80 U.S.

THE TRS·80 USERS JOURNAL

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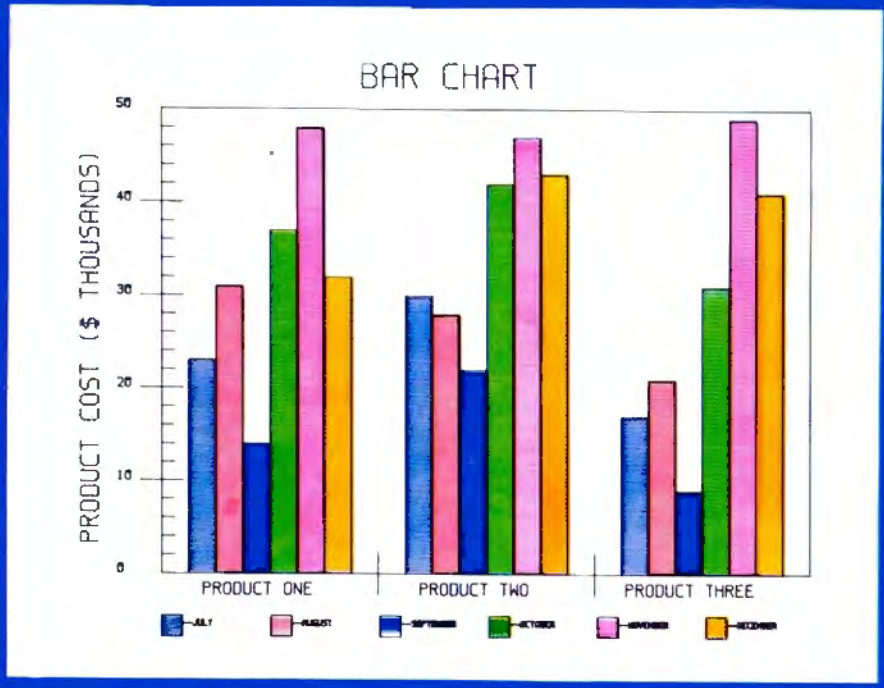

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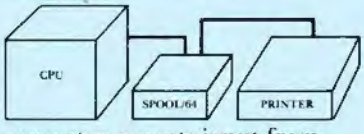

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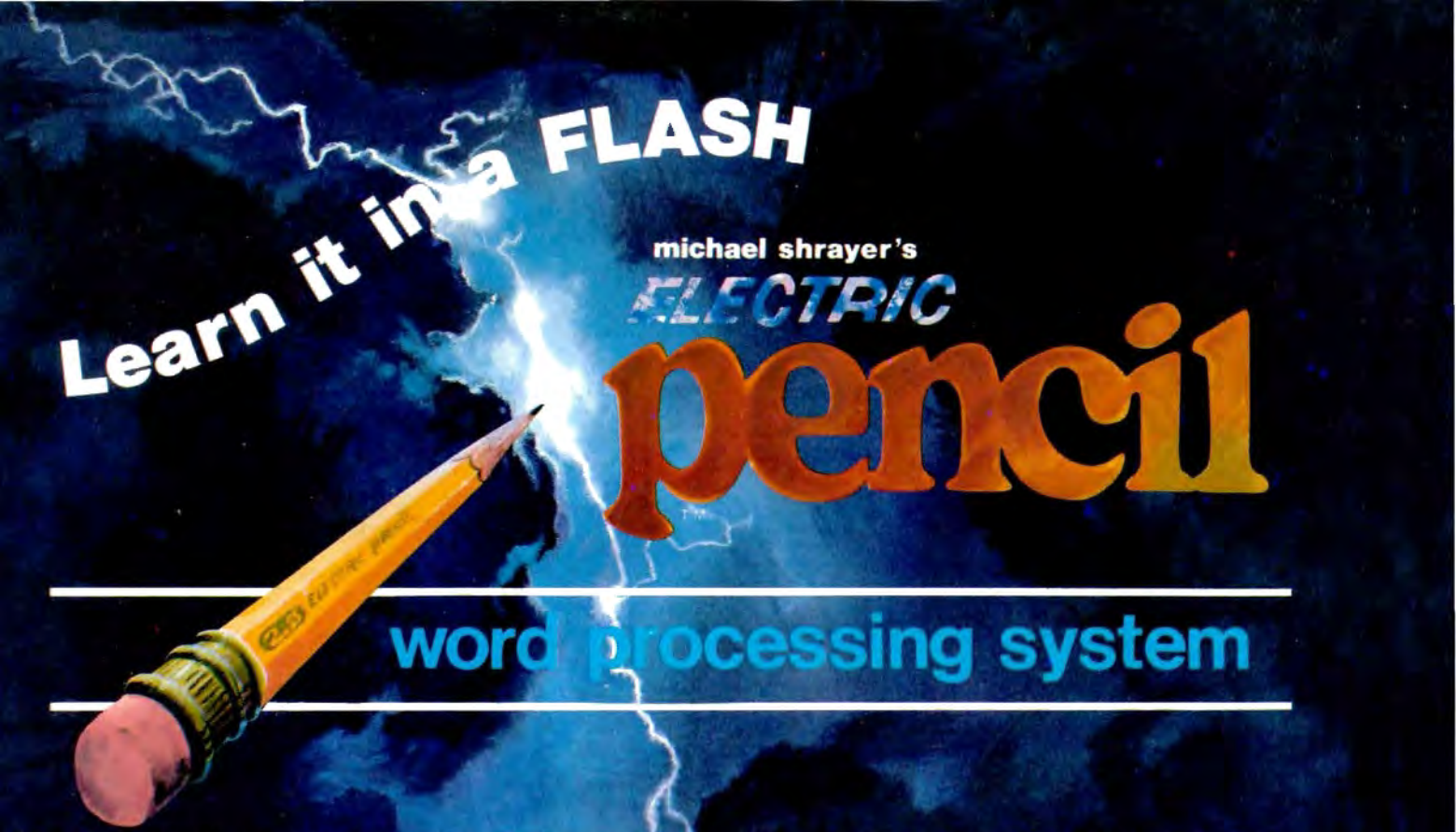

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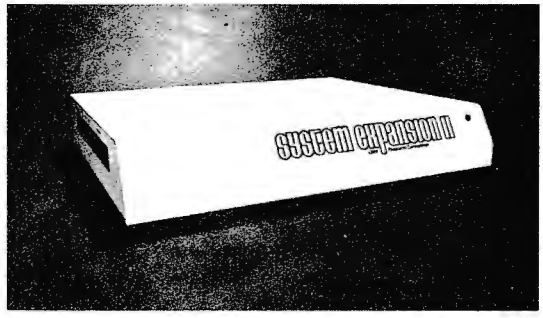

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*8" drive operation requires special cable. 8" double-density requires 3.55MHz CPU speed-up modification or LNW-80 4MHz computer.

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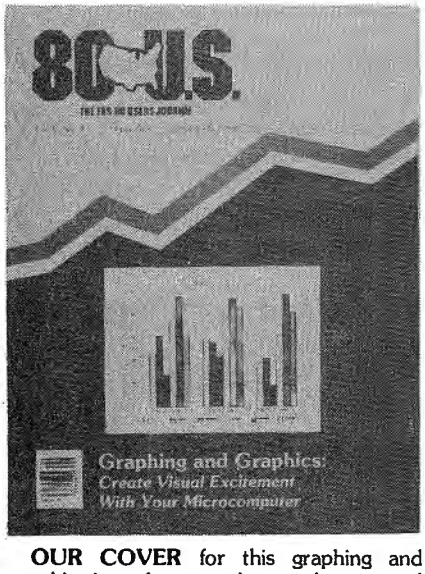

OUR COVER for this graphing and graphics issue features a bar graph generated on the TRS-80 Multi-Pen Plotter 26-1191. Photo courtesy of Radio Shack.

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THE TRS-80 USERS JOURNAL

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Editorial

By Cameron C. Brown

It is strange to be devoting an issue to one of the weakest areas of the TRS-80 line of computers. Graphics are lumpy. What we call a line makes other computer owners snicker. Low resolution is a fact that we have learned to tolerate (for the moment).

I believe that all of this has taught us something important. Visual representation is a key to understanding. Even the crudest of drawings helps to overcome the fog of words. Histograms, pie charts, bar graphs, arcs and segments serve us well. If the fact you are trying to convey is important, it will stand out like a beacon, even in low resolution black and white.

Over the years, I have seen programs progress from computation of simple averages to complete function graphers. Graphics and games go hand-in-hand. We have become so ho-hum in our search for new and better programs, that if they lack graphics (and even sound), they do not get a second look. In many ways, this issue is a look back to where it all began. The video graphs are as imprecise as ever, but they still serve a purpose.

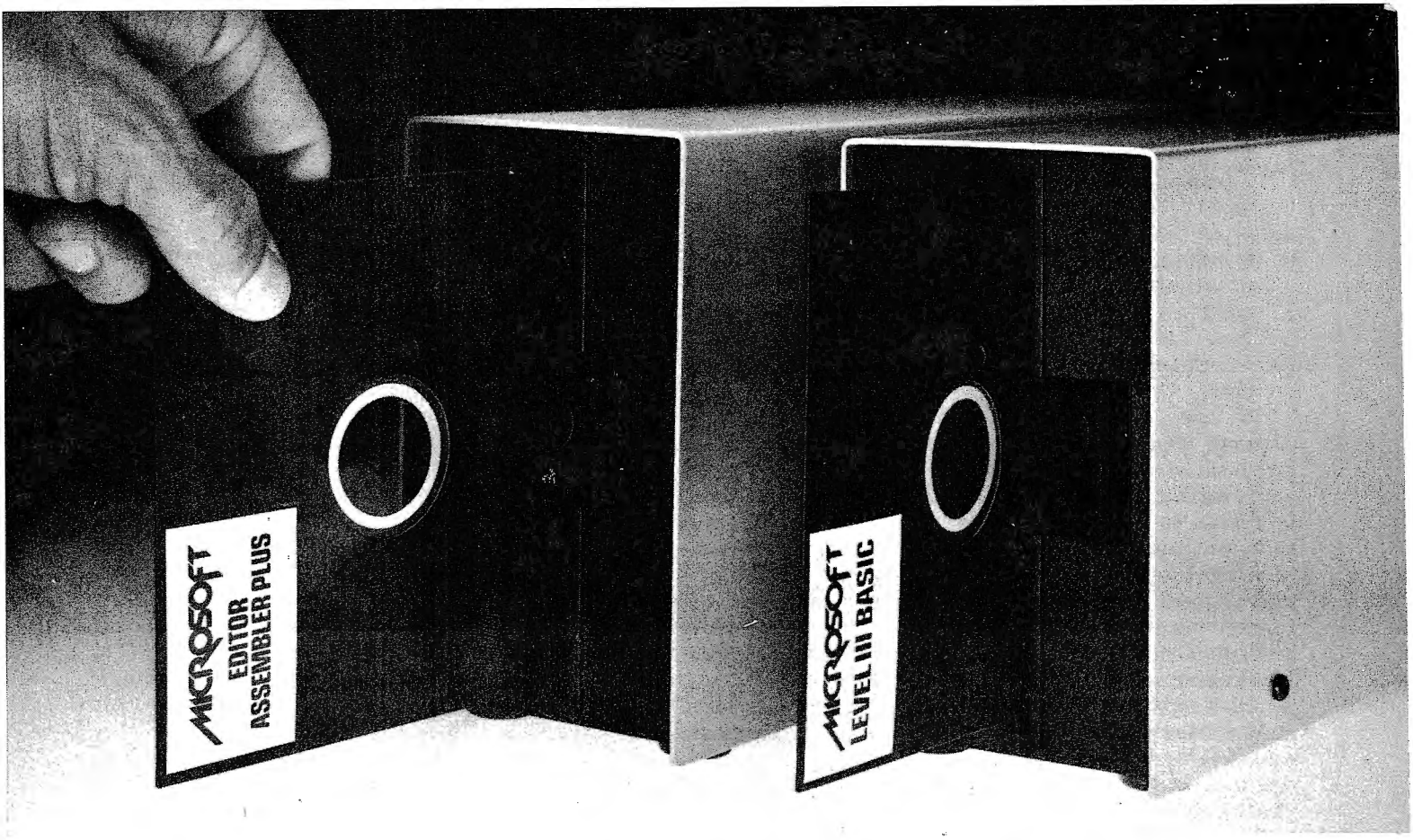
In reviewing the programs in this issue, I was struck by a relationship that is too easily overlooked. The programmer is an artist. The painter has his oils and canvas, we our SETs and CHR$s. Both of us are attempting to depict an idea (data) in visual form.

It is true that while early Model I attempts look more like cave drawings, the pictures are improving. Video has become an important link to the user. Consumers demand good format, clean displays, action and pictures. Programs that just fill the screen with text are becoming rare.

There must be a natural desire to include graphics — just look at the changes that have occurred in the past few years. We can purchase plotters that are multi-colored and dot matrix printers that give output as well as any pointillist. The quality of Color Computer display is just now being investigated. Pocket Computers print figures that used to be sent to an art department for production (at least that is what the Radio Shack ads depict). The Model II graphics codes are quite unique and varied, and they are almost unused in any of the software I have seen. Almost every printer can now faithfully reproduce video graphics and many have a built-in set of characters that are just waiting to be used.

In over 15 years of teaching and studying mathematics, it became very clear that the visual representation of a problem was fundamental to its understanding and solution. Talking about numbers and functions can be a beginning, but an accurate graph tells so much more. It is true that a picture is worth a thousand words. I know what Sin(X) ÷ X does, but there is still a joy in seeing it accurately displayed.

Radio Shack has just announced a graphics addition for my Model II. I am tempted to spend $500 so I can draw pretty pictures. Graphics are not a requirement for any of the work I do, but I will probably buy it. Why? Because I am an artist too. ■



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A friend who has had his Color Computer for only a couple of weeks called one night just before panic set in. He was unable to load any of his taped programs. I knew he was following the correct procedure as he had been using the tapes successfully since he had bought his computer.

The usual suggestions such as cleaning and demagnetizing the tape head were no help. The tapes he was using were purchased programs, so I asked him to type a short program, then save it on a new, blank tape. He did this with no improvement. By now I was out of suggestions and asked him to bring his equipment to my house. Not that I was going to open the case, since he still had warranty time left, but maybe there was tape recorder or cable trouble. We could change these two items and see if the difficulty cleared up.

We set his computer up on a card table and I observed as he began to load a tape he had brought. Eureka! The program loaded like a champ. Other attempts with more tapes were loaded without incident. A short program typed and saved worked as it should.

It was apparent that the problem was either at his house or a loose connection had vibrated enough during the twenty-mile trip from house-to-house. After a cup of coffee, my friend left for home, anxious to try loading the tape at his location.

We had agreed that Pat would call only if there was further trouble after setting up at his house. Later, when the phone began to ring, I didn't have to answer to know who was at the other end. The same old trouble occurred when he tried to load a tape. This time, I suggested that he try a wall outlet in a room where an outlet was on a different circuit breaker. It occurred to me that possibly there was a voltage problem. I waited on-line while Pat hooked up the computer in another room. Even before Pat left the other room, I knew he had been successful, for I heard a loud "ha" before he was even near the phone.

No! It wasn't the socket. The heavy wrought iron table holding Pat's computer was the culprit. Evidently the electrons in the tape had been pulled out of line by the massive metal table. Even in the second room the loading problem recurred if the computer was placed on it. The last I heard was Pat mumbling something about seeing a cabinetmaker in the morning.

Leigh L. Klotz, SR.
McComb, MS

I have just finished digesting the first six issues of 1982 of *The Journal*. I want to say that I enjoyed it very much and I am sorry that I did not subscribe sooner. I feel that I may have missed quite a lot. Anyhow, I certainly will be looking forward to future issues.

I like the format, the editorials and the short utility programs. I know you need revenues to exist but I really enjoy not having to wade through pages of advertising to get to the interesting part.

I don't have (take) the time I would like, nor have the brains for my TRS-80, but I do love to play with it. The short programs — Tiny Typer, to be specific — have a lot of educational value. At least for me. I tried to modify it to work with another program, and I am ashamed to tell how much time I did spend, when I got hung up in those IF...THEN, ELSE loops. I went back to my books and I am still scratching my head and mumbling to myself.

Please keep up the good work and humor us slow learners.

Wm. Barker Thornton
Lexington, KY

We like to think we humor everyone. — Ed.

I am writing to address a serious fault I see in the philosophy of the 'UN-NUMBER' program in your April 82 issue. The article admits that this program will not prevent piracy, but merely prevents tampering with *'your'* program. Somehow I fail to see why a *legitimate* user of *'your'* program shouldn't be free to revamp it, *as long as they give you credit for the program and also note that they have modified it so that you won't be blamed for errors that might have crept in.*

I believe that Un-number will only prevent tampering by a total novice. And that is just the person who will benefit most from 'revamping' other peoples' programs. The best ways to grow from a novice that has just finished the manual are: 1) to get the help of a more experienced programmer, and 2) to look at, tear apart, and modify the program of a more experienced programmer.

I feel that there are basically two types of pirates, neither of which I condone. #1 is just out to get any program he can get his hands on, and may not know enough to tamper anyway, while #2 will file off the serial numbers despite this program.

I have purchased three monitors with re-number functions. All of them can renumber an "Un-numbered' program into exactly the same program they would have created had it not been un-numbered first.

Computers are becoming so important that we should do everything we can to encourage the newcomer, not throw monkey-wrenches at him that won't even slow down the more experienced programmer, pirate or otherwise.

This is a well written program, and the techniques shown in the Un-number program are just the sort of thing that can open up new vistas for a newcomer. My only argument is that I believe the philosophy behind it was not thought out thoroughly.

Although I paid a good sum of money to take 16 weeks of BASIC programming courses in 1977, I would estimate that less than 25% of my present knowledge is from those courses. About 25% is from other programmers I have worked with directly, and the rest is from tearing into programs that do something I want to do, and finding out how it was done.

I have learned many valuable lessons from the programs in *80-U.S.*, *80-Micro*, *Softside*, and programs which I have purchased.

For those of you who realize, and I still do, that you don't know it all, I suggest that, on programs that you

JustWrite!

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NEWSCRIPT 7.0 is a high-quality word processing system for the TRS-80 Model I and III. It's based on the editing and formatting programs developed by IBM for use on mainframe time-sharing systems, and takes advantage of the easy-to-use capabilities of the Mod I and III. NEWSCRIPT 7.0 is intended for use by people with a wide variety of word processing requirements ranging from simple letters and form letters ot contracts, large books and dissertations. Although fairly easy to use, its many features ensure that, as your word processing expertise increases, NEWSCRIPT 7.0 will continue to meet your requirements.

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have legitimately acquired, see if you can find out how something is done that you cannot do. Or, see if you can improve on something the original author did. Or, you may find, that with a few changes, the program can do something that it wasn't originally intended to do.

But, when you do revamp it, give the original author some or most of the credit, depending on how much of the final (does anyone ever write a final version?) program is theirs, and note that you are responsible for changes.

David W. Kukuk
San Jose, CA

Today I purchased my first copy of your magazine. One of the things that caught my eye and led me to buying a copy was the article "Screen Printing with MX-80." Shortly after arriving home from one of the local computer stores, I keyed the program into my Model I (48K, 2-disk) using Radio Shack's Editor Assembler. Two problems immediately came into sight. First of all, I was using the tape version of the Editor Assembler, purchased before adding the drives. With the tape version, I was not able to put in the changes to line 00180 to allow TRSDOS operation. Using either BFB9H or FFB9H in place of 4152H produced error codes. So, I had to go back to the tape system completely. For right now this is not too much of a problem, but if I ever get a disk version of the Editor Assembler, I will make the changes.

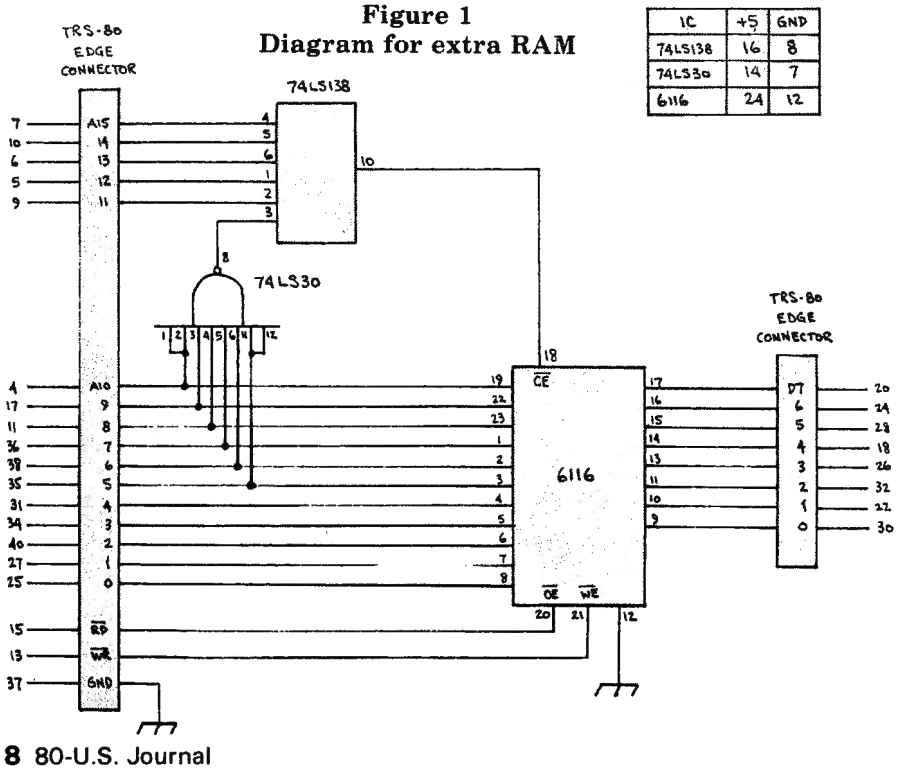
A more serious problem developed after getting the system tape in operation. Although the letters and numbers would print correctly, the graphics blocks would not. My MX-80 has the Graftrax 80 installed (provided at no charge by a local supplier with the MX-80 a couple of months ago). Taking a cue from the next-to-the-last paragraph in the article, I deleted line 00390. This, in effect, takes away the added 32 to the graphics codes. After doing this, the program works on a great number of BASIC programs. Some of the game type of programs, even though in BASIC, will not work. But, this is really not a problem. However, the graphics are printed correctly.

Finally, for someone who is not really into machine language, a hint at using the program: Load the Screen Print program first using SYSTEM. After the second *? appears, just hit ENTER. A SN ERROR will appear, but everything works okay when a BASIC program is entered or run (unless it has moving graphics as do some of the games).

Glen E. Zook
Richardson, TX

Figure 1
Diagram for extra RAM

IC	+5	GND
74LS138	16	8
74LS30	14	7
6116	24	12



Truman Krumholz's article "Extra RAM" in your March issue, is a good example of how to use the 2K bytes of memory that Radio Shack so graciously left free for "further expansion." I have used a similar device for over two years now for both RAM and EPROM (switch selectable), without so much as a single error. My version of a board using 2716 EPROMs (as well as a board to program them) was recently published in Volume 4 of the *Encyclopedia for the TRS-80* from Wayne Green, Inc., for anyone who might be interested.

Subsequently, I have changed the memory board circuit slightly to reduce the chip count by one, and thought that your readers might be interested in an approach somewhat different to that of Mr. Krumholz's (see Figure 1). This particular board has the advantage of being easier to build, using a total of three chips instead of 12; possibly being cheaper (I paid $10 for all three chips); and using all 2016 bytes that are available.

The circuit was wire wrapped using the same type of board Mr. Krumholz specified in his article. The only big difference is that I did not buffer any address or data lines and did not use pull-up resistors. However, I did keep the interconnecting cable short, about six inches. As I mentioned, I have not had any errors thus far (knock on wood)!

The combination of the 74LS30 and 74LS138 decodes all addresses from 3000H to 37DFH, which is all that is available for use anyway. The RAM is one of the new CMOS 2Kx8 static devices, the HM6116LP (200ns) from Hitachi.

Since this is a letter and not a "full description article," I will be more than happy to answer anyone's questions about the circuit if they will include an SASE for the reply.

Steven A. Larson
726 Somerset Way
Augusta, GA 30909

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This issue marks the beginning of our fifth year. I just looked back at Volume I, Number 1. It is hard to believe that a 16-page, all upper case, dot matrix-printed magazine could evolve to this—but it did. There is still a long way to go, and we are constantly taking steps toward a better publication.

Someone asked recently what the major factor in our continued success was. I thought for awhile, and finally came up with just one word—commitment. I think commitment and dedication to the task are our greatest assets. We will do our best to keep it that way.

Naturally, our thanks go to our readers and supporters, without whom we would not exist.

Contest Winner

Our "name the book division" contest winner has finally been selected. It took time and thought—we looked at many cute, funny and interesting entries. The winning entry (there was only one like it) was 80-N.W. Books. It was submitted by Greg Crouch, of Mishawaka, Indiana. It was decided to go with the obvious, since we already had identification in that direction. The $100 prize is on its way. Congratulations, Greg!

The Case of the Up-arrow

The up-arrow seems to be a real problem with listings published in magazines. There are several ways that line printers print this symbol. It usually doesn't look like an up-arrow at all. Typeset listings are not much better, since many typesetter fonts don't have such an animal.

In our listings for Models I and III, you may find the bracket ([ ) referring to an up-arrow. You might even find an actual up-arrow. In our Model II listings, you will probably find the caret (shift 6) in place of the up-arrow. The caret seems to be more standard in computing than the arrow or the bracket. Perhaps we should dispense with the arrow altogether and simply print A*A*A for A to the third power.

Bulletin Board

If you haven't noticed yet, we have changed our Unclassified Announcements to a Bulletin Board. This more accurately describes what it is. It's a place to sell one-of-a-kind items, ask for information, tell others you have information, or track some elusive items that no one seems to have. Use it freely. We will devote up to a page, if necessary, for this service.

Corrections

It turns out that the article called "Vidsave/ASM" in our July, 1982, issue has a machine language listing that will not assemble unless you are using an EDAS 3.5 Editor/Assembler. This was not stated in the article. We have learned (the hard way) that a working machine language program may not assemble under different editors, even though no flaws are present. Our apologies to those of you with Radio Shack editors who obtained 39 errors.

Also in the July issue, the "Togetherness" article has extra lines of code in Listing 1. Delete lines 140 through 280. It seems that the program worked too well and merged with a program already in memory!

In This Issue

Our theme this month is graphing and graphics for video and printers. I even got off my duff long enough to write two graphing routines for the Model II/16. It isn't really fair to call them Model 16 programs, because there still is no operating system nor BASIC for it, though they do have the Editor / Assembler / Linker available.

Color Computer enthusiasts should take note of the Assembler/Disassembler by Richard Tangeman on page 38. It's written in BASIC and lets you look inside your 6809E chip.

Jim Peyton, whom we have seen from time to time in these pages, has come through with a real belly-laugher. Take a look at Whiz Quiz on page 46, and see if your southern drawl is up to par.

High resolution graphics on the MX-80 is the subject of an article on page 14 by Kenneth R. Smith. Darrel L. Bartelheimer gives us routines to draw arcs, circles and lines on page 22. Making your disks compatible with other operating systems is covered in the article PDRIVE, by Sal Navarro, page 52.

Ron Goodman tells you how to connect your stereo to your computer and watch "Simple Joe" sing along with the music (page 54). Edward M. Roberts presents an evaluation of the Votrax voice synthesizer on page 57.

How to make your renumber program from Model I work on Model III is explained on page 94 by Jerry W. O'Dell. Lynn Davis has three Color Computer video tips on switching PMODES for different effects on page 96.

There is more: Pie charts by Jose Babilonia (page 78), Files and Foibles, Basically BASIC, an evaluation of part of the accounting system from Plus Computer Technology, and a bunch of reviews.

It's our fourth anniversary issue—enjoy it and remember that you saw it in *80-U.S. Journal.*

Mike

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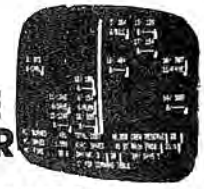

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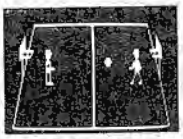

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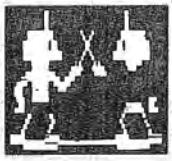

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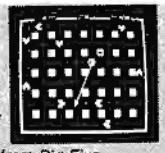

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High-resolution graphics

Dot addressable graphing

Model I/III with Epson MX-80 and Graftrax-80

Kenneth R. Smith, Baltimore, MD

It was with some uneasiness that I sold my Model I (Level II, 16K), with its Expandor Black Box printer and plunged forward with a new Model III (48K, 2 disk, RS232), an Epson MX-80 printer and a modem. Would it all work? Would I spend a lot of time converting old programs I had written for the Model I? Would I be happy with my new setup?

After conquering some of the small differences between the two models, I am quite happy with my new system. The MX-80, in particular, fascinated me. It printed uppercase, lowercase, all 64 TRS-80 graphics characters, compressed print, expanded print, emphasized print, doublestrike print and featured adjustable line spacing, and adjustable tractors. I was now able to generate listings and reports that approached "letter quality." Using SCRIPLUS by Roger Junk, a modification to SCRIPSIT, I could use all the MX-80 features directly from SCRIPSIT. Wow! Was I happy!

Still lurking inside the chips, waiting to be called forth, were those enticing high-resolution graphics.

Then a microcomputing magazine was delivered. Thumbing through the ads, I saw an incredibly beautiful ad by Epson for their GRAFTRAX-80. Needless to say, I rushed to my local supplier and purchased the kit for $95.00 plus tax.

Testing it Out

What I got was a plastic envelope containing three EPROMs and 24 pages of documentation. I opened the package and read the documentation very carefully ... twice. After I decided that I was capable of doing the job myself, I followed the instructions for taking the cabinet apart, removing the old PROMs and inserting the new chips (even though the instructions said I would only find one PROM to remove and indicated I had to cut a jumper wire which was already cut). Anyway, I reassembled the entire thing, plugged it in, and put it in the self-test mode. It worked!

By setting a dipswitch inside the printer, I now had slashed zeros. I also had italics! Still lurking inside the chips, waiting to be called forth, were those enticing high-resolution graphics. After reading the instructions a few more times, I decided to try those "dot-addressable" or "bit-image" graphics, so I entered:

```
LPRINT CHR$(27) CHR$(75) CHR$(224) CHR$(1);
```

which tells the printer that the next 480 bytes it receives are to be printed as bit-image graphics (more on this later). I followed this with:

```
FOR I=1 TO 480 : LPRINT CHR$(1); : NEXT I
```

After a brief pause, the printer drew a line of 480 dots across the page — in two passes. It did half the line, then homed the print head, and did the rest of the line on the second pass. Success!

The special codes that are sent to the printer are usually preceded by an "escape" character which is not printed, but "tells" the printer that the next byte or bytes that it receives will tell it which mode to switch itself to. In the preceding example, CHR$(27) is the escape character, CHR$(75) puts the printer into "480-mode graphics," and the two bytes transmitted to the printer by CHR$(224) and CHR$(1) together tell the computer that the next 480 bytes are graphics characters. They do this by the formula 224+256*1. If we only wanted to transmit 100 bytes of graphics in this mode, we would use:

```
LPRINT CHR$(27) CHR$(75) CHR$(100) CHR$(0);
```

because 100+256*0=100. The general formula is:

```
LPRINT CHR$(27) CHR$(75) CHR$(X) CHR$(Y);
```

where X is an integer between zero and 255, Y is either 0 or 1, and the number of bytes to be received is X+256*Y. Of course, it is necessary that X+256*Y must be less than or equal to 480 when in the "480-mode," or an error condition will be created within the printer. If any error occurs, the printer will "beep" eight times and refuse to accept further instructions until it is turned off and reset.

The other line of BASIC:

Summer Software Selection For Your TRS-80 Color Computer

Voyager I

From Avalon Hill
You're on board a spaceship infested with killer robots in this graphic science fiction game. You must clear the 4-level 144-location ship of robots and arm it to self-destruct. Can you do it and escape before you, too, are blown up? High-speed graphics are represented in 3-D perspective representing your eye's view; with instant switching to floor plan maps. Extended BASIC required.
16K Tape, $19.95

Ghost Gobbler

From Spectral Associates
In this new and exciting version of the popular arcade game, use your joysticks to move your Ghost Gobbler through the maze, eating dots and power pills to score points. 8 bonus shapes, super sound, and 16 skill levels. Extended BASIC not required; joysticks.
16K Tape, $21.95

Creatavader

By Fred Scerbo from Illustrated Memory Banks
Create your own antagonist, and fire away! Pick your pet target, or use ours: tv sets, killer tomatoes or smiley faces. Use the joystick to fire your cannon and clear the screen. Look out for the secret target defender! Extended BASIC and one joystick required.
16K Tape, $18.95

Madness and the Minotaur

From Spectral Associates
Classic adventure game with 200 rooms, assorted friendly and dangerous creatures, 8 magic spells and —of course—treasures. The computer obeys two-word commands such as "get lamp" to move you through your journey. You must enter the castle of King Minos, descend into the labyrinth and collect all the treasures you can.
16K Tape, $19.95

Color Computer Blockade

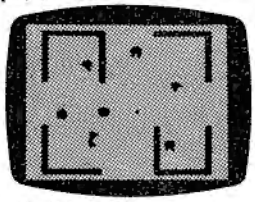
By Terry Kepner from Interpro
Compete against a friend or the computer in this real-time, full color arcade game with sound effects. Use your joysticks to draw a barrier around your opponent while avoiding the trap being set for you. Requires joysticks.
Level I 4K/16K or Level II with Extended BASIC
Tape, $14.95

Gator Zone

By Scerbo and Jammalo from Illustrated Memory Banks
Revenge on the Preppies at last!! The Preppy Craze has gotten completely out of control. You must journey to the planet "Preptune" to stop the 'gators from invading earth in assorted garment forms. Use your shirt shields and lasers to protect you as you aim the crosshairs and press the fire button on your joystick. Get the gators before they get your shirts! 3 levels of difficulty. Extended BASIC required; joysticks.
16K Tape, $18.95

Moon Lander

By Greg Zumwalt from American Small Business Computers
Pilot your spacecraft over the moon's landscape and try to land it amid the mountains and craters. While carefully controlling your fuel consumption, use your joysticks to maneuver your craft and control your velocity against the forces of gravity. Be careful to avoid the asteroids drifting through space.
16K Tape, $14.95



Robot Battle

From Spectral Associates
Can you dodge the never-ending horde of robots while avoiding the fatal touch of the Android? Realistic voices and 16 skill levels provide a tremendous arcade type challenge. Does not require Extended BASIC; joysticks.
16K Tape, $21.95

The Super "Color" Terminal

From Nelson Software Systems
Time Share, Smart Terminal, High-speed Data Transfer and Videotex. Turns your Color Computer into a Super-smart terminal with all the features of VIDEOTEX plus much more. Communicate with Dow Jones, Compuserve and computers like TRS-80 Models I, II, III, APPLE, etc. via modem or RS-232 direct. Save the data to tape, or print it! Cuts on-line costs to a minimum.
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TRS-80 Color Basic

By Bob Albrecht from John Wiley & Sons
Step-by-step guide to the unique color, sound and graphic capabilities of your new Color Computer. No previous experience is required. Teach yourself BASIC—there's a whole chapter on typical programming problems and solutions.
Softcover, $9.95

TRS-80 Programs and Applications for the Color Computer

By Alfred Baker from Reston
Handy guide to your Color Computer: how to play games, balance your checkbook, use your computer as a teacher, etc. With chapters on color and sound, art and music. Helpful for beginning or experienced computer user.
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Color Computer Scarfman

From The Cornsoft Group
Use the keyboard or joysticks to move your Color Scarfman through the maze to gobble up little yellow dots while avoiding 5 red monsters. If Scarfman can eat a yellow plus (+), a monster turns blue and can be eaten. Each time you clear the screen, the level and point value increase. Extended BASIC not required.
4K Tape, $19.95

Scepter of Kzirgla

From Rainbow Connection Software
Real-time graphics adventure game with arcade sound for the color computer. 13 floors of dungeon with monsters, treasure chests, hidden trap doors . . . even a flying magic carpet! All in your quest to find the Scepter of Kzirgla. Whatever you do, don't get caught in the poisonous gas cloud! Extended BASIC required.
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From Soft Sector Marketing
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```
FOR I=1 TO 480 : LPRINT CHR$(1); : NEXT I
```

sent the 480 bytes of graphics to the printer. Each byte was equal to 1, which told the printer to "fire" the bottom print needle at each of the 480 printable positions. A byte of 0 would have fired none of the needles. Even though the MX-80 uses a nine-needle print head capable of printing nine dots vertically, only the top eight needles are used in the graphics mode. Each needle corresponds to a bit in the byte received by the printer. The bottom needle is fired whenever the least significant bit is set. The top needle is fired whenever the most significant bit is set, and so on, according to this table:

Bit 7	Needle 8	(top)
Bit 6	Needle 7	
Bit 5	Needle 6	
Bit 4	Needle 5	
Bit 3	Needle 4	
Bit 2	Needle 3	
Bit 1	Needle 2	
Bit 0	Needle 1	(bottom)

Therefore, if we wish to fire more than one needle in a print position, we must set more bits. For example, to fire all eight needles in a print position, we would need to send a byte with all eight bits set. The byte we would need would be 255 decimal. Remembering that each bit of a byte corresponds to a power of two, we can just "add up" the values for the needles we want to fire, according to this table:

Needle 8	128
Needle 7	64
Needle 6	32
Needle 5	16
Needle 4	8
Needle 3	4
Needle 2	2
Needle 1	1

While this method will work for some simple applications, a more sophisticated method needs to be devised for more complex graphics. We will explore that method a little later on in this article.

The MX-80 also has "960-mode graphics" in which it is capable of printing 960 dots across the page in one line. To access this mode, the special sequence is:

```
LPRINT CHR$(27) CHR$(76) CHR$(X) CHR$(Y);
```

Again, the CHR$(27) is the escape character and the CHR$(76) which follows it tells the printer to shift into "960-mode graphics." The CHR$(X) and CHR$(Y) that follow tell the printer how many bytes of graphics characters it will receive by the formula X+256*Y, where X is an integer between 0 and 255, and Y is an integer between 0 and 3. For example:

