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COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

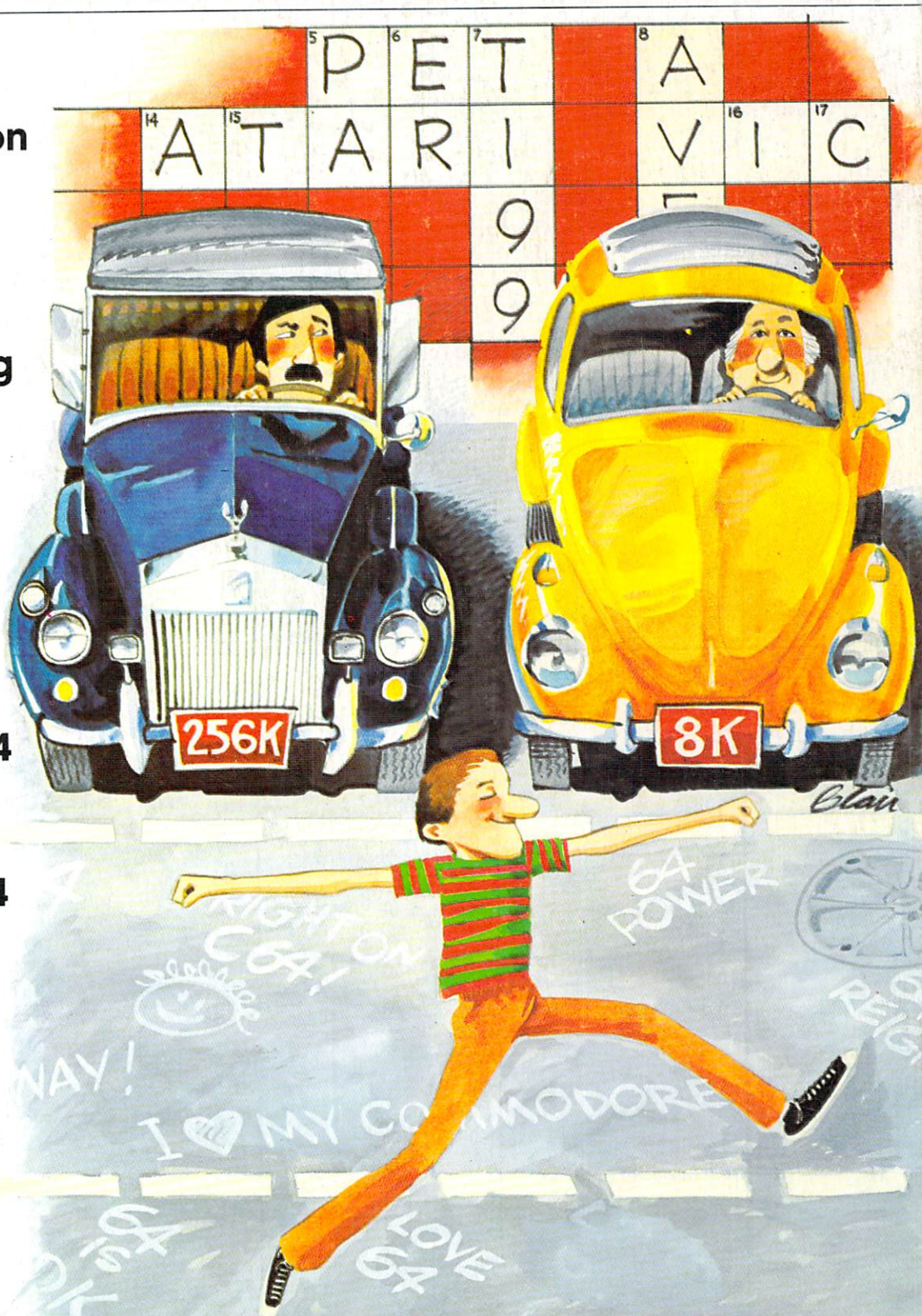
Commentary:
Is Memory Expansion Just A Status Symbol?

Crosswords:
A Puzzle-Generating Program For Atari, VIC-20, TI-99/4A, And Others

Jumping Jack:
A Unique Game For VIC-20, Atari, Texas Instruments, And Commodore 64

Instant Art On The Commodore 64

BASIC Utilities For Atari And Texas Instruments



***Reviews:* New Products And Software**

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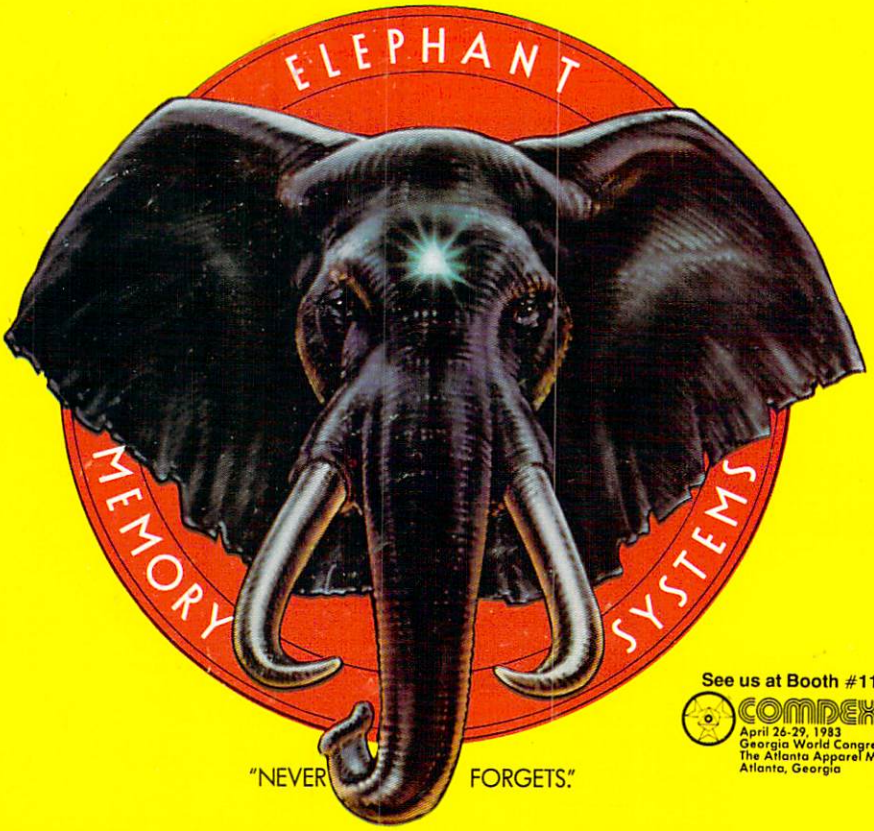

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MORE THAN JUST ANOTHER PRETTY FACE.

Says who? Says ANSI.

Specifically, subcommittee X3B8 of the American National Standards Institute (ANSI) says so. The fact is all Elephant™ floppies meet or exceed the specs required to meet or exceed all their standards.

But just who is "subcommittee X3B8" to issue such pronouncements?

They're a group of people representing a large, well-balanced cross section of disciplines—from academia, government agencies, and the computer industry. People from places like IBM, Hewlett-Packard, 3M, Lawrence Livermore Labs, The U.S. Department of Defense, Honeywell and The Association of Computer Programmers and Analysts. In short, it's a bunch of high-caliber nitpickers whose mission, it seems, in order to make better disks for consumers, is also to make life miserable for everyone in the disk-making business.

How? By gathering together periodically (often, one suspects, under the full moon) to concoct more and more rules to increase the quality of flexible disks. Their most recent rule book runs over 20 single-spaced pages—listing, and insisting upon—hundreds upon hundreds of standards a disk must meet in order to be blessed by ANSI. (And thereby be taken seriously by people who take disks seriously.)

In fact, if you'd like a copy of this formidable document, for free, just let us know and we'll send you one. Because once you know what it takes to make an Elephant for ANSI . . .

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New, low cost computer technology is now available at a fraction of what you would expect to pay. This technology allowed Commodore to introduce the new and revolutionary CBM 8032 Computer.

WordPro PLUS turns this new CBM 8032 Computer into a sophisticated, time saving word processing tool. With WordPro PLUS, documents are displayed on the computer's screen. Editing and last minute revisions are simple and easy. No more lengthy re-typing sessions. Letters and documents are easily re-called from memory storage for editing or printing with final drafts printed perfectly at over five hundred words per minute!

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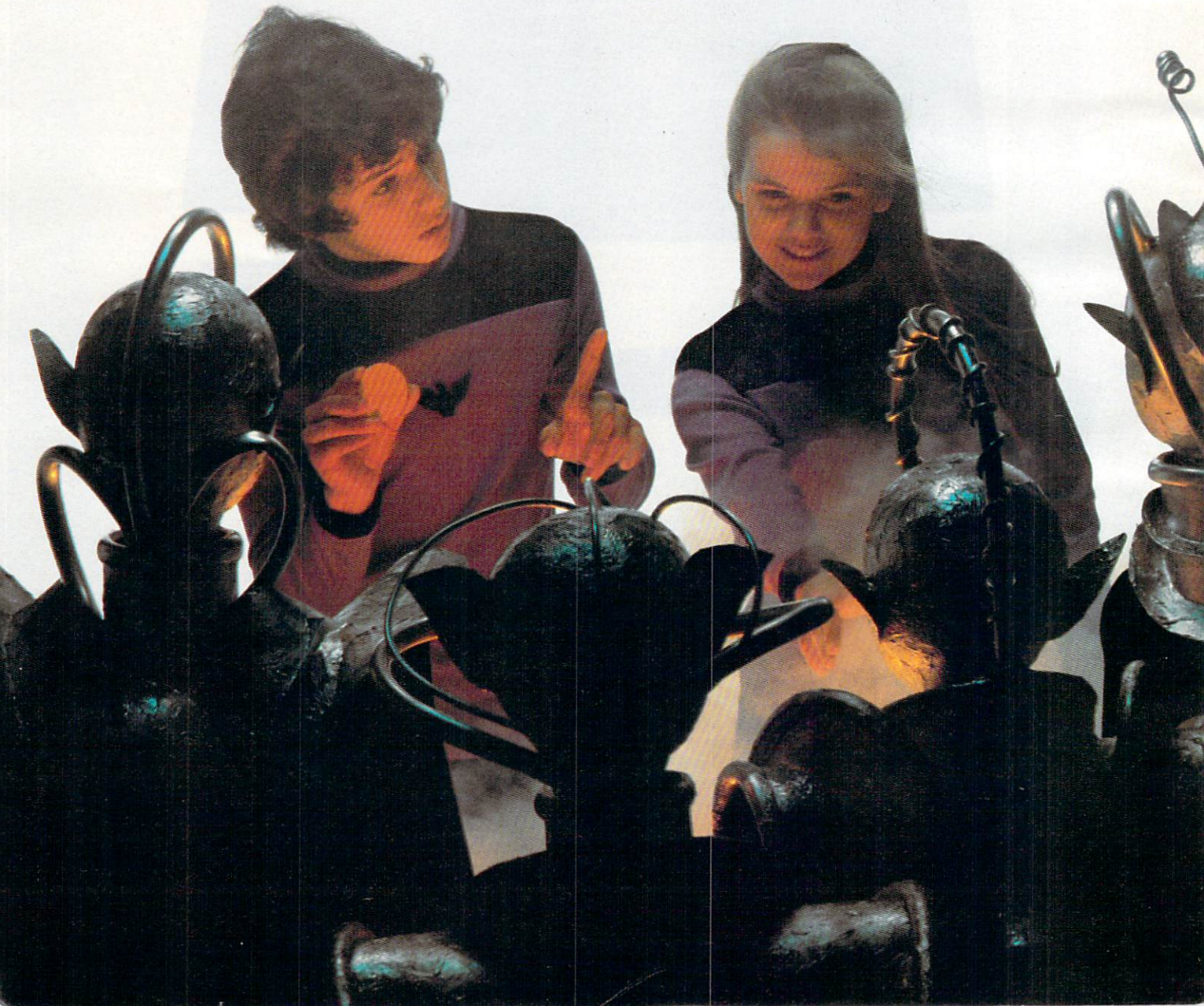
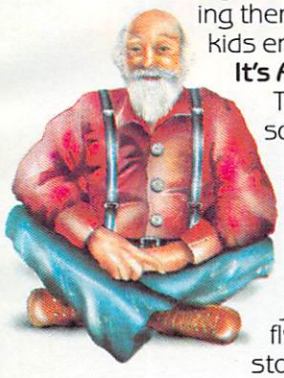
Finally, aliens your kids can reason with instead of destroy.



