor and all Z80 compatible software can still run using CP/M-80 and TRSDOS operating systems.

The 8086 Dual Processor Option resides in one slot in the TRS-80 motherboard. For more information contact Veritas Technology Inc., 2375 Zanker Road, Suite 245, San Jose, CA 95131, (408) 263-0646.

Reader Service ✓ 586

HOW TO USE YOUR EPSON WITHOUT WASTING COMPUTER TIME:



Your computer is capable of sending data at thousands of characters per second but the Epson can only print 80 characters per second.

This means your computer is forced to wait for the printer to finish one line before it can send the next. A waste of valuable time.

THE NEW MICROBUFFER™ ACCEPTS DATA AS FAST AS YOUR COMPUTER CAN SEND IT.

Microbuffer stores the data in its own memory buffer and then takes control of the printer. This frees your computer for more productive functions.

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Microbuffer model MBP-16K is a Centronics-compatible parallel interface with 16,384 bytes of on-board RAM for data buffering.

The MBS-8K is a full-featured RS-232C serial interface with both hardware and software (X-On/X-Off) handshaking, baud rates from 300 to 19,000 and an 8,192 byte RAM buffer.

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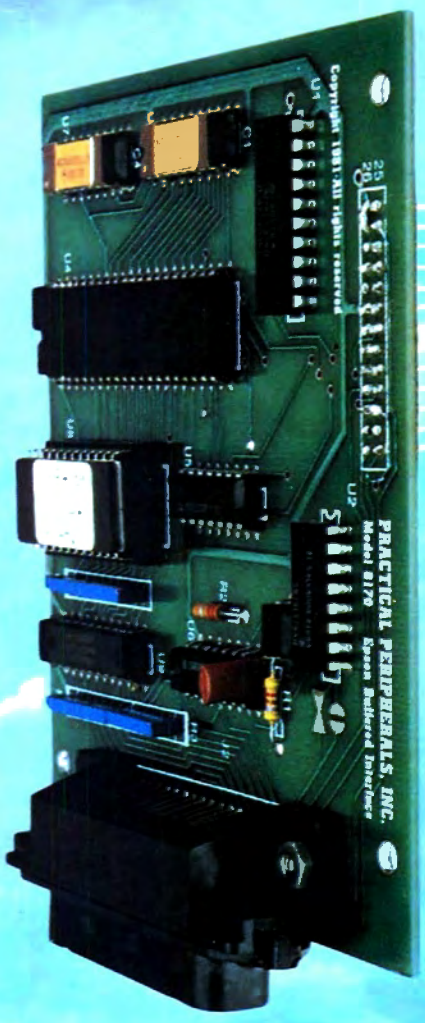
Either model fits the existing auxiliary interface connector inside the Epson MX-80, MX-80 F/T or MX-100 without modification, and is compatible with standard Epson cables and printer control software, including GRAFTRAX-80.

JUST $159.00*

When you think how much time Microbuffer will save, can you afford *not* to have one? Call us for your nearest dealer.



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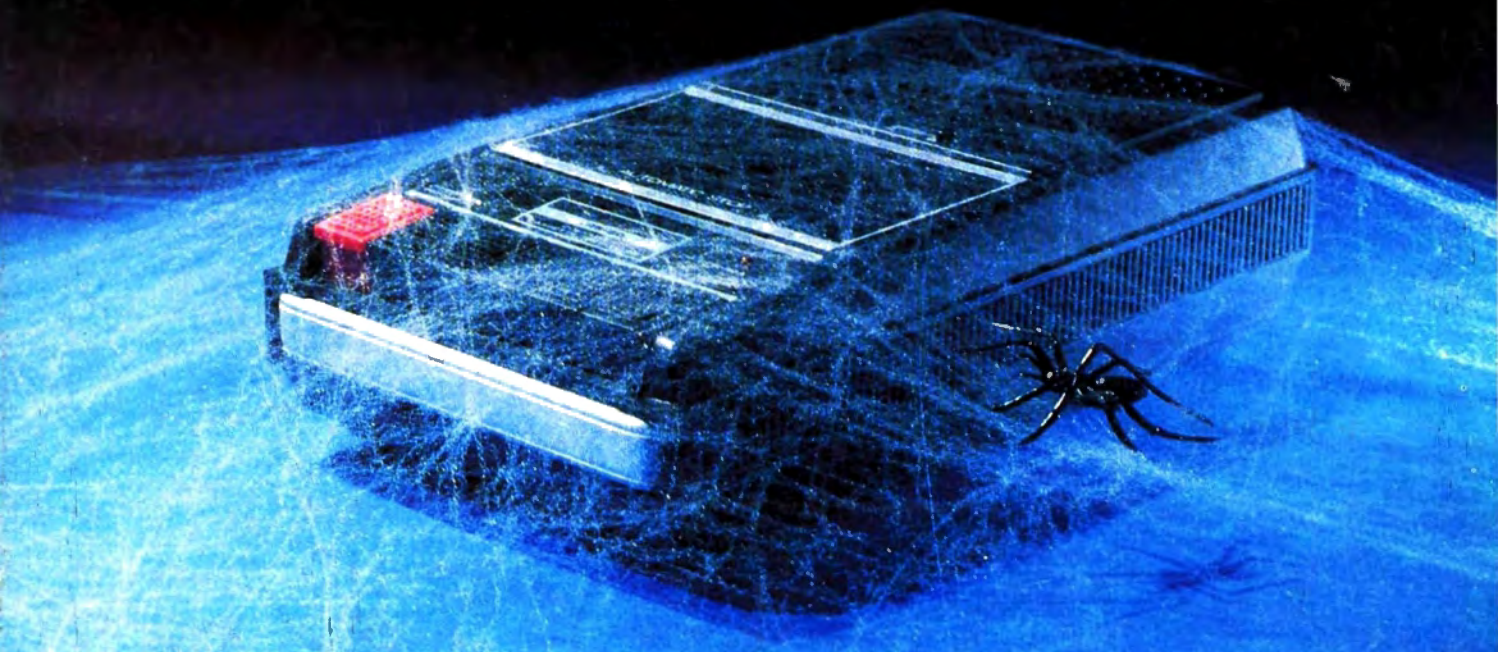
*Suggested retail price for either model.

TIRED OF WAITING?



Frustrating isn't it! No matter how much you speed up your program it still seems to take forever to save data onto a cassette. Wouldn't it be great if someone could design a mass storage system with the speed of a disk, but at half the cost? *Exatron* did, the *Exatron Stringy Floppy (ESF)* .

Totally self-contained, the ESF is an extremely fast, reliable, and economical alternative to cassette or disk storage of programs or data. All of the ESF's operations are under the computer's control, with no buttons, switches, knobs or levers to adjust or forget.

The ESF uses a miniature tape cartridge, about the size of a business card, called a wafer. The transport mechanism uses a direct drive motor with only one moving part. Designed to read and write digital data only, the ESF suffers from none of the drawbacks of cassettes - without the expense of disks.

Several versions of the ESF are available, for the *TRS-80, Apple, PET, OSI* and an *RS 232* unit. Even the slowest of the units is 15 times faster than a cassette, and all are as reliable as disk drives - in fact a lot of users say they are *more* reliable!

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exatron

To get further information about the ESF give Exatron a call on their Hot Line *800-538 8559* (inside California 408-737 7111).

If you can't wait any longer then take advantage of their 30 day money-back guarantee, you've nothing to lose but time!

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