```
LPRINT CHR$(27) CHR$(76) CHR$(100) CHR$(2);
```

would tell the printer to expect 612 bytes of graphics characters in the 960-mode because 612=100+256*2. Of course, when in this mode, X+256*Y cannot exceed 960. The same procedure used in the 480-mode is used for firing the needles in the 960-mode. On printing, though, a full line of 960 graphics is printed in four passes across the page, which really slows things down.

That Fancy Sine Curve

Now, let's investigate the program and techniques used to produce the pretty sine curve in Figure 1. Generally, the method is to set up an array of 480 bytes, one for each print position in the 480-mode. The bytes are then output to the printer, reset to zero, and the whole process is repeated for 90 lines. The variable used to represent the current line is L. Values of L are multiples of 8 from 0 to 712. Within each line, there are eight dots, numbered zero to seven. The variable used to represent the dot number is D. When L and D are added, their sum is an integer between 0 and 719. These are the unscaled values which will be used to form the X-axis of our graph, which will run "down" the page, rather than across it. The Y-axis, on the other hand, is numbered from 0 to 479 (480 bytes, remember?). This means that we have at our disposal 345,600 dots (480 across the page by 720 down the page).

I chose to let 100 dots = one unit on the X-axis (down the page) and 80 dots = one unit on the Y-axis (across the page). By doing this, one unit on the X-axis is almost the same absolute distance as one unit on the Y-axis. Also, the numbers 80 and 100 are easily subdivided to mark axis divisions. Therefore, as we print the Y-axis, every 8 dots = $\frac{1}{10}$ of a unit, and every 40 dots = $\frac{1}{2}$ of a unit. As we print the X-axis, every 10 dots = $\frac{1}{10}$ of a unit, and every 50 dots = $\frac{1}{2}$ of a unit.

Referring to Listing 1, line 150 sets every other dot along the X-axis, line 180 detects when X = 0 and sets up the Y-axis, and lines 190-210 detect units, tenths, and halves along the X-axis and make tick marks at those points. Line 120 is a safety measure taken to ensure that the printer's internal buffer is empty before attempting to enter the graphics mode. Line 130 sets the line spacing at eight dots per line so there will be no space between lines.

Line 170 produces a value of X between 0.00 and 7.19. Line 220 contains the function of X to be graphed. Line 230 transforms the functional value to a value which is scaled between 0 and 479. Line 240 calls the subroutine at line 5000 to actually set the dot.

The subroutine at line 5000 first checks to see if the number of the byte to be used is between 0 and 479. If not, it returns without setting any dots. If the value of Y is between 0 and 479, the proper byte is ORed with the value of the dot we wish to set, and then control is returned to the main program.

Line 260 puts the MX-80 into the graphics mode to receive 480 bytes of graphics, which are sent out by the FOR...NEXT loop in lines 270-320. Line 280 checks to see if the printer is ready to receive a byte. Line 290 detects if the computer is Model III, and if it is, outputs a byte to port 248 (the printer). Line 300, on the other hand, sees if the computer is Model I, and POKEs the

Figure 1
High-Resolution

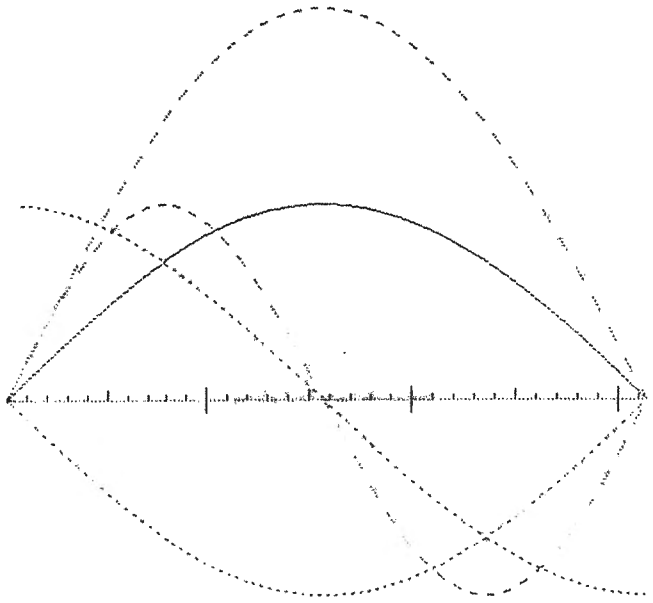
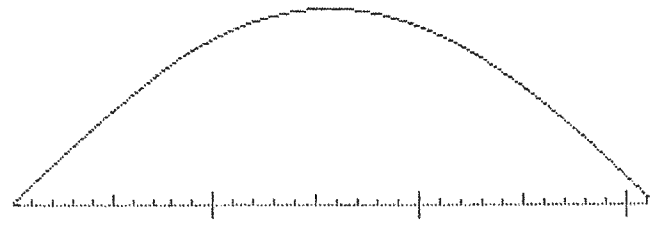


Figure 2
Low-Resolution



byte into location 14312, the printer "latch." Line 310 resets the byte just transmitted to zero for use in the next line.

Playing for Higher Stakes

Listing 2 shows how to produce similar curves in the 960-mode. In this mode, we have available to us 960 dots across the page and 720 dots down the page, for a total of 691,200 addressable dots. The output (Figure 2) will appear virtually the same as the Figure 1 except upon close examination. If you look closely, you will see many more "flat" portions in Figure 1. The curves in Figure 2 will appear to be more "naturally curved" than the curve in Figure 1.

In Figure 2, the sine curve is "solid," and all the other functions are "broken" into pieces of either four dots or two dots. Since the printer makes four passes on each of the 90 lines printed, plotting these curves takes an awfully long time, but the results are truly impressive!

A great deal of time can be saved by "packing" the programs as much as possible and by using integer variables wherever possible. In BASIC, however, these programs will run slowly no matter what you do. I suspect that the real key to faster high-resolution graphics is the use of assembler language or the use of a mixture of BASIC with assembler language subroutines. That is the project I have put on my "list of things to do" after I get a suitable editor/assembler for my Model III. In the meantime, however, I can still knock out some fantastic graphs!

Program Listing 1
Low-Resolution

```
100 DEFINT A-W  'THIS WILL HELP IT RUN
A LITTLE FASTER
110 DIM A(479) '480 BYTES MAKE ONE LINE
120 LPRINT CHR$(27)"@"; 'RESET MX-80 TO
 DEFAULT SETTINGS
130 LPRINT CHR$(27)"A"CHR$(8); 'SET 8 D
OTS PER LINE SPACING
140 FOR L=0 TO 712 STEP 8  'ONCE FOR EA
CH LINE OF 8 DOTS
150 A(240)=170 'SET EVERY OTHER DOT ON
THE X-AXIS
160 FOR D=0 TO 7  'MAKE COMPUTATIONS FO
R EACH NEEDLE
170 X=(L+D)/100   'X BETWEEN 0.00 AND 7
.29, 100 DOTS/UNIT
180 IF X=0 THEN GOSUB 1000 'SET UP THE
Y-AXIS
190 IF X=INT(X) THEN GOSUB 2000  'TICK
MARK EACH UNIT
200 IF X*2=INT(X*2) THEN GOSUB 3000 'TI
CK MARK EACH 1/2 UNIT
210 IF (L+D)/10=INT((L+D)/10) THEN GOSU
B 4000 'MARK EACH 1/10
220 Y=SIN(X) 'THIS IS THE FUNCTION TO B
E GRAPHED
230 Y = INT(Y*80+240.5) 'COMPUTE BYTE T
O SET DOT IN
240 GOSUB 5000  'SET THE DOT
250 NEXT D
260 LPRINT CHR$(27)CHR$(75)CHR$(224)CHR
$(1); ' SET MX-80 FOR GRAPHICS IN THE 4
80 MODE FOR THE NEXT 480 BYTES
270 FOR I=0 TO 479
280 IF PEEK(14312)<>61 THEN 280  'PRINT
ER BUSY?
290 IF PEEK(293)=73 THEN OUT 248,A(I) '
MODEL III
300 IF PEEK(293)<>73 THEN POKE 14312,A(
I) 'MODEL I
310 A(I)=0 'RESET BYTE
320 NEXT I
330 LPRINT 'ADVANCE TO NEXT LINE
340 NEXT L
350 END
1000 FOR Y=0 TO 479
```

```
1010 GOSUB 5000
1020 NEXT Y
1030 FOR Y=0 TO 479 STEP 80
1040 A(Y)=A(Y) OR 248 'MARK EVERY UNIT
1050 NEXT Y
1060 FOR Y=0 TO 479 STEP 40
1070 A(Y)=A(Y) OR 240 'MARK EVERY 1/2 U
NIT
1080 NEXT Y
1090 FOR Y=0 TO 479 STEP 8
1100 A(Y)=A(Y) OR 224 'MARK EVERY 1/10
1110 NEXT Y
1120 RETURN
2000 FOR Y=235 TO 245
2010 GOSUB 5000
2020 NEXT Y
2030 RETURN
3000 FOR Y=240 TO 244
3010 GOSUB 5000
3020 NEXT Y
3030 RETURN
4000 FOR Y=240 TO 242
4010 GOSUB 5000
4020 NEXT Y
4030 RETURN
5000 IF Y<0 OR Y>479 THEN RETURN 'OUT O
F RANGE
5010 A(Y)=A(Y) OR 2[(7-D) ' SET THE DOT
5020 RETURN
```

Program Listing 2
High-Resolution

```
100 DEFINT A-W  'THIS WILL HELP IT RUN
A LITTLE FASTER
110 DIM A(959) '960 BYTES MAKE ONE LINE
120 LPRINT CHR$(27)"@"; 'RESET MX-80 TO
 DEFAULT SETTINGS
130 LPRINT CHR$(27)"A"CHR$(8); 'SET 8 D
OTS PER LINE SPACING
140 FOR L=0 TO 712 STEP 8  'ONCE FOR EA
CH LINE OF 8 DOTS
150 A(480)=170 'SET EVERY OTHER DOT ON
THE X-AXIS
160 FOR D=0 TO 7  'MAKE COMPUTATIONS FO
R EACH NEEDLE
170 X=(L+D)/100   'X BETWEEN 0.00 AND 7
.29, 100 DOTS/UNIT
180 IF X=0 THEN GOSUB 1000 'SET UP THE
Y-AXIS
190 IF X=INT(X) THEN GOSUB 2000  'TICK
MARK EACH UNIT
200 IF X*2=INT(X*2) THEN GOSUB 3000 'TI
CK MARK EACH 1/2 UNIT
210 IF (L+D)/10=INT((L+D)/10) THEN GOSU
B 4000 'MARK EACH 1/10
220 Y=SIN(X)
230 Y = INT(Y*160+480.5) 'COMPUTE BYTE
TO SET DOT IN
240 GOSUB 5000  'SET THE DOT
241 IF D>3 THEN Y=SIN(2*X) : Y=INT(Y*16
0+480.5) : GOSUB 5000
242 IF D<4 THEN Y=2*SIN(X) : Y=INT(Y*16
0+480.5) : GOSUB 5000
243 IF D=0 OR D=1 OR D=4 OR D=5 THEN Y=
COS(X) : Y=INT(Y*160+480.5) : GOSUB 500
0
244 IF D=2 OR D=3 OR D=6 OR D=7 THEN Y=
-SIN(X) : Y=INT(Y*160+480.5) : GOSUB 50
00
250 NEXT D
260 LPRINT CHR$(27)CHR$(76)CHR$(192)CHR
$(3); ' SET MX-80 FOR GRAPHICS IN THE 9
60 MODE FOR THE NEXT 960 BYTES
270 FOR I=0 TO 959
280 IF PEEK(14312)<>61 THEN 280  'PRINT
ER BUSY?
290 IF PEEK(293)=73 THEN OUT 248,A(I) '
MODEL III
300 IF PEEK(293)<>73 THEN POKE 14312,A(
I) 'MODEL I
310 A(I)=0 'RESET BYTE
320 NEXT I
330 LPRINT 'ADVANCE TO NEXT LINE
340 NEXT L
350 END
1000 FOR Y=0 TO 959
1010 GOSUB 5000
1020 NEXT Y
1030 FOR Y=0 TO 959 STEP 160
1040 A(Y)=A(Y) OR 248 'MARK EVERY UNIT
1050 NEXT Y
1060 FOR Y=0 TO 959 STEP 80
1070 A(Y)=A(Y) OR 240 'MARK EVERY 1/2 U
NIT
1080 NEXT Y
1090 FOR Y=0 TO 959 STEP 16
1100 A(Y)=A(Y) OR 224 'MARK EVERY 1/10
1110 NEXT Y
1120 RETURN
2000 FOR Y=470 TO 490
2010 GOSUB 5000
2020 NEXT Y
2030 RETURN
3000 FOR Y=480 TO 488
3010 GOSUB 5000
3020 NEXT Y
3030 RETURN
4000 FOR Y=480 TO 484
4010 GOSUB 5000
4020 NEXT Y
4030 RETURN
5000 IF Y<0 OR Y>959 THEN RETURN 'OUT O
F RANGE
5010 A(Y)=A(Y) OR 2[(7-D) ' SET THE DOT
5020 RETURN
```

■

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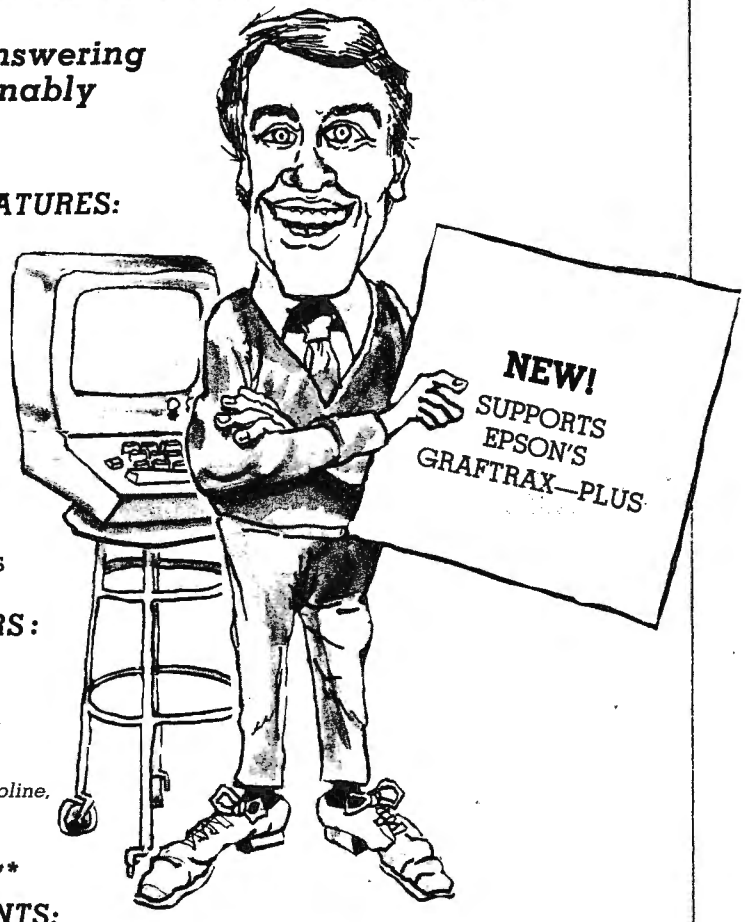

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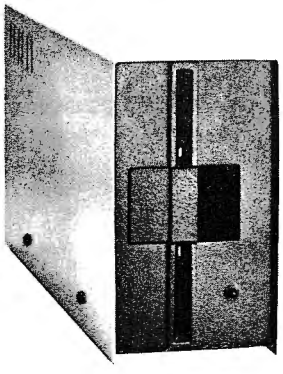

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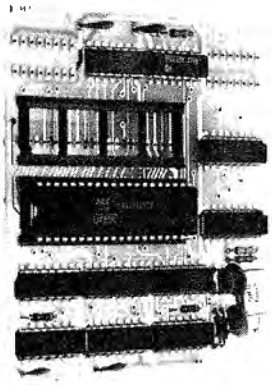

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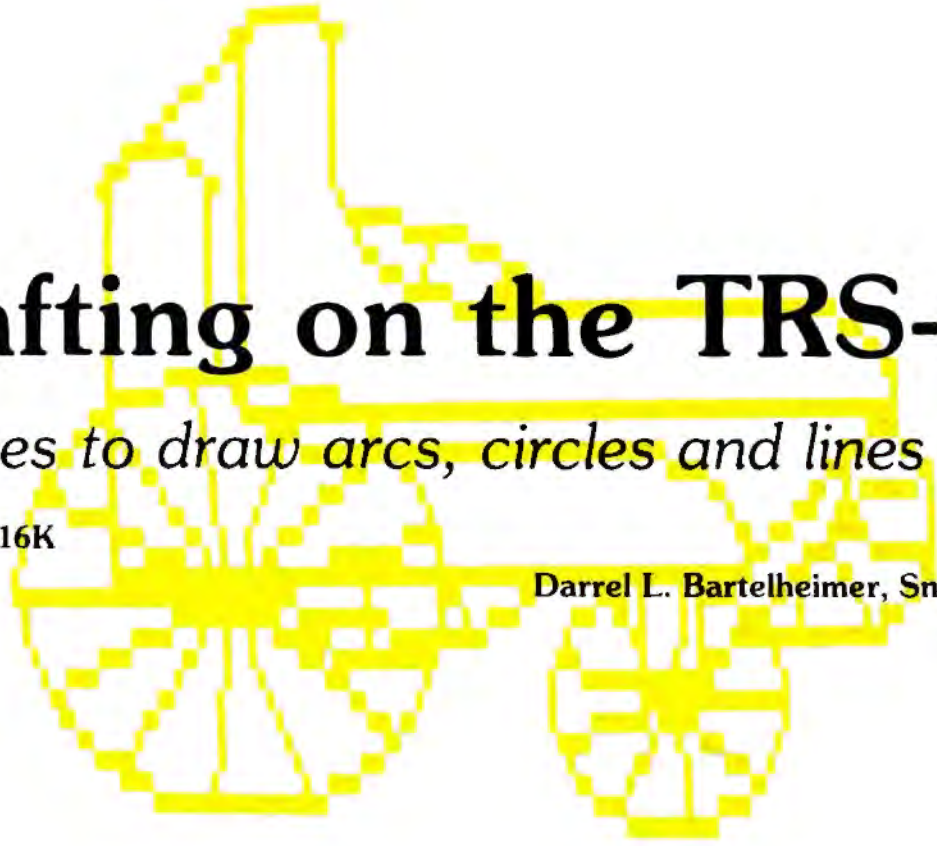
Drafting on the TRS-80

Routines to draw arcs, circles and lines

Model I/III, 16K

Darrel L. Bartelheimer, Snohomish, WA



I have become fascinated with CAD/CAM (Computer Aided Drafting/ Computed Aided Manufacturing) in industry. Never have I seen anything resembling this for the home computer. Therefore, I decided to write my own version of a computer drafting machine.

The TRS-80 has limited resolution graphics, with 47 points vertical and 127 points horizontal. A more serious problem is that the dots are not dots but rectangles with the vertical dimension about twice the horizontal dimension. This severely distorts circles and causes lines to be of different widths depending on whether they are vertical or horizontal.

Remembering from elementary drafting that almost any complex figure can be drawn using just a compass and straightedge, that is, using straight lines and arcs (of circles) or circles. This program defines the CRT (video screen) as being an 8-inch high by 10-inch wide drafting board. Coordinates are defined such that the point (0,0) is at the lower left hand corner of the screen. All coordinates are in inches. It draws arcs in a subroutine at location 1000 given the center location X and Y, the radius R, and the starting and ending angles TL and TU, respectively. The angles are defined as in a compass rose with zero degrees straight up (North), 90 degrees right (East), 180 down (South) and 270 left (West). Negative angles may be entered, but one must be certain that the starting angle is less than the ending angle. An option is the display of the center point of the circle. Set CC to 1 to display the center, 0 otherwise.

No attempt is made here to explain the operation of the line and arc subroutines since these involve trigonometry and analytic geometry. Towards the end of writing these routines, I sometimes did whatever it took to get them to work as specified instead of analyzing each step, so there are probably changes that can be made to make them 'more elegant.' For now, they work. Just use them. Treat them as software black boxes.

Lines 800 and 805 are approximately an hour timer to prevent the computer from writing over your display.

To draw your own displays, erase all lines from 50 to 799, and replace them with your own display commands.

A Guided Tour

I feel that the best method of teaching this system is to give a guided tour through the generation of the Test Pattern. Refer to the listing and the Test Pattern, Figure 1 for the following discussion.

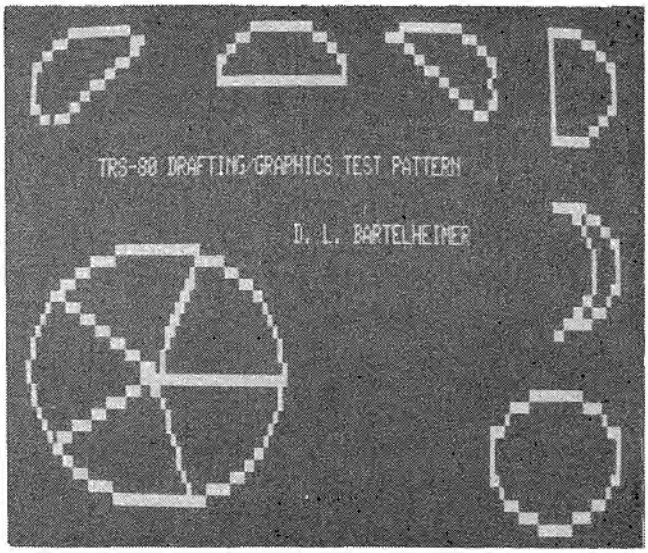
The semicircle in the upper right hand corner is generated from line 50. Its center position on the 8x10-inch page is X=8.9, Y=7.25 with a radius, R=1. Only the right hand side of the circle is displayed, corresponding to a starting angle, TL, of 0 (TL=0) and the ending angle, TU, of 180 (TU=180). We do not want the center displayed, so CC is set to 0 (CC=0). Actually, since we draw the diameter, this point is eventually displayed. The semicircle is drawn by calling the subroutine at location 1000 (GOSUB 1000) to draw the arc.

The vertical line of this figure is drawn from line 55. Starting at the top, X=8.9 (the same as the center of the circle), Y, however, is 7.25 plus a distance equal to the radius (=1) or Y=8.25. The distance is 2 (D=2), twice the radius. The angle is 180 (T=180), straight down. The line is drawn by the subroutine at location 2000

(GOSUB 2000).

Examining the figure immediately to the left, we notice that the figure is rotated 45 degrees (⅛ turn) counterclockwise. The semicircle is drawn from statement 60. X, Y and R should be self-explanatory at this point. The angles are TL=45 and TU=135. This is simply 45 subtracted from the angles of line 50. TL=315 and TU=495 would work just as well. Note, however, that TL=45 and TU=495 would draw the entire circle.

Figure 2



The diameter is drawn from line 65 at T=135 degrees. The location of the starting point was determined by trial and error, i.e., by picking an approximate point and then drawing the line (running the program). If the line is not where you wish it to be, use the Editor to change the coordinates. (Guess again.)

Another method of drawing this line is demonstrated in lines 85 and 87. These lines refer to the figure in the upper left hand corner. Here we use the center of the semicircle as the starting point and draw lines of length equal to the radius in the directions 45 and -135 degrees. (D=1 and T=45, -135 respectively.)

The next figure of interest is the quarter moon figure in the second row, far right. The outer semicircle is simply a half circle drawn from line 130. The inner circle is a partial circle of larger radius. Another subroutine at location 3000 was written to handle problems where the radius and angles are unknown but the starting and ending coordinates are known. Referring to line 135, the center point has the same Y coordinate (Y=4.25) but the X coordinate has been moved ½ inch to the left (X=8.4) The starting and ending coordinates of the arc can be determined from line 130. The X coordinate of both are the same as the previous center. The Y coordinates are one inch (the previous radius) above and below the present Y center coordinate (Y=5.25 and 3.25 resp.). New variables are defined to handle these starting and ending coordinates. These are XL and YL for the start of the arc and XU and YU for the end. After these variables are set, the subroutine at line 3000 is called.

The circle at the lower right hand corner is drawn from line 250. Here the starting and ending angles, TL and TU, are 0 and 360 degrees.

The large wheel with five spokes is drawn using the subroutine at line 4000. It is called from line 700. X, Y and R are set for the outer circle. The number of spokes is specified by setting NS (NS=5). TS is the angle where the first spoke is located. Note that the program evenly spaces the spokes angle-wise.

Drafting on Other Computers

For readers who may wish to rewrite these routines to run on non-TRS-80 computers, some comments are in order. Obviously, of course, any changes between the BASIC of the TRS-80 and other machines will have to be taken into account. This section is mainly concerned with scaling and display dimensions.

Lines 1000 and 2000 introduce the coordinate transformation for X and Y. The TRS-80 plots 12.7 points/inch on the X-axis and 5.371 points on the Y-axis. Since there are 47 points on the Y-axis and I wished to define (0,0) in the bottom left corner, I had to invert the display by the statement:

YS=47-5.371*Y

The statement: SF=2.36455 in lines 1000 and 3000 is merely the ratio of 12.7/5.371 needed for display angle calculations. Other constants in the listings are merely conversions from degrees to radians and vice-versa since the TRS-80 uses radians and I chose degrees in these routines for ease of use.

Ed. Note M/The demonstration program (Listing 2) will produce the drawing seen in the heading of this article.

Listing 1
Test Pattern

```
10 CLS
50 X=8.9: Y=7.25: R=1: TL=0 : TU=180 :
CC=0 : GOSUB 1000
55 X=8.9: Y=8.25: D=2 : T=180 : GOSUB 2
000
60 X=6.9 : Y=7.25 : R=1 : TL=-45 : TU=1
35 : CC=0 : GOSUB 1000
65 X=6.4 : Y=8 : D=2 : T=135 : GOSUB 20
00
70 X=4.5 : Y=7.25 : R=1 : TL=-90 : TU=9
0 : CC=0 : GOSUB 1000
75 X=3.5 : Y=7.25 : D=2 : T=90 : GOSUB
2000
80 X=1.5 : Y=7.25 : R=1 : TL=-135 : TU=
45 : CC=0 : GOSUB 1000
85 X=1.5 : Y=7.25 : D=1 : T=45 : GOSUB
2000
87 X=1.5 : Y=7.25 : D=1 : T=-135 : GOSU
B 2000
```

```
130 X=8.9: Y=4.25: R=1 : TL=0 : TU=180
: CC=0 : GOSUB 1000
135 X=8.4: Y=4.25:XL=8.9: YL=5.25: XU=8
.9: YU=3.25: GOSUB 3000
250 X=8.9: Y=1.25:R=1 :TL=0:TU=360:CC=0
:GOSUB 1000
300 PRINT@ 330, "TRS-80 DRAFTING/GRAPHI
CS TEST PATTERN";
320 PRINT@ 478, "D. L. BARTELHEIMER";
700 X=2.5 : Y=2.5 : R=2 : TS=20 : NS=5
: GOSUB 4000
800 FOR I=0 TO 1000000
805 NEXT I
990 REM **********
991 REM
992 REM ** THIS SUBROUTINE DRAWS ARCS O
R CIRCLES,
993 REM **     WITH CENTER AT X, Y
994 REM **     RADIUS OF R
995 REM **     STARTING ANGLE TL
996 REM **     ENDING ANGLE TU
997 REM **     FLAG CC=1, CENTER POINT D
RAWN, CC=0 OTHERWISE
998 REM
999 REM **********
1000 XS=12.7*X : YS=47-5.371*Y : RX=12.
8*R : RY=5.371*R : SF=2.36455 : IF TL>T
U THEN TU=TU+360
1005 IF TL<0 THEN TL=TL+360 : TU=TU+360
1010 IF CC=1 THEN SET(XS+0.5,YS+0.5)
1015 IF (TL <= 90 AND TU >= 90) OR TU >
=450 THEN 1020 ELSE 1025
1020 SET(XS+RX+0.5,YS+0.5)
1025 IF (TL <= 270 AND TU >= 270) OR TU
 >=630 THEN 1030 ELSE 1035
1030 SET(XS-RX+0.5,YS+0.5)
1035 IF (TL <= 180 AND TU >= 180) OR TU
 >= 540 THEN 1040 ELSE 1045
1040 SET(XS+0.5,YS+RY+0.5)
1045 IF (TL <= 0 AND TU >= 0) OR TU >=3
60 THEN 1050 ELSE 1055
1050 SET(XS+0.5,YS-RY+0.5)
1055 FL=0 : F1=0 : YL=RY
1100 FOR XX=1 TO RX
1110 YY=RY*RY - 0.1761*XX*XX
1112 IF YY<0 THEN  YY=0
1114 YY=SQR(YY)
1116 IF YL-YY>1 THEN YT=YY : YY=YL-1 :
FL=1 : ELSE FL=0
1118 TH=90-57.29578*ATN(SF*YY/XX) : T2=
TH : IF (TL <= T2 AND TU >= T2) OR TU >
= 360+T2 THEN 1120 ELSE 1125
1120 SET(XS+XX+0.5,YS-YY+0.5)
1125 T3=360-TH : IF (TL <= T3 AND TU >=
 T3) OR TU >= 360+T3 THEN 1130 ELSE 113
5
1130 SET(XS-XX+0.5,YS-YY+0.5)
1135 T2=180-TH : IF (TL <= T2 AND TU >=
 T2) OR TU >= 360+T2 THEN 1140 ELSE 114
5
1140 SET(XS+XX+0.5,YS+YY+0.5)
1145 T4=180+TH : IF (TL<=  T4 AND TU>=T
4) OR TU>=360+T4 THEN 1150 ELSE 1160
1150 SET(XS-XX+0.5,YS+YY+0.5)
1160 IF F1=1 THEN GOTO 1600
1175 IF FL=1 THEN YY=YY-1 ELSE GOTO 120
0
1180 IF YY<=YT-1 THEN 1200 ELSE GOTO 11
18
1200 YL=YY
1500 NEXT XX
1550 IF F1=0 AND YY>0 THEN F1=1 : GOTO
1118
1600 IF YY>0 THEN YY=YY-1 : F1=1
1610 IF YY>0 THEN GOTO 1118
1620 RETURN
1990 REM **********
1991 REM
1992 REM **  THIS ROUTINE DRAWS A STRAI
GHT LINE,
```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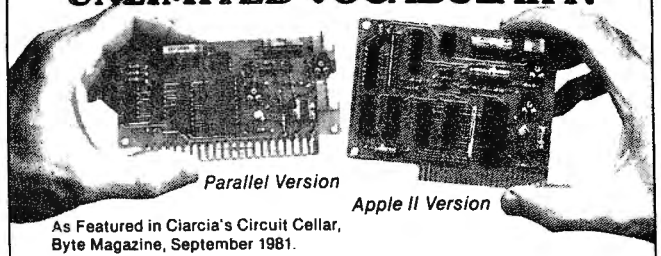

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Apple II Version

As Featured in Ciarcia's Circuit Cellar, Byte Magazine, September 1981.

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```
1993 REM **     STARTING AT X, Y
1994 REM **     OF LENGTH (DISTANCE) D
1995 REM **     AND ANGLE (IN DEGREES) O
F T (THETA)
1996 REM
1997 REM **********
2000 XS=12.7*X : YS=47-5.371*Y : T=0.01
745329*T
2010 DX=12.7*SIN(T)*D : DY=5.371*COS(T)
*D
2012 SS=0
2014 IF (-.349<T AND .349>T) OR T>5.934
 OR (2.51327<T AND 3.77>T)  THEN 2100 E
LSE 2015
2015 K=DY/DX : IF K=0 THEN ST=1 ELSE ST
=1/K
2017 IF ABS(ST)>1 THEN SS=1 ELSE SS=ABS
(ST)
2018 IF DX<0 THEN SS=-SS
2020 SET(XS+0.5,YS+0.5)
2040 FOR I=XS+1 TO XS+DX STEP SS
2050 J=YS-K*(I-XS)
2060 SET(I+0.5,J+0.5)
2062 NEXT I
2064 RETURN
2100 K=DX/DY : IF K=0 THEN ST=1 ELSE ST
=1/K
2110 IF ABS(ST)>1 THEN SS=1 ELSE SS=ABS
(ST)
2120 IF DY>0  THEN SS=-SS
2130 SET(XS+0.5,YS+0.5)
2140 FOR I=YS+1 TO YS-DY STEP SS
2150 J=XS-K*(I-YS)
2160 SET(J+0.5,I+0.5)
2170 NEXT I
2180 RETURN
2990 REM  **********
2991 REM
2992 REM  **  THIS ROUTINE DRAWS ARCS W
HERE
2993 REM  **    X,Y ARE COORDINATES OF
CENTER
2994 REM  **    XL,YL ARE COORDINATES O
F START OF ARC
2995 REM  **    XU,YU DEFINE THE ANGULA
R LENGTH OF THE ARC
2996 REM  **      THE ANGLES DO NOT HAV
E TO BE GIVEN FOR THIS
2997 REM  **      ENTRY POINT. THE CENT
ER IS NOT DRAWN
2998 REM
2999 REM  **********
3000 CC=0 : R=SQR((XL-X)[2 +(YL-Y)[2) :
 SF=2.36455 : IF YL-Y=0 THEN TL=90 ELSE
 TL=57.29578*ATN(SF*(XL-X)/(YL-Y))
3010 IF XL-X <0 THEN TL=TL-180
3020 IF YU-Y=0 THEN TU=0 ELSE TU=57.295
78*ATN(SF*(XU-X)/(YU-Y))
3030 IF XU-X <0 THEN TU=TU+180
3035 TL=90-TL : TU=90-TU
3040 GOTO 1000
3990 REM **********
3991 REM
3992 REM **  THIS SUBROUTINE DRAWS A WH
EEL WITH SPOKES
3993 REM **     X, Y ARE COORDINATES OF
CENTER
3994 REM **     R IS RADIUS
3995 REM **     NS IS NUMBER OF SPOKES
3996 REM **     TS IS ANGLE OF ONE OF TH
E SPOKES
3997 REM
3998 REM **********
4000 TL=0 : TU=360 : CC=1 : GOSUB 1000
4050 D=R : T=TS : GOSUB 2000
4100 TT=360/NS
4150 FOR II=1 TO NS
4200 TS=TS+TT : T=TS : GOSUB 2000
4250 NEXT II
4300 RETURN
```

Listing 2
Demonstration Program

```
10 CLS
50 X=1 : Y=2.3 : D=6 : T=90 : GOSUB 200
0
55 X=1 : Y=2.3 : D=3.5 : T=0 : GOSUB 20
00
60 X=1.5 : Y=5.8 : R=0.5 : TL=-90 : TU=
90 : CC=0 : GOSUB 1000
65 X=6 : Y=2.3 : R=1 : TL=0 : TU=90 : G
OSUB 1000
70 X=2 : Y=4.8 : D=1 : T=0 : GOSUB 2000
75 X=3.5 : Y=4.8 : R=1.5 : TL=180 : TU=
270 : GOSUB 1000
80 X=3.5 : Y=3.3 : D=2.8 : T=90 : GOSUB
 2000
85 X=7 : Y=2.3 : D=2 : T=45 : GOSUB 200
0
90 X=7.414 : Y=3.714 : R=1 : TL=0 : TU=
90 : GOSUB 1000
95 X=3.1414 : Y=6.214 : D=1 : T=0 : GOS
UB 2000
100 X=4.6414 : Y=6.214 : R=1.5 : TL=180
 : TU=270 : GOSUB 1000
105 X=4.6414 : Y=4.714 : D=2.8 : T=90 :
 GOSUB 2000
110 X=2.6414 : Y=7.214 : R=0.5 : TL=-70
 : TU=90 : GOSUB 1000
115 X=1 : Y=6.1 : D=2 : T=45 : GOSUB 20
00
```

```
120 X=6 : Y=2.3 : D=1 : T=180 : GOSUB 2
000
125 X=6.5 : Y=2.3 : D=1 : T=180 : GOSUB
 2000
130 X=6 : Y=1.3 : D=0.5 : T=90 : GOSUB
2000
135 X=6.25 : Y=1.1 : R=1.1 : TS=50 : NS
=9 : GOSUB 4000
140 X=2.314 : Y=3.9 : D=3.5 : T=0 : GOS
UB 2000
145 X=2.414 : Y=3.714 : D=6 : T=90 : GO
SUB 2000
155 X=6.5 : Y=1.3 : D=2 : T=45 : GOSUB
2000
160 X=7.914 : Y=2.714 : D=0.7 : T=0 : G
OSUB 2000
165 X=7.664 : Y=2.714 : R=1.1 : TL=30 :
 TU=220 : GOSUB 1000
180 X=8.698 : Y=2.3378 : D=0.85 : T=290
 : GOSUB 2000
190 X=8.698 : Y=3.09 : D=0.85 : T=250 :
 GOSUB 2000
193 X=8.214 : Y=1.7614 : D=0.85 : T=330
 : GOSUB 2000
196 X=7.473 : Y=1.8 : D=0.75 : T=10 : G
OSUB 2000
200 X=3.514 : Y=3.514 : R=2 : TL=-5 : T
U=55 : CC=0 : GOSUB 1000
210 X=3.514 : Y=3.514 : R=2 : TL=130 :
TU=230 : CC=0 : GOSUB 1000
230 X=4.122 : Y=5.419 : D=0.5 : T=198 :
 GOSUB 2000
240 X=4.919 : Y=4.919 : D=0.5 : T=225 :
 GOSUB 2000
250 X=3.38 : Y=1.7 : D=0.5 : T=3.85 : G
OSUB 2000
260 X=4.323 : Y=1.885 : D=0.5 : T=336 :
 GOSUB 2000
270 X=2.468 : Y=1.81 : D=0.5 : T=31.5 :
 GOSUB 2000
500 PRINT@ 10, "TRS-80 DRAFTING/GRAPHIC
S DEMONSTRATION PROGRAM";
550 PRINT@ 98, "DARREL L. BARTELHEIMER"
;
700 X=2.1 : Y=2.1 : R=2 : TS=20 : NS=13
 : GOSUB 4000
800 FOR I=0 TO 1000000
805 NEXT I
990 REM **********
991 REM
992 REM ** THIS SUBROUTINE DRAWS ARCS O
R CIRCLES,
993 REM **     WITH CENTER AT X, Y
994 REM **     RADIUS OF R
995 REM **     STARTING ANGLE TL
996 REM **     ENDING ANGLE TU
997 REM **     FLAG CC=1, CENTER POINT D
RAWN, CC=0 OTHERWISE
998 REM
999 REM **********
1000 XS=12.7*X : YS=47-5.371*Y : RX=12.
8*R : RY=5.371*R : SF=2.36455 : IF TL>T
U THEN TU=TU+360
1005 IF TL<0 THEN TL=TL+360 : TU=TU+360
1010 IF CC=1 THEN SET(XS+0.5,YS+0.5)
1015 IF (TL <= 90 AND TU >= 90) OR TU >
=450 THEN 1020 ELSE 1025
1020 SET(XS+RX+0.5,YS+0.5)
1025 IF (TL <= 270 AND TU >= 270) OR TU
 >=630 THEN 1030 ELSE 1035
1030 SET(XS-RX+0.5,YS+0.5)
1035 IF (TL <= 180 AND TU >= 180) OR TU
 >= 540 THEN 1040 ELSE 1045
1040 SET(XS+0.5,YS+RY+0.5)
1045 IF (TL <= 0 AND TU >= 0) OR TU >=3
60 THEN 1050 ELSE 1055
1050 SET(XS+0.5,YS-RY+0.5)
1055 FL=0 : F1=0 : YL=RY
1100 FOR XX=1 TO RX
1110 YY=RY*RY - 0.1761*XX*XX
1112 IF YY<0 THEN  YY=0
```