This year, thousands of kids will be searching for the most amazing thing.

At Spinnaker, we don't believe in the "kill or be killed" concept behind most computer games. In fact, we believe computer games should be instructive. Not destructive. But just as importantly, they should be fun.

That's why IN SEARCH OF THE MOST AMAZING THING™ is designed to let your kids negotiate with aliens instead of destroying them. Because given the opportunity, kids enjoy using their minds.



It's Amazingly Fun.

The Most Amazing Thing is out there somewhere. Finding it won't be easy. But relax, your kids will have the help of their old uncle Smoke Bailey. He'll give them a B-liner (sort of a cross between a hot air balloon and a dune buggy) to use on their journey. They'll have to learn how to fly the B-liner and navigate it through storms and fog. But before they do anything, your kids will have to talk to Old Smoke. He'll tell them about the Mire People and the strange language that they speak. He'll also tell them to avoid the dangerous Mire Crabs and how to get fuel for the B-liner.

Your kids will visit the Metallican Auction where they'll trade with the aliens for valuable chips. Your kids will then use these chips to buy things they'll need for their trip. And your kids will learn how to fly over the planet using their jet pack.

The Most Amazing Thing holds great powers, but it will take great skill, persistence and imagination to find it.

It's Amazingly Educational.

IN SEARCH OF THE MOST AMAZING THING is written by Tom Snyder, educator and author of the best-selling Snooper Troops™ Detective Series.

And like all Spinnaker games, IN SEARCH OF THE MOST AMAZING THING has real educational value. For instance, your kids will sharpen their ability to estimate distances and quantities. And since they'll be navigating their B-liner, they'll become aware of distance, direction and time. They'll also develop a knack for economic and monetary principles through trading with the aliens. And they'll solve problems through trial and error.

They'll learn all of these things, plus they'll learn that nothing is impossible if you put your mind to it.

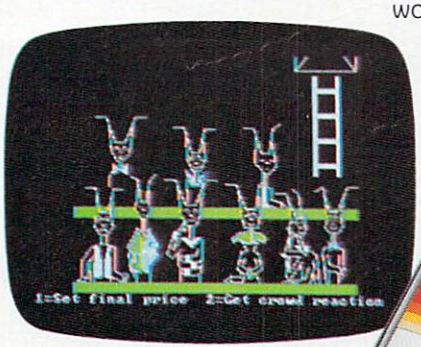
A Novel Approach to Computer Games.

Besides offering your children all of the above, IN SEARCH OF THE MOST AMAZING THING gives them an opportunity to develop their reading skills. Because included with the game is Jim Morrow's new novel The Adventures of Smoke Bailey.* So your children will have hours of fun reading the book or playing the game. And they'll be learning at the same time.

Parental Discretion Advised.

If you're a parent who would rather see your kids reason with aliens than destroy them, you've got plenty of reasons to ask your local software retailer for IN SEARCH OF THE MOST AMAZING THING. It's compatible with Apple,® IBM,® Atari,® and Commodore 64™ computers. And it offers so much fun you'll probably be tempted to play it yourself. Or you can write us directly at: Spinnaker Software, 215 First Street, Cambridge, MA 02142.

You'll find this is one computer game that won't alienate you from your children.



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May 1983 Vol. 5, No. 5

FEATURES

EDUCATION AND RECREATION

REVIEWS

COLUMNS AND DEPARTMENTS

THE JOURNAL

NOTE: See page 129 before typing in programs.

GUIDE TO ARTICLES AND PROGRAMS

AP Apple, **AT** Atari, **P** PET/CBM, **V** VIC-20, **O** OSI, **C** Radio Shack Color Computer, **64** Commodore 64, **S/T** Sinclair ZX-81, **TI** Texas Instruments, *All or several of the above.

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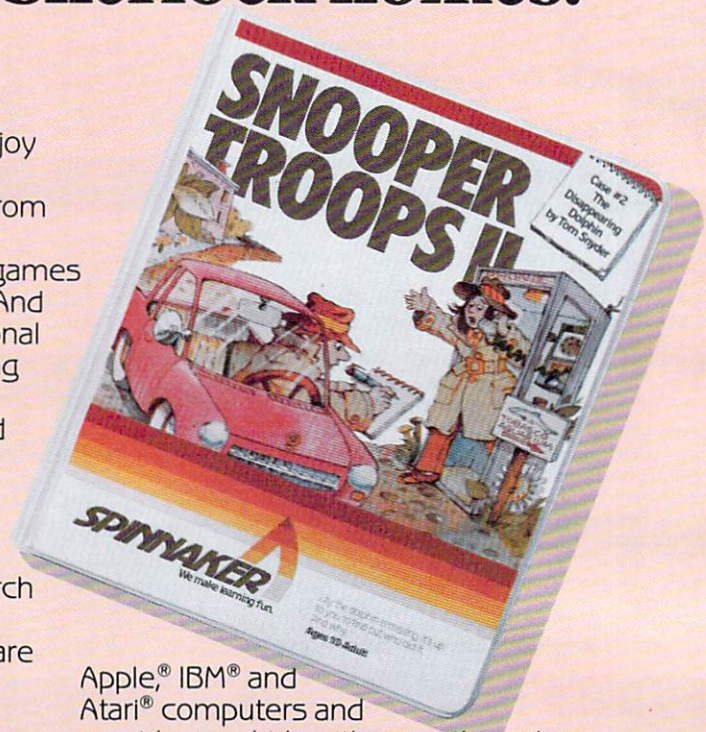
Introducing Snooper Troops™ detective series. Educational games that turn ordinary homes into Sherlock homes.



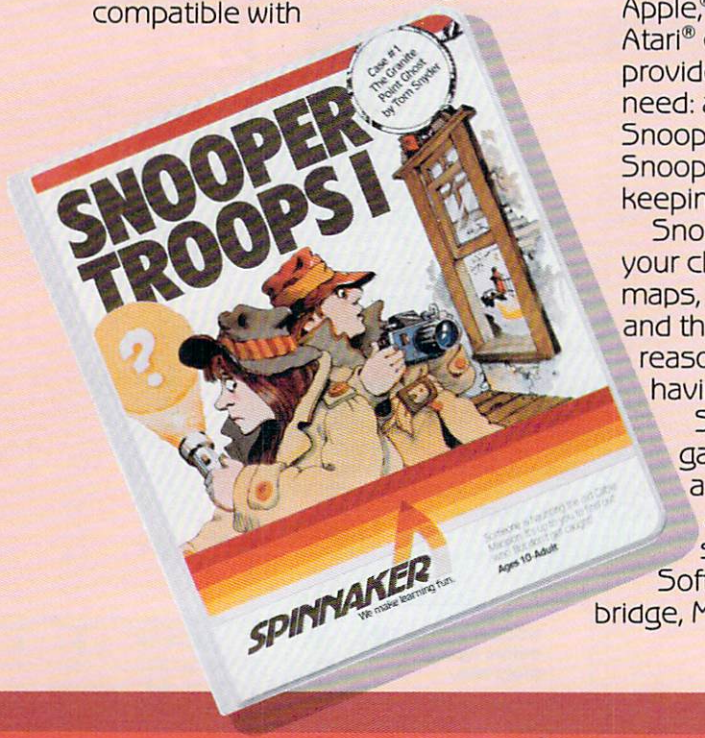
Where can you find educational games that your kids will really enjoy playing?

Elementary, my dear Watson. From Spinnaker.

Our Snooper Troops detective games are fun, exciting and challenging. And best of all, they have real educational value. So while your kids are having fun, they're learning.

As a Snooper Trooper, your child will have a great time solving the mysteries. But it will take some daring detective work. They'll have to question suspects, talk to mysterious agents, and even search dark houses to uncover clues.

The Snooper Troops programs are compatible with Apple,® IBM® and Atari® computers and provide your kids with everything they need: a SnoopMobile, a wrist radio, a SnoopNet computer, a camera for taking Snoopshots and even a notebook for keeping track of information.



Snooper Troops detective games help your children learn to take notes, draw maps, organize and classify information and they help develop vocabulary and reasoning skills. All while your kids are having a good time.

So if you want to find educational games that are really fun, here's a clue: Snooper Troops games are available at your local software store, or by writing to: Spinnaker Software, 215 First Street, Cambridge, MA 02142.

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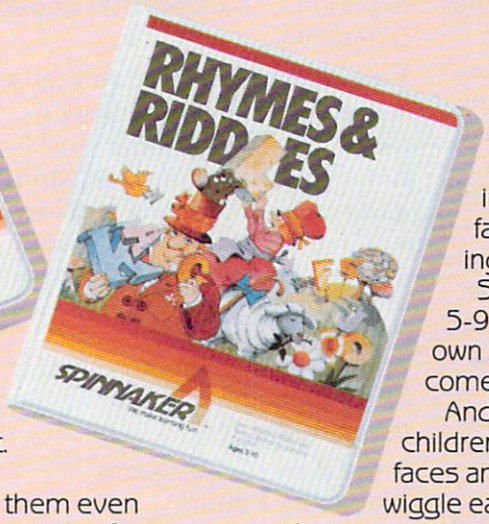
Spinnaker's early learning games will help make your children as smart as you tell everyone they are.



Your kids are pretty smart. After all, they're *your* kids.

Spinnaker can help make them even smarter. With a line of educational software that kids love to play.

Spinnaker games make the computer screen come to life with full color graphics and sound. And they're fun. Lots of fun. But they also have real educational value.

Some of our games help exercise your child's creativity. Others improve memory and concentration. While others help to improve your child's writing, vocabulary, and spelling skills.

And every Spinnaker game provides familiarity with the computer and helps your children feel friendly with the computer. Even if they've never used a computer before.

And Spinnaker games are compatible with the most popular computers: Apple,® Atari® and IBM.®

Our newest game, KinderComp™ (Ages 3-8) is a collection of learning exercises presented in a fun and exciting manner.

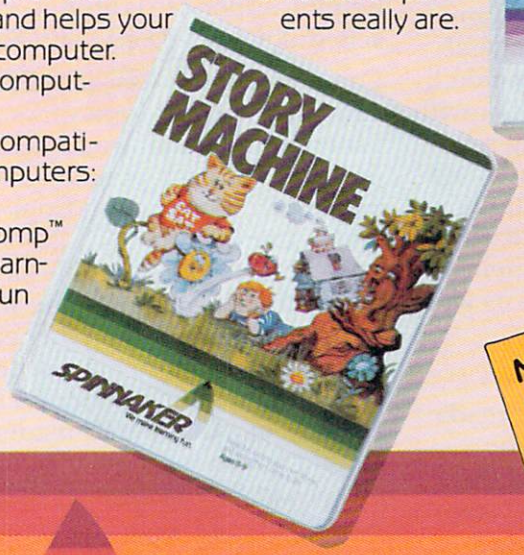
Rhymes and Riddles™ (Ages 4-9) is a letter guessing game featuring kids' favorite riddles, famous sayings and nursery rhymes.

Story Machine™ (Ages 5-9) lets children write their own stories and see them come to life on the screen.

And FACEMAKER™ lets your children create their own funny faces and make them wink, smile, wiggle ears (not your kids' ears, the ears on the screen), etc.

And we're introducing new games all the time.

So look for Spinnaker games at your local software retailer, or by writing to: Spinnaker Software, 215 First St., Cambridge, MA 02142. And show your kids how smart their parents really are.



Most titles also compatible with Commodore 64.™

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EDITOR'S NOTES

The Eighth West Coast Computer Faire was another triumph for organizer Jim Warren. It's truly a consumer show, and an exciting one, given that many of us who don't have a great deal of time for shows any more continue to make time to get to this one. The Civic Center was packed (not only were the hallways full of booths this year, but the freight unloading area as well). No one's quite sure why the Faire doesn't head for San Francisco's spacious new Moscone Convention Center, but we suppose there must be a reason. There is a reason, isn't there, Jim?

The Faire provides the opportunity for us to meet many of our readers and authors, giving us the chance to tie names to faces. The excitement of the show always stays with us for weeks.

Response to our call for editors in the January issue of **COMPUTE!** has been excellent, and we're quite pleased to announce the addition of several new staff members. Since you'll become much more familiar with them over the months ahead, through both the book and magazine divisions here, we thought we'd tell you a bit about their backgrounds now, and their own personal computers as well:

Orson Scott Card, Editor, **COMPUTE! Books** Division

Science fiction fans will already know Scott. The rest of you should know that he won the Campbell Award as Best New Science Fiction Writer of the year in 1978. And he was a four-time runner-up for the Hugo Award. Having also been an editor, Scott brings a wealth of experience to **COMPUTE! Books**. (Atari 800.)

Gail Walker, Production Editor

After several years of work in technical editing, communications, and corporate publishing and research in Texas and Iowa, Gail has joined our staff with primary responsibility for supervision of copy editing and coordination of scheduling and planning between our editorial and production departments. (Commodore 64.)

Tony Roberts, Assistant Managing Editor

Tony specializes in scheduling writers, bringing **COMPUTE!** the skilled training developed after many years of daily newspaper work, both as a reporter and as an editor. Tony's excitement about the personal computer revolution brought him to **COMPUTE!**, where he'll be assisting with the review of submitted manuscripts, editing, and helping supervise editorial scheduling. (TI-99/4A; TRS-80.)

Dan Carmichael, Assistant Editor

After spending several years programming mainframe computers and developing documentation, Dan moved from IBM Assembler to "VIC-20 Assembler." His experiences and enthusiasm for the VIC led him to **COMPUTE!**. VIC owners can look forward to his monthly column in the new *COMPUTE!'s Gazette*, and **COMPUTE!** readers should watch for regular contributions in these pages. (VIC-20.)

Stephen Levy, Assistant Editor

Stephen came to our attention via a series of excellent articles he'd written for **COMPUTE!**. After fifteen years as a public school teacher, he decided to bring his skills to us. His sensitivity to the needs of the average computer user make him a valuable addition to our editorial staff. (Atari 800.)

Random Bits

Rumor has it that we'll see Atari introducing a revised and expanded version of the 1200, with more features. Looks aren't *everything*. The recent moves by Texas Instruments to lock up the cartridge "marketing" market would seem to pose at least one clear danger. Rather than locking up that market, they may simply have it all to themselves. TI has refused to license the rights to their graphics ROM (GROM), and thus is the only manufacturer capable of producing TI cartridges. We suspect that smaller vendors may choose to support other computers rather than attempt to resolve the maze of dealing directly with TI. On the other hand, they do have a far more effective marketing reach than independent vendors usually do.

As the price of the VIC-20 and Commodore 64 charge downward, we hear that Commodore will be placing more and more emphasis on the development of the 64 market. And Commodore dealers, many of whom are upset over the placement of the 64 into the mass distribution chains, will be forced to concentrate their energies on the new P and B series machines.

Robert Lock

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As with all Professional Software products, **InfoPro** comes complete with a professionally written and fully-tested user oriented manual. **InfoPro** also includes a program ROM, and **InfoPro** System Diskette.

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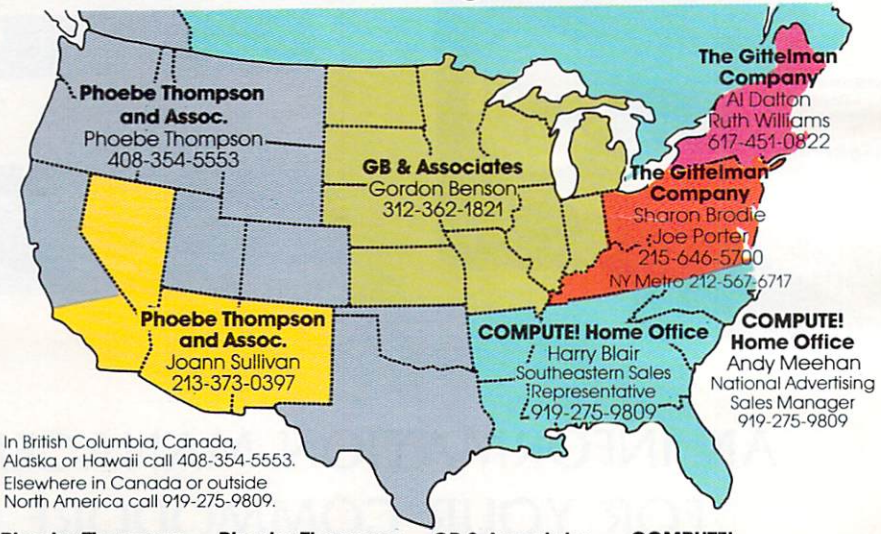

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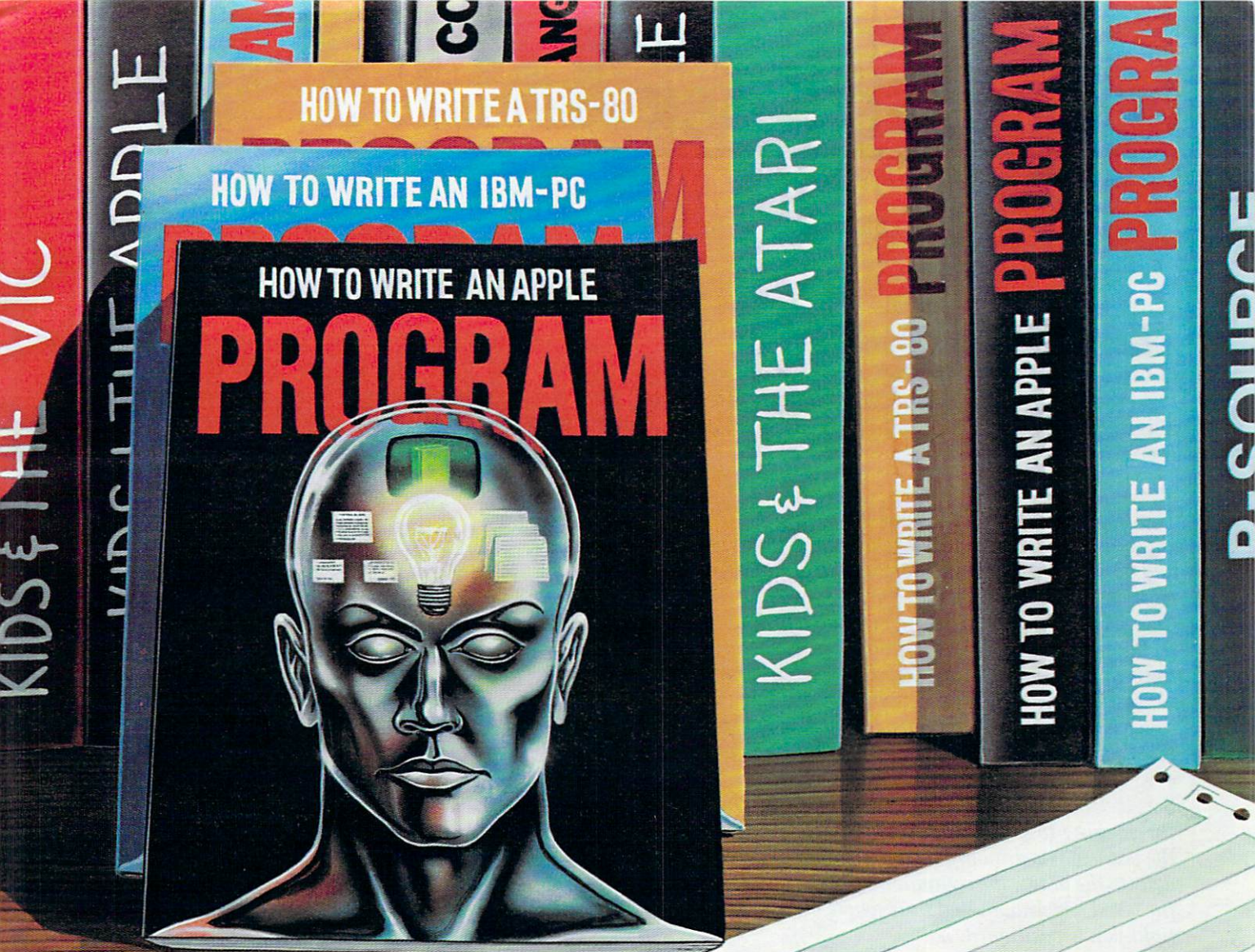

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READERS' FEEDBACK

The Editors and Readers of COMPUTE!