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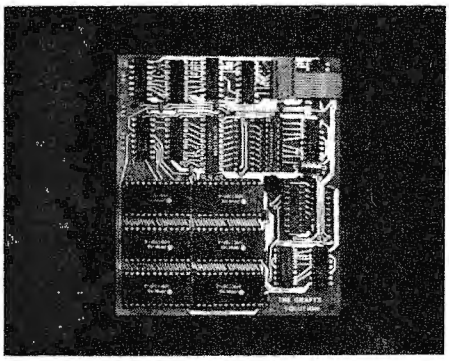
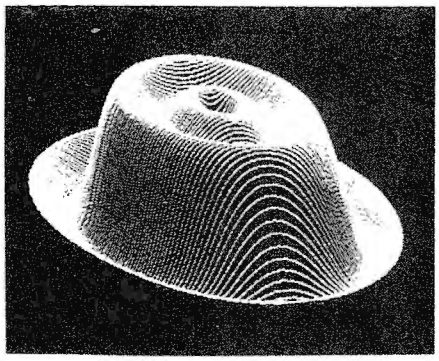
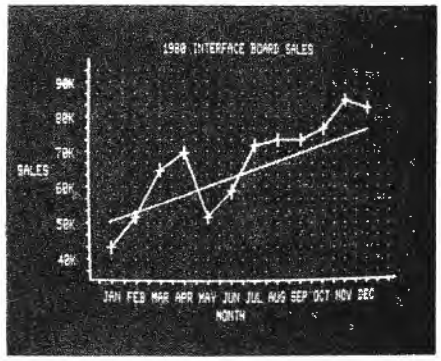
```
1114 YY=SQR(YY)
1116 IF YL-YY>1 THEN YT=YY : YY=YL-1 :
FL=1 : ELSE FL=0
1118 TH=90-57.29578*ATN(SF*YY/XX) : T2=
TH : IF (TL <= T2 AND TU >= T2) OR TU >
= 360+T2 THEN 1120 ELSE 1125
1120 SET(XS+XX+0.5,YS-YY+0.5)
1125 T3=360-TH : IF (TL <= T3 AND TU >=
 T3) OR TU >= 360+T3 THEN 1130 ELSE 113
5
1130 SET(XS-XX+0.5,YS-YY+0.5)
1135 T2=180-TH : IF (TL <= T2 AND TU >=
 T2) OR TU >= 360+T2 THEN 1140 ELSE 114
5
1140 SET(XS+XX+0.5,YS+YY+0.5)
1145 T4=180+TH : IF (TL<=  T4 AND TU>=T
4) OR TU>=360+T4 THEN 1150 ELSE 1160
1150 SET(XS-XX+0.5,YS+YY+0.5)
1160 IF F1=1 THEN GOTO 1600
1175 IF FL=1 THEN YY=YY-1 ELSE GOTO 120
0
1180 IF YY<=YT-1 THEN 1200 ELSE GOTO 11
18
1200 YL=YY
1500 NEXT XX
1550 IF F1=0 AND YY>0 THEN F1=1 : GOTO
1118
1600 IF YY>0 THEN YY=YY-1 : F1=1
1610 IF YY>0 THEN GOTO 1118
1620 RETURN
1990 REM **********
1991 REM
1992 REM **  THIS ROUTINE DRAWS A STRAI
GHT LINE,
1993 REM **     STARTING AT X, Y
1994 REM **     OF LENGTH (DISTANCE) D
1995 REM **     AND ANGLE (IN DEGREES) O
F T (THETA)
1996 REM
1997 REM **********
2000 XS=12.7*X : YS=47-5.371*Y : T=0.01
745329*T
2010 DX=12.7*SIN(T)*D : DY=5.371*COS(T)
*D
2012 SS=0
2014 IF (-.349<T AND .349>T) OR T>5.934
 OR (2.51327<T AND 3.77>T)  THEN 2100 E
LSE 2015
2015 K=DY/DX : IF K=0 THEN ST=1 ELSE ST
=1/K
2017 IF ABS(ST)>1 THEN SS=1 ELSE SS=ABS
(ST)
2018 IF DX<0 THEN SS=-SS
2020 SET(XS+0.5,YS+0.5)
2040 FOR I=XS+1 TO XS+DX STEP SS
2050 J=YS-K*(I-XS)
2060 SET(I+0.5,J+0.5)
2062 NEXT I
2064 RETURN
2100 K=DX/DY : IF K=0 THEN ST=1 ELSE ST
=1/K
2110 IF ABS(ST)>1 THEN SS=1 ELSE SS=ABS
(ST)
2120 IF DY>0  THEN SS=-SS
2130 SET(XS+0.5,YS+0.5)
2140 FOR I=YS+1 TO YS-DY STEP SS
2150 J=XS-K*(I-YS)
2160 SET(J+0.5,I+0.5)
2170 NEXT I
2180 RETURN
2990 REM  **********
2991 REM
2992 REM  **  THIS ROUTINE DRAWS ARCS W
HERE
2993 REM  **     X,Y ARE COORDINATES OF
CENTER
2994 REM  **     XL,YL ARE COORDINATES O
F START OF ARC
2995 REM  **     XU,YU DEFINE THE ANGULA
R LENGTH OF THE ARC
2996 REM  **       THE ANGLES DO NOT HAV
E TO BE GIVEN FOR THIS
2997 REM  **       ENTRY POINT. THE CENT
ER IS NOT DRAWN
2998 REM
2999 REM  **********
3000 CC=0 : R=SQR((XL-X)[2 +(YL-Y)[2) :
 SF=2.36455 : IF YL-Y=0 THEN TL=90 ELSE
 TL=57.29578*ATN(SF*(XL-X)/(YL-Y))
3010 IF XL-X <0 THEN TL=TL-180
3020 IF YU-Y=0 THEN TU=0 ELSE TU=57.295
78*ATN(SF*(XU-X)/(YU-Y))
3030 IF XU-X <0 THEN TU=TU+180
3035 TL=90-TL : TU=90-TU
3040 GOTO 1000
3990 REM **********
3991 REM
3992 REM **  THIS SUBROUTINE DRAWS A WH
EEL WITH SPOKES
3993 REM **     X, Y ARE COORDINATES OF
CENTER
3994 REM **     R IS RADIUS
3995 REM **     NS IS NUMBER OF SPOKES
3996 REM **     TS IS ANGLE OF ONE OF TH
E SPOKES
3997 REM
3998 REM **********
4000 TL=0 : TU=360 : CC=1 : GOSUB 1000
4050 D=R : T=TS : GOSUB 2000
4100 TT=360/NS
4150 FOR II=1 TO NS-1
4200 TS=TS+TT : T=TS : GOSUB 2000
4250 NEXT II
4300 RETURN
```

■







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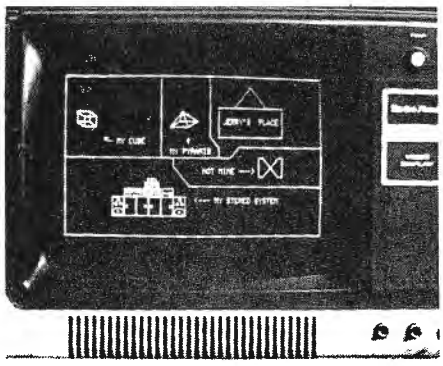

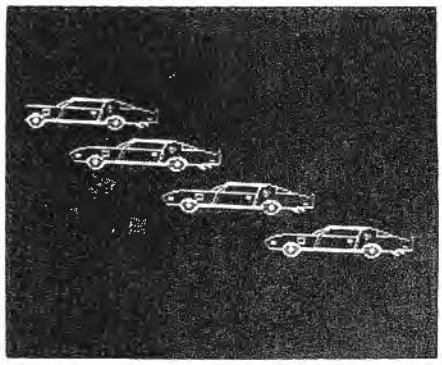

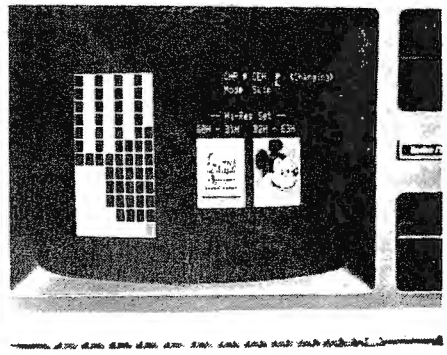

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Two graphs for Model II/16

Histograms and regression lines for your printer or video

Model II/16

Mike Schmidt, Publisher

Very little, in the way of graphics, has been seen for the Model II since it was released in late 1979. The absence of PEEK and POKE in the Model II BASIC has, no doubt, been responsible for at least some of the dearth of graphics for that machine.

Since no one seems to be doing graphics, we decided to do it ourselves. Two programs are presented here. The first, PLOT1, prints up to twenty items in a bar chart. It uses the Model II graphics in its display on the video screen. An option to lineprint on an 80-column or more printer is included. The line printer display is decidely different from that on the screen however. The command used in the Model II to cause the screen to print to the printer is SYSTEM "SCREEN." This command reads video memory and faithfully (up to a point) sends it to the lineprinter. In the TRSDOS system, all graphics characters are changed to periods when using SYSTEM "SCREEN."

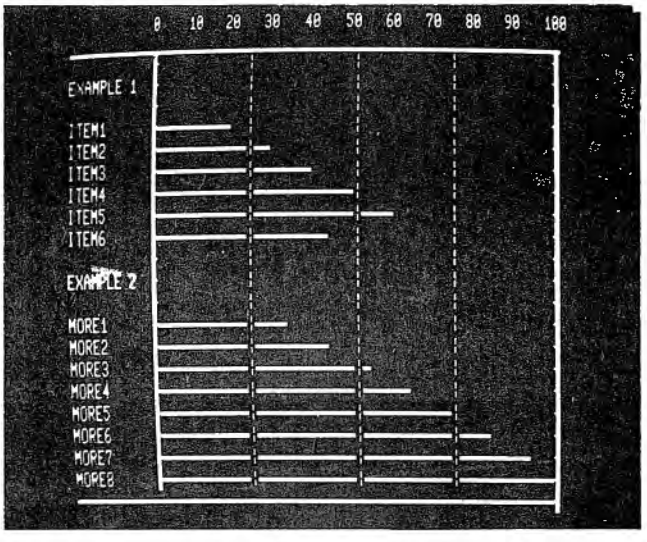
It still makes for a reasonably nice display, but the video display is preferable.

The program PLOT1 (Listing 1), is largely self-evident. Remark statements precede most modules. The scale is set by the user prior to entering data. It should be just slightly larger than the largest value to be entered. Although it is possible to use any number for the scale, it may be preferable to stick to decades, i.e., 10, 100, 1000, to prevent cluttering the scale annotation above the graph.

It is possible to name the plot by using the first item in this manner: ITEM,0. Vertical spaces between items may also be left by entering a value of (space),0. To terminate entering items, enter 0,0. The input of items will terminate itself if the items exceed twenty. There is error trapping for item names over nine characters long and for values which exceed the user-entered scale value. Values less than zero are not used in this histogram, since they would not print.

This program also works on a Model 16 operating under TRSDOS-II mode. In fact, it was created on a Model 16 and FCOPY was used to transfer it back to straight Model II. This is also true for the second program, Listing 2, which follows.

Listing 2 shows a different plot program for Model II/16. This program is designed to print only on a line printer. It requires a 132-character lineprinter, or printers like the Microline 80 or MX-80, which can be set to 132-character modes.



Screen photo of PLOT1.

In Listing 2, PLOT2, the data is entered at the end of the program as DATA statements. One of the features of this program is that it automatically saves itself after each run. This is so that newly entered (or added to) data statements will be saved.

Two additional features of this program are that the actual value of the data is printed (not scaled) to the right of the bar in the graph and the graph is followed by a three-period projection, also with values printed at the right. The values for the regression line are printed after the graph is completed. The scale factor for this program is not entered by the user, but is determined automatically by the program. The method used is to search the data statements for the largest value and

Figure 1
Sample printer output from PLOT1.

```
          0    50   100  150  200  250  300  350  400  450  500
.....................................................................
          .    |    |    |    |    |    |    |    |    |    |    .
ONE       ...........    |    |    |    |    |    |    |    |    .
TWO       ..............|....|    |    |    |    |    |    |    .
THREE     ..............|.....................|    |    |    |    .
FOUR      ..............|.....................|.....|    |    |    .
FIVE      ..............|.....................|.....|.....|    |    .
SIX       ..............|.....................|.....|.....|    |    .
SEVEN     ..............|.....................|.....|..   |    |    .
EIGHT     ..............|.....................|.....|    |    |    .
NINE      ..............|.....................|.....|    |    |    .
TEN       ..............|.....................|    |    |    |    .
ELEVEN    ..............|.....|    |    |    |    |    |    |    .
TWELVE    ..............|..   |    |    |    |    |    |    |    .
THIRTEEN  ...........    |    |    |    |    |    |    |    |    .
FOURTEEN  ......         |    |    |    |    |    |    |    |    .
FIFTEEN   ..............|    |    |    |    |    |    |    |    .
SIXTEEN   ..............|.....|    |    |    |    |    |    |    .
SEVENTEEN ..............|.....................|.....|    |    |    .
EIGHTEEN  ..............|.....................|.....|.....|    |    .
NINETEEN  ..............|.....................|.....|.....|    |    .
.....................................................................
```

then set the scale factor accordingly. Because of this, it is not a very presentable graph when widely varying values are used. For example, using all values in tens and then putting one value at 10000 would cause poor definition of all the lower values.

Some program notes on Listing 2 are in order. Line 80 clears about one-third of available memory.

You can name your graph by entering that name in line 300.

You can choose your own label in line 320.

Starting at line 350, the program searches through the data items to find the highest number. It then sets variable D1 for the scale factor.

Lines 360 and 420 allow for 1000 data items. This should be more than enough, but if you need more these two should be changed. The maximum number of data items is the limit of your memory.

The variable L in line 470 represents the length of the bar for the chart. The letter X is used to make the bar.

Figure 2
Sample run and output from PLOT2 program.

```
MODEL II/16 GRAPH PLOTTER WITH THREE PERIOD PROJECTION
        FOR USE WITH 132 CHARACTER LINEPRINTER

The data for this program must be entered as DATA lines at the
end of the program. The form of these DATA statements is:
      DATA LABEL,####
where LABEL is a name and #### is a numeric value.

The very last DATA statement should contain a dummy label and a
numeric value of -1, like this: DATA ,-1

The program will automatically save itself after it is run
to save DATA statements that has been entered or added to.

Line up your printer paper and ENTER to continue
?
                                GRAPH NAME

LABEL    0       1       2       3       4       5       6       7       8       9       1
         !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !   !
JAN 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                                    3200
FEB 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                           3850
MAR 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                                     4329
APR 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                      5560
MAY 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX            6430
JUN 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX         6028
JUL 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX      6500
AUG 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX      6340
SEP 82   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX     6210
PROJ     OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO   7409.67
PROJ     OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO  7815.01
PROJ     OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO 8220.34

THE X & Y FOR THE REGRESSION LINE ARE:
Y= 3356.34 + 405.334 X
```

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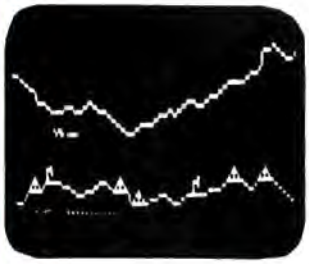

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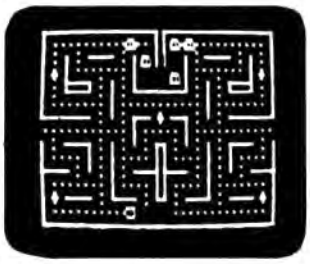

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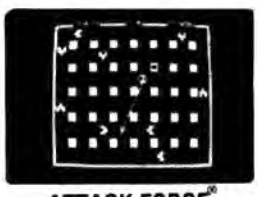
LUNAR LANDER

[illegible]



ATTACK FORCE®

As your ship appears at the bottom of the maze, eight alien ships appear on the top, all heading directly at you. You must move [illegible] destroy the aliens before they destroy you. The more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the [illegible] with sound effects.

COSMIC FIGHTER®

Your ship comes out of hyperspace under a variety of alien fire; destroy every one. But another set appears. These seem more intelligent. You must eliminate them too, or [illegible] destroying your last destroys [illegible] before you can move to the next station. [illegible] you!

GALAXY INVASION®

The [illegible] of the Klingons is coming you! Swarms have been spotted warping towards it. It's you, the last fighter left to [illegible] you for your planet's defense. A few meteorites [illegible] straight at you! You place your finger on the button, knowing that this is the most serious [illegible] with sound effects.

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You can substitute any other letter or number here if you like.

The data statements are read for a third time in line 510 to establish the trend line.

The values for the regression line are calculated starting at line 590. The three-period projection is figured starting at line 610.

Line 640 prints the projected values, using the small letter "o" to make the bar. Again, you may choose whatever you like here.

After your chart is printed, you can run a straight line through the last three o's and see your trend line.

We have found these plots both useful and fun to use. Try them, they are both short and easy to type in.

Listing 1
PLOT1

```
10 REM PROGRAM NAME IS PLOT1: (C) 1982
80-NW PUBISHING INC.
20 REM ********************************
30 REM *                              *
40 REM * VARIABLE SCALE GRAPH PLOTTER *
50 REM *    FOR MODEL II/16 WITH      *
60 REM * 80 COL PRINTER AND VIDEO     *
65 REM ********************************
70 CLS:CLEAR200:DIMN$(24),X(24)
80 PRINT STRING$(79,"_")
90 PRINT
100 PRINTTAB(17);"MODEL II/16 GRAPH PLO
TTER FOR UP TO 20 ITEMS"
110 PRINTTAB(20);"FOR USE WITH/WITHOUT
80-COLUMN PRINTER"
120 PRINT STRING$(79,"_")
130 PRINT:PRINT
140 PRINT"YOU CAN ENTER UP TO 20 DIFFER
ENT NAMES AND ITEMS. FOR INSTANCE:"
150 PRINT"ENTER A LABEL NAME, FOLLOWED
BY A COMMA, THEN THE VALUE."
160 PRINT
170 PRINT"MAX SCALE VALUE IS A NUMBER L
ARGER THAN THE LARGEST VALUE TO BE ENTE
RED."
180 PRINT
190 PRINT"ENTER 0,0 TO END INPUT OF ITE
MS."
200 PRINT
210 INPUT"ENTER A '1' NOW IF YOU WANT T
HE GRAPH TO DUMP TO THE PRINTER, IF NOT
, JUST PRESS ENTER";AA
220 PRINT"USE THE <BREAK> KEY TO EXIT T
HE GRAPH."
230 REM ---------- INPUT SCALE,
 NAMES AND VALUES ----------
240 PRINT:INPUT"MAXIMUM SCALE VALUE ";S
:S=S/100
250 CLS:PRINT:FOR Z =2 TO 21
260 PRINT"ITEM #";Z-1;:INPUT" - NAME, V
ALUE ";N$(Z),X(Z)
270 IF LEN(N$(Z))>9 THEN PRINT"NAMES LI
MITED TO 9 CHARACTERS ":GOTO260
280 IF X(Z)>100*S THEN PRINT"VALUES LIM
ITED TO A MAXIMUM OF";100*S:GOTO260
290 IF N$(Z)="0" THEN Z=Z-1:GOTO310
300 NEXTZ
310 REM ---------- ANNOTATE TOP
OF GRAPH ----------
320 CLS
330 FORI=0TO50STEP5
340 PRINT@I+10,INT(20*I*S)/10
350 NEXTI
360 REM ----------DRAW TOP
 LINE OF GRAPH ----------
370 FORI=0TO62
380 PRINTCHR$(152);
390 NEXTI
400 REM ---------- PRINT NAME
S AND VALUES ----------
410 S=S*2
420 FORI=0 TO Z
430 PRINT@I*80,N$(I);:PRINT@I*80+12,STR
ING$(X(I)/S,CHR$(150))
440 NEXTI
450 REM ----------DRAW THE VERTI
CAL LINES ----------
460 FORI=2TO22
```

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```
470 PRINT@I*80+11,CHR$(139)
480 PRINT@I*80+24,CHR$(124)
490 PRINT@I*80+37,CHR$(124)
500 PRINT@I*80+49,CHR$(124)
510 PRINT@I*80+62,CHR$(137)
520 NEXTI
530 REM ---------- CLOSE BO
TTOM WITH LINE ----------
540 PRINT@1760,STRING$(62,CHR$(150))
550 REM ---------- PRINTER OPTION --
----------
560 IF AA=1 THEN SYSTEM "SCREEN"
570 GOTO570
```

Listing 2
PLOT 2

```
5 REM LINE NUMBERS ENDING IN 5 NEED NOT
 BE TYPED IN, USE AUTO
10 REM PROGRAM NAME IS: PLOT2 : (C) 198
2 80-NORTHWEST PUBLISHING INC.
20 REM ********************************
30 REM *                              *
40 REM *   MOD II/16 GRAPH PLOTTER    *
50 REM *   WITH PRINTER AND THREE     *
60 REM *    PERIOD PROJECTION         *
62 REM ********************************
65 REM ---- THE NEXT LINE IS TO SET SOM
E PRINTERS, DELETE IF YOU DON'T NEED IT
.
70 LPRINTCHR$(29):REM----SETS MICROLINE
 80 PRINTER TO 132 CHAR MODE
75 REM ---- CLEARS ABOUT ONE THIRD OF M
EMORY ----------
80 CLEAR (2*MEM)/3
85 REM ---- SET FORMS ON YOUR LINE PRIN
TER ----------
90 SYSTEM "FORMS {P=66,L=66,W=132}
100 CLS
105 REM ---- PRINT HEADING AND INSTRUCTI
ONS ON VIDEO SCREEN ----------
110 PRINTSTRING$(79,"_")
120 PRINT
130 PRINTTAB(10);"MODEL II/16 GRAPH PLO
TTER WITH THREE PERIOD PROJECTION"
140 PRINTTAB(20);"FOR USE WITH 132 CHAR
ACTER LINEPRINTER"
150 PRINTSTRING$(79,"_")
160 PRINT
170 PRINT
180 PRINT"The data for this program mus
t be entered as DATA lines at the"
190 PRINT"end of the program. The form
of these DATA statements is:"
200 PRINT"        DATA LABEL,####"
210 PRINT"where LABEL is a name and ###
# is a numeric value."
220 PRINT
230 PRINT"The very last DATA statement
should contain a dummy label and a"
240 PRINT"numeric value of -1, like thi
s: DATA ,-1"
250 PRINT
260 PRINT"The program will automaticall
y save itself after it is run"
270 PRINT"to save DATA statements that
has been entered or added to."
280 PRINT
290 PRINT"Line up your printer paper an
d ENTER to continue":INPUT;
295 REM ---- YOU CAN PUT YOUR OWN GRAPH
 NAME IN THE NEXT LINE ----------
300 LPRINTTAB(40);"GRAPH NAME"
310 LPRINT" "
315 REM ---- YOU CAN PUT YOUR OWN LABEL
 (9 CHARS OR LESS) IN THE NEXT LINE --
320 LPRINT"LABEL";:LPRINTTAB(10);"0";TA
B(20);"1";TAB(30);"2";TAB(40);"3";TAB(5
0);"4";TAB(60);"5";TAB(70);"6";TAB(80);
"7";TAB(90);"8";TAB(100);"9";TAB(110);"
1"
330 :LPRINTTAB(10);"!";TAB(15);"!";TAB(
20);"!";TAB(25);"!";TAB(30);"!";TAB(35)
;"!";TAB(40);"!";TAB(45);"!";TAB(50);"!
";TAB(55);"!";TAB(60);"!";TAB(65);"!";T
AB(70);"!";TAB(75);"!";TAB(80);"!";TAB(
85);"!";TAB(90);"!";TAB(95);"!";TAB(100
);"!";
340 LPRINTTAB(105);"!";TAB(110);"!"
345 REM ---- FIND THE HIGHEST DATA VALUE
 SO YOU CAN SET THE SCALE ----------
350 D2=0
360 FORJ=1TO1000
370 READA$,D:IFD=-1THEN GOTO 410
380 IFD>D2 THEN D2=D
390 IFD2<100 THEN D1=1 ELSE IF D2<1000
THEN D1=10 ELSE IF D2<10000 THEN D1=100
 ELSE IF D2<100000 THEN D1=1000
400 NEXTJ
405 REM ---- RESTORE THE DATA FOR THE N
EXT READING OF IT ----------
410 RESTORE
415 REM ---- READ THE DATA, SCALE IT AN
D PRINT IT OUT ----------
420 FOR J = 1 TO 1000
430 READ A$,D
440 IF D= -1 THEN GOTO 500
450 C=C+1
460 L=(D/D1)+1
470 LPRINTA$;TAB(10);STRING$(L,"X");TAB
(120);D
480 NEXTJ
490 END
```

```
500 RESTORE
505 REM ----- READ THE DATA AGAIN FOR TH
E TREND LINE ----------
510 FOR J = 1 TO C
520 Q=J
530 READ A$,D
540 R=R+D
550 S=S+Q
560 U=U+Q*D
565 REM ----- USE THE 'SHIFT 6' KEY TO G
ET THE CARET (RAISE TO A POWER) ------
570 T=T+Q^2
580 NEXT J
585 REM ----- FIGURE THE VALUES FOR THE
REGRESSION LINE ----------
590 Y=(T*R-S*U)/(C*T-S^2):REM USE 'SHIF
T 6' FOR THE CARET (RAISE TO A POWER)
600 X=(C*U-S*R)/(C*T-S^2)
605 REM ----- FIGURE THE THREE PERIOD PR
OJECTION AND PRINT IT ----------
610 FOR F = C+1 TO C+3
620 F1=Y+X*F:IF F1 <=0 THEN PRINT"CAN'T
 PRINT NEGATIVE NUMBERS": GOTO 720
630 L=(F1/D1)+1
640 LPRINT"PROJ";TAB(10);STRING$(L,"o")
;TAB(120);F1
650 NEXT F
660 LPRINT" "
665 REM ----- PRINT THE VALUES FOR THE R
EGRESSION LINE ----------
670 LPRINT"THE X & Y FOR THE REGRESSION
 LINE ARE:"
680 LPRINT"Y=";Y;"+";X;"X"
685 REM ----- GIVE THE PRINTER A 'TOP OF
 FORM' COMMAND ----------
690 SYSTEM "FORMS T"
695 REM ----- SAVE THE PROGRAM ON DRIVE
0 ----------
700 PRINT"Now saving program on drive 0
"
710 SAVE"PLOT2:0"
720 PRINT"DONE"
730 END
735 REM ----- HERE IS WHERE YOU PUT YOUR
 DATA STATEMENTS - THOSE HERE ARE FOR
       SHOW ONLY. YOU CAN HAVE AS MANY
 AS THERE ARE SPACE FOR IN MEMORY.----
740 DATA JAN 82, 3200
750 DATA FEB 82, 3850
760 DATA MAR 82, 4329
770 DATA APR 82, 5560
780 DATA MAY 82, 6430
790 DATA JUN 82, 6028
800 DATA JUL 82, 6500
810 DATA AUG 82, 6340
820 DATA SEP 82, 6210
830 DATA ,-1
```

■

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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.

Color Computer assembler/disassembler

Get inside your 6809E

Color Computer

Richard Tangeman, Arkansas State University, AK

The 6809E Assembler in BASIC

The 6809E is one of the most modern and powerful 8-bit microprocessors. Because of its 16-bit index register, dual stacks, and well-chosen instruction set, it is probably easier to program than either the Z-80 or 6502. In order to explore these features, I decided to write an assembler in BASIC for my 16K Color Computer. The results of my effort appear here.

The full instruction set and all addressing modes are supported, along with some handy pseudo-ops. In order to save memory, the assembler itself has very fancy features, but symbolic addresses and forward references are supported. A small but adequate source language editor is included, along with routines to save source code on tape and load it back into memory. Once a program is assembled, the binary output of the assembler may be loaded into memory and executed.

The standard 6809E instruction set consists of 139 different mnemonics, most of which can be used with several different addressing modes. After the assembler is correctly typed in and saved to tape, run the program and hit BREAK in response to the first input prompt. Then execute from the direct mode:

```
FOR K = 1 TO 139:PRINT K,LEFT$(MN$(K),4): NEXT
K
```

This displays to the screen the available mnemonics. They are all standard except that ANDC is used instead of ANDCC.

Operands

Where operands are present, the object code output of the assembler depends heavily on operand format. Table 1 lists these formats and every operand should match one of these exactly. The assembler depends on operand lengths in particular, so be sure not to add any blanks. In Table 1, ** denotes any two-character hexadecimal constant and **** denotes a four-character hexadecimal constant or symbolic address (more on symbolic addresses later). W denotes any of the 16-bit registers S, Y, U or S. Where indirection is allowed, the operand may be optionally enclosed in square brackets.

The allowable operands for transfer and exchange instruction are all three characters long. Legal types are: M,N where each of M and N is one of the 8-bit registers A, B, C or Z; (C is the condition code register and Z is the direct page register) and V,W where each of V and W is one of the 16-bit registers D, X, Y, U, S, P. The operand for a push or pull instruction may be a single register or a list of registers separated by commas. D may not be used since it is really a pseudoregister. Instead of U or S, use the symbol ↑. Thus instead of PULS D,U we would use PULS A,B,↑. The order in which the registers appear is not important. Notice that the operand length would always be odd in this case.

Symbolic Labels

Any line may carry an optional label. Where present, a label must be exactly four characters long. The first character must be alphabetic and not a legal hex digit (G - Z). The other three characters should be alphanumeric (0 - 9 or A - Z). Labels are used to provide symbolic addresses and word constants, and any four-character hex constant in an operand may be replaced with a four-character symbolic label. (The DATA statement is an exception to this.)

Pseudo-ops

There are three pseudo-ops in addition to END. They are: EQU, ORG and DATA. These appear in the mnemonic field, and all require operands. EQU is used to set up symbolic word constants and (normally external) addresses. Thus instead of using JSRA1C1, we could declare a symbolic address: GRAB EQU A1C1 followed at some later point in the program by JSR GRAB. A statement of the form LDX #GRAB would also be legal. All EQU statements should appear at the

beginning of the program.

ORG sets the location counter, and usually would appear just once, after the EQU statements. Its operand is a four-character hexadecimal address, either a hex value or a previously defined symbolic location. The DATA pseudo-op provides a way to load ASCII or hex values at any desired location. It requires an operand, which may be either a string of ASCII characters enclosed by single quotes (apostrophes) or a string of hexadecimal characters having even length. Thus DATA 'ABC' and DATA 414243 would have exactly the same effect: loading 3 bytes starting at the present location. As usual, it is the responsibility of the programmer to keep data out of the line of execution.

The END statement must appear exactly once in a program, in the last line. It should not have a label, and must have an operand. The operand should be a four-character address, hex or symbolic. This address defines the starting address for execution after the program is assembled and loaded, and need not be the physical beginning of the program. Table 2 provides examples of correct usage of all the pseudo-ops. It is a simple program which prints a message to the center of the screen.

The Editor

To type in a program, RUN the assembler. You will be prompted three times for each line: label, mnemonic and operand. If a field is to be blank, just hit ENTER to get the next prompt. The input routine will loop until it receives END in the mnemonic field, at which point it asks for the final operand and then enters a keyboard scan routine. A description of the function of each of the several active keys follows.

L: — Lists the program. If it is longer than 15 lines, you will need to use shift @ to interrupt the list.

CLEAR: — Clears the screen.

D: — Prompts for a line number and then deletes that line.

R: — Prompts for a line number and then allows replacement of any one of the three fields for that line.

I: — Prompts for a line number and then inserts a blank line (three blank fields) after that line.

M: — Executes PRINT MEM.

T: — Enters a tape routine, which allows saving the present program or loading a previously saved one. Prompts are provided.

A: — Assembles the program. The object codes are loaded into a string array OC$(I). If there are forward references, the assembler will so indicate, possibly with an error message, but it will keep assembling in order to complete the symbol table. In this case, error or not, just assemble again. If there are no other problems, the second assembly should be complete and correct.

O: — Lists the opcodes and symbol table. Shift @ may be needed.

P: — POKEs the machine code into memory for execution.

E: — Executes the program via a USR call. Thus the logical end of your program should normally be RTS, returning control to the keyboard scan routine.

If your program is long, it is probably worth saving to tape before execution is attempted. A number of bad things can happen when running machine language, and the assembler may not catch all errors.

Memory Management

String space, graphics pages and array sizes are declared in line 5.

If your program is longer than 50 lines, you will need to increase the sizes of all the arrays and probably declare more string space. The PCLEAR3 may be changed to PCLEAR2 or PCLEAR1 with a gain of 1.5K of space for each graphics page given up. You may wish to give up the M and CLEAR commands of the monitor by deleting the appropriate lines. There are a few comments which can be removed. It is also possible to save a little space by renumbering very tightly, i.e. RENUM 1,,1.

Table 1

OPERAND	LENGTH	DESCRIPTION		EXAMPLE	INDIRECTION
#**	3	byte immediate	LDA	#5A	no
#****	5	word immediate	LDY	#A000	no
**	2	direct page	DEC	B3	no
****	4	extended	TST	0620	yes
+**,W	5	5-bit offset	STB	+0C,U	no
-**,W	5	5-bit offset	CMPY	-03,X	no
,W+	3	postincrement	LDB	,X+	yes
,W++	4	postincrement by 2	STB	,Y++	yes
,-W	3	predecrement	LSR	,-S	yes
,--W	4	predecrement by 2	CLR	,--X	yes
,W	2	simple index	LDA	,X	yes
A,W	3	accumulator offset	STB	A,Y	yes
B,W	3	accumulator offset	LDA	B,X	yes
D,W	3	accumulator offset	STY	D,X	yes
**,W	4	8-bit offset	STB	23,Y	yes
****,W	6	16-bit offset	LDX	123B,Y	yes
**,PCR	6	8-bit offset	LDA	23,PCR	yes
****,PCR	8	16-bit offset	LDX	1234,PCR	yes

Table 2
Sample program using the Assembler

```
1     MIDL    EQU     050D
2             ORG     0600
3             DATA    'ABCDEF'
4             DATA    00
5     STRT    LDX     #MIDL
6             LDY     #0600
7     MORE    LDA     ,Y+
8             TSTA
9             BEQ     QUIT
10            STA     ,X+
11            BRA     MORE
12    QUIT    RTS
13            END     STRT
```

Listing 1 for Assembler

```
5 PCLEAR3:CLEAR500:S=50:DIM L$(S),M$(S)
,O$(S),AD(S),OC$(S):GOSUB445:I=0:R$="DX
YUSPABCZ":N$="01234589AB":S$="CABZXY^P"
10 I=I+1:INPUT"LBL";L$(I):INPUT"MNE";M$
(I):LINEINPUT"OPD?";O$(I)
```

```
15 IFM$(I)="END"THENN=I:ELSE10
20 X$=INKEY$:IFX$="L"THEN70
25 IFX$=CHR$(12)THENCLS
30 IFX$="M"THENPRINTMEM
35 IFX$="E"THENE=USR1(0)
40 IFX$="I"THEN85
45 IFX$="O"GOSUB620
50 IFX$="P"GOSUB770
52 IFX$="T"THEN910
55 IFX$="D"THEN105
60 IFX$="A"THEN160
65 IFX$="R"THEN120ELSE20
70 FORI=1TON
75 PRINTI;TAB(3)L$(I)TAB(9)M$(I)TAB(14)
O$(I)TAB(21)OC$(I)
80 NEXTI:GOTO20
85 INPUT"AFTER";K:N=N+1
90 FORQ=N+1TOK+1STEP-1
95 L$(Q)=L$(Q-1):M$(Q)=M$(Q-1):O$(Q)=O$
(Q-1)
100 NEXTQ:L$(K+1)="":M$(K+1)="":O$(K+1)
="":GOSUB155:GOTO20
105 INPUT"#";K:FORI=K TON
110 L$(I)=L$(I+1):M$(I)=M$(I+1):O$(I)=O
$(I+1)
115 NEXTI:N=N-1:GOSUB155:GOTO20
120 INPUT"#";K
125 PRINT"L M O"
130 X$=INKEY$:IFX$=""THEN130
135 IFX$="L"THENPRINTL$(K):INPUTL$(K)
140 IFX$="M"THENPRINTM$(K):INPUTM$(K)
145 IFX$="O"THENPRINTO$(K):LINEINPUT"?"
;O$(K)
150 GOSUB155:GOTO20
155 FORI=1TO N:OC$(I)="":NEXTI:RETURN
159 REM ASSEMBLE
160 GOSUB155:FORI=1TON-1:PRINTI;
170 M$=M$(I):O$=O$(I):OC$="":LO=LEN(O$)
:PB=0
180 IFM$="ORG"ORM$="EQU"THENGOSUB725:AD
(I)=VAL("&H"+Q$):GOTO435
181 IFM$<>"DATA"THEN185
182 IFASC(O$)<>39THENOC$(I)=O$:GOTO185
183 FORQ=2TOLO-1:OC$(I)=OC$(I)+HEX$(ASC
(MID$(O$,Q,1))):NEXTQ
185 AD(I)=AD(I-1)+.5*LEN(OC$(I-1))
186 IFM$="DATA"THEN435
190 IFM$="TFR"ORM$="EXG"THEN825
195 IF LEN(M$)=3 THEN M$=M$+" "
200 FOR J=1 TO M
205 T$=LEFT$(MN$(J),4)
210 IFT$<>M$THEN220
215 T$=MN$(J):LT=LEN(T$):GOTO225
220 NEXTJ:GOTO440
225 IF ASC(T$)=80 THEN865
230 GOSUB600:REM PREBYTE
235 IF LO=0 THEN245
240 GOSUB 565:IF II=1 OR CP>0 THEN 280:
REM INDEX/IND
245 IF LT>6 THEN 255
250 OC$(I)=RIGHT$(T$,2)+MID$(O$,2):GOTO
 425
255 IFLO=3 OR LO=5 THENBP=5:LO=LO-1:GOT
O270
260 IFLO=2THENBP=7
265 IFLO=4THENBP=9
270 O$=RIGHT$(O$,LO):IF LO=4 GOSUB 725:
O$=Q$
275 OC$(I)=MID$(T$,BP,2)+O$:GOTO 425
280 OC$(I)=MID$(T$,11,2)
285 PB=128+16*II:FOR Q=LO TO LO-2 STEP
-1
290 Q$=MID$(O$,Q,1):RV=0
295 IF Q$="X"THEN320
300 IF Q$="Y" THEN RV=32:GOTO320
305 IF Q$="U" THEN RV=64:GOTO320
310 IF Q$="S" THEN RV=96:GOTO320
315 NEXT Q
320 PB=PB+RV:DV$=""
325 ON LO GOTO 440,330,355,385,335,400,
440,410
330 PB=PB+4:GOTO415
335 PB=VAL("&H"+MID$(O$,2,2))
340 IF ASC(O$)=45 THEN PB=-PB
345 PB=PB AND 31:PB=PB+RV
350 DV$="":GOTO415
355 Q1$=LEFT$(O$,1):Q3$=RIGHT$(O$,1)
360 IF Q1$="A" THEN PB=PB+6:GOTO415
365 IF Q1$="B" THEN PB=PB+5:GOTO415
370 IF Q1$="D" THEN PB=PB+11:GOTO 415
375 IF Q3$="+" THEN 415
380 PB=PB+2:GOTO 415
385 IF ASC(O$)=ASC(",") THEN PB=PB+1:GO
TO415
390 IFCP=0 GOSUB725:PB=&H9F:DV$=Q$:GOTO
415
395 PB=PB+8:DV$=LEFT$(O$,2):GOTO 415
400 IF MID$(O$,5,1)="," THEN PB=PB+9:O$
=LEFT$(O$,4):GOSUB725:DV$=Q$:GOTO 415
405 PB=PB+12:DV$=LEFT$(O$,2):GOTO 415
410 O$=LEFT$(O$,4):GOSUB725:DV$=Q$:PB=P
B+13
415 PB$=HEX$(PB):IF LEN(PB$)=1 THEN PB$
="0"+PB$
420 OC$(I)=OC$(I)+PB$
425 OC$(I)=PR$+OC$(I)+DV$
430 GOSUB630
435 DV$="":NEXTI:PRINT"OK":GOTO20
440 GOSUB900:GOTO20
445 M=139:DIM MN$(M):FOR I=1TOM
450 READMN$(I):NEXT:RETURN
455 DATAABX 3A,ADCA8999B9A9,ADCBC9D9F9E
9,ADDA8B9BBBAB,ADDBCBDBFBEB,ADDDC3D3F3E
3,ANDA8494B4A4
```