What Does A Light Pen Do?

I own a VIC-20. In **COMPUTE!** I see advertisements for a new light pen for the VIC. I am not sure what a light pen does exactly. What does it do? Do you recommend buying one?

Rich Cope

The display on a video screen is not nearly as static as it appears. It is actually "re-drawn" many times per second by an electron beam. Moreover, it is not a solid picture, but rather a stack of closely spaced horizontal lines like a jigsaw puzzle made up entirely of long, thin rectangular pieces. An important characteristic is that the beam always "draws" the entire screen, and at a constant speed. Thus the drawing always takes the same amount of time, whether the display is blank or filled with an intricate pattern.

The light pen is a light detection device. It "sees" the electron beam as it draws the lines across the screen. By checking to see how much time passes between when the beam starts drawing the picture and when the pen detects the beam, the computer can determine how far the beam has drawn, and thus where on the screen the light pen is positioned.

A light pen is useful for pointing to things on the screen. One of the most common uses for the pen is to select items from a list simply by pointing at the desired item. Another demonstration we have seen involves "playing" a piano by pointing with the light pen to the desired "keys" on a keyboard display. Light pens also provide you with an easy way to "sketch" on the screen.

TI Clock

Since there is no realtime clock built into the Extended BASIC on the TI-99/4A, is there any coding scheme to simulate one?

John J. Mahoney

You can insert a FOR/NEXT loop wherever you wish to make some time elapse. The number of times the loop is executed can be varied depending on the timing requirements of your program. First choose some arbitrary number of times that you wish the program to run through the FOR/NEXT loop. Then time the results when the program is executed. If the time that transpires when the program is run is too long, simply use a smaller limit in the loop. This method depends on actual processing time, so if you add or delete program statements, be sure to adjust the FOR/NEXT limit accordingly.

For example, see how long FOR T= 1 TO 5000:NEXT T takes to finish. Then change the 5000 limit to suit your needs.

Nüfekop Decoded

In your review of the latest games from Nüfekop Software (February 1983, p. 140), you write: "the word *Nüfekop*, according to the firm's early ads, has a Druid origin, and means putting an extraordinarily large amount into a small pocket or enclosure, possibly through the use of magic."

This must have been tongue-in-cheek. Surely you recognize "poke fun" spelled backwards.

J. R. Thompson, Jr.

Gary Elder, President of Nüfekop, responds:

We were completely shocked, but it's true! We're amazed, as always, at the visionary powers of the Druids.

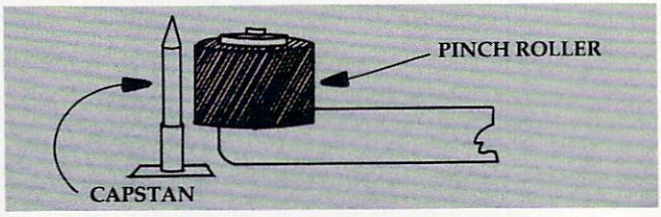
Cassette Drive Risk

I have set my VIC on a timer. The PLAY key on the tape drive is left depressed. When the system powers up I would like for it to load and run the program on the tape. How do I do this?

T. H. Homer III

It would be better to avoid leaving any of the tape-moving keys (REW, F.FWD, or PLAY) down while the unit is turned off. This can cause significant damage to a tape machine.

The tape is pulled through your drive at a uniform rate. The computer would not be able to load your programs from the tape drive if the rate deviated much from the norm. Inside the tape player are a capstan and a pinch roller (see illustration). When the PLAY button is pressed, the capstan revolves and the pinch roller holds the tape firmly against the capstan. The roller is made of hard rubber, but left pressed against a motionless capstan, it can be deformed.



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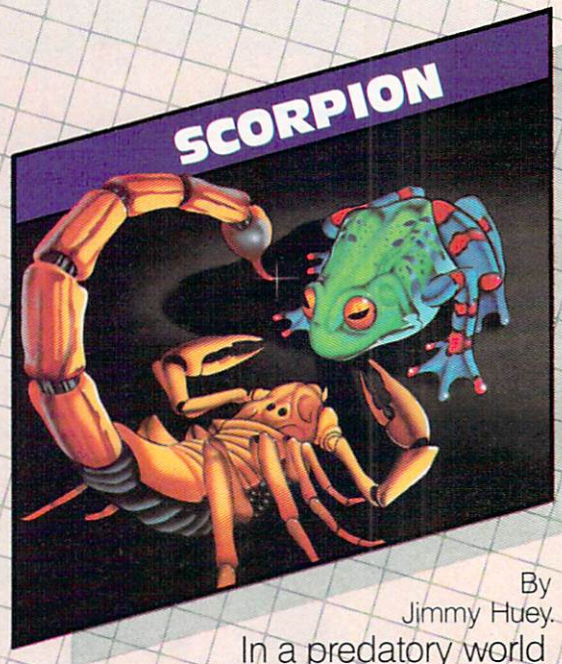

By Jimmy Huey.

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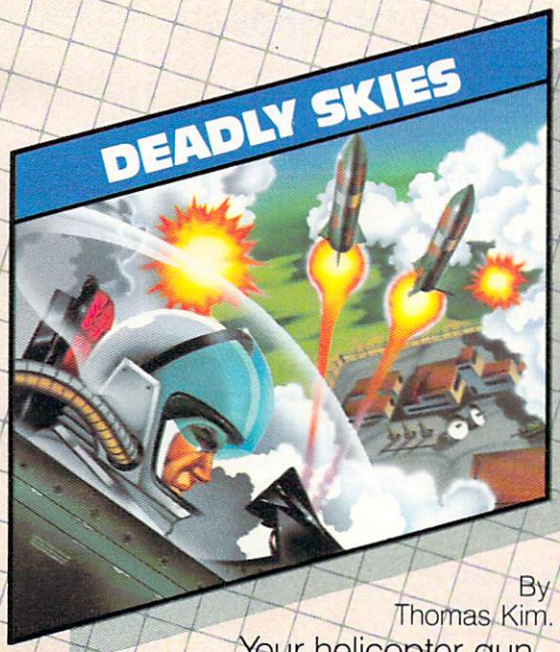

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Thomas Kim.

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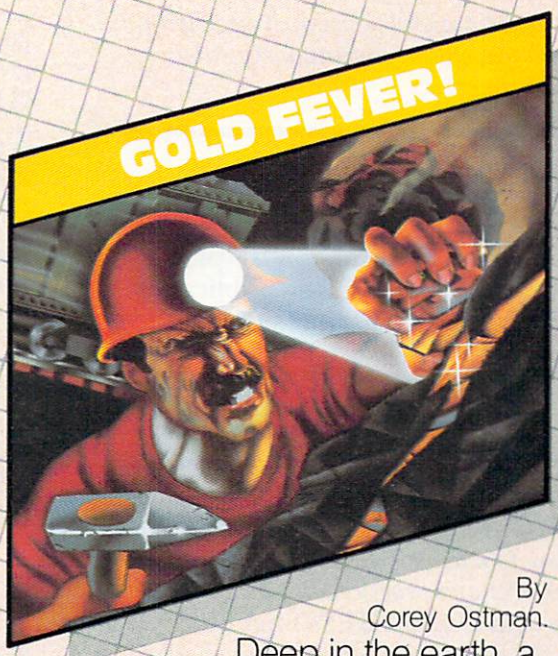

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From time to time you'll get a shopping cart at the market with a wheel that has been similarly damaged. In that situation, you're in for a noisy, bumpy trip through the store. A bad pinch roller would have far more serious effects: you would begin to have frequent load errors.

If you want a program to start running at a certain time, just set the internal clock. You don't need to involve the tape player at all. For example, to start a program that wakes you up with VIC music in eight hours:

```
10 TI$="000000": REM 00 HOURS/ 00M
    INUTES/ 00SECONDS
20 IF VAL(TI$) = 80000 THEN 40
30 GOTO 20
40 REM YOUR MUSIC PROGRAM STARTS H
    ERE
```

The VIC uses about a nickel's worth of electricity every 24 hours if you leave it on continuously. It's probably its own best timer.

How To Use Atari's Player/Missile Features

I am an Atari 800 owner. How do you *use* player/missile graphics? So far, in at least ten publications I have read about *enabling* it and that's where they stop.

Ely Manero

Player/missile graphics are a powerful, but complex tool. There are a number of things to learn before you can take advantage of all the options that P/M graphics make available to you. It's rather like learning BASIC itself; there's no way to master it in an hour. Your best bet might be to look over and practice with the numerous P/M articles in the new COMPUTE!'s First Book Of Atari Graphics. *The book was designed to teach Atari graphics, one step at a time. You might find one of Bill Wilkinson's contributions to that book, "Introduction To Player/Missile Graphics," especially helpful. See the* **COMPUTE! Books** *ads elsewhere in this issue.*

VIC PILOT Decimal Division

I teach a Computer Programming course to 8th graders at our school, Castillero Middle School, San Jose, California. We have seven Commodore PETs and a VIC-20. The language, of course, is BASIC.

But now we are also using PILOT .... from **COMPUTE!**'s December 1982 issue. Our students are finding it quite interesting to write programs in PILOT that they had previously written in BASIC.

One of my students, Mike Jennings, was intrigued with the notion that PILOT was integer only. He wondered whether it would be possible to have PILOT do decimal division. The result was a program he wrote which does just that. The user is prompted for two numbers, and for the number of decimal places desired. One small problem is when the division works out evenly: that is, when the decimal terminates. In such cases an additional zero is printed.

I thought it was a pretty good effort for an 8th grader with only a semester of programming.

Lawrence E. Corina

```
70 T:
1  *AGAIN
2  T:
3  T:2 NUMBERS?
4  C:#T=0
5  A:#A
6  I:#A=333
7  JY:* END
8  A:#B
9  T:CARRY OUT HOW MANY PLACES?
10 A:#L
12 *MAIN PART
14 I:#A<#B
16 TY:.;
18 JN:* A>B
20 CY:#A=#A*10
22 C:#C=#A/#B
24 C:#T=#T+1
26 C:#D=#C*#B
28 C:#E=#A-#D
30 C:#A=#E*10
32 T:#C;
33 I:#T=#L
34 JY:*AGAIN
35 I:#C=0
36 JN:22
38 JY:*AGAIN
44 *  A>B
46 C:#C=#A/#B
48 T:#C.;
50 C:#D=#B*#C
52 C:#E=#A-#D
54 C:#A=#E*10
56 J:35
60 *END
```

64 Tape Control

I'm a beginning programmer; I'm getting a big headache trying to solve what originally seemed to be a simple problem. My program instructs the user of a Commodore 64 to press fast forward on the Datassette. When it senses that the button is down it prints OK. After a time interval I want the Datassette turned off automatically by the computer. I've tried every POKE possible and haven't got one that works. I thought that this one would work:

```
POKE(1),PEEK(1)AND 39
```

... but it doesn't.

How can I do this?

Jim Butterfield replies:

You're close. Two more things, and you'll have every-

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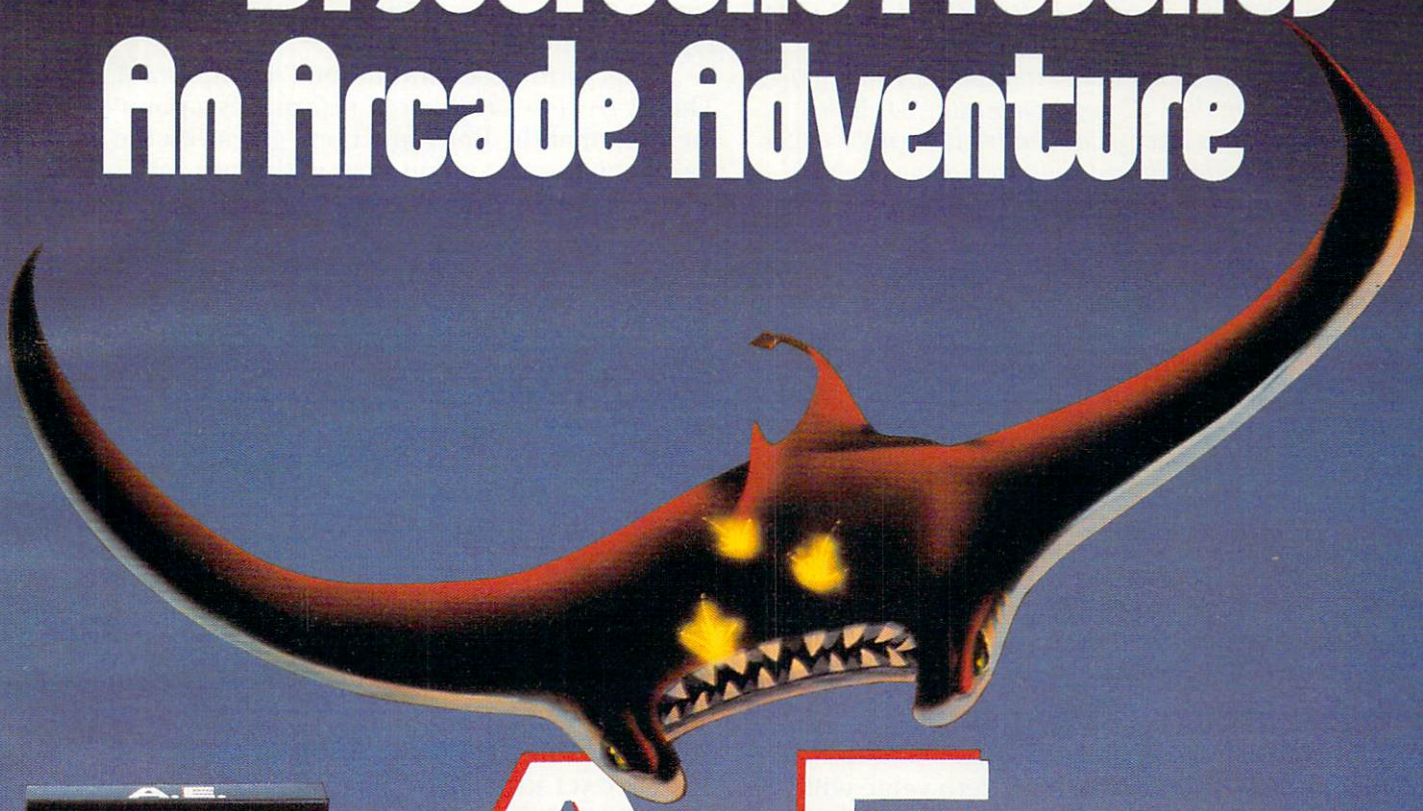
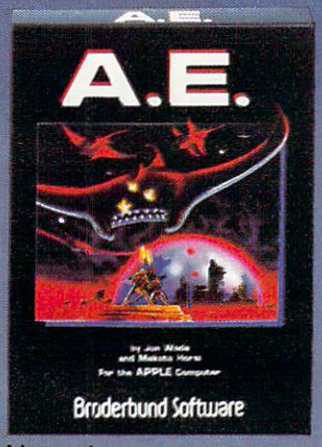


A.E.



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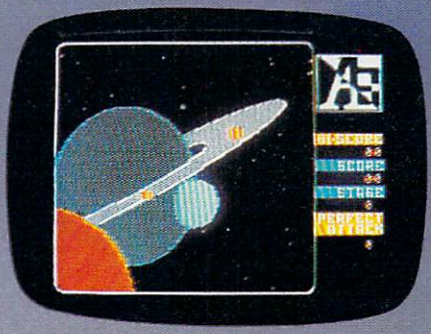

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thing working.

First: the motor logic is inverted, so to turn the motor off, you must turn the control bit (value 32) on. To turn bits on, you need an OR function rather than an AND. So your code will be: POKE 1,PEEK(1) OR 32.

Second: the motor is also controlled by an interlock, address 192 on the VIC and Commodore 64. If this location contains a zero, you can try to turn the motor off ... but it will be turned right back on again. You must set the interlock to any non-zero value after the motor has been turned on. Then, and only then, your POKE to address 1 will shut the motor off.

The interlock location, 192, will switch back to zero automatically when the user releases the Datassette key. If this key is still down, you can turn the cassette motor back on again very easily: just release the interlock with POKE 192,0.

So your procedure is as follows:

1. Wait for the user to press the appropriate cassette key which will cause the motor to start. Then POKE 192,1.

2. When the appropriate time has elapsed, POKE 1,PEEK(1) OR 32.

Zeroing Into VIC Tinymon

Why does Jim Butterfield say that a SYS to *any* memory location containing a zero value will invoke Tinymon? I would have thought that a SYS to the memory location containing the first byte of Tinymon would be the only way to make it run.

Roy Underhill

The zero means something special to the 6502 microprocessor chip. In its language (machine language), the zero is a BRK (break). That instruction forces control of the computer to go to an address contained in the "break interrupt vector." This is a two-byte-long "pointer" which you can change to point to any address. On the VIC, this vector is located in addresses 790 and 791 (decimal). If you make it point to the entry point in Tinymon (entry points are not always the first byte), then any time you SYS to a zero, the computer will "break" to the entry and Tinymon will be off and running.

True Random Numbers For TI-99/4

Regena writes about randomness on the 99/4 in her column in the February issue. I would like to share some discoveries I have made on this subject with your readers.

First of all, there seems to be some confusion about how the RANDOMIZE statement works in TI BASIC and TI Extended BASIC. As Regena pointed out, if you do not use this statement in your program prior to using the RND function, you will receive the same sequence of numbers each time you run the program. All your friends around the country with 99/4's will get the same numbers as you do, too. When the computer encounters the RANDOMIZE statement, it puts you back at the beginning of a new list of pseudo-random numbers.

That term "pseudo-random" is important. The *99/4A User's Reference Guide* makes a point to mention that the RND function "gives you the next pseudo-random number in the current sequence of pseudo-random numbers." If you use the RANDOMIZE statement once, then, you may or may not get the same sequence of numbers. However, using the RANDOMIZE statement over and over again in the program just puts you back at the beginning of another list. In reality, there seem to be certain numbers that the computer prefers to put at the top of its lists, so in games there may be some numbers that are never generated because you never make it far enough up into the current list to get that number. The point is, repeating the RANDOMIZE statement does NOT make your program more random.

I have found that the only way to make the computer generate a *totally* unpredictable set of numbers is to use the RANDOMIZE statement once at the start of the program, then when you need to wait for the user to press a key, do this:

```
100 CALL KEY(0,K,S)
110 Z=RND
120 IF S=0 THEN 100
```

Since the time it takes a human to press a key will not be exactly the same each time the program is used, the computer will read down the list of pseudo-random numbers an unpredictable number of places.