```
460 DATAANDBC4D4F4E4,ANDC1C??????,ASL ?
??087868,ASLA48,ASLB58,ASR ??077767,ASRA
47,ASRB57
465 DATABCC ?????24??,BCS ?????25??,BEQ ?
???27??,BGE ?????2C??,BGT ?????2E??,BHI ?
???22??
470 DATABHS ?????24??,BITA8595B5A5,BITBC
5D5F5E5,BLE ?????2F??,BLO ?????25??,BLS ?
???23??
475 DATABLT ?????2D??,BMI ?????2B??,BNE ?
???26??,BPL ?????2A??,BRA ?????20??,BRN ?
???21??,BSR ????8D??,BVC ?????28??,BVS ?
???29??
480 DATACLR ??0F7F6F,CLRA4F,CLRB5F,CMPA
8191B1A1,CMPBC1D1F1E1,CMPD8393B3A3A,CMP
S8C9CBCACB
485 DATACMPU8393B3A3B,CMPX8C9CBCAC,CMPY
8C9CBCACA,COM ??037363,COMA43,COMB53,CW
AI3C??????,DAA 19
490 DATADEC ??0A7A6A,DECA4A,DECB5A,EORA
8898B8A8,EORBC8D8F8E8,EXG 1E??????,INC
??0C7C6C,INCA4C
495 DATAINCB5C,JMP ??0E7E6E,JSR ??9DBDA
D
500 DATALBCC????24A,LBCS????25??A,LBEQ?
???27??A,LBGE????2C??A
505 DATALBGT?????2E??A,LBHI?????22??A,LBH
S????24??A,LBLE????2F??A,LBLO????25??A,
LBLS????23??A
510 DATALBLT????2D??A,LBMI????2B??A,LBN
E????26??A,LBPL????2A??A,LBRA????16??,L
BRN????21??A
515 DATALBSR????17??,LBVC????28??A,LBVS
????29??A
520 DATALDA 8696B6A6,LDB C6D6F6E6,LDD C
CDCFCEC,LDS CEDEFEEEA
525 DATALDU CEDEFEEE,LDX 8E9EBEAE,LDY 8
E9EBEAEA,LEAS??????32
530 DATALEAU??????33,LEAX??????30,LEAY?
?????31,LSL ??087868,LSLA48,LSLB58,LSR
??047464,LSRA44,LSRB54,MUL 3D,NEG ??007
060
535 DATANEGA40,NEGB50,NOP 12,ORA 8A9ABA
AA,ORB CADAFAEA,ORCC1A,PSHS34,PSHU36,PU
LS35,PULU37
540 DATAROL ??097969,ROLA49,ROLB59,ROR
??067666,RORA46,RORB56,RTI 3B,RTS 39,SB
CA8292B2A2
545 DATASBCBC2D2F2E2,SEX 1D,STA ??97B7A
7,STB ??D7F7E7,STD ??DDFDED,STS ??DFFFE
FA,STU ??DFFFEF
550 DATASTX ??9FBFAF,STY ??9FBFAFA,SUBA
8090B0A0,SUBBC0D0F0E0,SUBD8393B3A3,SWI
3F,SWI23FA,SWI33FB
555 DATASYNC13,TFR 1F??????,TST ??0D7D6
D,TSTA4D,TSTB5D
```


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```
560 REM IND/IND?
565 II=0:CP=0
570 IF ASC(O$)=91 THEN II=1:LO=LO-2:O$=
MID$(O$,2,LO)
575 FOR Q=1 TO LO
580 Q$=MID$(O$,Q,1)
585 IF Q$="," THEN CP=Q:RETURN
590 NEXT Q:RETURN
595 REM PREBYTE
600 PR$="":IF LT/2=INT(LT/2) THEN RETUR
N
605 PR$="10":IF RIGHT$(T$,1)="B" THEN P
R$="11"
610 LT=LT-1:T$=LEFT$(T$,LT):RETURN
620 FOR K=1TO N-1
625 PRINTK;TAB(5)L$(K)TAB(11)HEX$(AD(K)
);TAB(17)OC$(K):NEXT:RETURN
630 F$=LEFT$(M$,1):F2$=LEFT$(M$,2)
635 IF F2$="LB" THEN680
640 IF F2$="BI" OR F$<>"B" THEN RETURN
645 GOSUB725
650 BV=AD(I)+2:BV=VAL("&H"+Q$)-BV
655 IF BV<0 THEN BV=256+BV
660 IF BV<0 OR BV>255 THEN BV=0:GOSUB90
0
665 H$=HEX$(BV):IF LEN(H$)=1 THEN H$="0
"+H$
670 OC$(I)=LEFT$(OC$(I),2)+H$
675 RETURN
680 LC=LEN(OC$(I)):LC=LC-4
685 OC$(I)=LEFT$(OC$(I),LC)
690 GOSUB725
695 WV=AD(I)+4:WV=VAL("&H"+Q$)-WV
700 IFWV<0 THEN WV=65536+WV
705 IF WV<0 OR WV>65535 THEN440
710 H$=HEX$(WV)
715 IF LEN(H$)<4 THEN H$="0"+H$:GOTO715
720 OC$(I)=OC$(I)+H$:RETURN
725 O=ASC(O$):IF O<71 OR O>90 THEN Q$=O
$:RETURN
730 Q$="0000"
735 FOR Q=1 TO N-1
740 IF O$=L$(Q) THEN 750
745 NEXTQ:GOSUB900:RETURN
750 IF Q>I THEN PRINT"FORWARD"
755 Q$=HEX$(AD(Q))
760 IF LEN(Q$)<4 THEN Q$="0"+Q$:GOTO 76
0
765 RETURN
770 FORI=1TO N-1
775 O$=OC$(I):L=LEN(O$)
780 IF L=0 THEN 810
785 A=AD(I)
790 FOR Q=1 TO L-1 STEP 2
795 V=VAL("&H"+MID$(O$,Q,2))
800 POKE A,V:PRINTHEX$(A);" ";HEX$(V);"
  ";:A=A+1
805 NEXT Q
810 NEXT I
815 O$=O$(N):GOSUB725:PRINT
820 DEFUSR1=VAL("&H"+Q$):RETURN
825 R1$=LEFT$(O$,1):R2$=RIGHT$(O$,1)
830 FORQ=1TO10
835 Q$=MID$(R$,Q,1):NC$=MID$(N$,Q,1)
840 IF R1$=Q$ THEN N1$=NC$
845 IF R2$=Q$ THEN N2$=NC$
850 NEXT Q
855 O$="1E":IF M$="TFR" THEN O$="1F"
860 OC$(I)=O$+N1$+N2$:GOTO435
865 BV=0:FOR Q=1 TO LO STEP 2
870 Q$=MID$(O$,Q,1)
875 EP=INSTR(S$,Q$):IF EP=0 THEN 885
880 BV=BV+2^(EP-1)
885 NEXT Q
890 H$=HEX$(BV):IF LEN(H$)=1 THEN H$="0
"+H$
895 OC$(I)=RIGHT$(T$,2)+H$:GOTO435
900 PRINT"ERR LINE"I:RETURN
910 INPUT"L S";X$
915 IF X$="S"THEN950
920 IFX$<>"L"THEN980
925 GOSUB985
930 OPEN "I",#-1,"CODES"
932 INPUT#-1,N
934 FOR I=1 TO N
937 INPUT#-1,L$(I),M$(I),O$(I)
940 NEXTI:GOSUB155:GOTO980
950 GOSUB985
955 OPEN "O",#-1,"CODES"
960 PRINT#-1,N
965 FORI=1 TO N
970 PRINT #-1,L$(I),M$(I),O$(I)
975 NEXTI
980 PRINT"OK":CLOSE#-1:GOTO20
985 INPUT"READY TAPE";Q$:RETURN
```

The Color Computer Disassembler

In trying to learn about the 6809E, it is convenient to have available a disassembler, which is simply a program for converting machine code in memory to an assembly language listing. The disassembler presented here is written in Extended Color BASIC and runs in just over 6K. The mnemonics and operands are mostly standard, but there are a few exceptions. The instruction ANDCC is changed to ANDC in order to match the three or four-character length of the other mnemonics. The CC (condition code) register is also referred to as C when present as an operand in push, pull, transfer and exchange instructions. The other nonstandard output is also in connection with push and pull instructions. The presence of the up-arrow character in the operand field of one of these instructions refers to the stack pointer for the stack not involved in the mnemonic. Thus, for example, PULS ↑

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would mean: pull the user stack pointer from the system stack.

Output is to the screen, but it can easily be directed to a printer since all output is done in line 670. The semicolon at the end of this line, together with the print statement at the beginning, allows 16 lines of code to be present on the screen when the computer is interrupted with shift @.

All output is in hexadecimal in four fields similar to most assembler list outputs. These fields are: address, opcodes (and maybe data), mnemonic and operand.

A standard problem with disassemblers is the handling of data tables. Any sequence of bytes may be present in memory, and not all of these are valid opcodes. I handled this by placing horizontal lines in the mnemonic field and presenting, where possible, the corresponding ASCII character (in quotes) in the operand field. Of course, if a sequence of data bytes happens to make sense as code it is presented as such.

There is a short routine at lines 310-340 which allows the user to POKE machine code into memory. This code may then be disassembled for test purposes before being executed. To use this routine, just RUN 310 and enter END to exit.

To use the disassembler itself, simply type RUN and respond to the address request in decimal or hex. If hex is used, include the characters "&H" ahead of the desired value. Thus "&H600" or "1536" could be used here with the same effect. When POKEing code into memory, the same choice is available. The locations &H600 to &HBFF are not used by BASIC except for hi-res graphics, and thus provide a handy place for user routines. Color BASIC and Extended Color BASIC ROMS are located to begin at &H8000 and &HA000, respectively.

Listing 2 for Disassembler

```
10 PCLEAR1:RK$="CABDXY^P"
20 DIMX$(15):FORI=0TO15:READX$(I):NEXT:
REM TFR,EXC
30 DATAD,X,Y,U,S,PC,-,-,A,B,C,DP,-,-,-,
-
40 DIM R$(3)
50 FOR I=0 TO 3:READR$(I):NEXT
60 DATA X,Y,U,S
70 DIM M$(15,15):REM MNEUMONICS
80 FOR I=0 TO 15:FORJ=0TO15
90 READ M$(I,J):NEXT:NEXT
100 DATANEG 2,-,-,COM 2,LSR 2,-,ROR 2,A
SR 2,ASL 2,ROL 2,DEC 2,-,INC 2,TST 2,JM
P 2,CLR 2
101 DATA-,-,NOP 1,SYNC1,-,-,LBRA8,LBSR8
,-,DAA 1,ORCC4,-,ANDC4,SEX 1,EXG 5,TFR
5
102 DATABRA 3,BRN 3,BHI 3,BLS 3,BCC 3,B
CS 3,BNE 3,BEQ 3,BVC 3,BVS 3,BPL 3,BMI
3,BGE 3,BLT 3,BGT 3,BLE 3
103 DATALEAX9,LEAY9,LEAS9,LEAU9,PSHS4,P
ULS4,PSHU4,PULU4,-,RTS 1,ABX 1,RTI 1,CW
AI4,MUL 1,-,SWI 1SWI 2SWI 3
104 DATANEGA1,-,-,COMA1,LSRA1,-,RORA1,A
SRA1,LSLA1,ROLA1,DECA1,-,INCA1,TSTA1,-,
CLRA1
105 DATANEGB1,-,-,COMB1,LSRB1,-,RORB1,A
SRB1,LSLB1,ROLB1,DECB1,-,INCB1,TSTB1,-,
CLRB1
106 DATANEG 9,-,-,COM 9,LSR 9,-,ROR 9,A
SR 9,LSL 9,ROL 9,DEC 9,-,INC 9,TST 9,JM
P 9,CLR 9
107 DATANEG 7,-,-,COM 7,LSR 7,-,ROR 7,A
SR 7,LSL 7,ROL 7,DEC 7,-,INC 7,TST 7,JM
P 7,CLR 7
108 DATASUBA4,CMPA4,SBCA4,SUBD6CMPD6CMP
U6,ANDA4,BITA4,LDA 4,-,EORA4,ADCA4,ORA
4,ADDA4,CMPX6CMPY6CMPS6,BSR 3,LDX 6LDY
6,-
109 DATASUBA2,CMPA2,SBCA2,SUBD2CMPD2CMP
U2,ANDA2,BITA2,LDA 2,STA 2,EORA2,ADCA2,
ORA 2,ADDA2,CMPX2CMPY2CMPS2,JSR 2,LDX 2
LDY 2,STX 2STY 2
110 DATASUBA9,CMPA9,SBCA9,SUBD9CMPD9CMP
U9,ANDA9,BITA9,LDA 9,STA 9,EORA9,ADCA9,
ORA 9,ADDA9,CMPX9CMPY9CMPS9,JSR 9,LDX 9
LDY 9,STX 9STY 9
111 DATASUBA7,CMPA7,SBCA7,SUBD7CMPD7CMP
U7,ANDA7,BITA7,LDA 7,STA 7,EORA7,ADCA7,
ORA 7,ADDA7,CMPX7CMPY7CMPX7,JSR 7,LDX 7
LDY 7,STX 7STY 7
112 DATASUBB4,CMPA4,SBCB4,ADDD6,ANDB4,B
ITB4,LDB 4,-,EORB4,ADCB4,ORB 4,ADDB4,LD
D 6,-,LDU 6LDS 6,-
113 DATASUBB2,CMPB2,SBCB2,ADDD2,ANDB2,B
ITB2,LDB 2,STB 2,EORB2,ADCB2,ORB 2,ADDB
2,LDD 2,STD 2,LDU 2LDS 2,STU 2STS 2
114 DATASUBB9,CMPB9,SBCB9,ADDD9,ANDB9,B
ITB9,LDB 9,STB 9,EORB9,ADCB9,ORB 9,ADDB
9,LDD 9,STD 9,LDU 9LDS 9,STU 9STS 9
115 DATASUBB7,CMPB7,SBCB7,ADDD7,ANDB7,B
ITB7,LDB 7,STB 7,EORB7,ADCB7,ORB 7,ADDB
7,LDD 7,STD 7,LDU 7LDS 7,STU 7STS 7
150 DIM P$(3,15):REM POSTBYTE OPERANDS
155 FOR I=0TO3:FORJ=0TO15:READ P$(I
,J):NEXT:NEXT
200 DATA"+0,R","+1,R","+2,R","+3,R","+4
,R","+5,R","+6,R","+7,R","+8,R","+9,R",
"+A,R","+B,R","+C,R","+D,R","+E,R","+F,
R"
201 DATA"-10,R","-F,R","-E,R","-D,R","-
C,R","-B,R","-A,R","-9,R","-8,R","-7,R"
,"-6,R","-5,R","-4,R","-3,R","-2,R","-1
,R"
202 DATA",R+",",R++",",-R",",--R",",R",
"B,R","A,R",-,"**,R","####,R",-,"D,R","
**,PC","####,PC",-,-
```

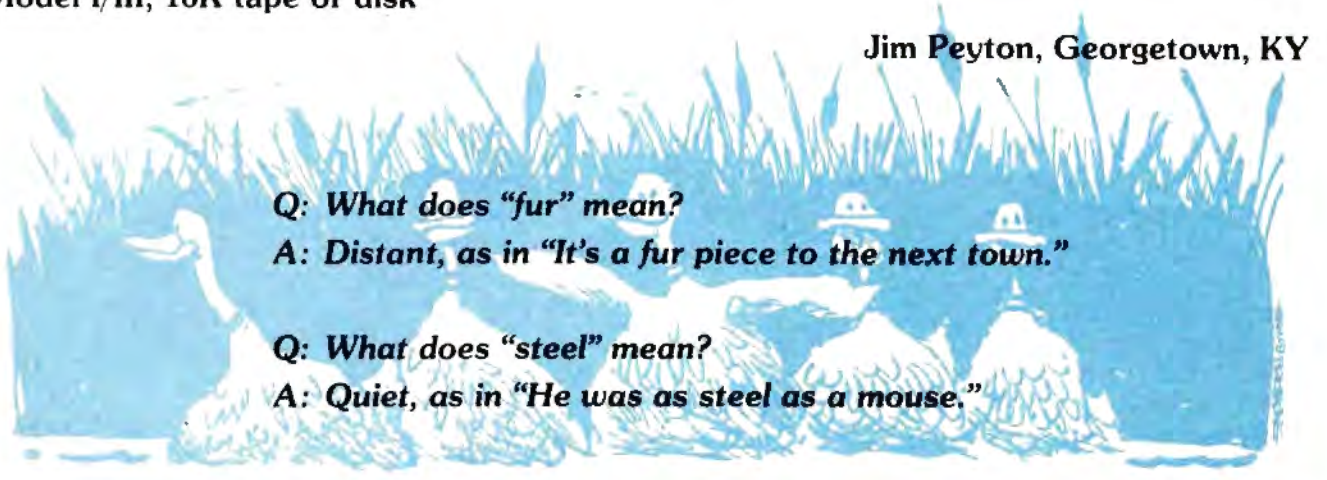
```
203 DATA-,"[,R++]",-,"[,--R]","[,R]","[
B,R]","[A,R]",-,"[**,R]","[####,R]",-,"
[D,R]","[**,PC]","[####,PC]",-,[####]
300 GOTO 500
310 INPUT"ENTER ADDRESS";M
320 INPUTB$:IF B$="END"THEN END
330 POKE M,VAL(B$)
340 M=M+1:GOTO 320
500 INPUT"ENTER ADDRESS";M
510 H$=HEX$(PEEK(M)):IFLEN(H$)=1THENH$=
"0"+H$
520 SM=M
530 I=VAL("&H"+LEFT$(H$,1))
540 J=VAL("&H"+RIGHT$(H$,1))
550 IF I=1 AND J<2 THEN 2140
560 REM 2-BYTE OPCODE ^
570 S$=M$(I,J):IFS$="-"THENS$="---  ":O
$=CHR$(39)+CHR$(16*I+J)+CHR$(39):GOTO62
0:'PHONEY OPCODE
580 S$=LEFT$(S$,5)
590 AT=VAL(RIGHT$(S$,1))
600 ON AT GOTO 1100,1200,1300,1400,1500
,1600,1700,1800,1900
610 ' INHERENT,DPAGE,REL,IMMED,REG,LONG
 IMMED,EXTD,LONG REL,POST
620 S$=LEFT$(S$,4)+"    "+O$
630 O$=""
635 T$=HEX$(SM)
637 IF LEN(T$)<4 THEN T$="0"+T$:GOTO 63
7
640 T$=T$+"  "
650 FORI=SM TO M:V$=HEX$(PEEK(I)):IF LE
N(V$)=1 THEN V$="0"+V$
660 T$=T$+V$:NEXT I
670 PRINT:PRINTT$;TAB(15)S$;
680 M=M+1
690 GOTO510:' NEXT INSTRUCTION
790 REM PEEK(M) TO HEX & BUMP M
800 M=M+1:V$=HEX$(PEEK(M)):IF LEN(V$)=1
 THEN V$="0"+V$
810 RETURN
1100 O$="":GOTO620
1200 GOSUB800:O$=V$:GOTO620
1300 M=M+1:V=PEEK(M):IFV>127 THEN V=V-2
56
1310 V=M+1+V:O$=HEX$(V)
1320 IFLEN(O$)<4 THEN O$="0"+O$:GOTO 13
20
1330 GOTO620
1400 GOSUB800:O$="#"+V$
1410 IF ASC(S$)<>80 THEN 620
1420 N=VAL("&H"+V$):O$=""
1430 FOR I=0TO7:'PUSH-PUL DECODE
1440 IF (N AND (2^I))>0 THEN O$=O$+","+
MID$(RK$,I+1,1):IF RIGHT$(O$,1)="D" THE
N O$=O$+"P"
1450 NEXT I
1460 O$=MID$(O$,2):GOTO 620
1500 GOSUB800:R1=VAL("&H"+LEFT$(V$,1)):
R2=VAL("&H"+RIGHT$(V$,1)):O$=X$(R1)+","
+X$(R2):GOTO620
1600 GOSUB800:O$="#"+V$:GOSUB800:O$=O$+
V$:GOTO620
1700 GOSUB800:O$=V$:GOSUB800:O$=O$+V$:G
OTO620
1800 GOSUB800:O$=V$:GOSUB800:O$=O$+V$
1810 V=VAL("&H"+O$)
1820 IF V>32767 THEN V=V-65536
1825 V=M+1+V
1830 IF V<0 THEN O$="---" ELSE O$=HEX$(
V)
1840 GOTO 620
1900 GOSUB800:REM GET POSTBYTE
1910 N1=VAL("&H"+LEFT$(V$,1))
1920 N2=VAL("&H"+RIGHT$(V$,1))
1930 R=N1 AND 6:R=R/2:RG$=R$(R)
1940 I=2*INT(N1/8)+(N1 AND 1)
1950 J=N2:O$=P$(I,J)
1960 L=LEN(O$)
1970 FOR I=1 TO L
1980 IF MID$(O$,I,1)="R" THEN 2010
1990 NEXT I
2000 GOTO 2020
2010 MID$(O$,I,1)=RG$:'REGISTER
2020 FORI=1TOL
2030 IF MID$(O$,I,1)="*" THEN2070
2040 IF MID$(O$,I,1)="#" THEN 2100
2050 NEXT I
2060 GOTO 2130
2070 GOSUB800
2080 MID$(O$,I,2)=V$
2090 GOTO 2130
2100 GOSUB800:T$=V$:GOSUB800
2110 T$=T$+V$
2120 MID$(O$,I,4)=T$
2130 GOTO 620
2140 GOSUB800:' 2-BYTE OPCODE
2150 IFLEFT$(V$,1)<>"2"THEN2210
2160 L1=2:' LONG BRANCH
2170 L2=VAL("&H"+RIGHT$(V$,1))
2180 T$=M$(L1,L2)
2190 S$="L"+LEFT$(T$,3)+RIGHT$(T$,1)
2200 GOTO 590
2210 P=6+5*J
2220 L1=VAL("&H"+LEFT$(V$,1))
2230 L2=VAL("&H"+RIGHT$(V$,1))
2240 T$=M$(L1,L2)
2250 S$=MID$(T$,P,5)
2260 IF LEN(S$)=0 THENS$="---  ":O$="--
-":GOTO620:' BYTE 2 FUNNY
2270 GOTO590
```

Whiz quiz . . .

or, do you speak Southern Country?

Model I/III, 16K tape or disk

Jim Peyton, Georgetown, KY



WHIZ QUIZ is an animated graphics program that administers almost any multiple choice quiz. It employs the basic learning principles of immediate feedback and positive reinforcement. When a question is answered correctly, two ducks respond with excitement and approval. If the answer is a poor choice, the ducks so indicate and present the user with an explanation of the correct or best answer.

Questions are presented in a different order each time the program is run. This allows the quiz to be administered to the same person several times, or until mastery is achieved, without generating a response pattern.

When a question is answered correctly, two ducks respond with excitement and approval.

A short quiz, "Do You Speak Southern Country?", is included in the program for demonstration purposes. Replace it with a quiz of your own choosing.

Here is a line analysis of the program:

Lines 10-20 perform initialization and housekeeping chores.

Lines 30-40 ask the user to wait while the program reads the graphic data for the ducks into strings.

Line 100 prints the quiz title in the top center of the screen.

Line 110 prints the ducks on either side of the screen.

Line 120 selects a question-and-answer set using the randomized index and POKEs the address of the set into the data pointers.

Line 130 reads the question-and-answer set and checks for end-of-data.

Line 140 absorbs any unwanted input from the keyboard and adds arrows to the string which holds the question.

Line 150 erases the portion of the screen which holds the answer choices.

Line 160 sets up an INKEY$ input.

Line 170 selects at random a movement for the left duck.

Line 180 does the same for the right duck.

Line 190 prints the question centered in the upper part of the screen.

Lines 200-210 number and print the answer choices.

Line 220 waits a bit, then prompts the user to type in his answer.

Line 230 prints a question mark in the space to contain the response. If no response is immediately forthcoming, the program loops back to line 160 and processes the block again, animating the ducks with random movements. If the keyboard scan does find a response, the response is tested and, if valid, it is printed.

Line 240 compares the response to the correct answer. If a match is found, the variable holding the number of correct responses is incremented and the program goes to the wing-flap and head-nod routine. A mismatch increments the incorrect response variable and sends the program to the head-shake and explanation-crawl routine.

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Line 250 calculates and prints a percentage score.

Line 260 closes the loop and begins the cycle for the next question.

Lines 300-510 read the graphic data into strings.

Lines 520-570 create strings containing line feeds and back spaces needed in constructing the figures.

Lines 580-690 concatenate the strings into figures and parts of figures.

Lines 700-720 read through the quiz data, saving the addresses of each question-and-answer set.

Lines 730-780 create a randomized index by first generating a series of random numbers and an ordered index and then sorting the random series with the index tagging along.

Lines 1000-1510 are subroutines used to animate the ducks.

Lines 2000-2140 are DATA statements containing the ASCII numbers for the graphic blocks needed to create the ducks.

Lines 3000-3210 contain the data for the sample quiz.

In substituting your own quiz, it is essential that the items be in the following sequence: (1) Title, (2) Question, (3-6) Choices, (7) The number of the correct answer, (8) Explanation. Now, repeat the series starting at (2).

It is necessary that the explanation string have a trailing blank. It is also required that the last DATA statement contains six commas, since the program uses these as an end-of-data marker.

The listing for WHIZ QUIZ contains several REM statements. Omitting these will save typing and memory and allow the program to operate more efficiently. Only the lines ending in zero need be preserved.

Program Listing for WHIZ QUIZ

```
1 '=***=  W H I Z   Q U I Z  =***=
2 '
3 '          BY JIM PEYTON
4 '             ROUTE 2
5 '       GEORGETOWN KY 40324
6 '
7 '==============================
8 '  INITIALIZE
9 '==============================
10 CLS:CLEAR1100:RANDOM:DEFSTRB-H
20 DEFINTI-Z:DIMA(50),R(50,2),T(50)
30 PRINT@469,"PLEASE WAIT A MOMENT
40 GOTO300
96 '
97 '==============================
98 '  MAIN PROGRAM
99 '==============================
100 CLS:S=0:T=0:PRINT@31-(LEN(X$)/2),X$
110 FORJ=1TOI:P=519:Q=568:GOSUB1000:GOS
UB1010
120 POKE16639,R(A(J),1):POKE16640,R(A(J
),2)
130 READ I$,J$,K$,L$,M$,N$,O$:IFI$=""TH
EN270
140 Y$=INKEY$:I$="===>  "+I$+"  <==="
150 PRINT@128,CHR$(30);:PRINT@256,CHR$(
30);:PRINT@320,CHR$(30);
160 Z$="":Z$=INKEY$
170 A=RND(9):ON A GOSUB1160,1180,1200,1
220,1240,1260,1300,1320,1350
180 A=RND(9):ON A GOSUB1170,1190,1210,1
230,1250,1270,1310,1330,1370
190 PRINT@159-(LEN(I$)/2),I$
200 PRINT@261,"<1>  "J$;:PRINT@292,"<3>
  "L$;
210 PRINT@325,"<2>  "K$;:PRINT@356,"<4>
  "M$
220 GOSUB1510:PRINT@464,"TYPE THE NUMBE
R OF YOUR CHOICE
230 PRINT@606,"?";:IFZ$=>"1"ANDZ$<="4"T
HENPRINT@606,Z$;ELSE160
240 IFZ$=N$THENS=S+1:GOSUB1450ELSET=T+1
:GOSUB1470
250 PRINT@921,"SCORE =";INT((S/(S+T))*1
00);
260 NEXTJ
270 END
296 '
297 '==============================
298 '  READ DATA INTO STRINGS
299 '==============================
300 READA1:FORI=1TOA1:READA:B0=B0+CHR$(
A):NEXT
310 FORI=1TOA1:READA:B1=B1+CHR$(A):NEXT
320 FORI=1TOA1:READA:B2=B2+CHR$(A):NEXT
330 FORI=1TOA1:READA:B3=B3+CHR$(A):NEXT
340 READA2:FORI=1TOA2:READA:C0=C0+CHR$(
A):NEXT
350 FORI=1TOA2:READA:C1=C1+CHR$(A):NEXT
360 FORI=1TOA2:READA:C2=C2+CHR$(A):NEXT
370 FORI=1TOA2:READA:C3=C3+CHR$(A):NEXT
380 FORI=1TOA2:READA:C4=C4+CHR$(A):NEXT
390 FORI=1TOA2:READA:C5=C5+CHR$(A):NEXT
400 FORI=1TOA2:READA:C6=C6+CHR$(A):NEXT
410 FORI=1TOA2:READA:D0=D0+CHR$(A):NEXT
420 READA3:FORI=1TOA3:READA:D1=D1+CHR$(
A):NEXT
430 READA4:FORI=1TOA4:READA:E0=E0+CHR$(
A):NEXT
440 FORI=1TOA4:READA:E1=E1+CHR$(A):NEXT
450 FORI=1TOA4:READA:E2=E2+CHR$(A):NEXT
460 FORI=1TOA4:READA:E3=E3+CHR$(A):NEXT
470 FORI=1TOA4:READA:F0=F0+CHR$(A):NEXT
480 FORI=1TOA4-1:READA:F1=F1+CHR$(A):NE
XT
490 FORI=1TOA4:READA:F2=F2+CHR$(A):NEXT
500 FORI=1TOA4:READA:F3=F3+CHR$(A):NEXT
510 FORI=1TOA3:READA:F4=F4+CHR$(A):NEXT
```

```
516 '
517 '============================
518 '  LINE FEEDS AND BACK SPACES
519 '============================
520 G0=CHR$(26)+STRING$(7,24)
530 G1=CHR$(26)+STRING$(5,24)
540 G2=CHR$(26)+STRING$(6,24)
550 G3=CHR$(26)+STRING$(9,24)
560 G4=CHR$(26)+STRING$(10,24)
570 G5=CHR$(26)+STRING$(13,24)
576 '
577 '============================
578 '  CUMULATE STRINGS INTO FIGURE
579 '============================
580 HA=B1+G1+C0+G0+D0+G4+E0+G5+F0+G3+F4
590 HB=B1+G1+C0+G0+D0+G0+D0+G4+E0+G5+F0
+G3+F4
600 HC=B1+G1+C1+G0+D0
610 HD=B1+G1+C2+G0+D0
620 HE=B2+G1+C3+G0+D0
630 HF=B3+G1+C4+G0+D0
640 HG=B0+G1+C5+G2+D1
650 HH=B1+G1+C6+G0+D0
660 HI=E0+G5+F0+G3+F4
670 HJ=E1+G5+F1
680 HK=E2+G5+F2
690 HL=E3+G5+F3
696 '
697 '============================
698 '  SAVE DATA POINTERS
699 '============================
700 I=0:READX$:I=I+1:R(I,1)=PEEK(16639)
:R(I,2)=PEEK(16640)
710 READI$,J$,K$,L$,M$,N$,O$:IFI$=""THE
NI=I-1:GOTO730
720 I=I+1:R(I,1)=PEEK(16639):R(I,2)=PEE
K(16640):GOTO710
726 '
727 '============================
728 '  RANDOM INDEX FOR POINTERS
729 '============================
730 FORJ=1TOI:T(J)=RND(999):A(J)=J:NEXT
J
740 FORJ=1TOI:FORK=1TOI-J
750 IFT(K)>T(K+1)THENT=T(K):T(K)=T(K+1)
:T(K+1)=T:A=A(K):A(K)=A(K+1):A(K+1)=A
760 NEXTK
770 NEXTJ
780 GOTO100
996 '
997 '============================
998 '  ANIMATE DUCKS
999 '============================
1000 PRINT@P+63,HA;:RETURN
1010 PRINT@Q+63,HA;:RETURN
1020 PRINT@P-1,HB;:RETURN
1030 PRINT@Q-1,HB;:RETURN
```


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```
1040 PRINT@P-1,HC;:RETURN
1050 PRINT@Q-1,HC;:RETURN
1060 PRINT@P-1,HD;:RETURN
1070 PRINT@Q-1,HD;:RETURN
1080 PRINT@P-1,HE;:GOSUB1020:RETURN
1090 PRINT@Q-1,HE;:GOSUB1020:RETURN
1100 PRINT@P-1,HF;:GOSUB1020:RETURN
1110 PRINT@Q-1,HF;:GOSUB1030:RETURN
1120 PRINT@P-1,HG;:GOSUB1020:RETURN
1130 PRINT@Q-1,HG;:GOSUB1030:RETURN
1140 PRINT@P-1,HH;:GOSUB1350:GOSUB1020:
RETURN
1150 PRINT@Q-1,HH;:GOSUB1370:GOSUB1030:
RETURN
1160 PRINT@P+63,HC;:RETURN
1170 PRINT@Q+63,HC;:RETURN
1180 PRINT@P+63,HD;:RETURN
1190 PRINT@Q+63,HD;:RETURN
1200 PRINT@P+63,HE;:RETURN
1210 PRINT@Q+63,HE;:RETURN
1220 PRINT@P+63,HF;:RETURN
1230 PRINT@Q+63,HF;:RETURN
1240 PRINT@P+63,HG;:PRINT@P+63,HA;:RETU
RN
1250 PRINT@Q+63,HG;:PRINT@Q+63,HA;:RETU
RN
1260 PRINT@P+63,HH;:PRINT@P+63,HA;:RETU
RN
1270 PRINT@Q+63,HH;:PRINT@Q+63,HA;:RETU
RN
1280 PRINT@P+250,HI;:RETURN
1290 PRINT@Q+250,HI;:RETURN
1300 PRINT@P+250,HJ;:GOSUB1490:GOSUB128
0:RETURN
1310 PRINT@Q+250,HJ;:GOSUB1490:GOSUB129
0:RETURN
1320 PRINT@P+250,HK;:GOSUB1280:RETURN
1330 PRINT@Q+250,HK;:GOSUB1290:RETURN
1340 PRINT@Q+250,HK;:RETURN
1350 PRINT@P+250,HL;:GOSUB1280:RETURN
1360 PRINT@P+250,HL;:RETURN
1370 PRINT@Q+250,HL;:GOSUB1290:RETURN
1380 GOSUB1020:PRINT@P," ";:PRINT@P+62,
" ";:PRINT@P+66," ";:GOSUB1000:RETURN
1390 GOSUB1030:PRINT@Q," ";:PRINT@Q+62,
" ";:PRINT@Q+66," ";:GOSUB1010:RETURN
1400 FORI=1TO5:PRINT@P-1,HG;:PRINT@Q-1,
HG;:PRINT@P-1,HB;:PRINT@Q-1,HB;:NEXTI:R
ETURN
1410 FORI=1TO5:PRINT@P+250,HJ;:PRINT@Q+
250,HJ;:PRINT@P+250,HI;:PRINT@Q+250,HI;
:NEXTI:RETURN
1420 FORI=1TO5:PRINT@P-1,HE;:PRINT@Q-1,
HE;:PRINT@P-1,HB;:PRINT@Q-1,HB;:PRINT@P
-1,HF;:PRINT@Q-1,HF;:PRINT@P-1,HB;:PRIN
T@Q-1,HB;:NEXT:RETURN
1430 FORI=1TO5:GOSUB1260:NEXTI:RETURN
1440 FORI=1TO5:GOSUB1270:NEXTI:RETURN
1450 GOSUB1510:GOSUB1000:GOSUB1010:GOSU
B1020:GOSUB1030:GOSUB1490:GOSUB1060:GOS
UB1050:GOSUB1500
1460 GOSUB1020:GOSUB1030:GOSUB1510:GOSU
B1410:GOSUB1400:GOSUB1510:GOSUB1380:GOS
UB1390:RETURN
1470 GOSUB1510:GOSUB1000:GOSUB1010:GOSU
B1020:GOSUB1030:GOSUB1490:GOSUB1060:GOS
UB1050:GOSUB1500:GOSUB1420:GOSUB1510:GO
SUB1380:GOSUB1390:GOSUB1360:GOSUB1180:G
OSUB1340:GOSUB1510
1480 O$=STRING$(30,32)+O$:FORI=1TOLEN(O
$):PRINT@785,MID$(O$,I,30);:FORR=1TO20:
NEXTR:NEXTI:GOSUB1510:RETURN
1490 FORR=1TO5:NEXTR:RETURN
1500 FORR=1TO300:NEXTR:RETURN
1510 FORR=1TO30:NEXTR:RETURN
1994 '
1995 '==============================
1996 '  GRAPHIC DATA
1997 '  NO. OF ITEMS = 185
1998 '  CHECKSUM = 22709
1999 '==============================
2000 DATA   3, 32, 32, 32, 32,176, 32,1
60,176, 32, 32,160,144
2010 DATA   7, 32,176,182,191,185,176,
32,176,176,182,191,189
2020 DATA  32, 32, 32, 32,190,191,185,1
76,176,160,184,187,183
2030 DATA 189,144, 32, 32,160,190,187,1
83,180,144, 32,176,158
2040 DATA 191,173,176, 32, 32,176,190,1
91,189,176, 32, 32, 32
2050 DATA  32,191, 32, 32, 32,  5,130,1
31,191,131,129, 13, 32
2060 DATA  32, 32,184,191,189,191,190,1
91,180, 32, 32, 32,139
2070 DATA 175,191,191,191,189,191,190,1
91,191,191,159,135,139
2080 DATA 175,191,191,191,189,191,190,1
91,180, 32, 32, 32, 32
2090 DATA  32, 32,184,191,189,191,190,1
91,191,191,159,135, 32
2100 DATA  32, 32,139,191,191,191,191,1
91,135, 32, 32, 32, 32
2110 DATA  32, 32, 32,139,191,191,191,1
35, 32, 32, 32, 32, 32
2120 DATA  32, 32,139,191,191,191,191,1
35, 32, 32, 32, 32, 32
2130 DATA  32,139,191,191,191,191,135,
32, 32, 32, 32,176,187
2140 DATA 131,183,176
2996 '
2997 '==============================
2998 '  DATA FOR QUIZ
2999 '==============================
```