Steve Davis

TRS-80 Color Computer Group

I would like to inform your readers through your "Ask The Readers" column, that there is now a TRS-80 Color Computer Users Group in Milwaukee, WI. For more information write to:

CoCo-MUG
c/o Tom Fandre
2420 Misty Lane
Waukesha, WI 53186
(414)542-0600

Steve Koszuta

COMPUTE! *welcomes questions, comments, or solutions to issues raised in this column. Write to: Readers' Feedback,* **COMPUTE!** *Magazine, P.O. Box 5406, Greensboro, NC 27403.* **COMPUTE!** *reserves the right to edit or abridge published letters.* ©

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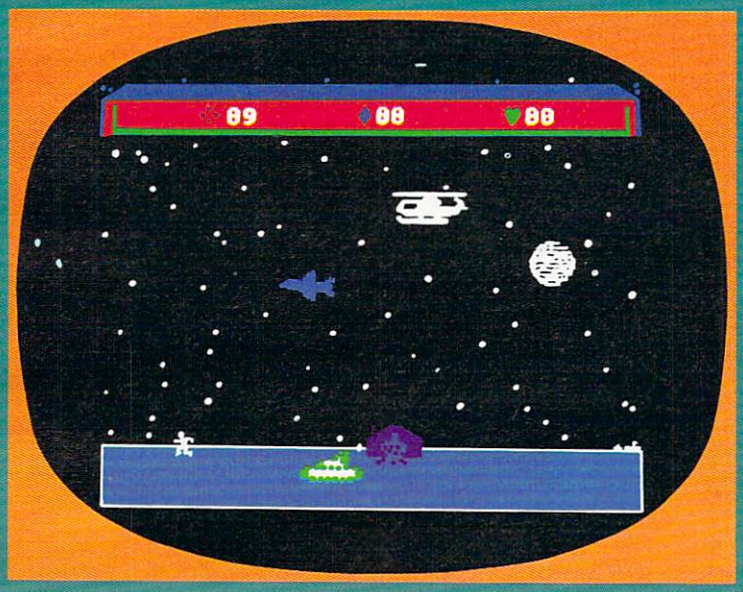

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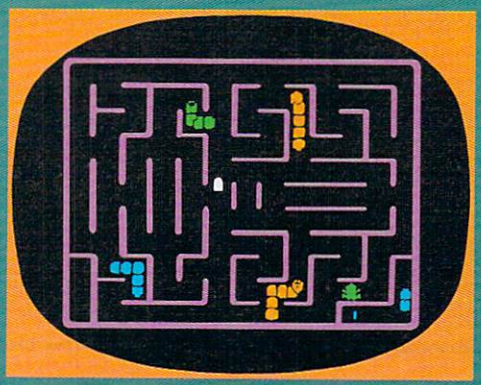

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The New Low-Cost Printer/Plotters

Tom R. Halfhill, Features Editor

Recent price breakthroughs are making color printer/plotters as easy to afford as the new low-end home computers. Here's a roundup of the major models now appearing on the market for Atari, Commodore, Radio Shack, and Texas Instruments computers.

If you're a person who likes to doodle on your memo pad at work, or in the margins of your notes at school, then this article is probably for you.

Especially if you sometimes doodle in color. And if you envy the graphic designs on this page. And if you wish there were more to computer graphics printouts than black-and-white dot-matrix dumps.

Multicolor graphic designs, drawings, charts, and graphs have long been possible with peripheral devices known as *plotters*. Plotters are closely related to printers. The main difference is that printers create an image by striking the paper with a print head, while plotters actually draw on the paper with ballpoint or felt-tip pens, just as people do. Of course, because plotters are controlled by computers, they can draw with greater precision than the finest human draftsman.

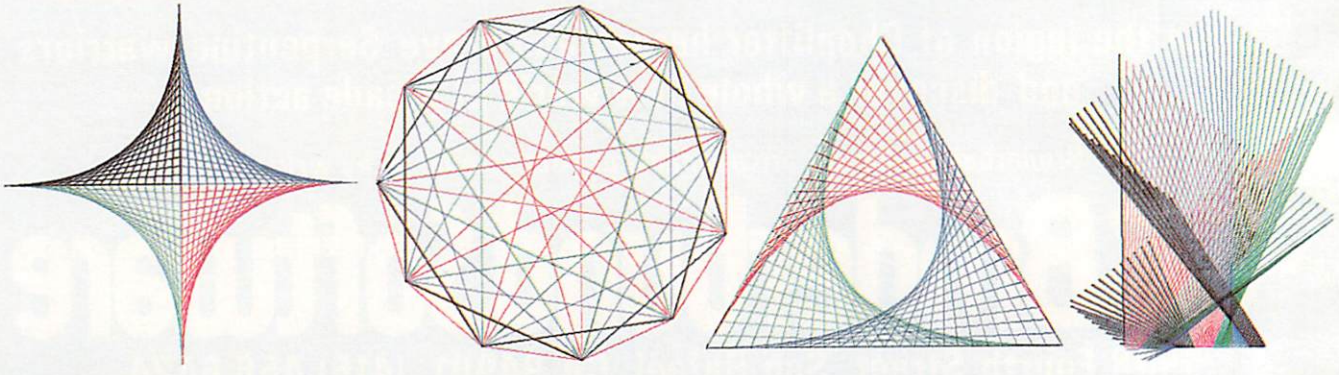
Although plotters have been around for years, they haven't seen much use on home/personal computer systems because of their high cost, typically several thousand dollars. But that's about to change, thanks to a new generation of economical *printer/plotters* (so-named because they can print text in addition to plotting figures). For example, the four-color designs illustrating this article were produced by the new Atari 1020 Printer/Plotter, which is just coming on the market for only $299. Similar low-cost models for other home computers have been introduced by Commodore, Radio Shack, and Texas Instruments.

A Revolver Loaded With Pens

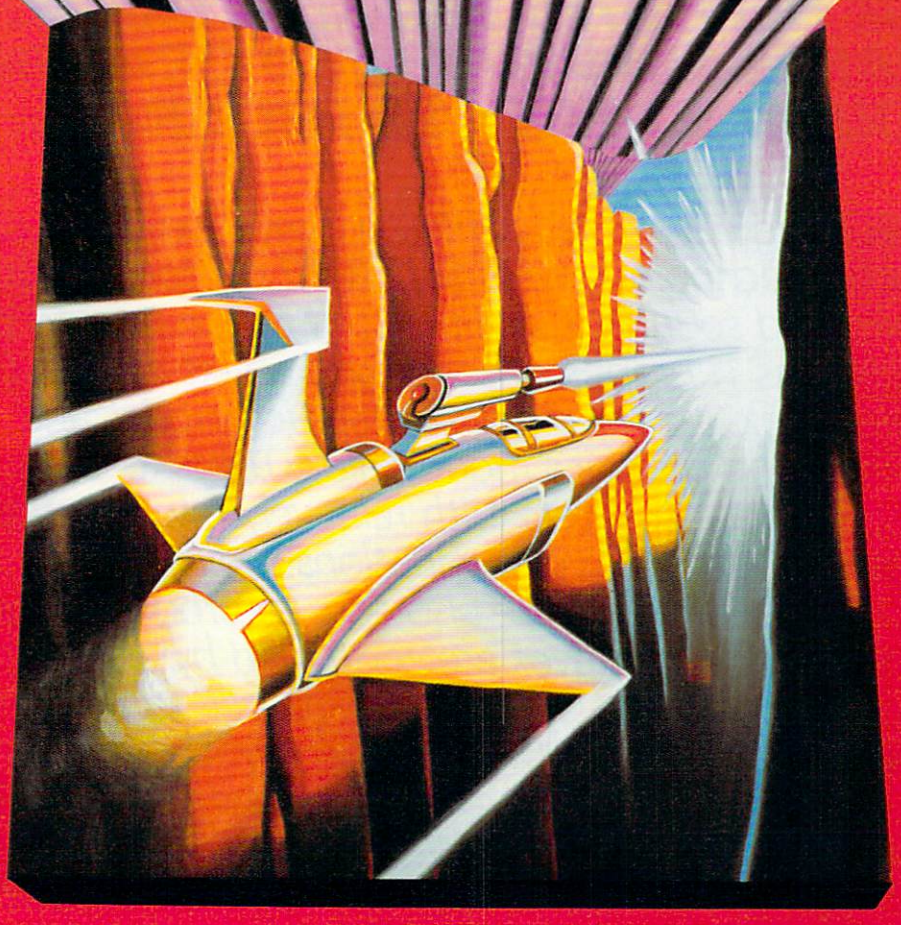
Three main features separate printer/plotters from ordinary printers: the ability to draw continuous lines in any direction, the ability to draw in several colors, and the ability to scroll the paper both forward and backward as they draw.

Printers are designed primarily for printing out text and are severely limited when it comes to graphics. So-called *daisywheel* or *letter-quality* printers – those that stamp their characters on paper with a typewriter-like striker – are limited to the characters on their striking wheels or balls. By printing patterns of X's, asterisks, periods, or so forth, they can create crude figures or charts.

Dot-matrix printers are a little more flexible. Their print heads have a row of tiny pointed wires which are "fired" at the paper in certain patterns to form characters out of small dots. In addition to regular alphanumeric characters, most dot-matrix printers also have special graphics characters. Generally these are small shapes or blocks which can be grouped together to make figures. With special programs, most dot-matrix printers



TRION IN 3 DIMENSIONS



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also can produce *screen dumps* – direct dot-by-dot copies of images on the computer screen. The limitations are that the screen dumps are only black-and-white, and have low resolution, since they are composed of masses of dots.

Plotters work on an entirely different principle. Expensive plotters usually have an arm, guided by tracks or rails, which grasps one ballpoint or felt-tip pen at a time. Beneath the arm, the sheet of paper (or plastic transparency) is held flat and stationary on the plotter. Under computer control, the arm can slide in any direction on its guide rails to draw continuous lines. When a line is supposed to end, the arm lifts the pen off the surface a fraction of an inch, moves to where the next line is to begin, and sets the pen back down to resume drawing. To change colors, the arm automatically lifts the pen, moves it off the paper, sets it in a rack, and picks up another pen from the rack. Some expensive plotters have racks with a dozen or more different-colored pens.

The new low-cost plotters for home computers take a somewhat different approach, but the result is the same. To cut costs, the complex movable arms, guide rails, and racks of pens are eliminated. Instead of drawing lines by moving an arm over flat, stationary paper, the new plotters hold the pen stationary and roll the paper beneath it. To make it possible to draw lines in any direction, the paper roller can rotate forward and backward, unlike conventional printers. And the low-cost plotters can lift the pen off the paper and set it back down to draw lines of any length similar to their more expensive cousins.

The new plotters also have a simpler way of changing pen colors. Instead of using a movable arm to pluck pens from a rack, they store four very small, colored pens in a rotating barrel. The barrel looks something like the cylinder of a revolver, except that there are spring-loaded pens where the bullets would be. To change colors, the plotter rotates the barrel, and a plunger presses the correct pen into contact with the paper.

As you might guess, the whole operation requires lots of precision, and it's amazing to see such devices sell for only a few hundred dollars. To further cut costs, all the new plotters use narrower paper (about 40 columns wide), and are limited to four colors at one time – although the pens are sometimes interchangeable so that many different colors are possible.

The Patience Of A Monk

Now that you know how a plotter draws pictures, you might be wondering how a printer/plotter prints text. After all, it doesn't have a conventional print head.