```
3000 DATA D O   Y O U   S P E A K   S O
 U T H E R N   C O U N T R Y ? ?
3010 DATA AIR,ATMOSPHERE,MELODY,AURA,A
SPAN OF TIME,4
3020 DATA "... <4>  A SPAN OF TIME EQUA
L TO 60 MINUTES; AS IN,  IT'LL TAKE ABO
UT AN AIR TO FINISH THIS JOB ... "
3030 DATA BALL,A FORMAL DANCE,TO BUBBLE
 WHEN HEATED,A ROUND OBJECT,TO CRY,2
3040 DATA "... <2>  TO BUBBLE WHEN HEAT
ED; AS IN,  I'M GONNA BALL ME SOME WATE
R ... "
3050 DATA CORE,HEART,INNERMOST PART,ESS
ENTIAL MEANING,AUTOMOBILE,4
3060 DATA "... <4>  AN AUTOMOBILE; AS I
N,  MY OLD CORE IS DONE QUIT ON ME ...
"
3070 DATA FAR,A CONFLAGRATION,DIFFERENT
 IN QUALITY,REMOTE IN TIME,DISTANT,1
3080 DATA "... <1>  A CONFLAGRATION; AS
 IN,  LARD-A-MIGHTY!  THE HOUSE IS ON F
AR! ... "
3090 DATA FUR,TO LEVEL OUT,ANIMAL HAIR,
A COAT,DISTANT,4
3100 DATA "... <4>  DISTANT; AS IN,  IT
'S A FUR PIECE TO THE NEXT TOWN ... "
3110 DATA HEP,AN OUTDATED SLANG WORD,WI
SE,ASSIST,UP-TO-DATE,3
3120 DATA "... <3>  ASSIST; AS IN,  HEP
 ME MAKE IT THROUGH THE NIGHT ... "
3130 DATA LACK,SIMILAR TO,A DEFICIENCY,
NEED,MISSING,1
3140 DATA "... <1>  SIMILAR TO; AS IN,
 THIS HOUSE LOOKS LACK A TORNADO DONE H
IT IT ... "
3150 DATA STEEL,WEAPON,QUIET,HARD METAL
,TAKE UNLAWFULLY,2
3160 DATA "... <2>  QUIET; AS IN,  HE W
AS AS STEEL AS A MOUSE ... "
3170 DATA THANK,EXPRESS GRATITUDE,MEDIT
ATE,HOLD RESPONSIBLE,PRAYER,2
3180 DATA "... <2>  MEDITATE; AS IN,  L
ET ME THANK ON IT FOR AWHILE ... "
3190 DATA WRENCH,A TOOL,TO INJURE,TO TW
IST,WASH LIGHTLY,4
3200 DATA "... <4>  TO WASH LIGHTLY; AS
 IN,  I MUST WRENCH OUT MY UNDERWEAR ..
. "
3210 DATA ,,,,,,                          ■
```


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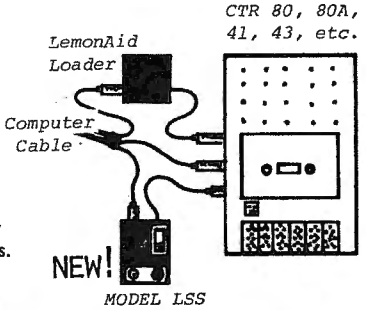

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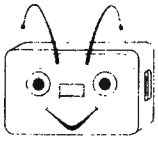

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PDRIVE

A library command for disk compatibility

Model I/III with NEWDOS/80 version 2.0

Sal Navarro, East Rutherford, NJ

Today the question of "What is compatible," is presenting quite a problem to users. It doesn't matter if we are using our system for personal or business use. We still are faced with the problem of compatibility between TRSDOS, LDOS, DOSPLUS and NEWDOS/80 versions 1.0 and 2.0 operating systems. In this article I will tell you one of the ways that NEWDOS/80 version 2 has tried to overcome this with a library command called 'PDRIVE.' I am now using NEWDOS/80 on a 48K Model III with two 40-track and one 80-track disk drives. Below are some PDRIVE setup tables that I've come across in the short time that I've been using it. Before I list the specs for PDRIVE, I should tell you that the reason that you can't read LDOS and DOSPLUS double density disks is that they have strayed from the norm. The norm in the computer industry at present appears to be whatever the programmer or designer decides that it will be at the time that they start their project. Now it would take approximately 5K of program to allow NEWDOS/80 to read their type of directory in double density. While either one will read between a double or single density Model I or Model III of their own type, they are not able to read one of the others. So if you have some disks of DOSPLUS or LDOS and want them on NEWDOS/80, copy them to single density diskettes and then set up the PDRIVE to example 1 in the table below. This will allow NEWDOS/80 to read and copy them onto a NEWDOS/80 system or formatted disk. One thing that may not be clear at first is that you are not limited to two letters in the 'TI' spec of PDRIVE. In the manual it states:

TI = *etc., Where TI consists of one or more alphabetic letter flags chosen from, etc.*

This means one or *more* alphabetic letter flags can be used in the 'TI' spec. Even though all the examples consist of one or two you can have *three* if so needed. Example 6 in the manual shows:

PDRIVE, dn1, dn2, TI=AK, TD=E, TC=39, SPT=18, TSR=3, GPL=2, DDSL=17, DDGA=2

This specification is for the Model III for 5-inch disk, 40 tracks, double density, single-sided diskette that has track zero formatted in single density. Now if you change the TI=AK to TI=AL, you have the same specification except that you can read that same 40-track disk in an 80-track drive.

Examples of PDRIVE Tables

Example 1

PDRIVE, 0, 9, TI=A, TC=40, SPT=10, TSR=3, GPL=2, DDSL=17, DDGA=2

This spec will allow you to read LDOS single density disks and DOSPLUS single density disks that are 40 tracks.

Example 2

PDRIVE, 0, 8, TI=AM, TD=E, TC=40, SPT=18, TSR=3, GPL=6, DDSL=17, DDGA=2

This spec will allow you to copy a file from a Model III TRSDOS disk. You still will not be able to read the directory, as the TRSDOS directory is not compatible with any other system on the market. You can read the TRSDOS 'DIR' in one of two ways: Boot up the TRSDOS diskette and call up the directory, or call up 'SUPERZAP' and enter the drive number from 'DDS' that contains the TRSDOS diskette and relative sector within that drive. This will display the directory while in NEWDOS/80 using the above 'PDRIVE' setup.

Example 3

PDRIVE, 0, 7, TI=AK, TD=E, TC=39, SPT=18, TSR=3, GPL=2, DDSL=17, DDGA=2

This spec tells your Model III that you are using a Model I disk that is double density with track zero in single density.

Example 4

PDRIVE, 0, 6, TI=AL, TD=E, TC=40, SPT=18, TRS=3, GPL=2, DDSL=17, DDGA=2

This is the standard Model III setup except that you can read the 40-track disk in an 80-track drive.

Example 5

PDRIVE, 0, 5, TI=AL, TD=A, TC=40, SPT=10, TSR=3, GPL=2, DDSL=17, DDGA=2

This spec is the same as example 1 except that you can read it in an 80-track drive.

Example 6

PDRIVE, 0, 4, TI=ALM, TD=E, TC=40, SPT=18, TSR=3, GPL=6, DDSL=17, DDGA=2

This one is the same as example 2 except that the disk is read in an 80-track drive.

Example 7

PDRIVE, 0, 3, TI=A, TD=E, TC=80, SPT=18, TSR=3, GPL=2, DDSL=17, DDGA=2

This is a standard setup for the Model III for an 80-track drive.

Example 8

PDRIVE, 0, 2, TI=A, TD=E, TC=40, SPT=18, TSR=3, GPL=2, DDSL=17, DDGA=2

This is the 40-track standard setup.

Here's another hint. If you have two drives on your system, set up the 'SYSTEM' options command of 'AL=2.' This will give you the use of the other seven PDRIVE tables as a storage area for the tables that you are likely to be using at different times. If you have three drives, set 'AL=3.' When you need a different drive option, you only type 'PDRIVE, 0, 1=7' and presto, you are ready to go. By resetting the system 'AL' function, you not only gain the extra storage space, but your system need not go looking through the extra drives that you don't have, or look for a file on a drive that doesn't exist. This will even increase your disk I/O time. Not by very much but every little bit helps. Hope these little tidbits help. ■

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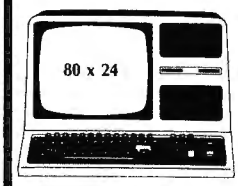

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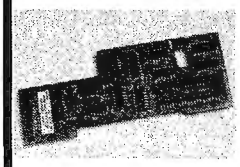

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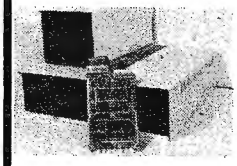

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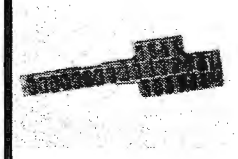

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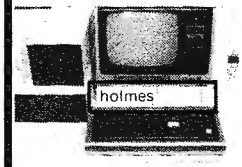

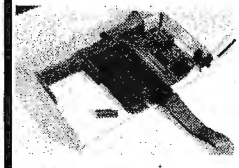

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Simple Joe

Accompany your stereo with graphics

Model I

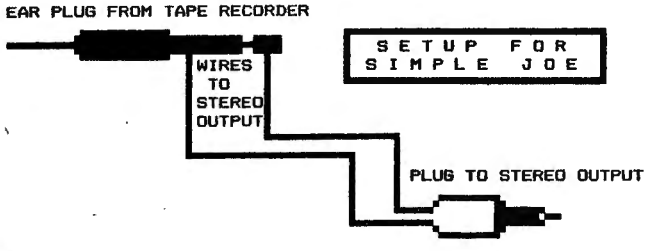
Ron Goodman, North Hollywood, CA

"This is Doctor Demento on KMET Los Angeles. Once again it's Stevens and Grdnic with 'Commercials on 45'." Yes, it was Sunday night in North Hollywood, California, and time for the Doctor Demento show, a special show where weird songs and parodies are played for four hours. While I was sitting there I said, "Boy, wouldn't this be good if it were a live show." The closest though, that I could come to a live show was to draw a face on my TRS-80 screen, and watch. But I wasn't satisfied, and off I went to write the program, Simple Joe.

Simple Joe is a program in which a picture of a man is on your video display. But rather than sitting there like a bunch of dead CHR$s, he moves his mouth in time with the talking or music that your radio makes. The program is rather short, and the hardware isn't really much at all.

Go over to your stereo. Find the wire coming from one of the two speakers. If you have four speakers, use the primary speakers (sometimes called A speakers or main speakers). Find out what type of plug it is that connects to your stereo system, go to your local electronics store, and buy an equivalent plug. Connect two wires to each terminal of the plug. Make sure the two wires are long enough to reach from the back of your stereo to your computer. I use zip cord to avoid dangling wires, but you can use separate wire if you wish. The next thing you'll need is a pair of wires with alligator clips at both ends of each of them. Clip an end of one of the wires to either of the wires coming from the stereo plug. Clip the other end to the lower portion of the EAR plug from the TRS-80. Clip one end of the remaining wires to the other wire from the stereo plug. And finally, clip the last alligator clip to the upper portion of the EAR plug.

Figure 1



Now type in the program. When you RUN the program, a stream of numbers will start going up the screen. If your stereo is off, the numbers should all be 127s. Put the stereo plug in the socket that your speaker's plug normally goes to (it doesn't matter which of the two speakers you remove). Turn on your stereo, and tune to a radio station. Turn the volume all the way down. The numbers on the screen now should be 127s. Turn the balance so that it is right in the middle. Slowly start turning the volume up until 255s are printed with the 127s. The best setting will be when there is a fairly even mix between 127s and 255s. If the volume is too high, and the 127 and 255 mix is good, turn the volume down a little and adjust the balance towards the side from which you removed your speaker. When your stereo is at a good volume and the 127 and 255 mix is good, press ENTER. Simple Joe will appear, and assuming you did everything well, he will be talking and singing right along with your radio.

What is going on? Well, the cassette port has the ability to sense sound, just as it does when you are loading a program or data into your computer. Simply, when there is sound, the leftmost bit goes on, and changes the value from 01111111 (127) to 11111111 (255). This program constantly changes the value at the port back to 127, so when INP(255), where 255 is the number for the cassette port, is equal to 255, there must be sound. Hence, Simple Joe's mouth is opened. When INP(255) is 127, Simple Joe closes his mouth.

By storing the values (either 127 or 255) of this port,

there is another possible use for this hardware setup. It might be used for voice or musical recognition. By comparing a list of data to incoming data, it is possible that the incoming data could be recognized as the original. I have done such experiments, and found that when the song I played to my computer was the same, the list was generally between 65% and 85% the same as the incoming data. And when the song was different, the range was between 40% to 60% the same. While this is not extremely accurate, the potential is there for having some remarkable voice/music recognition experiments.

Program Listing for Simple Joe

```
5 REM * BY RON GOODMAN
10 CLS:CLEAR200:DEFINTA-Z:M=1
20 FORX=0TO6:FORY=0TO9:READA:A$(X)=A$(X
)+CHR$(A):NEXTY,X
30 A=INP(255):OUT255,0
40 PRINT@25,"SET VOLUME & BALANCE. THE
N PRESS ENTER";
50 PRINT@960,"VALUE";A
60 IFINKEY$<>CHR$(13)THEN30
70 CLS:A$="* ":A$=A$+A$+A$+A$:A$=LEFT$(
A$+A$+A$+A$,31)
80 PRINTCHR$(23);A$:PRINT@960,A$;:A$="*
"+STRING$(29,32)+"*"
90 FORX=64TO896STEP64:PRINT@X,A$;:NEXTX
100 PRINT@140,"S I M P L E";CHR$(195);"
J O E";
110 FORX=0TO2:PRINT@22+64*(X+6),A$(X);:
NEXTX:A=INP(255):IFA=63THENM=1ELSEM=0
120 A=INP(255):OUT255,8
130 IFA=63ANDM=1THENM=0:PRINT@598,A$(3)
;:PRINT@662,A$(4);
140 IFA=191ANDM=0THENM=1:FORT=1TO50:NEX
TT:PRINT@598,A$(5);:PRINT@662,A$(6);
150 GOTO120
10000 DATA160,140,131,131,131,131,131,1
31,140,144
10010 DATA149,32,130,129,32,32,130,129,
32,170
10020 DATA149,32,32,32,172,156,32,32,32
,170
10030 DATA149,32,176,176,176,176,176,17
6,32,170
10040 DATA130,140,176,176,176,176,176,1
76,140,129
10050 DATA149,32,152,131,131,131,131,16
4,32,170
10060 DATA130,140,178,188,188,188,188,1
77,140,129
20000 CLS:INPUTA:PRINTCHR$(23);:OUT255,
A:INPUTX$:GOTO20000
```

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Notes

This month's set of Notes covers a variety of topics. Thanks to many of you for sending in tid-bits and notices.

In March '82, we published a program that enabled you to print graphics on your MX-80 printer. Mr. Henk C. Visser of The Netherlands has gone one better. If you are using NEWDOS/80 version 1.0, change bytes B9 and BA in SYS0/SYS, sector 2 from 3E2E to C620. For NEWDOS/80 version 2.0, change bytes C1 and C2 in SYS3/SYS, sector 4 from 3E2E to C620. For the 2.0 version you will also need to enter under DOS Ready the command SYSTEM 0 AX=127. The changes can easily be made with SUPERZAP under the DFS mode. After the changes are made, both systems will now print graphics and lowercase when JKL is pressed. However, do not use the TRS-80 setting of your MX-80 printer. Obviously, this permanent patch is preferrable to having to run the program every time you desire graphics or lowercase. Don't forget to reboot your system before trying the JKL function.

Lemons Tech Services, Buffalo, MO, has notified us that their LemonAid Loader demonstrates marginal performance with the early cassette recorders (Radio Shack CTR-41). They recommend that if your CTR-41 is not working properly with the LemonAid that you replace the recorder with the new CTR-80 or 80A.

Mr. Daniel Schultz, ICM Industries, Carmel, IN, has sent in a marvelous patch for the Model III DEBUG utility. The DEBUG that is supplied on TRSDOS will not operate on memory below 5600H. This three-byte patch will solve the problem:

Under TRSDOS Ready type:

PATCH *5 (ADD=4EDA, FIND=56, CHG=00)

PATCH *5 (ADD=4F00, FIND=56, CHG=00)

PATCH *5 (ADD=5069, FIND=56, CHG=00)

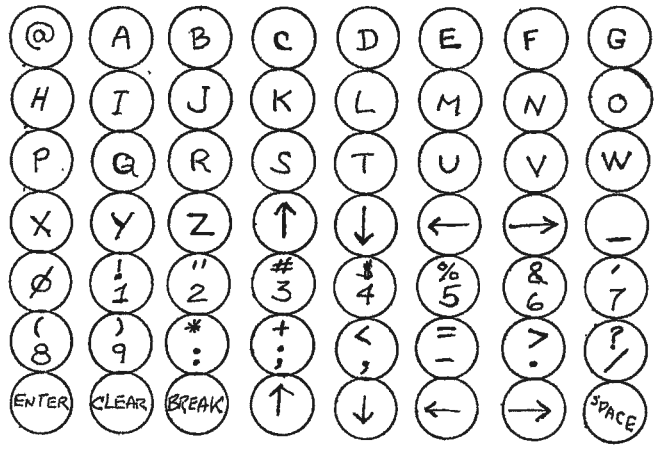
Now your DEBUG utility can display all of memory and alter any part of RAM!

It's the little things that can get to you. In generating listings, we run the programs out on a Model III whenever possible. To fit column width requirements, the FORMS command is used to set the printer. After much tribulation, we tracked down an undocumented bug. The FORMS command prints two extra characters besides those specified in the WIDTH option. So, when requesting a width of 39, be sure to specify only 37. Radio Shack has verified the problems, and according to them, that is the way it is designed to work. They have put the notice in the latest edition of the owner's manual. Makes us wonder why a patch wasn't offered instead of a "mention four lines from the bottom of page 49 in the new manual."

Mr. Michael L. Phillips, Softronics, Inc., Tulsa, OK, offers a change to our program "Short Leaders for Data Tapes," April '82. For those of you with new ROM releases of the Model I (those that say MEM SIZE?), the following should work. In the assembler listing, change line 440 to read JP NZ,207CH and change line 480 to read JP 2079H. The BASIC listing is altered by changing the values in line 300 from 155 to 124 and from 150 to 121.

As one last piece of information, Mr. Deitmar Goltz of West Germany observed an intriguing characteristic of the Model I. (Model III owners will have trouble with automatic key repeat.) Various technical references have shown the following keyboard matrix:

Figure 1



When depressing two keys at once, you can get unexpected results. By holding down any two keys from the same column (e.g., Q and Y), when you depress a third key it will result in two characters being displayed. If the third key being depressed comes from the same row as the Q, then the extra letter displayed is from the same row as the Y. So, holding down Q and Y and then depressing P will result in an X at the same time. Depressing an S,T,U or V while holding the Q and Y keys will give you arrows. It makes for fun — we leave its worth up to some inventive programmer.

Thanks again for the contributions. Your ingenuity is heartwarming. ■

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#2

Sweet talker

Teaching your TRS-80 to speak

Model I/III

Edward M. Roberts, Glen Head, NY

Recently, I ran across a crumbling artifact of a time long, long ago: a *Scientific American* of September, 1972. On page 165 was an ad that began: "Votrax — world's first low-cost miniaturized voice synthesizer, opens communication channels between man and machine."

Beneath that terse headline was a picture of three large circuit boards. The text said the size of the device was 10x11x14 inches and the cost was "under $2000 in production quantities."

Currently, Votrax offers the same capabilities compressed into a 22-pin DIP, designated the SC-01. Steve Ciarcia, writing in *BYTE*, (September 1981), described his implementation of this chip. A 3x4-inch circuit board with four other ICs and a few passive components comprise the entire system, including a parallel interface and a one-watt audio amplifier (excluding the power supply).

Ciarcia's design, which he calls "The Sweet Talker," is available from The Micromint, Inc. Tempted beyond endurance by the $139 price, I ordered an assembled and tested unit which, together with a nice little power supply and shipping, brought my bill to $176.

We are at the dawn of the age of the talking gadget. The best known is undoubtedly Texas Instruments' "Speak 'n Spell." If you haven't played with one of these, you owe yourself a trip to the nearest toy store. National Semiconductor's "Digitalker" is somewhat similar to TI's synthesizer, and is offered by several mail order advertisers in TRS-80 compatible circuits. Almost all such devices have a limited vocabulary stored internally. This is fine for dedicated applications, but severely limits usefulness as a general-purpose peripheral.

The Votrax SC-01 is quite different. It will produce, on request, any of the sounds needed for English speech and will blend each sound into the next, just as a human speaker does. The sounds are generated by sending appropriate ASCII code to the Sweet Talker board via the TRS-80's parallel printer port. Thus, the simple command, LPRINT "ittkCjzkMC" will cause the device to say, "Your turn." Before I go further, let me try to answer the burning question: What does it really sound like?

Well, first off, there's no doubt it's a machine talking. The intelligence we perceive in the inflections of the human voice is simply not there. "Drop dead, dammit!" and "Peace, brother" come out in the same emotionless tone, saved from an absolute monotone only by Votrax's "automatic inflection."

Comprehension depends greatly on context. If your new Buick suddenly said, "Limes halt scurvy," there's not a chance in a hundred it would be understood. So, keeping in mind that speaking comprehension is poorer than reading, I would rate the intelligibility of The Sweet Talker as excellent. I encoded the following: "I am a TRS-80 computer, my master is Ed Roberts, my name is R17 D23 — do you know my uncle R2 D2?" My wife had some difficulty with this, but a passing telephone repairman understood it instantly. On the other hand, the Lord's Prayer brought forth from my wife the comment that I must be doing something better because it was now so easy to understand. The

complete programmability of the SC-01 makes it possible to compensate for any such problems by choice of vocabulary, word order and even emphasis (which is determined more by duration than loudness).

The device can speak in either of two programmable pitches, describable as baritone and tenor. A potentiometer on board offers pitch adjustment. An aggressive experimenter would find it possible to secure complete control over pitch since the frequency-determining clock can be controlled externally.

Most methods of indicating pronunciation use symbols not available on a computer keyboard. Consequently Votrax evolved the system shown in Table 1. Observe that it is merely a tool or mnemonic device; the actual instruction to the chip is a one-byte code. In the case of the TRS-80/Sweet Talker, this code corresponds to the ASCII characters 64 to 127 for the low pitch, and the numbers 192 to 255 for high pitch.

The Votrax phoneme notation is logical and easy to learn. Although there are about 45 sounds in English, Votrax has expanded this to 64 by offering vowels in different lengths, as well as two different pauses and a stop. Kathryn Fons and Tim Gargagliano (employed by Votrax as speech scientist and computer engineer, respectively) prepared an article, "Articulate Automata — An Overview of Speech Synthesis." It appeared in the February, 1981, *BYTE* and is well worth searching out. It contains much specific information on using the Votrax synthesizer and translating words into a suitable phonetic form for synthesis. A footnote comments that these two people have a particular interest in the needs of speech handicapped and they welcome inquiries in this area.

Two somewhat unrelated comments are in order here. First, Radio Shack's discontinued Voice Synthesizer, although similar in principle to the Sweet Talker, was connected differently and used different ASCII characters to encode the phonemes. Second, the Votrax "TYPE-'N-TALK," now being advertised for $375, is a complete unit with the added capability of direct translation of text to speech. That is, if you type, "Mary had a little lamb," it will say, "Mary had a little lamb."

Interfacing The Sweet Talker to the TRS-80 is fairly easy. Note, however, that it consists only of a completed circuit board. You must make up the connections and supply a speaker yourself. Soldering skills, the ability to understand simple schematics, and an elementary understanding of a parallel interface are desirable. Micromint's nicely prepared manual is helpful.

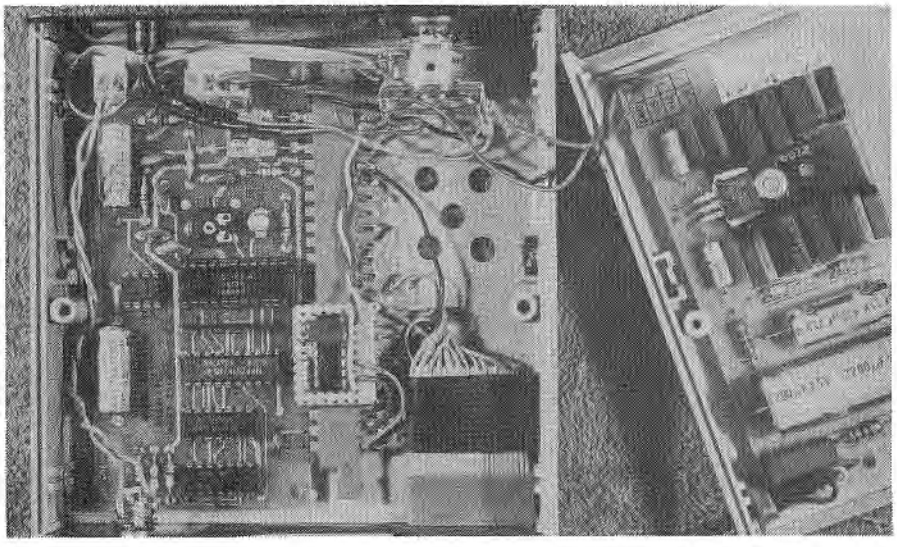
"The Sweet Talker" connects directly to the parallel printer port of the Model III or the expansion interface box of the Model I. An unexpanded Model I would require the active printer cable. Since I already had a printer connected to my Model III, I made a "Y"

Table 1. Phoneme Chart

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
00	EH3	59	jacket
01	EH2	71	enlist
02	EH1	121	heavy
03	PA0	47	no sound
04	DT	47	butter
05	A2	71	made
06	A1	103	made
07	ZH	90	azure
08	AH2	71	honest
09	I3	55	inhibit
0A	I2	80	inhibit
0B	I1	121	inhibit
0C	M	103	mat
0D	N	80	sun
0E	B	71	bag
0F	V	71	van
10	CH*	71	chip
11	SH	121	shop
12	Z	71	zoo
13	AW1	146	lawful
14	NG	121	thing
15	AH1	146	father
16	OO1	103	looking
17	OO	185	book
18	L	103	land
19	K	80	trick
1A	J*	47	judge
1B	H	71	hello
1C	G	71	get
1D	F	103	fast
1E	D	55	paid
1F	S	90	pass

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
20	A	185	day
21	AY	65	day
22	Y1	80	yard
23	UH3	47	mission
24	AH	250	mop
25	P	103	past
26	O	185	cold
27	I	185	pin
28	U	185	move
29	Y	103	any
2A	T	71	tap
2B	R	90	red
2C	E	185	meet
2D	W	80	win
2E	AE	185	dad
2F	AE1	103	after
30	AW2	90	salty
31	UH2	71	about
32	UH1	103	uncle
33	UH	185	cup
34	O2	80	for
35	O1	121	aboard
36	IU	59	you
37	U1	90	you
38	THV	80	the
39	TH	71	thin
3A	ER	146	bird
3B	EH	185	get
3C	E1	121	be
3D	AW	250	call
3E	PA1	185	no sound
3F	STOP	47	no sound

/T/ must precede /CH/ to produce CH sound.
/D/ must precede /J/ to produce J sound.



The Sweet Talker board mounted in the bottom half of a Radio Shack case, with the power supply in the top half. The pulse extender (see text) was assembled on a piece of perfboard and mounted on the connector with foam tape.

connection by installing a 25-pin D-submini male connector (Radio Shack #276-1559) across the first 25 lines of my printer cable. The matching female connector (#276-1565) plugs into this. An 18-inch piece of 25-conductor cable, made up from #278-771, and a card edge socket (#276-1550) completed the connection. Both printer and Sweet Talker remain connected at all times, with selection being made by switching on the desired device and turning off the other.

To complete the job, I bought Radio Shack's Deluxe Project Box (#270-218), an LED pilot light, a mini jack for the speaker connection and a miniature 10K panel mounted volume control with a DPST switch (#271-215). This replaces the PC-style pot on the Sweet Talker board and switches both the 5-volt and 12-volt lines. My Radio Shack bill for all this was a mere $30.

The photo shows the box with the top open and the power supply mounted on the top half of the cabinet. Along the connector is mounted a little piece of perfboard — my only real criticism of The Sweet Talker. The manual explains that the strobe input line must remain low for 100 microseconds, but that the pulse from the TRS-80 is only one microsecond or so. It is necessary to make up a little one-shot or pulse extender circuit consisting of an IC, a resistor and a capacitor. Micromint supplies the parts, and assembling them is easy enough, but they really should have been provided on the main board.

The Micromint power supply consists of a heavy wall transformer and a well-made board rated at 5 volts — 300 MA, and +12 and -12 volts at 50 MA each. I measured The Sweet Talker as drawing 80 MA at 5 volts and 30 MA at +12 volts. Many users may have alternatives to paying $29 (kit) or $37 (assembled and tested) for the Micromint supply.

I have a final note of caution. As I've grown accustomed to its voice, I'm beginning to think of it as a real person in there . . . a good friend . . . an old friend who talks to me . . . ■

Sweet Talker is available for $139 from The Micromint, Inc., 917 Midway, Woodmere, NY 11598, 1-800-645-3479 (orders), 1-516-374-6793 (information).

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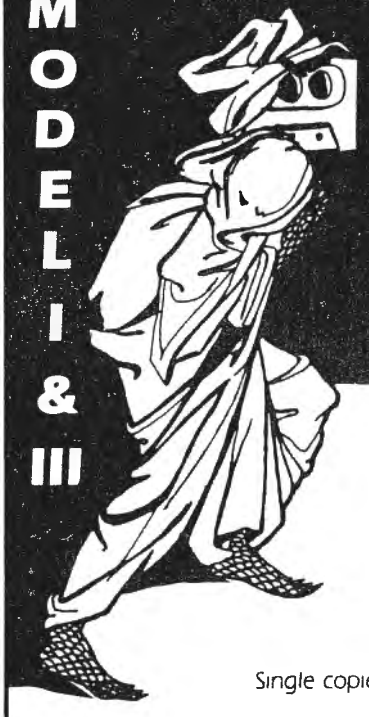

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Integrated accounting

An evaluation of Plus Computer Technology's General Ledger

Model III, 48K with 2 disks

80 U.S. Staff
Based on notes and observations by John Strader, CPA

The problem of finding just the right business software for microcomputers seems to have been with us since day one. This is due, no doubt, to the diversity of business operations. We seem to expect the software to conform to *our* way of doing business, and are prone to adapt our business operations to available software.

Another problem with business software is that it is usually rather expensive, and one must pay the piper in order to find that it is not what was expected, or that it will not do the job.

We were told, by several readers, of the merits of Plus Computer Technology, Inc., and their integrated business software for the Model II and III. Accordingly, we solicited a Model III system from them. In addition to several days of operation at *80-U.S. Journal*, we asked our CPA, John Strader, to use it and comment on it. The following commentary is based on our own experience as well as that of our CPA.

System Overview

The packages included are: General Ledger, Accounts Receivable, Accounts Payable, Payroll, Fixed Assets and a utility called Easytrak. These are available as a complete package, or each program may be purchased separately. The price per package for the Model III is $325.00 (Easytrak is $125.00). The Model II prices are slightly higher.

All of the programs operate under TRSDOS. The features of each program are extensive. Each program is packaged in its own attractive binder. The documentation is complete and easy to follow. Because of the extensive features of each program, the documentation for each is almost two inches thick in a three-ring binder.

The company supports their software for the first 60 days at no additional charge. After the first 60 days, a maintenance program is available for an additional fee of $100.00 per package. This includes support and technical bulletins, as well as a newsletter covering all of the packages.

The entire system is interactive. The way they make it so is rather interesting. A master diskette is provided which is used with all of the available programs. The master diskette is used to "boot up," after which a menu appears and you may select the package you wish to run.

If you choose Accounts Receivable (for example), the master diskette menu will tell you when to remove the master diskette and insert the Accounts Receivable diskette and its data diskette. You may choose not to have an interactive system. In any case, after you finish with Accounts Receivable, you are instructed to insert the master diskette again. It collects the data which must be transferred to another of the packages.

If you decide not to be interactive, the lineprinter will print the data which must be posted manually to the appropriate package. The decision to go interactive may be made even after manual transfer has been in operation for a time. This assumes, of course, that general ledger numbers were properly assigned in the first place. The master diskette is also used to install the various programs and to initialize them.

The system uses a machine language subroutine for screen input in all programs. This makes input of information fast and easy. Each program is completely menu driven, and there are several menus for each. The menu always shows which screen you are using at the upper left of the video monitor. The @ key is used to step through the various menus.

The many menus used in this system seem intimidating at first. After doing some work with the system, however, this becomes routine.

The General Ledger

The General Ledger program for the Model III with two drives will handle 150 to 600 accounts with 1500 to 3000 journal entries per month. The files may be expanded if more drives are added to the system.

It is possible to review file status and various processing months with this system. This General Ledger has a journal entry routine which gives plenty of flexibility to make entries and changes to the entries. It allows posting of corrections, or adjusting entries not posted in the other application programs in the system.

Like other General Ledger programs, this one will prepare a general ledger, balance sheet and income statement. It also has a significant number of items which make it a valuable tool for any business. The income statement can be structured to meet your individual needs. You may enter your own headings and account-total descriptions. You can compare year-to-date and monthly income figures with prior years figures. You also have the ability to print an income statement which compares ammounts for the current month and year-to-date with budgeted amounts for those periods. These features are especially important during the current economic situation.

The specialized report request is another attractive feature of the General Ledger program. It allows you to build a special report by selecting various accounts. The structure of this report is entirely user-defined—you could select all of the sales accounts for a detailed sales analysis report.

The General Ledger reports are designed for an accountant, and will provide you with all of the traditional accounting reports except the Changes in Financial Position and Retained Earnings Report. These two reports are required by generally-accepted accounting principles, but are not usually produced by the majority of smaller public companies.

The program has good audit trails. These are important if you want to follow an individual entry through the different application program reports.

The General Ledger program also produces a monthly trial balance, quarterly trial balance, comparative balance sheet, detail general ledger, journal activity report, master chart of accounts, budget worksheet, and financial statement footnotes.

The only significant shortcoming observed with the General Ledger is that no "other assets" or "other liabilities" classifications are available in the balance sheet. The income statement did not appear to handle departmental reporting. Perhaps this may be done with the special report feature, which provides essentially the same information.

The General Ledger package is impressive. We will take time to evaluate other packages in this integrated system in later issues. ■

This package is available from Plus Computer Technology, Inc., 6900 North Austin Ave., Chicago, IL 60648. Since the writing of this evaluation, several revisions have been made to the package. Balance Sheet categories for "other assets" and "other liabilities" have been added, 2400 character footnotes are available, and an expanded form Income Statement which is totally user-defined has been added to the Financial reports.

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Files and foibles

Binary tree file handling

Model I/II/III

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We previously introduced the binary tree as a data structuring device that allows rapid access to any part of a data base. This time, we'll go over a complete program listing for a simple binary tree file handling program. All the complications are now incorporated and we can add, edit and delete. There are some changes, so work through the program carefully.

Binary Trees

Binary trees come out of the combination of linking techniques we've learned and the basic binary divide and conquer technique. Since we've covered linking, let's look at the binary divide and conquer technique.

Let's say we have an array to search for something. Maybe it's a list of 1000 names. If we start searching in the array at the first element and proceed until we find it, we would have to look at one-half of the array (on the average).

With the binary technique (properly called the binary search), we can cut this down to 10 tries at most! The basic procedure involves first sorting the array into order. Then, look at the center element. If we have what we want, we are done. If not, we look to see if the element we want is less than the center one. If it is, we only worry about the first part of the array up to the center element and repeat the procedure by taking the center of this portion of the array and dividing again if we haven't found the correct element. Try this a few times to see how it works. See if you can take more than 10 tries in a list of 1000 items. If you do, you've probably done it wrong. If we make a BASIC subroutine to search array A, of N items, for item X, we get:

```
1000 REM BINARY SEARCH
1010 LW=1:HI=N
1020 MPT=(HI+LW)/2
1030 IF A(MPT)=X THEN PRINT"FOUND AT ";MPT: RETURN
1040 IF X<A(MPT) THEN HI=MPT-1: GOTO1020
1050 LW=MPT+1: GOTO1020
```

Try this by hand on a small array (say 10 items) to see how it works.

How does this relate to the binary tree? By using pointers, we can make the tree the same as the sorted list with a midpoint (the root), a less than side (left sub-tree) and a greater than side (right sub-tree). By using the same decision process, we can eliminate half the tree with every comparison.

For a tree however, this only works if the whole structure is "balanced." If we think of each data item as weighing one pound, then for any given element, the left sub-tree should weigh as much as the right sub-tree.

How do you prevent a tree from getting out of balance? With a binary tree, it works best if the data items are entered in random order. If you enter them in sorted order, the tree will be out of balance.

Try this experiment with the sample program: Make up a list of names or numbers to enter. Enter them in sorted order and print the full list. Then, draw the binary tree with arrows as shown in Figure 1. Next, kill the data file and enter the same names in random order. Draw the tree again. Do you see the difference? See Figure 2.

The procedures for printing the tree and deleting a data item were not talked about before when we discussed trees. Look over the listings to see how they work.

The printing routine at line 4200 prints the tree out in sorted order. This requires implementing a recursive procedure. If you look at Figure 3 carefully, you'll see that it could be written as a recursive procedure like this:

Get the current element.
If its left pointer isn't zero, Print the left sub-tree.
Print the current element.
If its right pointer isn't zero, Print the right sub-tree.

Understand that when we say print a sub-tree, we start the whole procedure over from the beginning with the new current element being the root of the sub-tree.

The program does not use a recursive GOSUBing technique. Instead, all of the GOSUBs are replaced by equivalent GOTOs. Try rewriting the printing procedure using the recursive calling techniques from the August installment.

The delete procedure is fairly intricate since we have to move the two sub-trees of the element we're deleting to appropriate places. Work through this one by hand until you understand it.

The program was written on a Model II and has been run on Model I and III with minor changes. It's also been run under CP/M using Microsoft MBASIC. For the Color Computer, the most significant problem is the fact that there is no LOF function. That's noted in the

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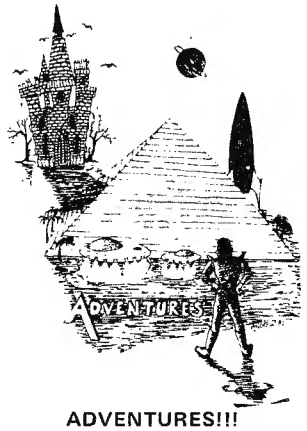

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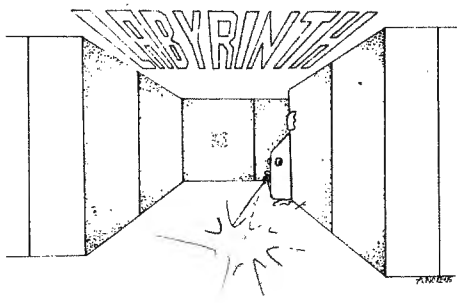

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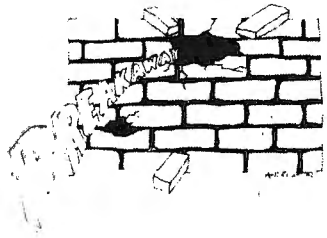

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Ed. Note — Model II owners: Following the Binary Tree listing is last month's Tower of Hanoi Program adapted to Model II graphics.

Figure 1
Binary Tree formed by entering sorted list.

LIST: Albert, John, Larry, Mike, Terry, William

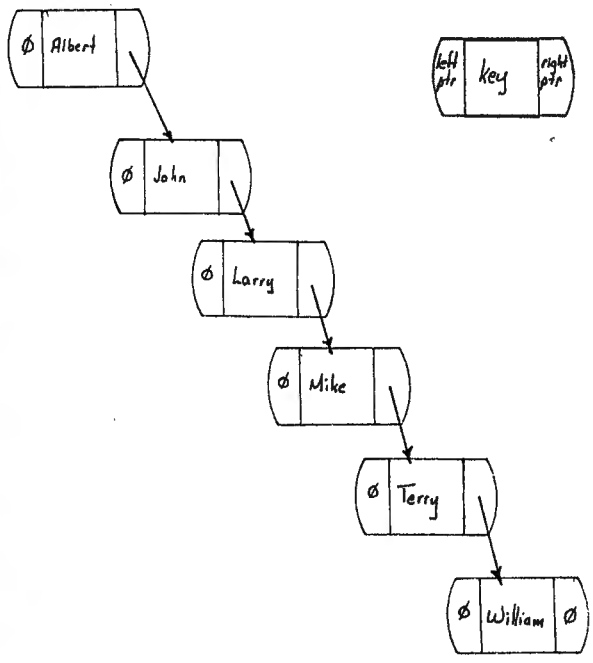

Figure 2
Binary Tree formed by entering random list.

LIST: Mike, Terry, John, Larry, William, Albert

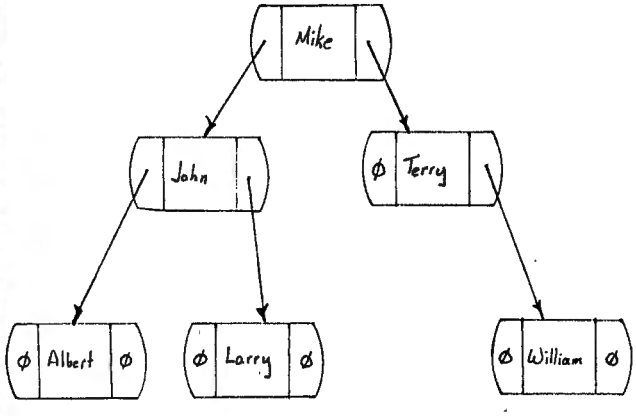

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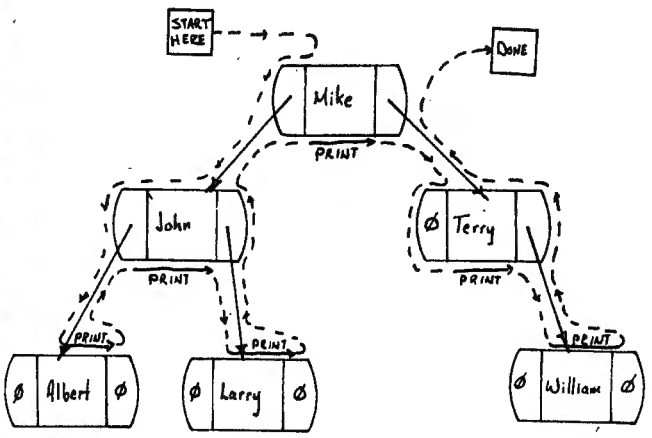
Figure 3
Path to print tree in Sorted Order.



Listing 1