The answer is simple, though the method is not. A printer/plotter draws characters the same way it draws pictures: one line at a time. It's fun to watch. Tediously but precisely, with the patience of a medieval monk, the plotter scrolls the paper back and forth under the pen to carefully scribe each letter, number, and symbol. Since printing is a lot slower than typing, printer/plotters take a long time to generate text. Although the characters come out looking sharper than a dot-matrix printout, you probably won't want to use a printer/plotter for listing many programs – unless you, too, have extraordinary patience.

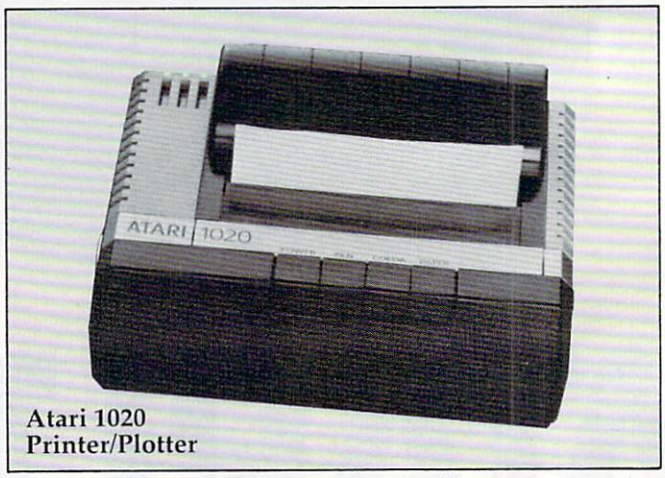
To control a plotter, you can write a program in BASIC or in another language that may be available for your computer (Logo, PILOT, etc.). The syntax varies, but generally you specify the X (horizontal) and Y (vertical) coordinates for each line; or, in the case of languages with turtle graphics, a direction and distance (i.e., RIGHT 90:FORWARD 10). To print text, you use a PRINT-type statement similar to BASIC's "PRINT." Printer/plotters have built-in character sets, so you don't have to issue volumes of commands to form each tiny character. Some printer/plotters even have several different-sized character sets to choose from.

Besides drawing pretty graphics designs, printer/plotters also are widely used for creating illustrative figures, charts, and graphs. It's usually easy to mix graphics and text.

In alphabetical order, here's a roundup of the new generation of low-cost printer/plotters for popular home computers:

Atari 1020

The Atari 1020 uses standard 4½ inch-wide roll paper and has text modes of 20, 40, or 80 characters per line. The text modes are selectable from the computer keyboard and can be freely mixed with charts, tables, and figures. In the 40-column mode, it prints at 10 characters per second (cps). There's also an international character set to complement the one on the new Atari 1200XL computer. The 1020 is styled to match the 1200XL and to fit neatly



Atari 1020 Printer/Plotter

Games you can take home to your mummy.

Available in disk, cassette and cartridge for the Atari 400/800 computers. These and other titles available soon for the Commodore 64, the VIC-20, TI-99/4A, Apple II, Radio Shack Color Computer, and IBM-PC.

synapse SOFTWARE

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atop its case.

Under program control, the printer/plotter can draw to any vertical/horizontal coordinates with its four-pen print head. The standard colors are black, red, blue, and green. Eight other colors also will be available. Four buttons on the plotter control the power, pen color, pen change, and paper feed.

Atari says the 1020 should be available this spring for $299.

Commodore CBM 1520

The CBM 1520, announced at the Winter Consumer Electronics Show (CES), uses standard 4½ inch-wide roll paper in a 5-inch carriage. Prototypes had a four-color print head with black, purple, green, and red pens.

Commodore CBM 1520 Printer/Plotter

Prototypes also appeared to have two different-sized text modes. High-resolution figures are possible with the plotter's ability to "step" up to 480 positions horizontally and 999 positions vertically. The plotter has a power switch on the side and three topside buttons for paper feed, color change, and pen change.

The 1520 is designed primarily for the VIC-20 and Commodore 64 computers, but could be interfaced to other models as well.

Commodore says the 1520 should be available this spring for $199.95.

Radio Shack CGP-115

The CGP-115, already on the market, uses standard 4½ inch roll paper and comes with red, blue, green, and black pens in its four-color print head. Like Commodore's CBM 1520, the Radio Shack plotter can step up to 480 positions horizontally. However, there is no limit to the vertical steps.

There are two text modes – 40 or 80 columns at 12 cps. Under program control, other size characters can be drawn and even rotated. Topside buttons control the power, paper feed, and color selection.

Radio Shack CGP-115 Color Graphics Printer

The CGP-115 sells for $249.95.

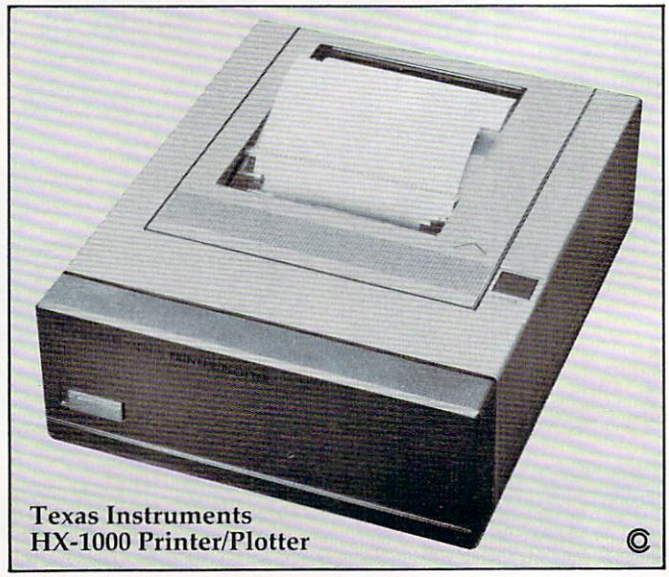
Texas Instruments HX-1000

The HX-1000 differs from the other printer/plotters in that it is portable and uses narrower 2¼ inch-wide roll paper. In the text mode, it can print up to 18 standard characters or 36 compressed characters per line, but eight other sizes are available as well. It prints at 12 cps.

The four-color print head comes with black, blue, red, and green pens. Ten control codes sent from the computer control various functions of the plotter. There is also an on-off/reset switch and a paper feed button.

The HX-1000 is powered by five AA-size (penlight) batteries or an AC adapter/charger. It is designed to work directly with Texas Instruments' two newest computers, the under-$100 TI-99/2 and the portable Compact Computer 40. The plotter also works with the TI-99/4A if connected through a $59.95 Hex-Bus Interface.

Texas Instruments says the HX-1000 should be available this spring for $199.95. The Hex-Bus Interface should be available shortly thereafter.



Texas Instruments HX-1000 Printer/Plotter

PRESENTING THE REMARKABLE SV-318.

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SPECTRAVIDEO SV-318 COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	NEC 6001	RADIO SHACK COLOR COMPUTER
BASE PRICE	**$299**	**$1,540**	**$899**	**$595**	**$399**	**$299**
COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	16K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	32K	16K
BUILT-IN EXTENDED MICROSOFT* BASIC	YES	YES	ADDITIONAL COST	NO	YES	ADDITIONAL COST
BUILT-IN RAM	32K**	48K	16K	64K	16K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	15	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	10
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO IO	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY (LOW PROFILE)	256K	143K	96K	170K	N/A	170K
	YES	NO	NO	NO	NO	NO
CP/M* COMPATIBILITY (80 column programs)						
CP/M* 2.2	YES	NO***	NO	NO ****	NO	NO
CP/M* 3.0	YES	NO	NO	NO	NO	NO

* 16K user address able plus 16K graphic support
** 128K user address able plus 16K graphic suppori
*** Apple II can accept modified 40 or 80 column CP/M
**** Commodore 64 accepts 40 column CP/M

Sadly, many personal computers will become tomorrow's junk in the attic. The SV-318 is one that will not. Because as you get better, it gets better. It does so because of its capability and expandability—both far beyond those of any other affordable computer.

CAPABILITY. *The SV-318 isn't just more capable. It's much more capable. No other computer at even twice the price combines all these extraordinary features: 32K ROM expandable to 96K; 32K RAM expandable to 144K; Extended Microsoft Basic (the industry standard); even Standard CP/M 80-column capability so you can immediately utilize over 10,000 existing software programs. The SV-318 also has a unique built-in joystick/cursor control—an immeasurably useful feature when it comes to playing your favorite video game.*

EXPANDABILITY. *As you become more and more skillful with computers, you'll love how the SV-318 "stretches" to meet your demands (and actually leads you in fascinating, new directions). For one thing, all eleven of our important peripherals are available immediately. With most other models, you have to wait months. For another, the SV-318 is beautifully designed to interface with new options as they become available.*

AFFORDABILITY. *The SV-318 is not only eminently affordable, it's the first true bargain of the computer age! Besides home budgeting, business applications, word processing, programming and self-teaching, the SV-318 is the best entertainment value in town. Not only can you use it with your TV to play hundreds of different video games, you can also use your SV-318 with a TV as a drawing tablet or music synthesizer. In play, as in work, the SV-318 will continually expand to meet your potential.*

Whether you're just wetting your toes in computers, or fully asail on the waters, the SV-318 is a computer that will serve you for many, many years. You see, we believe that even in the computer age, you don't become an object of real value unless you're around for a while.

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David D. Thornburg, Associate Editor

The Robots Are Coming

Technological advances seem to be hitting the consumer marketplace with such force and frequency that we are in danger of becoming numbed by their announcement. It is hard, for example, to believe that the personal computer field is only a few years old – or that powerful languages like Logo have become available to the home computerist only in the past two years.

As we watch these developments eclipse each other, we might ask ourselves what will happen next? What technological development could possibly hit the consumer marketplace with such force that it might displace our current technological wonders as the benchmarks of our age?

Well, I've given it a lot of thought, and I have an answer.

Domestic robots.

By now, many of you have seen news stories on the Heath HERO-1 and the Androbot TOPO. In watching these contraptions on the evening news, you might have said to yourself, "So what?" After all, we see robots in the movies all the time, and the use of robots in dangerous or boring assembly tasks has been going on for years.

The reason domestic robots are important is that, like the personal computer, they are designed for personal use by people in their own homes. This means that, for the first time, we will individually take control of robots and shape them to our personal needs, just as we did with computers.

The robots used by industry are reminiscent of the computers used by business – large specialized machines designed to perform clearly defined tasks with efficiency.

In more ways than one, the domestic robot in 1983 reminds me of the home computer in 1978. For example, in 1978 there wasn't a whole lot one could do with a personal computer. The software industry was in its infancy (residing mainly in spare rooms and garages), but the people who bought computers then were pioneers – brave souls who not only were the first to experience the computer revolution, but who also helped to make it happen either by writing software themselves or by helping to identify those areas where software was needed.