```
95 REM            INITIALIZE THE PROGRAM
100 CLEAR10000:DEFINTA-Z:DIM STK$(30),S
TK(30)
105 REM           GET THE DATA FILE & DEF
INE IT
110 OPEN"R",1,"BINARY/DAT",60
120 FIELD#1, 20 AS KEY$,2 AS LP$,2 AS R
P$,36 AS DT$
130 FORI=1TO30:FIELD#1,(I-1)*2 AS DUM$,
2 AS STK$(I):NEXT I
135 REM           DEFINE THE POSSIBLE COM
MANDS
140 PC$="ADD   EDIT  DELETEPRINT HELP
END   "
145 REM           THIS FUNCTION PRINTS A
GRAPHICS CHARACTERS AND THEN BACKS UP
150 DEF FNFLD$(X)=STRING$(X,144)+STRING
$(X,28)
155 REM           CHECKS TO SEE IF THE FI
LE ALREADY EXISTS, IF NOT THEN
156 REM           THE FILE IS INITIALIZED
 FOR USE BY STARTING THE STACK
157 REM           AND INITIALIZING THE LI
ST HEAD RECORD
160 IF LOF(1)=0 THEN LSET STK$(1)=MKI$(
1):PUT1,1:LSETKEY$="":LSETLP$=MKI$(0):P
UT1,2
165 REM           PRINT LOGIN MESSAGE
170 CLS:PRINT"BINARY TREE DEMONSTRATION
"
180 PRINT"TYPE <HELP> FOR A COMMAND LIS
T"
```

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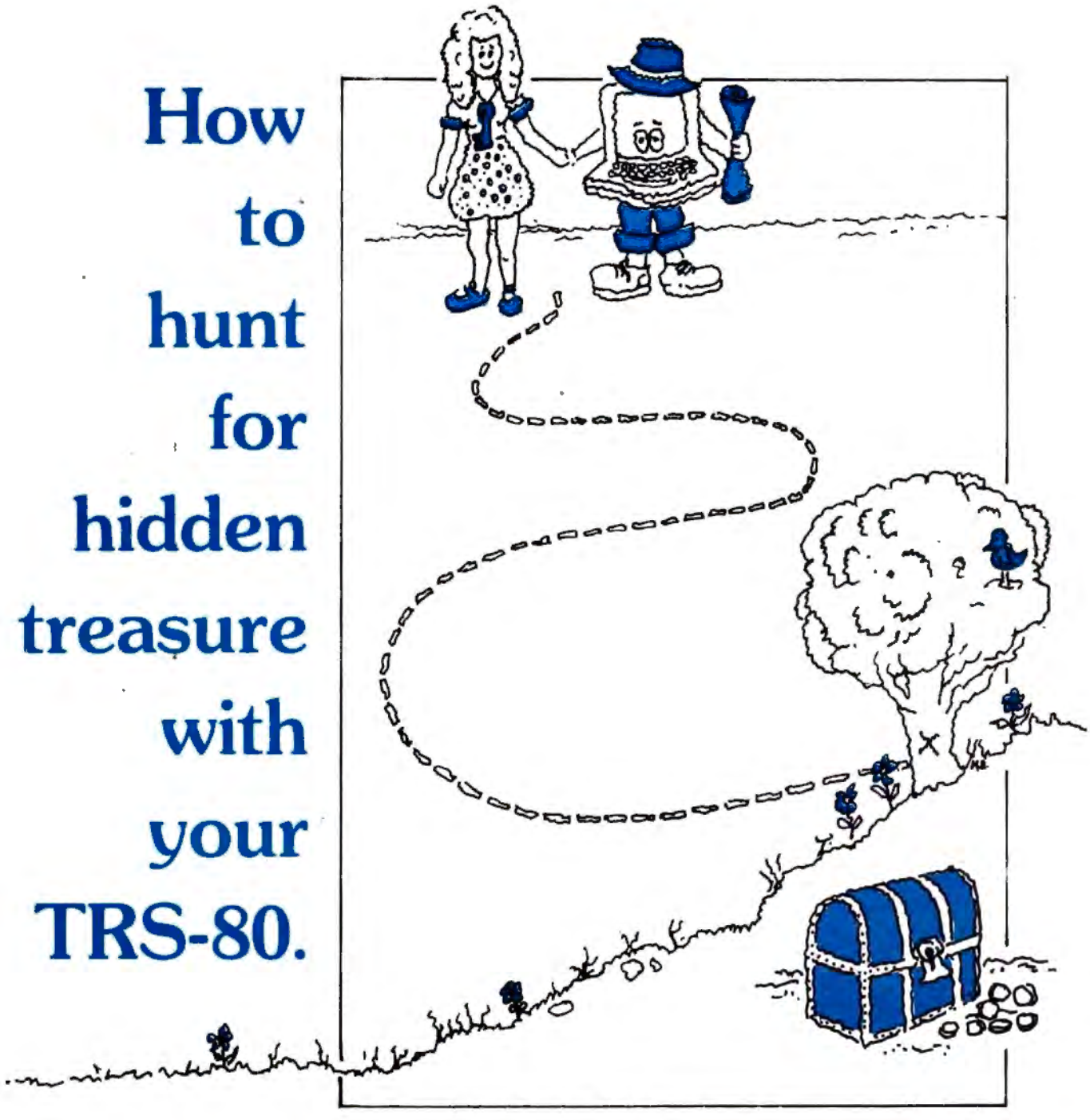

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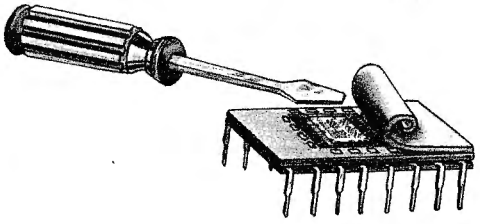
```
200 REM - - - - - - - - - COMMAND LOOP -
- - - - - - - - - - - - - - - - - - - -
205 REM          THERE CAN BE 2 WORDS ON
 A LINE (FW$ & LW$), INITIALIZE TO
206 REM          NOTHING AND GET A COMMA
ND
210 FW$="":LW$="":LINE INPUT">>";CD$
215 REM          IF THERE IS NO BLANK IN
 THE LINE, ASSUME ONLY 1 WORD
220 L=INSTR(CD$," "):IF L=0 THEN FW$=CD
$:GOTO250
225 REM          OTHERWISE GET THE TWO W
ORDS
230 FW$=MID$(CD$,1,L-1):LW$=MID$(CD$,L+
1)
235 REM          GET RID OF LEADING BLAN
KS ON THE LAST WORD
240 IF MID$(LW$,1,1)=" " THEN LW$=MID$(
LW$,2):GOTO240
245 REM          IS THE COMMAND IN PC$?
FIND IT
250 CD=INSTR(PC$,FW$):IF CD=0 THEN PRIN
T"COMMAND ERROR - TRY HELP":GOTO200
255 REM          GET THE NUMBER OF THE C
OMMAND
260 CD=INT(CD/6)+1
265 REM          EXECUTE THE COMMAND
270 ON CD GOSUB 1000,2000,3000,4000,500
0,300
280 GOTO200
300 REM - - - - - - - - END OF PROGRAM -
- - - - - - - - - - - - - - - - - - - -
305 REM          CLOSE OUT THE PROGRAM N
ORMALLY
310 CLOSE:CLS:PRINT"GOODBYE":END
400 REM - - - - - - - - INPUT A CHARACTER
 - - - - - - - - - - - - - - - - - - -
405 REM          WAIT HERE UNTIL A SINGL
E CHARACTER IS TYPED AT THE KEYBOARD
410 C$=INKEY$:IFC$=""THEN410
420 RETURN
500 REM - - - - - - - - INPUT A LINE - -
- - - - - - - - - - - - - - - - - - - -
505 REM          PRINT THE INPUT FIELD &
 SET THE INPUT BUFFER (IN$) TO NOTHING
510 PRINT FNFLD$(ZF);:IN$=""
515 REM          GET A CHARACTER, IF IT'
S <ENTER> THEN WE'RE DONE
520 GOSUB400:IF ASC(C$)=13 THEN RETURN
```


Accessing the TRS-80* ROM...



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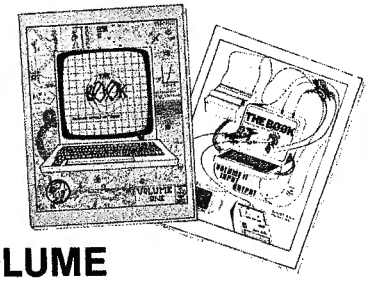

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```
525 REM          IF IT WAS A BACKSPACE,
THEN GET RID OF THE LAST CHARACTER
526 REM          IF THERE IS ONE
530 IF ASC(C$)=8 THEN IF LEN(IN$)>0 THE
N IN$=MID$(IN$,1,LEN(IN$)-1):PRINTC$;FN
FLD$(1);:GOTO520
535 REM       HAVE WE ALREADY GOT TOO
MANY CHARACTERS, IF SO IGNORE THE
536 REM          LAST ONE
540 IF LEN(IN$)>=ZF THEN 520
545 REM          IF WE PASS ALL THE TEST
S, ADD THE CHARACTER TO THE BUFFER
546 REM          AND PRINT IT THEN GO GE
T MORE
550 IN$=IN$+C$:PRINTC$;:GOTO520
600 REM - - - - - - - - - - - SEARCH FOR
KEY - - - - - - - - - - - - - - - -
605 REM          CL IS THE RECORD LOCATI
ON TO LOOK AT, FD IS THE FLAG THAT
606 REM          SAYS WE FOUND IT, AND L
L IS THE LAST LOCATION WE LOOKED
610 CL=2:FD=0:LL=CL
615 REM          GET THE CURRENT RECORD
& GET THE LEFT & RIGHT POINTERS
620 GET1,CL:LP=CVI(LP$):RP=CVI(RP$)
625 REM          IF WE'RE LOOKING AT THE
 HEAD POINTER WHICH USES ONLY
626 REM          THE LEFT POINTER, & LP
IS 0 THEN THE LIST IS EMPTY
630 IF CL=2 AND LP=0 THEN RETURN
635 REM          IF WE'RE AT THE HEAD PO
INTER, FIND THE ROOT RECORD AND
636 REM          GO TO PROCESSING
640 IF CL=2 THEN LL=CL:CL=LP:GOTO620
645 REM          CHECK FOR THE KEY, IF I
T'S FOUND THEN SET THE FOUND
646 REM          FLAG & RETURN
650 IF INSTR(KEY$,X$)<>0 THEN FD=1:RETU
RN
655 REM          IF WHAT WE'RE LOOKING F
OR IS LESS THEN THE KEY, SEARCH
656 REM          TH E LEFT SUB-TREE, IF
THERE IS NONE, THEN WE'RE DONE
660 IF X$<KEY$ THEN IF LP=0 THEN RETURN
 ELSE LL=CL:CL=LP:GOTO620
665 REM          OTHERWISE WE SEARCH THE
 RIGHT SUB-TREE UNLESS IT'S EMPTY
670 IF RP=0 THEN RETURN ELSE LL=CL:CL=R
P
680 GOTO620
```


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```
700 REM - - - - - - - - - - - ADD ITEM -
- - - - - - - - - - - - - - - - - - -
705 REM          GET SOME SPACE & THEN P
UT THE NEW ITEM THERE
710 GOSUB900:LSETKEY$=X$:LSETDT$=Y$:LSE
TLP$=MKI$(0):LSETRP$=MKI$(0)
715 REM          STORE IT
720 PUT1,LC
725 REM          GET THE RECORD THAT THI
S IS BEING ATTACHED TO & SET THE
726 REM          THE POINTERS APPROPRIAT
ELY
730 GET1,CL
740 IF CL=2 OR X$<KEY$  THEN LSET LP$=M
KI$(LC):PUT1,CL:RETURN
750 LSET RP$=MKI$(LC):PUT1,CL:RETURN
800 REM - - - - - - - - - - - REPLACE ITE
M - - - - - - - - - - - - - - - - - -
810 LSETKEY$=X$:LSETDT$=Y$:PUT1,CL:RETU
RN
900 REM - - - - - - - - - - - GET SPACE F
OR AN ITEM - - - - - - - - - - - -
905 REM          FIRST CHECK THE STACK,
IF IT'S EMPTY THEN GET SPACE AT THE
906 REM          THE END OF THE FILE ...
 NOTE THE COLOR COMPUTER DOESN'T
907 REM          HAVE LOF, SO YOU'LL HAV
E TO KEEP THE LENGTH OF THE FILE IN
908 REM          THE FILE ITSELF
910 GET1,1:IF CVI(STK$(1))<=1 THEN LC=L
OF(1)+1:RETURN
915 REM          IF THE STACK ISN'T EMPT
Y, THEN GET THE TOP RECORD NUMBER
916 REM          OFF THE STACK
920 SP=CVI(STK$(1)):LC=CVI(STK$(SP)):LS
ETSTK$(1)=MKI$(SP-1)
930 RETURN
1000 REM - - - - - - - - - - ADD ITEMS -
- - - - - - - - - - - - - - - - - - -
1005 REM         THIS IS WHERE WE ENTER
ITEMS FROM THE KEYBOARD
1006 REM         GET THE DATA
1010 ZF=36:PRINT"DATA: ";:GOSUB500:PRIN
T
1015 REM         X$ IS THE KEY, Y$ IS TH
E DATA
1020 PRINT"ADDING DATA":X$=LW$:Y$=IN$
1025 REM         SEARCH TO SEE IF THE KE
Y IS ALREADY THERE
1026 REM         IF IT IS, REPLACE THE R
ECORD, OTHERWISE ADD IT
1030 GOSUB600:IF FD=1 THEN GOSUB800 ELS
E GOSUB700
1040 RETURN
2000 REM - - - - - - - - - - EDIT ITEMS -
 - - - - - - - - - - - - - - - - - - -
```


CONVERT YOUR SERIAL PRINTER TO PARALLEL

The UPI serial printer interfaces allow an ASCII serial printer to be connected to the parallel printer port on TRS-80 Models I, II and III.

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```
2005 REM          IF THERE WAS NO KEY ON
THE COMMAND LINE, THEN ERROR
2010 IF LW$="" THEN PRINT"COMMAND ERROR
 - TRY HELP":RETURN
2015 REM          SEARCH FOR THE KEY, IF
NOT FOUND THEN CAN'T EDIT
2020 X$=LW$:GOSUB600:IF FD=0 THEN PRINT
"NOT IN LIST":RETURN
2025 REM          PRINT THE DATA
2030 PRINT"DATA:
       ";DT$
2040 PRINT"ENTER CHANGES (ENTER IF NO C
HANGE): ";
2045 REM          GET CHANGES IF ANY, IF
JUST HIT ENTER THEN DON'T CHANGE
2046 REM          ANYTHING
2050 ZF=36:GOSUB500:PRINT:IF IN$="" THE
N RETURN
2055 REM          IF MORE THAN <ENTER> WA
S TYPED, THEN REPLACE THE RECORD
2060 Y$=IN$:X$=KEY$:GOSUB800
2070 RETURN
3000 REM - - - - - - - - - DELETE ITEMS
 - - - - - - - - - - - - - - - - - - -
3005 REM          IF NO KEY, THEN INCORRE
CT COMMAND
3010 IF LW$="" THEN PRINT"COMMAND ERROR
 - TRY HELP":RETURN
3015 REM          SEARCH FOR IT, IF IT IS
N'T THERE, WE CAN'T DELETE IT
3020 X$=LW$:GOSUB600:IF FD=0 THEN PRINT
"NOT IN LIST":RETURN
3025 REM          PRINT IT JUST TO MAKE S
URE WE REALLY WANT TO DELETE IT
3030 PRINT"KEY:";TAB(40)KEY$
3040 PRINT"DATA:";TAB(40)DT$
3050 PRINT"DELETE (Y/N)? ";:ZF=1:GOSUB5
00:PRINT:IF IN$="N" THEN RETURN
3055 REM          ONLY IF "Y" IS ANSWERED
 WILL THE RECORD BE DELETED
3060 IF IN$<>"Y" THEN 3050
3065 REM          GET THE FATHER OF THE I
TEM WE WANT TO DELETE,
3066 REM          SEE IF WE'RE DELETING T
HE LEFT OR RIGHT CHILD
3067 REM          THE SET THE CORRECT POI
NTER TO POINT TO THE LEFT SUB-TREE
3068 REM          OF THE DELETED ITEM
3070 GET1,LL:IF CL=CVI(LP$) THEN LSETLP
$=MKI$(LP) ELSE LSETRP$=MKI$(LP)
3075 REM          IF THERE'S NO RIGHT POI
NTER, THEN SIMPLY SAVE THE DELETED
3076 REM          LOCATION ON THE STACK
3080 PUT1,LL:XL=CL:CL=LP:IF RP=0 THEN 3
200
```


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```
3085 REM          IF THE DELETED ITEM HAD
 A RIGHT SUB-TREE, THEN WE'VE GOT TO
3086 REM          MOVE IT UP TO THE CORRE
CT PLACE WHICH WILL BE DOWN THE RIGHT
3087 REM          SUB-TREE OF THE LEFT-SU
B-TREE OF THE DELETED ITEM
3088 REM          TRY THIS ONE BY HAND TO
 SEE HOW IT WORKS
3090 GET1,CL:IF CVI(RP$)=0 THEN LSET RP$
=MKI$(RP):PUT1,CL:GOTO3200
3095 REM          MOVE DOWN THE RIGHT SUB
-TREE
3100 CL=CVI(RP$):GOTO3090
3200 REM  PUSH OPEN SPACE ON STACK
3210 GET1,1:SP=CVI(STK$(1))
3215 REM          ARBITRARILY IGNORE MORE
 THAN 30 DELETED ITEMS
3220 IF SP>=30 THEN PRINT"STACK FULL":R
ETURN
3225 REM          STACK THE DELETED RECOR
D NUMBER
3230 SP=SP+1:LSETSTK$(SP)=MKI$(XL):LSET
STK$(1)=MKI$(SP)
3240 PUT1,1:RETURN
```

```
4000 REM - - - - - - - - - - PRINT LIST -
 - - - - - - - - - - - - - - - - - - -
4005 REM          LOOK FOR LEGAL COMMANDS
 FULL OR ORDERED
4010 IF LW$="FULL" THEN 4100
4020 IF LW$="ORDERED" THEN 4200
4030 PRINT"COMMAND ERROR - TRY HELP":RE
TURN
4100 REM - - - - - - - - - - PRINT ITEM
S - - - - - - - - - - - - - - - - - -
4105 REM          FULL OPTION TO PRINT, C
HECK TO MAKE SURE THERE IS
4106 REM          OTHERWISE PRINT THE HEA
DING
4110 IF LOF(1)<=2 THEN RETURN ELSE PRIN
T"      KEY","LEFT PTR","RIGHT PTR","DAT
A"
4115 REM          LOOP OVER ALL AVAILABLE
 RECORDS
4120 FOR I=3 TO LOF(1)
4125 REM          GET EACH RECORD AND PRI
NT IT'S NUMBER
4130     GET1,I:PRINTUSING"###: ";I;
4135 REM          PRINT ALL THE DATA, KEY
, LEFT POINTER, RIGHT POINTER, AND
```


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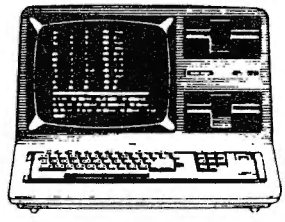

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```
4136 REM          DATA, ONLY PRINT THE FI
RST PART OF KEY AND DATA
4140     PRINT MID$(KEY$,1,10),CVI(LP$),
CVI(RP$),MID$(DT$,1,10)
4150     NEXT I
4160 RETURN
4200 REM - - - - - - - - - PRINT ITEMS IN
 KEY ORDER - - - - - - - - - - - - - -
4205 REM          THIS IS A SORTED ORDER
PRINT WHICH COMES FROM RECURSIVELY
4206 REM          FOLLOWING THE TREE DOWN
 AND THEN BACK UP AS DISCUSSED
4207 REM          IN THE ARTICLE ON RECUR
SIVE PROCEDURES, THIS ONE HAS BEEN
4208 REM          ADAPTED TO CONVERT THE
RECURSIVE CALLS INTO SIMPLE GOTO'S
4209 REM          MAKING IT TECHNICALLY N
OT RECURSIVE ANYMORE
4210 SP=0:CL=2:PRINT"      KEY",,"DATA"
4215 REM          GET THE CURRENT RECORD
AND IT'S POINTERS
4220 GET1,CL:LP=CVI(LP$):RP=CVI(RP$)
4225 REM          IF THE TREE IS EMPTY, W
E'RE DONE
4230 IF CL=2 AND LP=0 THEN RETURN
4235 REM          IF WE'RE AT THE HEAD RE
CORD, FIND THE ROOT
4240 IF CL=2 THEN CL=LP:GOTO4220
4245 REM          IF THE LEFT POINTER ISN
'T ZERO, STACK THE CURRENT RECORD
4246 REM          AND GO BACK FOR THE LEF
T SUB-TREE
4250 IF LP<>0 THEN SP=SP+1:STK(SP)=CL:C
L=LP:GOTO4220
4255 REM          WHEN WE FINALLY GET A Z
ERO LEFT POINTER, PRINT THE DATA
4256 REM          RECORD WE'RE CURRENTLY
LOOKING AT
4260 PRINTUSING"###: ";CL;
4270 PRINTKEY$,DT$
4275 REM          IF THE RIGHT POINTER IS
N'T ZERO, THEN STACK THE CURRENT
4276 REM          RECORD NUMBER (NEGATIVE
 SO WE KNOW WE'RE DOING IT FOR A
4277 REM          RIGHT SUB-TREE TRAVERSA
L) AND THEN GO BACK AND GET THE
4278 REM          RIGHT SUB-TREE
4280 IF RP<>0 THEN SP=SP+1:STK(SP)=-CL:
CL=RP:GOTO4220
```

```
4285 REM          WHEN THE RIGHT SUB-TREE
 IS DONE, THEN WE'RE DONE IF THERE IS
4286 REM          NOTHING LEFT ON THE STA
CK.
4290 IF SP=0 THEN RETURN
4295 REM          OTHERWISE, GET THE TOP
FROM THE STACK, IF IT'S FROM A LEFT
4296 REM          TRAVERSAL THEN WE GET T
HE NEW CURRENT RECORD AND PRINT IT
4300 SP=SP-1:CL=ABS(STK(SP+1))
4310 IF STK(SP+1)>0 THEN GET1,CL:LP=CVI
(LP$):RP=CVI(RP$):GOTO4260
4315 REM          OTHERWISE UNSTACK ANOTH
ER ITEM
4320 GOTO4290
5000 REM - - - - - - - - - - HELP - - - - -
 - - - - - - - - - - - - - - - - - - - - -

5010 PRINT:PRINTTAB(10)"COMMANDS"
5020 PRINTTAB(15)"ADD <KEY>";TAB(40)"AD
D AN ITEM"
5030 PRINTTAB(15)"EDIT <KEY>";TAB(40)"E
DIT AN ITEM"
5040 PRINTTAB(15)"DELETE <KEY>";TAB(40)
"DELETE AN ITEM"
5050 PRINTTAB(15)"PRINT FULL";TAB(40)"P
RINT FULL FILE INFORMATION"
5055 PRINTTAB(15)"PRINT ORDERED";TAB(40
)"PRINT KEY ORDERED LIST"
5060 PRINTTAB(15)"HELP";TAB(40)"PRINT T
HIS LIST"
5070 PRINTTAB(15)"END";TAB(40)"END OF P
ROGRAM"
5080 PRINT:PRINT
5090 RETURN
```

Listing 2

```
10 REM ********************************
20 REM
30 REM  TOWERS OF HANOI
40 REM  DEMO OF RECURSION IN BASIC
50 REM  TERRY R. DETTMANN
60 REM
70 REM  VERSION 1.0  05/01/82
80 REM
90 REM ********************************
100 CLEAR1000:DEFINTA-Z
110 MX=25:DIM STK(25,4),TWR(10,3),TP(3)
,LB$(4)
120 SP=0:BL$=STRING$(20," ")
```


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```
130 FORI=1TO4:READLB$(I):NEXTI
140 DATA N,FROM,TO,TEMP
150 DEF FNDSK$(N)=STRING$(10-N,32)+STRI
NG$(N,153)+CHR$(155)+STRING$(N,153)
160 DEF FNNDSK$(N)=STRING$(10,32)+CHR$(
155)+STRING$(10,32)
200 REM - - - - - - - - - COMMANDS - -
- - - - - - - - - - - - - - - - - -
210 CLS:PRINT"TOWERS OF HANOI":INPUT"HO
W MANY DISKS (1-10)";N:IF N>10 OR N<1 T
HEN 210
220 NUM=0:EX=2^N-1:FRM=1:TT=2:TMP=3:PRI
NTCHR$(2)
230 GOSUB900:GOSUB1200
240 GOSUB1000
250 PRINT@(23,0),;:INPUT"AGAIN (Y/N)";Y
N$:IF YN$="Y" THEN 200 ELSE IF YN$<>"N"
 THEN 250
260 END
900 REM - - - - - - - - - INITIALIZE N
TOWERS - - - - - - - - - - - - - - - -
910 FORI=1TON:TWR(I,1)=N-I+1:TWR(I,2)=0
:TWR(I,3)=0:NEXTI
915 IF N<10 THEN FORI=N+1TO10:FORJ=1TO3
:TWR(I,J)=0:NEXTJ:NEXTI
920 TP(1)=N:TP(2)=0:TP(3)=0
930 RETURN
1000 REM - - - - - - - - - - MOVE N TOWER
S - - - - - - - - - - - - - - - - - -
1010 IF N>1 THEN GOSUB2000:N=N-1:FRM=FR
M:T=TT:TT=TMP:TMP=T:GOSUB1000
1020 GOSUB1100:GOSUB1305
1030 IF N>1 THEN GOSUB2000:N=N-1:T=FRM:
FRM=TMP:TT=TT:TMP=T:GOSUB1000
1040 GOSUB2100
1050 RETURN
1100 REM - - - - - - - - - - MOVE ONE DIS
K - - - - - - - - - - - - - - - - - -
1110 T=TWR(TP(FRM),FRM):TWR(TP(FRM),FRM
)=0:TP(FRM)=TP(FRM)-1
1120 TP(TT)=TP(TT)+1:TWR(TP(TT),TT)=T
1125 NUM=NUM+1
1130 RETURN
1200 REM - - - - - - - - - PRINT TOWERS -
 - - - - - - - - - - - - - - - - - -
1210 FORJ=1TO3:CL=(J-1)*25
1220     PRINT@(10,CL),USING"TOWER ##";J
;
1230     FOR I = 10 TO 1 STEP -1:RW=10+1
0-I+1
```


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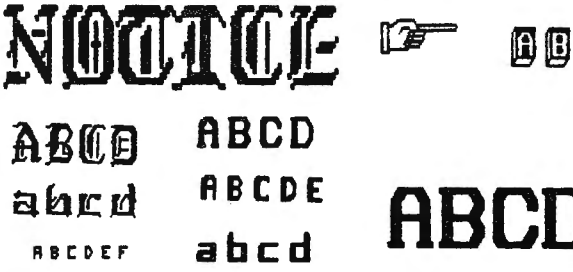
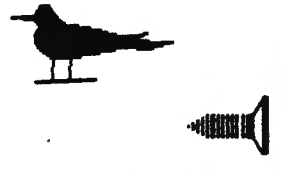


SAMPLES - High Res and Modified Characters



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Files

```
1240       IF TWR(I,J)=0 THEN PRINT@(RW
,CL),FN NDSK$(0); ELSE PRINT@(RW,CL),FN
DSK$(TWR(I,J));
1250     NEXTI
1260 NEXTJ
1270 RETURN
1305 REM - - - - BLANK FROM, ADD TO - -
 - - - - - - - - - - - - - - - - - - -
1310 RW=10+10-TP(FRM):CL=(FRM-1)*25
1320 PRINT@(RW,CL),FNNDSK$(0);
1330 RW=10+10-TP(TT)+1:CL=(TT-1)*25
1340 PRINT@(RW,CL),FNDSK$(TWR(TP(TT),TT
));
1350 RETURN
2000 REM - - - - - - - - - PUSH PARAMETER
S ON THE STACK - - - - - - - - - - -
2010 IF SP>=MX THEN PRINT"ERROR - STACK
 FULL":END
2020 SP=SP+1:STK(SP,1)=N:STK(SP,2)=FRM:
STK(SP,3)=TT:STK(SP,4)=TMP
2030 RETURN
2100 REM - - - - - - - - - POP PARAMETERS
 OFF THE STACK - - - - - - - - - - -
2110 IF SP<=0 THEN RETURN
2120 N=STK(SP,1):FRM=STK(SP,2):TT=STK(S
P,3):TMP=STK(SP,4)
2130 SP=SP-1:RETURN
```

■

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Tandy topics

Ed Juge, Director, Computer Merchandising
1500 One Tandy Center, Fort Worth, TX 76102

Last month (May) was a blur! I was buried in catalog work, travel, a conference in New York, N.C.C. in Houston, and a few other time-consumers. I am sorry Tandy Topics was missing from the August issue. It was my fault, and I'll try not to let it happen too often.

My travels provided my first chance at fairly serious (business use) programming on the new Pocket Computer PC-2. Wow! I'm impressed! If you haven't seen one, go look.

For those of you who have a PC-2, I have three bits of information. First, a command was inadvertently omitted from the owner's manual. When dimensioning string arrays, PC-2 has the capability to assign the exact number of storage locations required for the array. It was not explained. The form of the declaration is:

DIM name (size)*length

"Name" is a standard allowed array name. "Size" is the maximum number of array elements, from zero to 255. Remember, you'll get one more than specified. "Length" is an optional length of each string (1 to 80 characters), and defaults to 16 if not specified. DIM NA$ (12)*20, for example, creates an array named NA$, which can have subscripts from zero to 12 (thirteen elements in the array), and strings can be up to 20 characters long.

The second thing concerns commands specific to the printer. If you detach the PC-2 from the printer and list the program, you get a tilde ("squiggle" to those who didn't take high school Spanish) in place of all printer/plotter commands. Reason: They are contained in ROM in the printer, not the PC-2, so the PC-2 can't convert the compressed command back into the real command for listing. So don't do what I did the first time, and retype all those commands again . . . they *are* still there.

Third, there is a mandatory power-up procedure, when you've inserted batteries or pressed the LL RESET switch. It's simple:

1) Turn the PC-2 on. It should say NEW0:CHECK.
2) Press CLEAR.
3) Be sure you're in PROgram mode (Use MODE key).
4) Type NEW0 and press ENTER.
5) Press SHIFT MODE to go to RESERVE mode.
6) Type NEW and press ENTER.

This resets all pointers and readies the PC-2 for work. Why? Because on power-up, internal pointers need to be reset, or the PC-2 may think it has zero memory.

PC-2 is really an amazing computer — next best thing to carrying a Model III in your pocket! Of course, I've watched it being developed, reviewed hardware and language specifications, physical design — the whole thing, but actually working with one was a real pleasure. I hope you'll be as impressed with it as I was.

Hard Disk Owners

TRSDOS 4.1 (our new hard disk operating system which is compatible with slim-line or standard floppy drives) and its final hard disk owner's manual, are now available. If you have purchased a hard disk, and sent in your registration card from the temporary manual, you should now have yours. A letter went out to all owners of record.

Model 16 Multi-User System

It appears we've overestimated the number of hours in our engineers' days. I told you in July about the delay in Arcnet. Well, we're going to have to slip the Model 16 multi-user operating system around to the first quarter of 1983, too. Development teams are (and have been) working on both projects, but there weren't enough people available to hold the original expected dates. We apologize, and will attempt to keep you up to date.

New Radio Shack Catalog

The new 1983 Radio Shack catalog will be available in our stores during the first days of September. You'll find computers on the last 12 pages and the back cover. There are some major new hardware items and lots of new software listed. Be sure to pick one up at your nearest outlet.

In July, I told you Model III Super Scripsit would be out in June, and Profile III Plus in late July. An obscure bug or two in Scripsit took longer to find than expected, causing about a two-month slip. Profile III Plus was also delayed, but should be showing up about the time you read this. Murphy said it: "Anything that can go wrong, will!" See you next month. ■

Pie charts

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Jose Babilonia, Rio Piedras, Puerto Rico

The use of graphic aids in presentations and reports enhances the message to be delivered. The time that has to be invested in the production of these is often so high that people shy away from the task and use few (or no) graphics with the material documentation. For these reasons, throughout the history of computing, several pieces of hardware and software have been developed for relatively easy production of graphics with the help of computerized tools.

Video screens and slow printers may be effectively used for this task. The straightforward, initial applications one sees in this field are the graphs of single value functions (as in a series of characters on the printer paper) with, perhaps, coordinates drawn and coordinate marks and labels. Further on, one sees more full graphics with histograms and bar charts, very useful for examining and analyzing experimental frequency distributions. Finally, one sees circles.

There is a special case of the circle (with some additional stuff) that is very popular in presentations: the pie chart. The pie chart is another way to graphically represent a frequency distribution. One usually finds colored or shaded versions of these, and when there are not too many "pieces of pie," it really drives home strong statistics. A pie chart is a circle in which a number of lines project radially from the center. These lines divide the circle into segments. The area of each segment is proportional to the relative percent that piece of circle represents in the frequency distribution.

One could see this proportionality in a different way. In general, if one has a proportion p (where $0 < p < 1$) of the circle to represent, the angle formed by the two straight line segments is $360 \times p$ degrees.

Difficulties in Drawing Lines

The main difficulty in drawing any line is distortion. Probably all of us have sent the image we had on the screen to the printer—maybe a graphic image that really impressed us. That's why we wanted a hard copy in the first place. If the image we have on the screen is a circle, it comes out on the printer as a very flat ellipse! This phenomenon happens, not only with curvilinear figures such as circles, parabolas, ellipses and hyperbolae; but also with straight lines. With lines, we don't notice too much distortion. If you make a 45-degree line on the screen and output to the printer, it still looks straight, yet it is no longer a 45-degree line.

What we wish to do is to transform a graphic pattern without distorting it. Think of a straight line equation, multiply everything by the same factor and maybe add a constant to everything. If you are familiar with algebra, you know this is called a linear transformation.

We want to make a linear transformation on the circle so that it looks like a circle, no matter which computer medium was used.

With the line, there are milder problems that have to be solved. A linear transformation on the equation of a straight line will retain the same slope it started with. A second problem is that, once we have figured out where our circle is to be, we must make sure that the line passes exactly through its center. A third problem is that we don't want to draw the whole line, but only a piece of it—one that connects the center of the circle with the correct point on the periphery of the circle.

Algebra and Trigonometry

In Figure 1, lx is the horizontal axis (marked out in inches), ly is the vertical axis (also marked out in inches), and r is the radius of the circle (in inches). The equation for a circle of radius r, with center a inches from the ly axis and b inches from the lx axis is, using TRS-80 BASIC notation:

(1) $\quad (lx-a)\uparrow 2 + (ly-b)\uparrow 2 = r\uparrow 2$

Unfortunately, the units of measurement available to us on the printer are not inches but specific points on the line, separated at regular intervals. The lines are spaced at specific regular intervals. On an Okidata Microline-80, one can print characters on the line at densities of 5, 10 or 16.5 characters per inch; and print these lines at densities of 6 or 8 lines per inch. Given the printing parameters, we would like our circle to come out as a circle every time.

Let's call xf the horizontal printing density and yf the vertical printing density. If nry are the number of vertical lines that correspond to r inches, nx the number of horizontal points that correspond to lx inches, ny the number of lines that correspond to ly inches, nax the number of horizontal points that correspond to a inches, and nby to the number of lines that correspond to inches, the following relations are straightforward:

(2) $\quad lx * xf = nx \qquad ly * yf = ny$

$\quad a * xf = nax \qquad b * yf = nby$

$\quad r * yf = nry$

The equation for the circle (1) can be expressed (instead of in inches) in our available units by using the simple relations above (2).

(3) $\quad ((nx-nax)/xf)\uparrow 2 + ((ny-nby)/yf)\uparrow 2 = (nry/yf)\uparrow 2$

With simple algebraic manipulations, we can solve for nx and get:

(4) $\quad nx = xf * (a \pm SQR(r\uparrow 2 - (ny/yf-b)\uparrow 2))$

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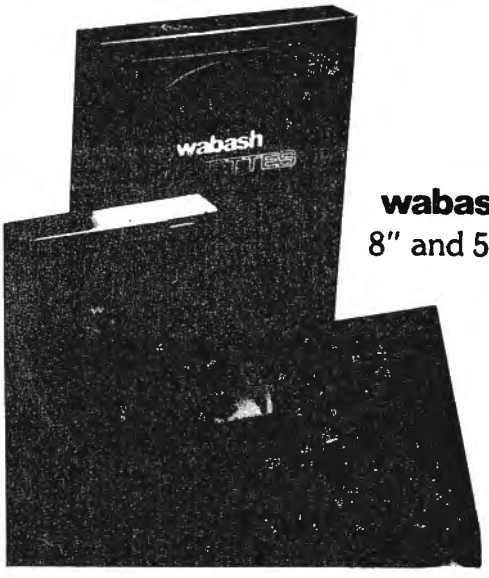

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where we changed back to a and r, since that is what the user will enter in inches. No matter how we set up the printer, this equation gives the linear transformation of the original so that its form and internal proportions are preserved.

The straight line equation and its treatment are very similar. Using the same notation and looking at Figure 2, the equation of a line that passes through point (a,b), with slope beta, is:

(5) $(ly - b) = beta * (lx - a)$

Solving for lx:

(6) $lx = a + (ly - b)/beta$

Using the equations relating lx to nx, and ly to ny (2), the equation is transformed to:

(7) $nx/xf = a + (ny/yf - b)/beta$

Since beta is the slope, we can substitute TAN(theta), where theta is the angle between the horizontal axis and the straight line. Making that substitution and solving for nx, the equation for the line becomes:

(8) $nx = xf * (a + (ny/yf - b)/TAN(theta))$

This equation is also free of the first two problems that were discussed previously in relation to the line.

The reason we are solving for x (or for nx), is that in the program, the independent variable is ly (or ny). These two equations, (4) for nx (circle), and (8) for nx (line), are the ones that are to be used in the program.

The Product of the Program

After all of the conversational song-and-dance where the user provides information, the program displays a segmented circle or pie chart. After striking any key, the program produces a new screen with two lines of a descriptive title and data corresponding to the segments the user supplied.

On the printer, the program gives the user a chance to align the page and prints the two lines of user-supplied title. This is followed by the pie chart drawn with a user-specified keyboard character, and by user-supplied labels and percentages of each segment of the pie.

The user must supply printer parameters: size and position of the circle, number and proportion of each segment or pie piece, heading labels, and segment labels. The information to be entered is as follows:

—Description or title of the pie chart.

—Number of segments.

—Description or label of each of the segments.

—Video or printer output.

—Position of the center of the circle relative to the left and top edges of the screen or paper. For the printer, the answers must be in inches. For the screen, there are special instructions. If a part of the circle, or one of the radial lines, does not fall within the physical boundaries, there is no problem. You will see only the part of the figure that can be drawn.

—Enter the proportion, or fraction of the pie, that a segment is to cover. The last segment is computed automatically. Each of the quantities must be larger than zero and less than one. The algorithm checks whether the sum of fractions is less than one.

—Select the character to be used by the printer. Screen graphics are drawn with SET(x,y).

—Physical parameters for the printer: horizontal

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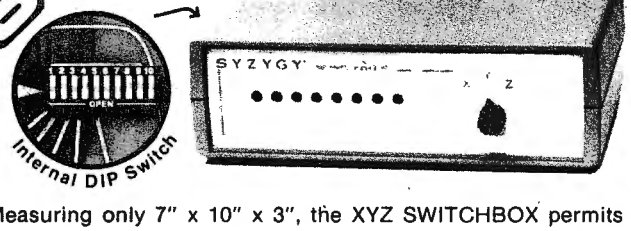

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printing density and vertical printing density.

Program Comments

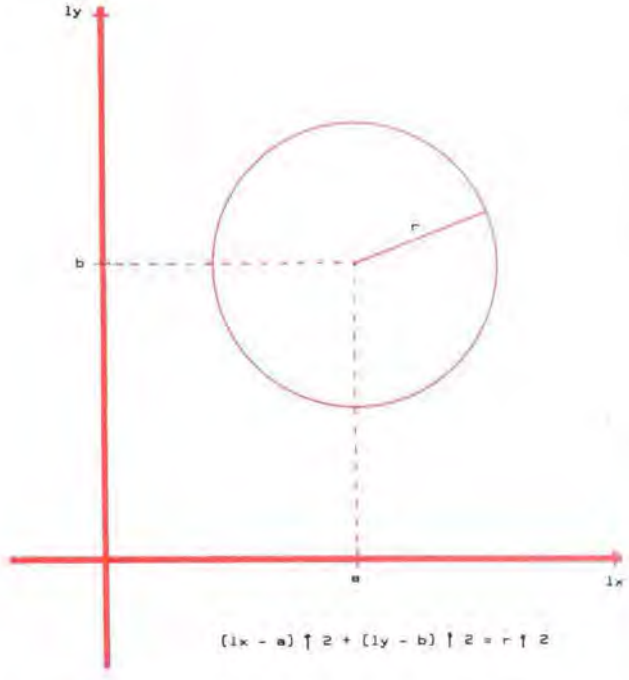
The program is essentially equations (4) and (8). The rest of the program is the necessary supporting cast. Only those portions of the program that require an explanation are discussed here.

Line Specs— Each of the lines to be used as a pie segment is described by its slope, and therefore by its angle. For the screen, this is determined in lines 720 to 820, and in lines 2150 to 2250 for the printer. The variable used for the angle of line I is AN(I).

Circle Loop— The loop for drawing a circle consists of lines 840 to 1100 (video), and lines 1340 to 1620 (printer).

Hidden Lines— Controls have been built in so that only the portion of the figure that falls within the limits of the computing medium is drawn. If a user is careless enough, no pie chart will appear. These controls may be observed in the transfers to the NEXT Y command in line 1100 (screen) and line 1620 (printer).

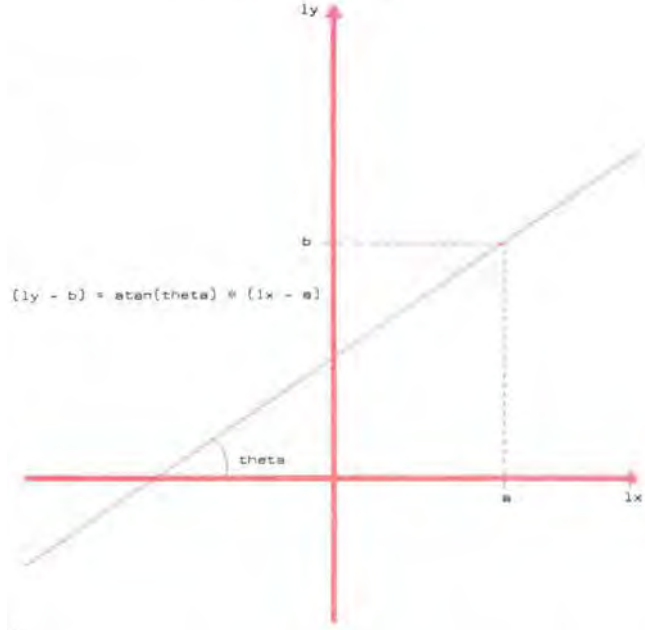
Figure 1
Equation and graphic representation of a circle.



Formulas— The formula for the circle (4) is on lines 1400 and 1410 for the printer. The formula for the line appears on line 1520. For the screen, the formulas are a bit different. The one for the circle is on lines 890 and 900, and for the line on lines 1010 and 1060.

Straight Lines— The loop to draw the points on lines that fall within the circle and on the horizontal slice is between lines 930 and 1080 (screen) and between 1430 and 1590 (printer). Vertical lines are treated as special cases.

Figure 2
Equation and graphic representation of a straight line.



Boundaries of Straight Lines— To draw only a piece of the line, the left and right halves of the circle are treated separately and it is determined whether the point falls within the boundary (center vertical line and circle periphery). In the program, this vertical line is

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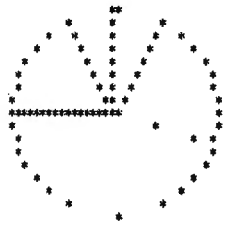
Figure 3
Sample printer output of the program.

Test for Hardcopy Output of a Pie Chart
Grade Distribution on Test Number 3



```
Segment numbering: starting from 12 noon, clockwise

( 1) Proportion of A's                    8.00 %
( 2) Proportion of B's                   22.00 %
( 3) Proportion of C's                   45.00 %
( 4) Proportion of D's                   17.00 %
( 5) Proportion of F's                    8.00 %
```

determined by A% (screen) and A (printer). These decisions are made in lines 990 to 1020 and 1040 to 1070 (screen), and 1500 to 1530 and 1550 to 1580 (printer).

Zero— The twelve noon radial line is the arbitrary zero, or starting point, to draw the rest of the radial lines. Each point on this line is drawn in lines 1090 (screen) and 1580 (printer).

This program solves the problems associated with distortion of graphics in a media where horizontal and vertical scales are different, and vary from run to run. These problems are classic with the printer—horizontal and vertical printing densities may be set to different values in each run.

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Program Listing for Pie Charts

```
100 '  MACHINE DEPENDENT FEATURES
110 '
120 'This program was developed to run
on a Model III TRS-80
130 'operating under TRSDOS 1.2, and us
ing an Okidata
140 'Microline 80 printer for the hardc
opy output.  The use of
150 'Disk BASIC implies only one set of
 changes for non disk
160 'BASIC: the use of the MID$ functio
n on the left hand side
170 'of the equal sign.  This is easily
 resolved for these
180 'systems by making the following ch
anges:
190 '
200 '   Change statements of the form
210 '
220 '           MID$(W$,M,N)=U$
230 '
240 '   to the form
250 '
260 '           W$=LEFT$(W$,M-1)+U$+RIG
HT$(W$,LEN(W$)-M-N+1)
270 '
280 'The statements that are specific t
o the printer are the
290 'LPRINT statements that output cont
rol characters.  To make
300 'the necessary changes just change
the statements
310 '
320 'Horizontal density:
330 '           LPRINT CHR$(30) : 10
char/in
340 '           LPRINT CHR$(31) :  5
char/in
350 '           LPRINT CHR$(29) : 16.5
char/in
360 'and vertical density:
370 '           LPRINT CHR$(27);CHR$(54
) : 6 lines/in
380 '           LPRINT CHR$(27);CHR$(56
) : 8 lines/in
390 '
400 'to the corresponding statements fo
r a particular printer.
```

```
410 '
420 DEFINT I-N, X, Y
430 DIM AN(20), PR(20), DE$(21)
440 CLEAR 2000
450 PI=3.1415926
460 CLS: PRINT TAB(23) "Pie chart graph
ics"
470 GOSUB 2330 'Get descriptions
480 CLS
490 PRINT "Output to the (1)screen, (2)
printer.  (3)Finish."
500 K$=INKEY$: IF K$="" THEN 500  ELSE
K=VAL(K$)
510 IF K<1 OR K>3 THEN 500
520 IF K=2 THEN 1260
530 IF K=3 THEN CLS: END
540 '
550 ' ***** Output to the video *****
560 '
570 CLS
580 PRINT "Measurements will be in pixe
l units:  The screen measures"
590 PRINT "48 units vertically (Y units
) and 128 units horizontally"
600 PRINT "(X units).  If the specified
 units are too large, only the"
610 PRINT "piece of the pie that passes
 over the screen will be visible."
620 C0=2.1
630 PRINT
640 INPUT "Pie radius in Y units: "; R%
650 PRINT
660 INPUT "X units from left margin to
pie center: "; A%
690 PRINT
700 INPUT "Y units from top margin to p
ie center: "; B%
710 AP=0
720 FOR I=1 TO NP
730 PRINT: PRINT "Fraction of piece"; I
;: INPUT " of pie: "; PR(I)
740 IF PR(I)>=1 OR PR(I)<=0 THEN GOTO 7
30
750 AP=AP+PR(I)
760 IF AP>1 THEN AP=AP-PR(I): PRINT "Su
m of fractions greater than 1": GOTO 73
0
770 PR(I)=AP
```


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```
780 IF PR(I)=.5 THEN AN(I)=-PI/2: GOTO
820
790 IF PR(I)=.75 THEN AN(I)=PI: GOTO 82
0
800 AN(I)=ATN(TAN(PR(I)*2*PI-PI/2))
810 IF PR(I)>.5 AND PR(I)<1 THEN AN(I)=
-AN(I)
820 NEXT I
830 CLS
840 FOR Y=FIX(B%-R%+.5) TO FIX(B%+R%+.5
)
850 IF Y<0 OR Y>47 THEN GOTO 1100
860 SQ=R%*R%-(Y-B%)[2
870 IF SQ<-.1 THEN GOTO 1100
880 SQ=SQR(ABS(SQ))
890 XL=FIX(A%-C0*SQ+.5)
900 XR=FIX(A%+C0*SQ+.5)
910 IF XL >=0 AND XL<128 THEN SET(XL,Y)
920 IF XR >=0 AND XR<128 THEN SET(XR,Y)
930 FOR I=1 TO NP
940 IF ABS(AN(I))<>PI/2 THEN GOTO 980
950 IF SGN(AN(I))>0 THEN GOTO 1080
960 IF Y>B% AND A%>=0 AND A%<128 THEN S
ET(A%,Y): GOTO 1080
970 GOTO 1080
```


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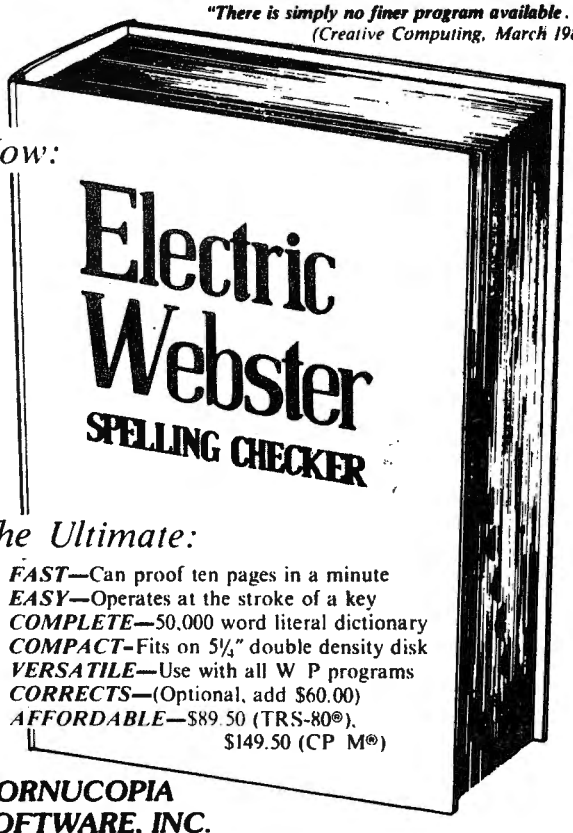

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```
980 IF PR(I)<.5 THEN GOTO 1040
990 IF ABS(TAN(AN(I)))<=.001 AND Y=FIX(
B%+.5) THEN FOR X=A% TO XL STEP -1: IF
X<0 OR X>127 THEN NEXT X: GOTO 1100 ELS
E SET(X,Y): NEXT X: GOTO 1080
1000 IF ABS(TAN(AN(I)))<=.001 THEN GOTO
 1080
1010 X=FIX(A%+C0*(Y-B%)/TAN(-AN(I))+.5)
1020 IF X>XL AND X<A% AND X>=0 AND X<12
8 THEN SET(X,Y)
1030 GOTO 1080
1040 IF ABS(TAN(AN(I)))<=.001 AND Y=FIX
(B%+.5) THEN FOR X=A% TO XR: IF X<0 OR
X>127 THEN NEXT X: GOTO 1080 ELSE SET(X
,Y): NEXT X: GOTO 1080
1050 IF ABS(TAN(AN(I)))<=.001 THEN 1080
1060 X=FIX(A%+C0*(Y-B%)/TAN(AN(I))+.5)
1070 IF X<XR AND X>A% AND X>=0 AND X<12
8 THEN SET(X,Y)
1080 NEXT I
1090 IF Y<=B% AND A%>=0 AND A%<128 THEN
 SET(A%,Y)
1100 NEXT Y
1110 K$=INKEY$: IF K$="" THEN 1110
1112 '
1113 ' ***** Output labels to the scree
n *****
1114 '
1120 CLS: I1=1
1130 FO$="!##! %
                              % ###.## !"
1140 PRINT T1$: PRINT T2$: PRINT
1150 IF NP+1<=12 THEN I2=NP+1
1160 FOR I=I1 TO I2
1170 IF I=1 THEN PC=PR(1)
1180 IF I=NP+1 THEN PC=1-PR(NP)
1190 IF I>1 AND I<=NP THEN PC=PR(I)-PR(
I-1)
1200 PRINT USING FO$; "(";I;")";DE$(I);
PC*100;"%"
1210 NEXT I
1220 K$=INKEY$: IF K$="" THEN 1220
1230 IF I2<>NP+1 THEN I1=I2+1: I2=NP+1:
 GOTO 1160
1240 GOTO 480
1250 REM
1260 REM ***** Output to printer *****
1270 REM
1280 PRINT: LINE INPUT "Character to dr
aw pie with: "; C$
1290 C$=LEFT$(C$,1)
1300 GOSUB 1750 'Printer alignment
1310 LPRINT T1$: LPRINT T2$: LPRINT: LP
RINT
1320 GOSUB 1880 'Get printer parameters
1330 KB=FIX(XF*A+.5)
```

```
1340 FOR Y=FIX(YF*(B-R)+.5) TO FIX(YF*(
B+R)+.5)
1350 IF NM>FIX(1+XF*(A+R)+.5) THEN NM=F
IX(1+XF*(A+R)+.5)
1360 PL$=STRING$(NM,32)
1370 SQ=R*R-(Y/YF-B)[2
1380 IF SQ<-.1 THEN GOTO 1620
1390 SQ=SQR(ABS(SQ))
1400 XL=FIX(1+XF*(A-SQ)+.5)
1410 XR=FIX(1+XF*(A+SQ)+.5)
1420 IF XL>=1 AND XL<NM+1 THEN MID$(PL$
,XL,1)=C$
1430 FOR I=1 TO NP
1440 IF Y<=YF*B THEN MID$(PL$,KB,1)=C$
1450 IF ABS(AN(I))<>PI/2 THEN GOTO 1490

1460 IF SGN(AN(I))>0 THEN GOTO 1590
1470 IF Y>YF*B THEN MID$(PL$,KB,1)=C$:
GOTO 1590
1480 GOTO 1590
1490 IF PR(I)<.5 THEN GOTO 1550
1500 IF ABS(TAN(AN(I)))<=.001 AND Y=FIX
(YF*B+.5) THEN FOR X=XL TO KB: IF X<1 O
R X>NM THEN NEXT X: GOTO 1590 ELSE MID$
(PL$,X,1)=C$: NEXT X: GOTO 1590
1510 IF ABS(TAN(AN(I)))<=.001 THEN GOTO
 1590
1520 X=FIX(1+XF*(A+(Y/YF-B)/TAN(-AN(I))
)+.5)
1530 IF X>XL AND X<KB AND X>=1 AND X<NM
+1 THEN MID$(PL$,X,1)=C$
1540 GOTO 1590
1550 IF ABS(TAN(AN(I)))<=.001 AND Y=FIX
(YF*B+.5) THEN FOR X=KB TO XR: IF X<1 O
R X>NM THEN NEXT X: GOTO 1590 ELSE MID$
(PL$,X,1)=C$: NEXT X: GOTO 1590

1560 IF ABS(TAN(AN(I)))<=.001 THEN 1590

1570 X=FIX(1+XF*(A+(Y/YF-B)/TAN(AN(I)))
+.5)
1580 IF X<XR AND X>KB AND X>=1 AND X<NM
+1 THEN MID$(PL$,X,1)=C$
1590 NEXT I
1600 IF XR>=1 AND XR<NM+1 THEN MID$(PL$
,XR,1)=C$
1610 LPRINT PL$
1620 NEXT Y
1630 LPRINT CHR$(30): LPRINT CHR$(27);C
HR$(54)
```


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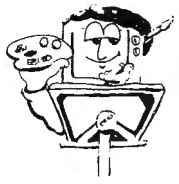
Color Computer News



Are you tired of searching the latest magazine for articles about your new Color Computer? When was the last time you saw a great sounding program listing only to discover that it's for the Model I and it's too complex to translate? Do you feel that you are all alone in a sea of Z-80's? On finding on ad for a Color Computer program did you mail your hard earned cash only to receive a turkey because the magazine the ad appeared in doesn't review Color Computer Software? If you have any of these symptoms you're suffering from Color Computer Blues!

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```
1631 '
1632 ' ***** Output of labels to the pr
inter *****
1633 '
1640 FO$="!##! %
                        % ###.## !"
1650 LPRINT: LPRINT
1660 LPRINT "Segment numbering: startin
g from 12 noon, clockwise": LPRINT
1670 FOR I=1 TO NP+1
1680 IF I=1 THEN PC=PR(1)
1690 IF I=NP+1 THEN PC=1-PR(NP)
1700 IF I>1 AND I<=NP THEN PC=PR(I)-PR(
I-1)
1710 LPRINT USING FO$; "(";I;")";DE$(I)
;PC*100;"%"
1720 NEXT I
1730 GOSUB 1750 : GOTO 480
1740 REM
1750 REM ***** Printer alignment *****
1760 REM
1770 PRINT
1780 PRINT "Want to align printer (Y/N)
: ";
1790 K$=INKEY$: IF K$="" THEN 1790
1800 IF K$="N" THEN RETURN
1810 IF K$<>"Y" THEN 1790
1820 PRINT
1830 PRINT: PRINT "Make sure the printe
r is turned on, then hit <ENTER>"
1840 K$=INKEY$: IF K$="" THEN 1840
1850 PRINT: PRINT "To stop paper moveme
nt, hit any key."
1860 K$=INKEY$: IF K$<>"" THEN RETURN E
LSE LPRINT: GOTO 1860
1870 REM
1880 REM ***** Get printer parameters *
****
1890 REM
1900 CLS
1910 PRINT "Horizontal linear density -
 in characers per inch"
1920 PRINT "      (1) 10 Characters/inch
 - normal"
1930 PRINT "      (2)  5 Characters/inch
 - big"
1940 PRINT "      (3) 16.5 Characters/in
ch - tiny"
1950 K$=INKEY$: IF K$="" THEN 1950
1960 K=VAL(K$)
1970 IF K<1 OR K>3 THEN 1950
1980 IF K=1 THEN XF=10 ELSE IF K=2 THEN
 XF=5 ELSE XF=16.5
1990 IF K=1 THEN LPRINT CHR$(30): NM=71
2000 IF K=2 THEN LPRINT CHR$(31): NM=36
2010 IF K=3 THEN LPRINT CHR$(29): NM=13
2: GOSUB 2270
2020 PRINT
2030 PRINT "Vertical linear density - i
n characters per inch"
2040 PRINT "      (1) 6 Lines/inch - nor
mal"
2050 PRINT "      (2) 8 Lines/inch - com
pact"
2060 K$=INKEY$: IF K$="" THEN 2060 ELSE
 K=VAL(K$)
2070 IF K<1 OR K>2 THEN 2060
2080 IF K=1 THEN YF=6 ELSE YF=8
2090 IF K=1 THEN LPRINT CHR$(27);CHR$(5
4)
2100 IF K=2 THEN LPRINT CHR$(27);CHR$(5
6)
2110 PRINT: INPUT "Circle radius, in in
ches: "; R
2120 PRINT: INPUT "Inches from the left
 margin to the pie center: "; A
2130 PRINT: INPUT "Inches from the top
margin to the pie center: "; B
2140 AP=0
2150 FOR I=1 TO NP
2160 PRINT: PRINT "Fraction of piece";
I;: INPUT "of pie: "; PR(I)
2170 IF PR(I)>=1 OR PR(I)<=0 THEN GOTO
2160
```


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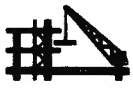

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```
2180 AP=AP+PR(I)
2190 IF AP>1 THEN AP=AP-PR(I): PRINT "S
um of fractions is greater than 1.": GO
TO 2160
2200 PR(I)=AP
2210 IF PR(I)=.5 THEN AN(I)=-PI/2: GOTO
 2250
2220 IF PR(I)=.75 THEN AN(I)=PI: GOTO 2
250
2230 AN(I)=PR(I)*2*PI-PI/2
2240 IF PR(I)>.5 AND PR(I)<1 THEN AN(I)
=-AN(I)
2250 NEXT I
2260 RETURN
2270 REM ***** Warning for use of tiny
characters *****
2280 PRINT
2290 PRINT "You should have executed 'F
ORMS (WIDTH=132)' while under"
2300 PRINT "TRSDOS if a large circle wi
th tiny characters is needed."
2310 PRINT: PRINT "Hit any key to conti
nue, or hit <BREAK>."
2320 K$=INKEY$: IF K$="" THEN 2320 ELSE
 RETURN
2330 REM
2340 REM *** Titles and segment descrip
tions ***
2350 REM
2360 PRINT: LINE INPUT "Line 1 of title
: "; T1$
2370 T1$=LEFT$(T1$,63)
2380 PRINT: LINE INPUT "Line 2 of title
: "; T2$
2390 T2$=LEFT$(T2$,63)
2400 PRINT: INPUT "Number of segments i
n pie (>1): "; NP
2410 IF NP<=1 THEN PRINT "Number must b
e greater than one": GOTO 2400
2420 NP=NP-1
2430 PRINT: PRINT "For each of the"; NP
+1; "segments of the pie enter a"
2440 PRINT "description or label (<48 c
haracters):": PRINT
2450 FOR I=1 TO NP+1
2460 PRINT "Segment"; I;: LINE INPUT DE
$(I)
2470 DE$(I)=LEFT$(DE$(I),47)
2480 NEXT I
2490 RETURN
```

■

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Captain 80

The adventures of a software secret agent

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This is the city. Peterborough, New Hampshire. There are three thousand occupants of this quaint little New England hamlet. Each one has a story. I live here, too. I'm a software reviewer.

It was Friday the seventh. I was working the day shift out of Arcade Division when a late breaking game came in. My assignment . . . review it. The boss is Mike Schmidt, my partner is a sentient expansion interface resident named Max. My name's Eighty.

By now we all know the success story behind Big Five Software. The boys who yanked this fine little company up by its bootstraps have been extolled in legend and on Good Morning America. Their rags-to-riches story is most inspiring for all the toilers in the vineyards of computerdom. But did they *earn* all this attention? You bet they did.

Each of the arcade games released under the Big Five label has unique entertainment qualities that offset any flaws, major or minor, that a critic might find. Even Robot Attack which I panned in a recent column has highly polished graphics and very passable sound.

This new Defense Command, (as seen on TV's Good Morning America), is *superb*! It combines several proven elements of arcadia into a super hybrid of laudable quality.

Picture this if you will. Momma Ship slides out onto the screen and disgorges assorted playing pieces, including you, the canisters you are protecting and some of the many creepy, floaty thingies that are your enemies. Shooting Momma Ship produces an unusual video tantrum. One usually does that once only.

Now that the playing field is arranged we have invaders, things floating down from the sky while you, brave defender, blast them into atoms. If the aggressors get past you they steal the little canisters. You can still shoot the invaders as they abscond with the goodies, but then you have to catch them as they fall, (for extra points, natch).

You have smart bombs. But there are pregnant aliens ala the Merv bombs in Missile command. Hit one of those and you'll *need* a smart bomb . . . or two . . . or three.

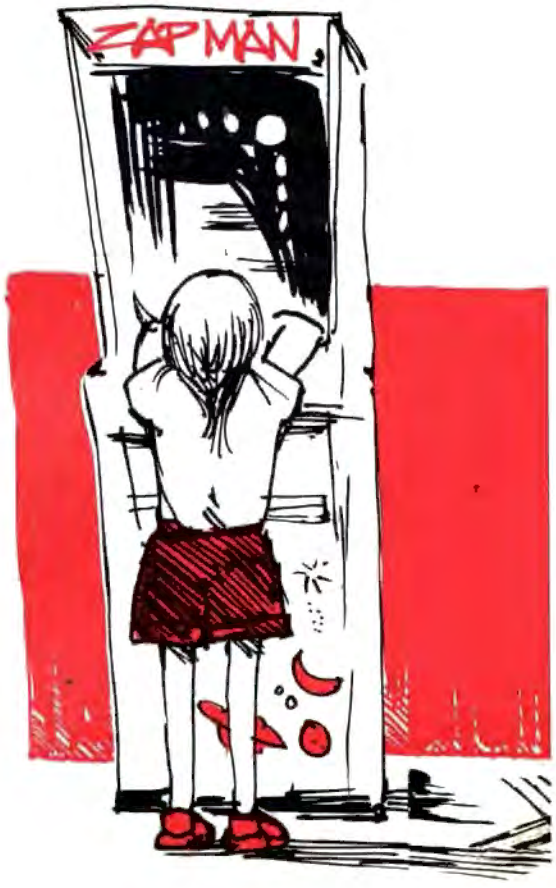
There are other surprises in Defense Command. But something that comes as no surprise is the utter excellence of the game. As an entertainer, as an arcade, as an outlet for hand-eye coordinationists, and as a dollar value Defense Command succeeds. In short, my money was well spent and I had a good time with the game. Big Five . . . keep up the good work.

As I stare out the window at Mt. Monadnock, which overlooks the house I live in, I am reminded of other success stories in this fledgling industry. It is possible to make it selling computer software but not as easy for beginners as it was.

Acorn, for example, which has many fine titles, and one of the best reputations in the industry, customer wise, started in the coal cellar of a Washington, D.C. townhouse. Its first program was an inauspicious little number called Ting Tong, which mimicked the earliest of classic video games.

Acorn has had many hits since Ting Tong. Its first version of Pinball was an exciting graphic exercise, and who can forget Duel-N-Droids, a Christopherson classic which paved the way for the new graphics era.

Even Instant Software, which constantly suffers from the Wayne Green shoot-in-foot syndrome, had humble beginnings. Long before the purchase of the huge motel they occupy, they were just a hole-in-the-wall, one of the many Wayne Green experiments that have gone up the flagpole over the years. Many top flight authors. Sparky Sarks,



(Starfighter from Adventure International) introduced the Solar Galactic Authority Navy in a still marketed program called Ball Turret Gunner. Jake Commander who wrote Macro-Mon, (The Shadow, from AOS) rated one of the top utility tools in 80 microdom, began with Instant Software as a submitee, with simple renumber and patch programs. Jake is now technical editor at *80 Microcomputing Magazine* and a respected authority on TRS-80 products and procedures.

Robert Krotts, of Dayton, Ohio, whose tounge-in-cheek Softcore Software Company pokes fun at the seriousness with which Adventure publishers market their work, has experienced modest success with Wet Tee-Shirt Contest and Madame Rosa's Massage Parlor, both of which aren't suitable for your 10 through 12-year-old. He'll never get rich, but then, he's not really trying to.

Al Loose, of Las Vegas, Nevada, producer of Forbidden Planet and Forbidden City, which are popular talking Adventures, is another new face experiencing success. His programs are worth their price and the public knows it.

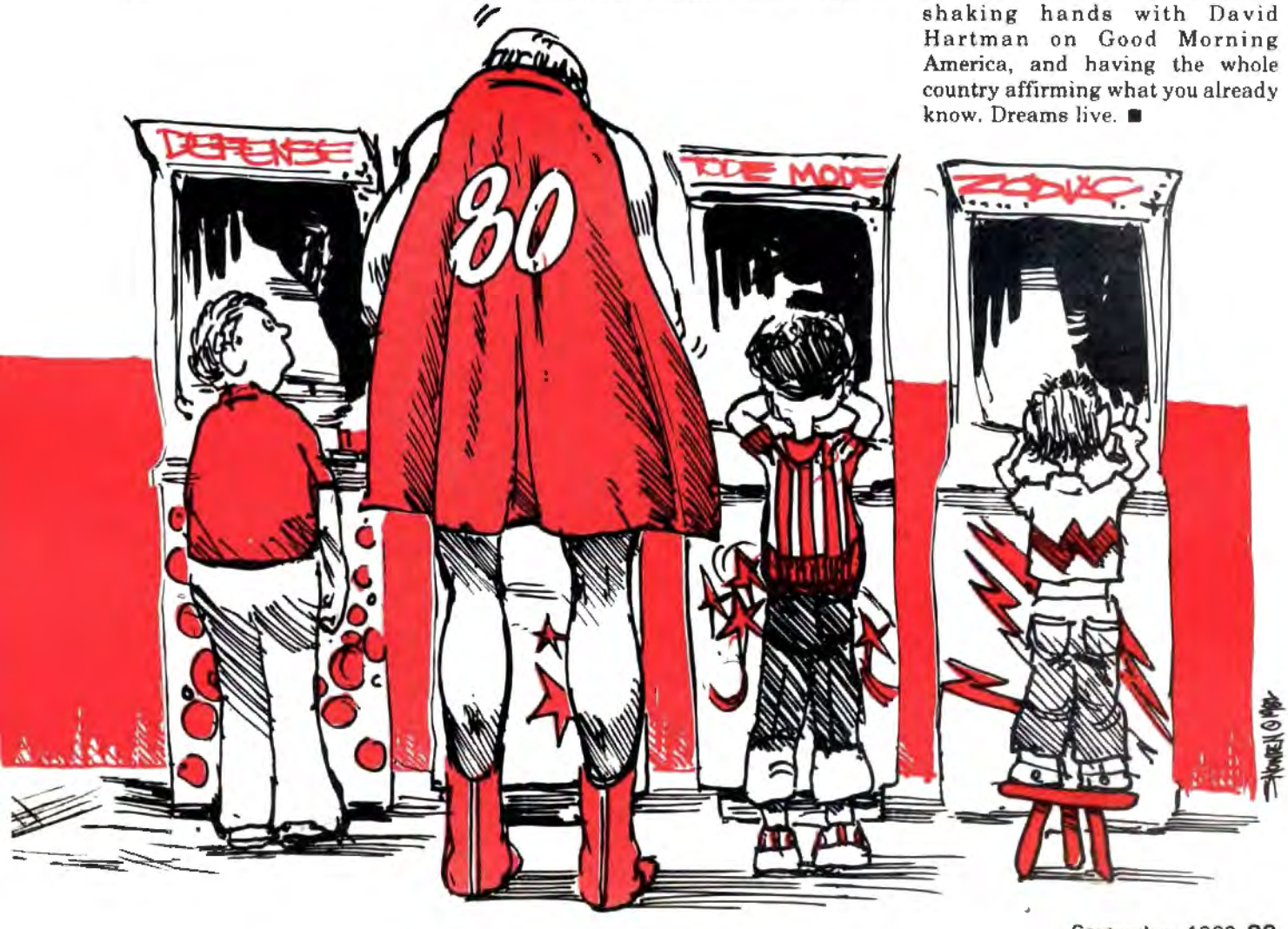
But for every success story there are shattered dreams. Mad Hatter Software died early on, taking Greg Hassett with them. Only Fasteroids, renamed Planetoids for Adventure International, survived. Adventure World, Greg's own attempt at marketing, failed. Computer Light and Sound, a southern California company which had two really top notch arcade games, never made it to the national marketplace. Even Programma International, which had everything you could ask for, marketing wise, bit the dust in a flurry of bankruptcy and broken promises.

What's the handle for that trip to the stars, then? How do some companies succeed where others fail? Advertising is one. Without national advertising over a period of months, a new company cannot hope to survive. And it is not direct sales response that floats the new company, it is dealer sales. The advertisements must be backed up by widespread distribution or the consumer will not buy.

You, the very reader who holds this issue of *80-U.S.* in his hands, may be the next dreamer whose hopes are dashed to bits, or the next fresh entrepreneur who feeds the burning consumer flame in its quest for new programs.

So it is with the voice of experience that I beseech you, *be careful* if you plan to market your program. *Know your publisher*, if he is your marketeer, or, if you are doing it yourself, *don't give credit* in any amount you can't afford to shrug away. Put your end user before yourself and give him more than what he pays for.

Do this, and one day you might be shaking hands with David Hartman on Good Morning America, and having the whole country affirming what you already know. Dreams live. ■



@ News

Spencer Hall, Associate editor

Hands Across the Sea

Answers to two letters from Europe will be of general interest to all persons overseas who are interested in the ESF. First to Bernhard von Tauchnitz of Berlin, Germany, let me apologize for what seems to have been an oversight at Exatron. Your letter dated last November, was in the collection I received from Jim Perry. There was a large green question mark on it. Exatron has an overseas software catalog. You should write to them direct at 181 Commercial Street, Sunnyvale, CA 94086. Also, you say there are errors in the German translation of the Operator's Manual. Because you have waited so long, I am personally sending you a copy of @LOAD Volume 0, Number 1, and my spare copy of the manual. I hope the bits don't get knocked off the wafer by stray radiation during the long journey.

A more recent letter to me, care of *80-U.S.*, comes from Derek Trayler in Hornchurch, Essex, England. They tell me at Exatron that they are not actively promoting the establishment of ESFOA chapters in foreign countries. Primarily because the discount on Exatron products which these groups receive cannot be offered to them. It appears that this would violate agreements with foreign distributors of Exatron products. Your question about the Video Genie will interest many, I'm sure. Can the ESF be used with it? The answer is yes and possibly no. Video Genie is a product of EACA International, Limited, of Hong Kong. It is distributed in the U.S. as the PMC . . . of which there are several models. Those models which contain a built-in cassette deck are virtual clones of the TRS-80 Model I. The ESF can be used with it if you can obtain the bus conversion accessory which converts the fifty-lead cable to the standard Model I forty-lead cable. PMC sells this in the U.S. Whether it is obtainable in England or not, I don't know.

Lore of the ESF

FMS (File Management System) has been Exatron's all time best selling program . . . and for good reason. Version 2 makes a good thing substantially better.

FMS is a Database Manager. It produces a user defined file of records which contain named fields, such as author, title, last name, first name, street address . . . anything the user designates, up to fourteen-string, integer or single-precision fields. These records can be sorted on any field, selected to include specified elements only, formatted in tabulations or as labels with confidential data not printed, etc., etc.

Unfortunately, for many of us, the complete set of programs will cost $80.00 versus a mere $19.95 for the old FMS. If you want this power, though, it's still a bargain compared to the equivalent software available on disk. At this writing, deliberations are underway concerning whether to sell some of the important modules separately for a fraction of the total cost.

The documentation of all six programs in the system is consistently excellent. Two of these programs are new ESF I/O routines, versions 4.1B and 4.1C, written especially for this package. These almost certainly will be available separately. They are, to say the least, remarkable. Features common to both are as follows. Recorded before the main FMS on your wafer, they end their load by starting LOAD of the next file. As shipped, the main FMS is recorded in AUTORUN mode which means that it runs as soon as it loads. Thus you @LOAD1 only. The I/O message appears, FMS loads automatically and starts. There's never a chance to forget the I/O routine! That's only the beginning.

With I/O 4.1B and 4.1C in place you can TAB all the way to 132 without any funny business to get past 64.

These routines also add two powerful words to BASIC. The @LINE command beats INPUT and many of the INKEY$ routines we have all written (*80-U.S.* has a

file full of manuscripts containing such input routines). It does what LINE INPUT in Level III and disk BASIC does, namely, accepts all punctuation including the delimiters (quote, semi-colon, comma). It is lightning fast and doesn't gobble string space like an INKEY$ routine. Many programs, including FMS, accept all input as strings, converting numerics via a VAL statement. With @LINE you can make this conversion before any string space is used! This avoids visits from the "garbage collector" to remove unneeded strings . . . which can cause horrendous slowdowns if a program uses large amounts of string space.

More spectacular is the @S command. When used with the proper array designators as operands, this calls an incredibly fast machine language routine to sort the array on the field designated. For me it sorted an eight-record file within a small fraction of a second. I was back in the menu so fast I thought the program contained a bug! Throw away your big treatises on the many kinds of BASIC sorts. Just use @S in your programs. Users will be glad to know that @PRINT does not leave 256-byte gaps on the wafer, and hence, makes much more efficient use of wafer capacity. Last, but by no means least, they verify the file and warn you if it was not successfully recorded.

Buy FMS 2 and you get super-power to use in your own programs. Don't, however, plan to market your own software using them. The author has not, in this release, placed his powerful code in the public domain.

Another reason for the hefty price tag is that the author has put remark statements in the BASIC code of the main program so that you can now see where each command is executed. This has two advantages. First, FMS 2 is much easier to customize, which is customary in all big ticket applications programs. Second, you can increase your programming skills by studying the many elegant touches with which FMS abounds.

Reason for two I/O routines is that there are two FMS programs. The "regular" one takes strings and numeric fields. The other takes only strings, holding more in the same memory size than the first and processing them even more efficiently.

The power of FMS 2 becomes apparent when you decide what you want to do. As just one example, a file by name and address could contain birthdates, phone numbers and possibly some confidential information such as credit rating, ages of family members, etc. You can make mailing labels from this file by suppressing, or HIDEing what you don't want to appear and then formatting the output as a mailing label complete with the necessary spaces between records to fit the size of your continuous feed labels. You could code a music cassette library with just one alpha character to represent the quality of each recording and then select just those with an E for excellent (or P for poor) and make a special listing of these. Your file of colored slide descriptions could be similarly coded to indicate S (snow scenes), F (family pictures) or whatever. Now you can easily SELECT the slide numbers to pull actual slides from the file box which fall in the desired category. Get the point?

In addition to the two I/O routines and the two versions of FMS 2, there are two more programs. One is a BASIC routine which will convert an all-string file written with either the old or the new version of FMS in the string-and-numeric pattern for use in the string-only mode. Yes, you heard right. FMS 2 will read files written by the original FMS. You don't have to reenter them to get the increased power and capacity. The last program will analyze the format of an FMS file in terms of the FMS format scheme. With this information, you can then write your own applications programs which access and process FMS data files.

The bottom line is simply that FMS 2 is a total system and not a toy. The author worked until recently as a programmer for a blue chip mainframe corporation — and it shows in FMS 2. ■

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Basically BASIC

Alphanumerics, variables and assignment statements

Model I/II/III

James A. Conrad, Seattle, WA

Think of a computer as a combination of a high-powered calculator and a smart typewriter. It processes information — numbers like a calculator, letters and words like a typewriter. These two kinds of information have the formal titles *numeric* and *alphanumeric*.

Most of us easily understand the idea of *numeric* information — numbers. We routinely add, subtract, multiply, divide, compute square roots and do a lot of other number manipulation with calculators.

Alphanumeric information is like typewriter characters — letters and numbers. In computer jargon we call this "STRING" information — and we spell STRING with a $. String information is designated by quotation marks, e.g., "GEORGE", "2", "TRS-80". When the computer sees the quotation marks it knows it's dealing with strings.

Some novice programmers don't understand why an alphanumeric "2" can't be mathmatically manipulated like a numeric "2." Remember typewriter characters — a "2" on a typewriter is just another alphanumeric character, like "L" or "&" or "H" or "?." A typewriter doesn't recognize the character "2" as a number, nor does a computer when it's processing alphanumeric information.

Variables

The computer stores numeric and alphanumeric information in memory cells called *variables*. Numeric variables hold numeric information and string variables contain alphanumeric information. Visualize variables as little boxes in the computer's memory. When you're trying to figure why a program is being ornery, draw some little variable boxes to show what each variable contains.

Names one or two characters long identify variables. The first character must be a letter — A to Z. The optional second character may be either a letter or a number. We can choose from hundreds of names — from A to Z, from A0 to A9 to Z9, and from AA to AZ to ZZ. Siegfried, my computer, calculated that there are 962 different possible names for either kind of variable (I'm assuming that he understood the program I wrote for him).

Both numeric and string variables use the same set of names but string variables are differentiated by the "$" string sign following the variable name. String variable A1$ is called "A one string." When my son was learning about string variables he continually referred to "X dollar sign" — and I continually corrected him to pronounce it "XString." I knew I had won when he asked: "Dad, may I borrow five strings?

Novices sometimes get confused by similarly named variables, such as A, A1, AA, A$ and A1$. Each of these is a different variable, related in name only, and each contains information different from the other.

Assignment

An *assignment statement* assigns the value of the expression on the right of the equal sign to the variable named on the left. The most common is the LET statement. Its form is:

LET variable name = expression

The *expression* can be a constant, a variable, or a formula. A few examples:

```
LET A = 12                (constant)
LET B = A                 (variable)
LET A6 = L*W              (formula)
LET G$ = "Stripper"       (constant)
LET P2$ = NA$             (variable)
LET C1$ = R$ + "Joe"      (formula)
```

When the expression is a formula the LET statement calculates its value before assigning it to the variable.

The equal sign in an assignment statement looks like the same equal sign we remember from Algebra I — but it isn't. An assignment statement is not an algebraic equation. In computer language not all equal signs are equal (yes, Mr. Orwell, some are more equal than others).[1]

In computer pseudocode a left-pointing arrow shows assignment (LET A ← 12). This reminds us that an assignment statement doesn't use a real equal sign — one which shows equality — instead it assigns the value on the right to the variable on the left with an assignment sign.

The verb "LET" is optional in a LET statement — omitting it won't affect the assignment. The computer recognizes that the statement "J4 = K + BB" is the same as "LET J4 = K + BB." Beginners, however, should avoid possible confusion by using LET until they are comfortable with both uses of the equal sign. (LET will become mandatory if the proposed national standards for BASIC are adopted.)[2]

Replacement

Novice programmers often

encounter another algebraic enigma when they assign a new value to an old variable. When I first saw the algebraic aberation K=K+1, I instinctively knew it was wrong. The stern apparition of Miss Simmons, my old Junior High algebra teacher, appeared in my head and said, "Once you've given it a value, a variable is defined and you can't change it."

Not so, Miss Simmons. We're discussing computers, not algebra — assignment statements, not equations. When we assign a value to a variable, *the new value replaces the old.* Use the little boxes mentioned earlier to illustrate this.

	X is Now
10 LET X=2	2
20 LET X=X+2	4
30 LET X=X*X	16
40 LET X=X-6	10

When we assign the value of one variable to another, e.g., LET B=A, What happens to the contents of the variable on the right? They remain unchanged — copied, not transferred, into the variable on the left.

Programming Tips

1. Don't use a variable for more than one purpose in a program if you're a beginner. You could easily misuse it and ambush yourself with mystifying errors.

Experienced programmers, however, often recycle variables to save memory. This requires a systematic approach, such as using the variables A and A$, A1 and A1$ for temporary storage; and X, Y and Z for counters or index variables (as in FOR...NEXT loops).

2. Although the computer recognizes only the first two characters of a variable's name, it doesn't complain about longer ones. You can, therefore, create some very descriptive labels, such as NAME$, ADDRESS$, SALES and COST. But it's not a good idea. Two reasons:

a. You could accidentally use the same variable for different purposes. Both FIRSTNAME$, and FILE$, for example, use the variable FI$.

b. A reserved word[3] can sneak into a variable name and cause a syntax error when the program executes.

Examples: ORder, subTOtal, TANdy.

3. List your variables in REM statements at the beginning of your program. This clarifies the program and helps avoid unintentional multiple-use variables.

Include REM statements showing the maximum and minimum limits of numeric variables and the maximum length of string variables. Especially if they're to be printed in columns or stored in fixed length fields.

4. If you use a constant more than once, assign it to a variable. Then you can plug the variable quickly and easily into the program without retyping — and maybe mistyping — the constant. A few examples:

```
LET PI = 3.14159
LET L1$ = STRING$ (40, "=") : REM A 40 CHARACTER DOUBLE LINE
LET M1$ = "MESSAGE ONE"
LET P1$ = "###.##" : REM PRINT USING FORMAT
```

BASIC has three other assignment statements: INPUT, LINEINPUT and READ. They have uses different from LET but they perform the same function — assigning values to variables.

A thorough understanding of numeric and alphanumeric information, the variables that store it, and the assignment statements that put it into the variables will make your programming quicker, easier, and less frustrating. That's BASIC. ■

[1] As we learn more about BASIC we will find another use for the equal sign — as a *relational operator* testing the truth of an equation. This is generally found in IF...THEN statements (IF A+B=C+D THEN...).

[2] Thomas E. Kurtz, *"On the Way to a Standard BASIC," BYTE,* June 1982.

[3] See your manual for a list of reserved words.

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RENUM IV your III

Patch the Model I renumber program

Model III

Jerry W. O'Dell, Ph.D., Ypsilanti, MI

A renumbering program is an indispensable tool for the BASIC programmer. However, I was astounded to discover that there is apparently none available for the Model III, certainly none from local sources. There are several versions for the Model I, from various companies, but not for the Model III. Since I really needed the program, I decided to attempt to change the old Radio Shack program, RENUM (Catalog number 26-2004) for the newer machine.

Disassembly of RENUM shows that the change should be fairly easy. The starting address for a BASIC language program in the Model I is 42E9H, and its 43E9H in the Model III. Therefore, if one changes all references to this location (7CA6H, 7D00H, 7D3EH, 7DB9H and 7EACH) from 42H to 43H, the job should be done. However, it doesn't work. The problem seems to be that the data stored at the highest pointer location, 7FD4H, is destroyed, apparently by the stack. Consequently, one must change the references to 7FD4H to some other value. To be on the safe side, I moved this to just under the beginning location of RENUM, at 7C4AH. The locations that must be changed are 7C6EH, 7CC4H, 7DF7H, 7E0CH, 7E19H, 7E31H, 7E38H and 7E41H. Making this change fixes the problem. RENUM now seems to work perfectly. I've tried it on all sorts of programs, and it seems to function without a hitch.

If you have a machine language monitor, like DEBUG or TASMON, you can make the changes directly, and save the repaired program on tape. If you don't have such a monitor, the little program in Listing 1 will do the job. Load the Model 1 RENUM into your 16K machine according to the instructions packed with it. However, when the computer comes on, set the MEMORY SIZE? to 31817, rather than 31819, to allow for the two extra bytes needed. Now run the program in Listing 1. It will make the necessary changes in RENUM automatically. RENUM may be left in the computer, and may be recalled at any time by typing SYSTEM (enter), and then /31820 (enter). Unfortunately, with this method, RENUM must be repaired every time the computer is powered up. But it's worth it to have the ability to renumber programs!

Program Listing for RENUM

```
10 POKE 31910,67:POKE 32000,67:POKE 320
62,67:POKE 32185,67
20 POKE 32428,67:POKE 31854,74:POKE 318
55,124
30 POKE 31940,74:POKE 31941,124
40 POKE 32247,74:POKE 32248,124:POKE 32
268,74:POKE 32269,124
50 POKE 32281,74:POKE 32282,124:POKE 32
305,74:POKE 32306,124
60 POKE 32312,74:POKE 32313,124:POKE 32
321,74:POKE 32322,124
```

■

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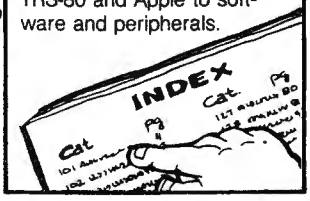

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Three C. C. video tips

Switching PMODEs for effect

Color Computer with Extended Color BASIC

Lynn Davis, Clay, NY

Here are some programs that point out various tricks in using the video on the Color Computer. They are all written for 16K Extended BASIC. Two of the programs, "Color the Screen," Listing 1, and "Getting Colored Letters," Listing 2, deal with using signal drift from the computer to the TV while you are in the PMODE 4,1 and SCREEN 1,1 mode. This setup should, but doesn't always, result in a buff/black color configuration. However, the resulting blue and orange colors can be used.

In Listing 3, "Two Circles with One Command," the computer is tricked when a program goes from PMODE 4 to PMODE 2 without inserting a SCREEN command. Anyone looking at the program would assume it would draw three circles, all with a radius of 90. This is not the case — the last circle command actually draws two circles, each with a radius of 45. It also looks to me that both circles are drawn at the same time (although, I don't know how to prove it).

Ed. Note: We had to add line 5 in Listing 3 to make it run on the earlier ROM of the Color Computer. The addition is compatible with all versions.

Listing 1
Color the Screen

```
100 REM TRS-80 COLOR COMPUTER
110 REM 16K EXTENDED BASIC
120 REM
130 REM
140 CLS
150 PRINT"WHAT COLOR SCREEN DO YOU WANT
?"
160 PRINT" 1. BLUE"
170 PRINT" 2. ORANGE"
180 PRINT:INPUT"TYPE NUMBER & PRESS <EN
TER>";C
190 IF C<1 OR C>2 THEN 140
200 PMODE 4,1:PCLS:SCREEN1,1
210 FOR X=C-1 TO 256 STEP 2
220 FOR CC=1 TO 2
230 COLOR CC*3,CC
240 LINE(X+CC,0)-(X+CC,192),PSET
250 NEXT CC,X
260 GOTO 260
```

Listing 2
Getting Colored Letters

```
110 REM TRS-80 COLOR COMPUTER
120 REM 16K EXTENDED BASIC
130 REM
```

```
150 CLS
160 PRINT"WHAT COLOR PRINTING WOULD YOU
"
170 PRINT"LIKE TO SEE?"
180 PRINT"1. BLUE"
190 PRINT"2. ORANGE"
200 PRINT:INPUT"TYPE NUMBER & PRESS <EN
TER>";C
210 IF C<1 OR C>2 THEN 150
220 PMODE 4,1:PCLS:SCREEN1,1
230 ON C GOSUB 260,290
240 GOTO 240
250 REM DRAWS A BLUE LINE IF HORIZONTAL
 COORDINATE IS AN ODD NUMBER
260 DRAW"S8;BM87,100;U7R4F1D1G1NL4F1D2G
1NL4BR1 BR4 NU7R5 BR4 BU1NU6F1R3E1NU6BF
1 BR4 U7NR5BD3NR4BD4R5"
270 RETURN
280 REM DRAWS AN ORANGE LINE IF HORIZON
TAL COORDINATE IS AN EVEN NUMBER
290 DRAW"S8;BM86,100;BR1H1U5E1R3F1D5G1N
L3BR1 BR4 U7R4F1D1G1NL4F1D3 BR4 U6E1R3F
1D2NL5D4 BR4 U7BD1E1R3F1D6 BR4 BU1U5E1R
3F1D1BD2NL2D2G1L3H1BF1BR4 BR4 U7NR5BD3N
R4BD4R5"
300 RETURN
```

Listing 3
2 Circles with One Command

```
5 PCLS:PCLEAR6
90 REM TRS-80 COLOR COMPUTER
100 REM 16K EXTENDED BASIC
110 REM
120 REM ******************************
130 REM DRAWS CIRCLE TO SHOW SIZE IN PM
ODE 2
140 PMODE 2,1:PCLS:SCREEN1,1
150 GOSUB 260
160 REM DRAWS SAME CIRCLE TO SHOW SIZE
IN PMODE 4
170 PMODE 4,1:PCLS:SCREEN1,1
180 GOSUB 260
190 REM SWITCH TO PMODE 2 AND DRAW THE
SAME CIRCLE
200 REM NOTE THE CONSTRUCTION OF TWO CI
RCLES WITH ONE COMMAND!
210 REM THIS ALSO MAKES A FAST SMILING
FACE
220 PMODE 2,1:PCLS
230 REM THERE IS NO SCREEN COMMAND HERE
240 GOSUB 260
250 GOTO 250
260 CIRCLE(128,96),90,1
270 FOR T=1 TO 2500:NEXT T
280 RETURN
```

■

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Programs for Beginners on the TRS-80
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$8.95

When I first got my TRS-80 Model I back in the dark ages (of personal computing) in early 1980, I didn't know anything about Beginners All-purpose Symbolic Instruction Code, better known as BASIC. But that didn't matter because Radio Shack had included the very excellent User's Manual for Level I by Dr. David A. Lien. His manual was terrific as a beginners manual, and it successfully taught me the elementary basics of BASIC.

However, I soon found myself in need of more information on how to program in BASIC.

Unfortunately, back in the early 1980s, personal computers were really just beginning to come into their own as a serious new industry that could appeal to more than the trained computer programmer. Consequently, there wasn't much published on learning BASIC that the beginner could understand. So in those days most of us learned BASIC from magazine articles, like those found in fledgling magazines like *80 Microcomputing* or *80-U.S. Journal*.

Today, things are much different. In just two years time (since 1980), there are other alternatives for learning BASIC after one has absorbed Dr. Lien's BASIC Manual. One of the better texts that I have run across in this regard is *Programs for Beginners on the TRS-80*, by Fred Blechman.

What You Get

Actually, the title is a little misleading, since it implies that it is for beginners, when actually some rudimentary knowledge of BASIC is required. In fact, a better title might be "BASIC After Dr. Lien," or perhaps "Moving Towards Usable BASIC Programs."

So what, you might ask, do you get for your $8.95? Well, to begin with, you get 150 pages of paperback instruction on writing BASIC programs in Level I or Level II for a TRS-80 Model I. An addendum sheet from the author (for an SASE) will provide you with the few changes required to make the programs given in the book work with the Model III.

But what makes this book so useful for the reader is the clear and concise way that the author leads the reader through each program. Each chapter, and there are 21 of them, contains a BASIC program for both Level I and Level II. Each chapter starts out with a "You'll Learn" section which describes the BASIC commands covered in the program in that chapter. Next

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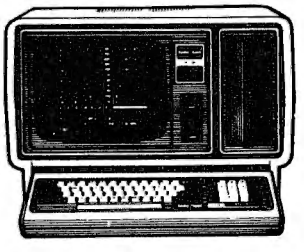

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comes a "Description" section which explains what each program does. Then an "Explanation" section describes how the program works, line-by-line, in real English, not presupposing that the reader has a Masters degree in Computer Science. At the end of each chapter is a list of the variables used in the program in that chapter and what each means.

The result of this format is a tutorial in BASIC for the layman that is clear, and that will find immediate application to other programs that the reader might desire to write.

Some Specifics

Some of the programming techniques covered by the programs in the book include screen prompts, use of strings, branching, use of pseudo-random numbers, ON-GOTO, using subroutines, graphics, use of READ and DATA statements, timing loops, screen and printer formatting, rounding off numbers, using loops and use of arrays.

The author also provides a test program to allow the reader to determine if the top or bottom line of the video display is cut off by incorrect positioning of the display raster. If this is the case, and it certainly is for a number of TRS-80 Model Is, the author describes how to open up the back of the display and readjust the centering tabs on the CRT. The author also notes that this can be done by adjusting two potentiometers in the Model I keyboard, but warns that this would invalidate the Radio Shack warranty.

At the back of the book are some very useful appendices, including two cassette loading time charts. These tell the reader how long it will take to load a cassette tape if you know the number of bytes, or how many bytes are contained in the program if you know the time it takes to load the tape. In addition there is a design for an Audio/Visual Control Box, which allows you to hear tape signals during record and playback, as well as manually control the motor. There is also an Appendix of "Slick Tricks" which contains some simple programs for keyboard debounce, and a single line program for advancing the tape after recording a program, so that you are ready to start the next recording run on the tape, without having had to manually advance the tape.

For those readers who don't want to go to the trouble of typing in and debugging the programs, the publisher has arranged for a cassette tape to be available for $10.95 of all of the programs in the book.

So what do you get for $8.95? A lot of very clear and useful information on how to progress from Dr. Lien's beginning to a more advanced understanding, with some very useful examples, of BASIC. *Programs for Beginners on the TRS-80* is a good book for the beginning to intermediate BASIC programmer.

Tony Gitt

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$12.95

I'm sick and tired of hearing from Bob, my Apple-owning friend, about the wonders of hi-res graphics. I, for one, think the TRS-80 computers provide very nice graphics. Sure we don't have control over every single dot, but for the money I don't think you'll find better micros anywhere. And I won't even bother going into the features my new Model III has over the Apple.

Still, it takes a bit of knowledge to get the most out of your computer's graphics. Nevertheless, once you get the hand of programming TRS-80 graphics, you'll be surprised at the images you can get on your display. After all, there isn't an arcade game around that hasn't yet found its TRS-80 equivalent. Anyone who knocks these machines' graphics just hasn't seen them work under the programming of a master.

TRS-80 Graphics: For the Model I and III is an excellent introductory text to the field. Written in a breezy and generally conversational tone, this book, by authors David A. Kater and Susan J. Thomas, belongs on every TRS-80 owner's bookshelf. It's certainly the most fun computer book I've read in months.

Easy to use and full of practical and imaginative applications, this informative guide provides a full treatment on the uses of graphics in games, education, business, mathematics, statistics, animation and art. Comprehensive in scope, it takes a thorough look at graphics and elementary animation that can be created by using the TRS-80's SET, RESET, PRINT, PEEK, POKE and OUT features. The book even manages to toss in some basic machine language programming, sure to satisfy the requirements of the hardy souls interested in that field.

TRS-80 Graphics is a great way to learn about your computer by doing things that also happen to be a lot of fun. Now please excuse me as I animate myself away from this review and back to my games.

John Edwards

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The BASIC Handbook
2nd Edition
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$19.95

Several years ago, when the TRS-80 Model I was first introduced, the reference manual that was delivered was an easy to read, very simple introduction to computer programming. Professional programmers may have felt that it didn't give them the information they wanted quick enough, but most everyone else who used it just loved it.

The manual has become a classic and has spawned a number of other books by the same author all with the emphasis on simplicity and learning. That author was David Lien. To the average TRS-80 owner,

David Lien's name has become familiar. The BASIC handbook, 2nd Edition, will make it even more so.

The BASIC handbook is an encyclopedia of the BASIC language. It gives possible commands in alphabetical order with one or more pages devoted to expanding on what that command means.

A typical entry (i.e., POKE) includes a discussion of the command, a test program to see how it works, information about sample runs, and information about variations in usage between computers. There are cross references to other commands.

The book is not solely devoted to the TRS-80. It covers BASIC for a large number of computers such as the Apple, Atari, IBM, DEC, Hewlitt-Packard, Pet, Northstar and others. Far from clouding over what each command means, this actually makes the handbook a more useful tool.

Have you ever wanted to make a program written for the Apple work on your TRS-80? Well this is the book to help you do it. Many of the commands include a section on what to do if your computer doesn't have the particular command. For example, MAT INV (matrix inverse) includes a complete subroutine to do the function if the command isn't available (it's not on the TRS-80). The book even has a short section at the beginning which deals with how to convert programs. If you're new to this kind of activity, read it carefully.

The only thing I think he missed is that not enough alternatives are given for commands that are not implemented. For example, INPUT1 is used to prevent the computer from going to the next line after an input statement. That's a handy command but the book doesn't tell you how to do it.

Overall the book is valuable for general reference, even if you never look at a program from another computer. It's essential if you're trying to convert programs.

Personally, I like it!

T.R. Dettmann

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tarantula) will release ten aliens, each carrying a precious fuel cell. As they drop to the bottom of the screen to release the fuel cells, a Flagship drops you off. Then, the aliens will return to the Transporter vessel.

After the Transporter vessel vanishes, the game begins. The aliens come from the top of the screen and descend. If you do not shoot them before they reach the bottom, they will grab a fuel canister and go back up. If you shoot them now, they will die and the canister will fall. You must catch it or it will explode. If, for some reason, you were not able to shoot the ascending alien, he and the canister will be gone forever.

Along with the typical crew of aliens, there are two which should be feared more than any other, the Slicer and the Flagship. The Flagship, fortunately, has no laser. If you hit him, he will release a random number of aliens, among which may be the evil Slicer. The Slicer generally makes his appearance when you have only one or two fuel cells left. Its sole purpose in life is to destroy one of your fuel cells. If he makes it down to the bottom of the screen, he will almost certainly accomplish this goal.

If Defense Command were being judged only by its merits as an arcade game, it could only be termed excellent. However, it is being judged as a Big Five game, and as this it just misses. My major complaint of the game is that it is slow moving. When the game begins, the aliens come down at the rate of one every few seconds. This is more than ample time to exterminate the alien, so the game is fairly monotonous until your score reaches about 20000. Then, the game is well paced.

If not for this one fault, the game would probably come close to Robot Attack in quality. Of course, as in Robot Attack, this game has voice effects. Due to memory limitations, the cassette version has very little voice. On the disk edition, when you shoot the Transporter vessel, a voice booms out "Prepare to die, human." And when you lose a ship, the computer says in a voice that approaches sarcasm, "You're dead!"

If you are seeking to buy a game that will top Robot Attack, then Defense Command is not it. However, if you are just out to have some good, clean fun, then pick up a copy of Defense Command and enjoy!

Matt Friedenberg

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Imagine it's toward midnight and you're just putting the final touches on the program of the century that's going to make millions, and much to your dismay you discover a hideous mistake. You've used Tandy as a variable and since AND is a BASIC keyword it's SYNTAX ERROR time in the big city. Wouldn't it be wonderful to have your computer find all the mistakes and be able to correct them on the screen instead of line by line? Now you can, with this new inexpensive utility.

To edit a program using the standard line editor supplied in ROM on all TRS-80s is sometimes a difficult task. An entire set of subcommands must be mastered and each line of the program must be changed one at a time. However, a full-screen editor, found standard on some computer systems, allows you

to make changes within the listing on the screen using cursor controls. This allows changes to multiple lines to be made quickly and without the need for special commands. If a word is spelled wrong, you change the spelling directly on the listing as opposed to entering the EDIT mode, spacing to the mistake, hitting 2C to change two letters, and then finally changing the letters.

Ever hit LIST and then watch the line you wanted to look at scroll by before you could master the SHIFT @ key sequence? This utility also allows you to list your program either forward or backward sixteen lines at a time. The program may also be scrolled forward one line at a time. To me this is a great improvement over the standard listing functions. Program lines may be searched for any string of characters to allow for easy changes of variable names or occurrences of a particular function. Program lines may be inserted between legal numbers or lines may be deleted easily. The program does not renumber however. Material within program lines may be edited or deleted with easy to learn commands.

The program loads into low memory and takes up less than 2000 bytes. Instead of typing LIST to see your program, you type CMD and now you're in the full-screen edit mode. It's that simple. Pressing the BREAK key returns you to standard BASIC and LIST is still effective if you desire. Documentation consists of five pages, standard notebook size, that contain very clear explanations of all the commands.

If you're like me, you'll find once you use a full-screen editor you'll never go back to a line editor again. This program is a very useful utility and beginning programmers would find its easy editing a great help during the difficult stages of computer learning. It's like having a word processor for writing programs. For ease of operation and function, it's a tough package to beat.

Mark E. Renne

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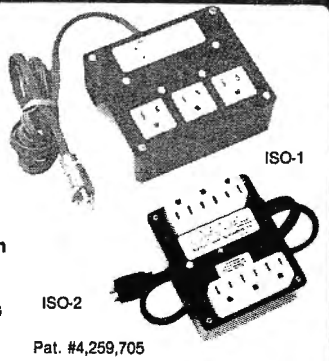

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about 56 seconds for a multi-drive system and about 2½ minutes for a single drive) on the Model II. It steps through the backup process effortlessly and quickly.

As with most of RACET's utilities, FASTBACK does more than just this function. FASTBACK provides the normal backup functions available with the TRSDOS BACKUP, but it also provides the ability to backup disks that have bad directories by using the ALL option. This forces it to copy all tracks on the disk. Some would claim that that's a ridiculous thing to do, but if it's the only copy you've got, you want it.

The options available for FASTBACK are:

Source disk — you can specify the source drive with or without a disk ID.

Destination disk — same as for source.

ABS — backups without worrying about data on the destination disk.

ALL — backups all 77 tracks.

PROMPT — prompts for disk entry before starting the backup.

NOVER — no verify mode, intended for demonstrations only since it turns off verification of the backup disk.

FASTBACK is not a bit copier. It won't make protected disks available to you for copying. It simply makes your normal, legitimate backups simpler and easier. In my book, that's well worth it.

T.R. Dettmann

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Power Draw, by Kim Watt, is a powerful graphic screen editor from Breeze/QSD, Inc. Having reviewed several of Kim Watt's other works, we looked forward with anticipation to taking an in-depth look at Power Draw. We were not disappointed. Power Draw is up to Kim's usual excellent standards. Supplied on a standard 5¼" diskette as a/CMD file, it works with all known operating systems. From DOS ready, simply type PDRAW to load the program. After loading, a menu appears and Power Draw is readied by pressing ENTER.

There are two modes, graphics and text, and initially you are in graphics mode. A single pixel flashes in the upper left corner to indicate the cursor position. The arrow keys move the cursor, and shifting them speeds them up. There are three modes in graphics: draw, erase and skip. In draw, moving the cursor leaves a lit pixel at the current cursor position. In erase, moving the cursor erases a lit pixel at the current cursor position. In skip, the cursor may be moved without affecting the picture at all. Diagonal lines are not drawn using two arrow keys simultaneously, but a command defines the angle to be drawn, and then the I, O, K and L keys control the direction of the line. A solid or dotted line may be

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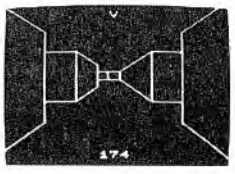

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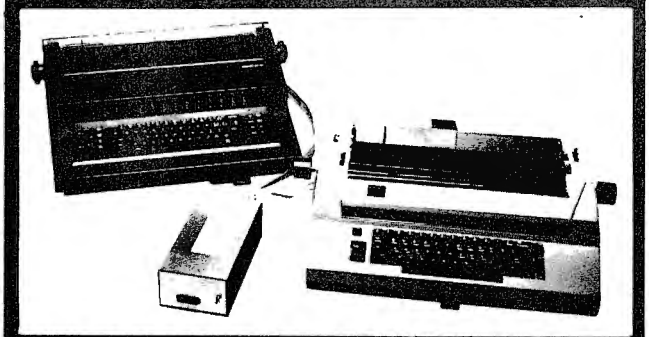

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defined.

All commands are single keystrokes while in graphics mode. For example, pressing "U" immediately displays the cursor position in the upper right corner (like the TRACE function in TRSDOS). Pressing "J" displays a grid system to aid in centering figures on the screen. The entire screen may be reversed, with all white characters becoming black and vice versa. To manipulate the drawn figure, you may flip the right and left halves, create a top-to-bottom mirror image, or a right-to-left mirror image. You may also move the entire figure in any direction — useful when creating animated scenes. Single and double-wide video is toggled with another key, as is text entry.

To enter text mode, simply hit "T"; whereupon, the cursor changes shape. Now, text can be entered as on a word processor, with the exception of no line wrap-around. You must manually move the cursor to the start of the next line. All commands are invoked by pressing CLEAR, together with the letter for the command. There is an additional command, available only in text mode, called the special key. With this command, you can define areas on the screen to either clear, fill, reverse or duplicate with a certain character. All text can be intermixed with graphics; however, video reverse works only on graphics.

The really interesting thing about Power Draw is the way that it stores and recalls the screens that are created. There are up to 34 buffers, depending on memory size. Each buffer holds the contents of one screen. After one screen is created, you can store it in one of the buffers. Return to the workspace buffer, move the picture in any direction, and store the new picture in the next buffer. Continue this process until all the buffers are filled, and then you can watch all the buffers played back in high speed, frame by frame, as if watching a movie! You can even insert a delay between each frame to slow down the apparent motion. These buffers can be stored on disk or tape, re-loaded into the program, or even accessed and played back by a utility program called PLAY/CMD. You may even string several files together to form a really long "movie." In addition, you may save your screen to disk or tape in BASIC string format, BASIC data format, EDAS format, EDTASM format or DOS load file format.

There are also three separate screen printer drivers included in the program. Of course, these are useful only if one's printer is capable of printing graphics characters. Power Draw also supports the Alpha Products joystick. The program performed flawlessly during evaluation, with no notable bugs detected. This is certainly one of the most useful utilities for a TRS-80 owner to own. Just think how fantastic that title page will look on your next masterpiece, or how about a 2-minute opening movie?

Jim Klaproth

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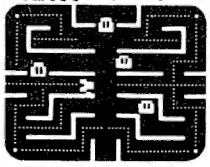

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New Products

Portable Model III

The Adcock & Johnson Model 3000 is a conversion which transforms the Radio Shack TRS-80 Model III from a desktop into a fully portable computer. The Model 3000 is the first portable computer to be fully compatible with the broad range of software and hardware already in use and under intense development for Radio Shack computers.

Offering a rugged, brushed aluminum case, dual 184K disk drives and optional internal direct connect modem, the Model 3000 incorporates a large nine-inch, green phosphor CRT, with a anti-glare finish for easy viewing. The unit weighs only 28 pounds.

The Model 3000 is available either as a conversion for a Model III at $795 or as a complete machine for $2895. Internal 10 Meg hard disk, modem and upgrades for Model III owners are available at additional cost. For more information, contact Adcock & Johnson, Drawer 8778, Fort Worth, TX 76112, (817) 429-5131.

 # 200

Weighing only 28 pounds, the portable Model 3000 from Adcock & Johnson is fully compatible with the broad range of software and hardware.

Communications Program

Term/Host is a comprehensive self-contained communications program designed for Model I or II with 48K of memory, disk or tape. The same version runs on all configurations. The program handles all types of files in binary or ASCII modes. Term/Host supports complete remote operation of the user's system. As a host, you may run machine language or BASIC programs, or down/up load files from any remote terminal or system. The program is menu driven, includes a 27-page users guide, and is priced at $34.95.

Term/Host Bulletin Board uses Term/Host for a driver with an appendage. It includes a series of BASIC support programs, and data files, supports about 200 users; has general, club and confidential password protection; complete up/down loading; auto UART configuration. One disk drive with 48K is the minimum requirement. The appendage and support programs are priced at $39.95.

Both programs are distributed by Freedom Financial Enterprises of Washington, Inc., 3601 Carriage Dr., Raleigh, NC 27612, (919) 787-8082.

 # 201

Computer Consumer Protection

A 35-page booklet *Consumer Protection for the Microcomputer Owner* covers the steps to consider before purchasing a computer. Information about the general Law of Sales is given to advise buyers of the legal issues that can arise if he is not careful, such as: When is a sale valid? Are advertised prices binding? What can be done about partial delivery? What and when must the seller deliver? Hints on how to legally reject and revoke a prior acceptance of a product are included. There are suggestions on how to complain effectively and hints every computer purchaser will find useful. The booklet is available by mail for $15.00 from L. J. Kutten, Attorney at Law, 201 S. Central Avenue, P.O. Box 16185, St. Louis, MO 63105.

 # 202

C.C. Audio Spectrum Analyzer™

Radio Shack is now providing audiophiles and high fidelity enthusiasts with a new way to use the TRS-80® Color Computer as a test instrument or as a colorful aid to their audio systems. Audio Spectrum Analyzer™ (26-3156), available for $19.95 at Radio Shack stores, provides a colorful, graphic display (of the power-frequency distribution) of energy in sound presented to the computer's cassette port input. Color bargraphs show the relative power distribution over a nine-octave audio range. Both fast-response (peak measurement) and slow-response (RMS measurement) modes are available. A cable is required (e.g., Radio Shack 26-1027, not included) for connection of the audio source to the Color Computer cassette input port.

 # 203

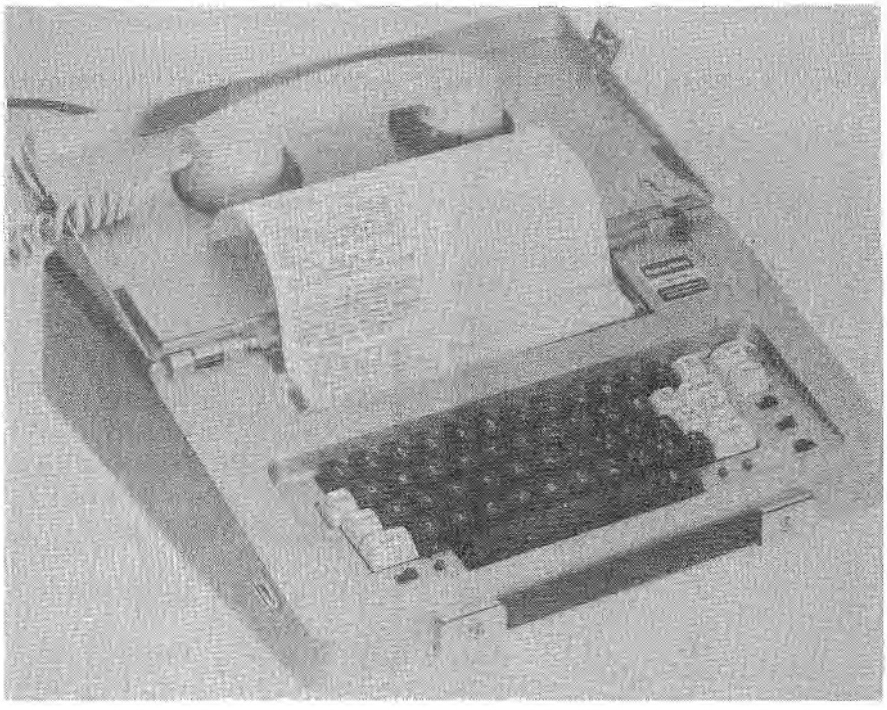
Portable Data Terminal

Radio Shack is introducing a new portable printing data terminal. The TRS-80 PT-210 Portable Data Terminal (76-1001) is available for $995. The terminal includes a full typewriter keyboard, a thermal printer and a 110/300 baud (Bell 103A compatible) acoustic telephone coupler.

An optional add-on RS232C Interface Module (76-1002), available for $69.95, can be user (plug-in) installed. This facilitates use of the terminal as a local (to a computer or selected peripheral) "front end" dumb terminal and/or printer. RS232C is also a convenient way to connect the terminal to a direct connect modem.

The PT-210 features a full-sized ASCII keyboard, generating a total of 99 codes, and offers a switch-selectable digital keypad. 110 baud or 300 baud operation may be switch selected, as may half-duplex or full-duplex operation and odd-parity / even-parity / no-parity modes. The PT-210 is housed in silver-grey case measuring 15½ x 14½ x 5 inches, and weighing 15 pounds with paper installed. It is FCC registered, and UL-listed for 120 VAC 60 Hertz operation. The line cord is detachable for easy portability. A light duty black vinyl dust cover and one roll of paper are included. A travel case (76-1010) is available separately for $24.95.

 # 204



Radio Shack's TRS-80 PT-210 Portable Data Terminal consists of a keyboard, thermal printer and 110/300 baud acoustic telephone coupler.

Speed-up Peripheral

The Sprinter™ is a speed-up peripheral that will run your system two to three times faster, plugs inside your keyboard, and lets you add a parallel printer. You select from 16 different (OUT) software commands that control execution speed. The Sprinter automatically slows down for disc and I/O operations, and compensates for slow ROMs. For high speed performance, a Z80B is included.

Designed to plug into the Z80B socket inside TRS-80 Models I/III and PMC-80/81, the Sprinter is the first speed-up that doesn't require technical know-how to install and remove. The Sprinter can be purchased for $99.50. Add $24.50 for a parallel printer port and $19.50 for a printer cable. The Sprinter is available from Holmes Engineering, Dept. #20, 3555 South 3200 West, Salt Lake City, Utah 84119, (801) 967-2324.

 # 205

TRS-80 Graphics Book

TRS-80 Graphics (62-2073), by J. D. Robertson and John P. Grillo, is available for $7.95 at Radio Shack stores, Computer Centers and participating dealers. The book provides sample programs and illustrations for three general methods of generating computer graphics—character graphics, pixel graphics and line printer graphics.

 # 206

Disk File Index

"Maindex," and its sort program "Alphadex," is an easy to use, yet thorough program that will aid you in the indexing of your files on disk. With Maindex you will know the disk containing any file within seconds. Files can be located and reviewed by name, partial name, user defined categories, or by scanning the file descriptions.

Maindex for the TRS-80 Model I or III, requires 48K, at least one disk drive, and NEWDOS/80. Distributed on cassette with over 14 pages of easy to read documentation, Maindex does all this for $34.95. More information is available from E-Z Software, P.O. Box 591, Novato, CA 94948.

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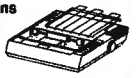

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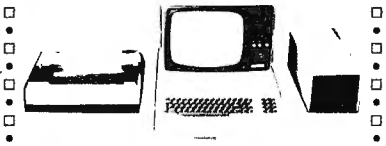

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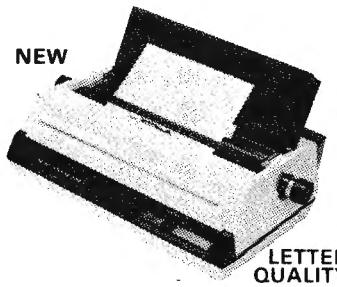

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These notices are free of charge and will be printed one time only on a space available basis. Notices will be accepted from individuals or bona fide computer user clubs only. All announcements must be typed, contain 75 words or less and include complete name and address.

Michael B. Shane, Chairman of Leading Edge Products, has announced that one cent from the sale of every Elephant diskette sold throughout the world will be contributed to the Jimmy Fund. The Jimmy Fund has long been a source of aid and comfort to parents of children unfortunate enough to develop cancer. The Fund's contributions to the Sidney Farber Cancer Institute for the past 35 years, has meant life to many of these children, and could someday be a major force in funding the research leading to a cure of many forms of cancer. They expect sales to continue substantial growth, benefitting the fund and the Institute.

Rimes Computer Products announces its Grand Opening. Major brands of business, home, personal and entertainment software will be sold at discount prices. Many popular models of computers will be supported, beginning with Radio Shack's TRS-80 Models I and III. A free catalog may be obtained by writing to them at 262 Tracey, Grand Island, NY 14072.

FOR SALE: *BYTE* — Jan. 79, Apr. 79 to Apr. 81, Jul. to Oct. 81, Dec. 81, Jan. 82, Apr. to Jun. 82. $1.50 ($3.50). *Creative Computing* — Apr. 79 to Jul. 79, Sep. 79 to Oct. 81, Dec. 81 to Aug. 82. $1.50 ($3.00). Prices in parenthesis include postage. Excess postage will be refunded on multiple orders. Call Douglas Stewart, 15 Mountain View Road, Cape Elizabeth, ME 04107, (207) 767-2351.

The Southern Maine TRS-80 Group, 15 Mountain View Road, Cape Elizabeth, ME 04107, meets the first Tuesday of every month at 6:30 p.m. in Classroom 2, Maine Medical Center, Bramhill Street, Portland, ME 04102. Dues: $10 per year/$1 per month. Newletter: Byte Babble.

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