All of which brings me to 1983 and the beginning of a new industry.

Where Are They Headed?

The domestic robot, as this is being written, is largely a tool for discovery, experimentation, and entertainment. The Heath product is oriented to the technical educational market as a tool for learning about robotics *per se*. The buyer of the Heath HERO not only gets to assemble the device (thus learning about everything from microprocessors to wheel drive systems), but also gets to program the robot at the most basic levels. The Androbot TOPO, on the other hand, is a fully assembled device designed to be operated with turtle graphics commands from a separate computer using BASIC or Logo.

Because of philosophical differences in the design of these two products, they will serve the needs of different audiences. I expect the Heath product to have more appeal to the hardware tinkerer – the sort of person who built his or her Northstar Horizon from a kit. TOPO may appeal more to application-oriented users.

At first glance, TOPO looks about as useful as an overgrown, radio-controlled Big Trak. It is sent commands to move forward and backward by some amount, or to turn to the right or left by some angle. It is thus a physical analog to the display turtle associated with languages like Logo and Atari PILOT.

In order to understand my enthusiasm for domestic robots, you almost need to experience them for yourself. There is something quite appealing about being able to write a program that sends a three-foot tall robot on a tour of your house. After watching a robot in action, you can't help but come up with lists of applications for these devices.

In the few weeks I have had TOPO, I have used it to help teach computer programming to

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third graders and to dance to a piece of music I play at the piano. These aren't earthshaking applications, but I've had TOPO only a short time.

Where are robots like TOPO headed? There are many applications that come to mind. When equipped with a simple cart, robots can help handicapped people carry things from room to room. If properly programmed, a robot can "walk" around the house each night "looking" for intruders. (I can't imagine very many intruders who would be willing to tangle with a robot.)

Clearly, just as with personal computers, the entertainment possibilities are endless. You could design games for groups of children that use a robot as one of the players – truly picking a child at random, for example. A robot that can be programmed to move pseudo-randomly in a room can be used for another game in which the children divide into two teams. One team has the goal of always staying to the "north" of the robot, while the other must always stay to the "east." As the robot moves, the children must move with it. Any children caught outside the safe zone are "out" until the next game.

The more I think about it, robots may help counter the fear I have heard that computers are turning our children into sedentary creatures. If this were true (and I tend to doubt it), robots would help reverse this trend.

What I find interesting is that the applications I mentioned (carrying things, roaming the house, playing games) are all feasible with today's robots and just a little bit of software development.

And what about the future? Will we still look on robots as the foreboding evil mechanisms destined to eliminate the less-than-perfect carbonaceous beings that created them?

I think not.

The personal computer made computing less intimidating to us by placing the power of this machine in the hands of individuals. So it will be with robots. By creating a domestic robot industry, we all benefit, even if we choose not to use robots ourselves.

As with computers, users and non-users alike should learn about robots.

Why?

Because they are there.

Next Time

Next month we will continue to explore this topic by looking at the promise and potential of the next generation of robots, androids that adaptively program themselves in response to their environment.

In the meantime, you might want to read Isaac Asimov's book *I, Robot*. It will be moved off the fiction shelves soon.

THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

People are putting their home computers to all kinds of uses. Last month – to get an overview – we separated personal computing programs into fifteen broad types: 1. Graphics, 2. Music, 3. Word Processing, 4. Education, 5. Home Applications, 6. Accounting, 7. Games, 8. Financial Simulation, 9. Data Base Management, 10. Languages, 11. Operating Systems, 12. Disk Operating Systems, 13. Utilities, 14. Telecommunications, and 15. Artificial Intelligence. We reviewed the first three, so now let's take a look at the second group.

Education

Although fears have been expressed that Computer Assisted Instruction (CAI) could lead to a brave new world of cold, inhuman, assembly line schooling – just the opposite seems to be taking place. How the computer teaches is entirely dependent on how it's programmed to teach. A CAI program *can* be sarcastic, or teach too slowly or too quickly, or offer endless, boring drills. But this is not something inherent in *computerized* teaching; bad teachers have been doing all these things for centuries.

The opportunities for personalized, interactive, effectively paced CAI are just beginning to be explored. It wasn't long ago that we heard a good deal about attempts at new, unstructured educational styles. "Learning can be fun" was the slogan, but the results of these experiments were, to put it mildly, mixed. A part of an entire generation failed to learn fundamental spelling, arithmetic, and even reading skills.

CAI might well be the answer. After all, learning *should* be exciting and challenging. When combined with sound and animation, many learning programs are indistinguishable from games. Nearly every month, **COMPUTE!** publishes a CAI game or program. "Crosswords," in this issue, will construct crossword puzzles which can build vocabulary or teach spelling. Last month, there was "Math Fun." And as games themselves become more sophisticated, the "hidden" lessons within them will become more effective. Much remains to be discovered about CAI technique, but it seems quite possible that, via computers, math (and all the other subjects) can become fun for the average student.

Home Applications

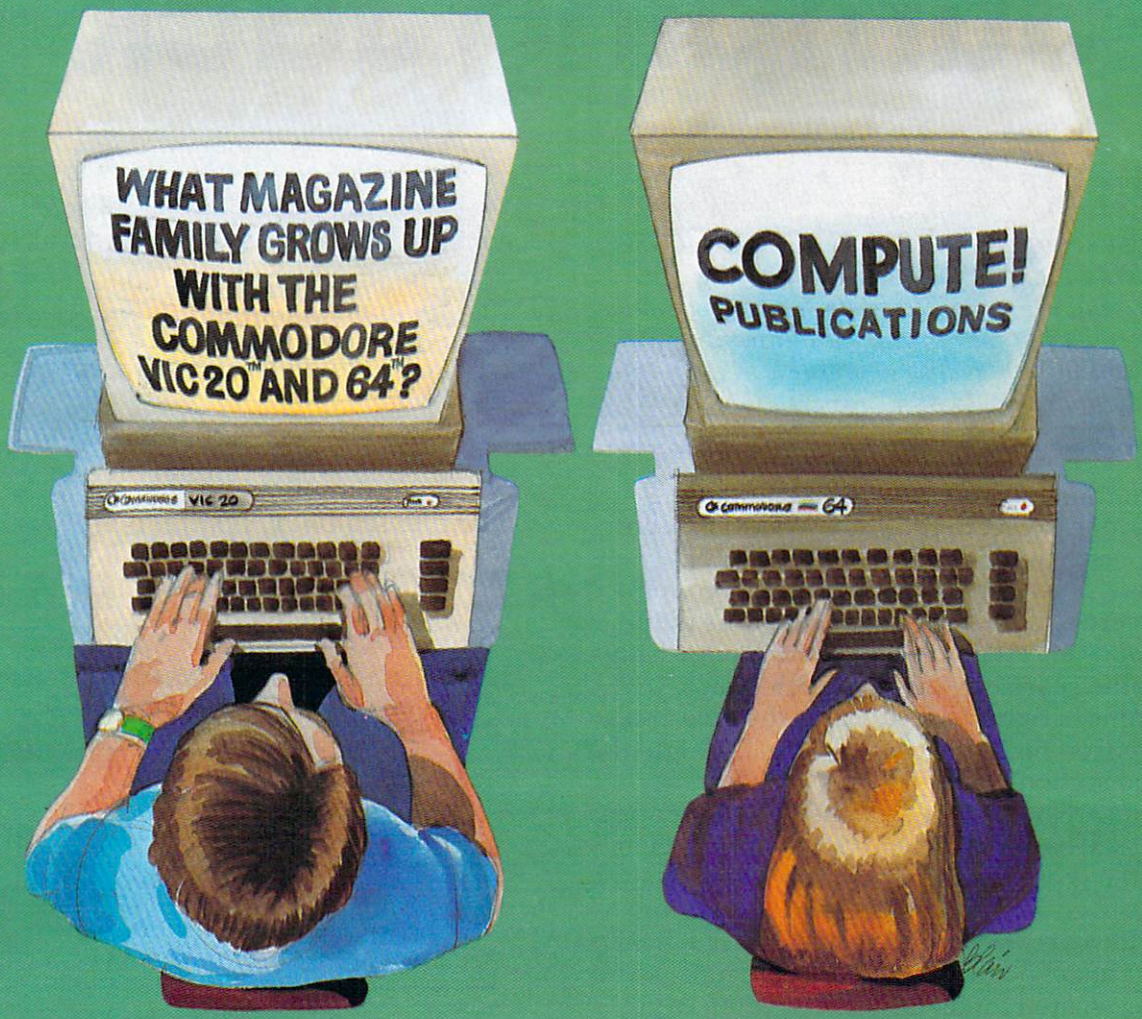
This is a catch-all category. Growing out of hobbies or special needs, these programs perform a personal service such as keeping track of the birds a birdwatcher sees or the stamps a collector buys. Sometimes, home applications are just scaled-down versions of business programs. For example, the professional advertiser's mailing list program becomes, in the home, a personal Christmas/birthday card manager. It will not only address the envelopes; it can remind you when to mail the cards. Other examples include personal inventory programs (record, book, coin collections, etc.) or personal analysis (biorhythms, nutritional planning, scheduling, computerized bowling league scorekeeping, and so forth).

Big business and government have had years to computerize themselves. Some estimates suggest that computers do as much as 80 percent of the work in areas such as national defense. Home computerization is in its infancy, but the future seems to promise increasing use of "intelligent" appliances, information services, even robot vacuum cleaners. To all of us who try, with more or less difficulty, to keep our home and personal affairs in order, the offer of smart-machine domestic services can only be viewed as a major blessing.

Descending Luxury: Accountants For Everyone

Personal budgeting, retirement planning, investment analysis, and tax preparation are among the currently popular applications of computers in home accounting. Most of us don't face financial decisions of sufficient complexity to require the services of a human accountant. On the other hand, most of us could use some help with our money management. Getting this help from our home computer is yet another example of what could be called *descending luxury*.

To define that idea, let's look at another example: movies. When I was in college, we'd hear about the movie that the President or a Hollywood star had shown guests the night before. It seemed an extraordinary luxury to be able to watch a movie in your own house. Indeed, such freedom was only available to the very wealthy. Now home video equipment is making home theaters increasingly available to everyone. In a few years, the technology of high resolution, large-screen TV should be affordable everywhere. Another luxury has descended. ©



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Jumping Jack

Paul Burger

Jumping Jack, for the unexpanded VIC, Atari 400/800, Commodore 64, and TI-99/4A is a challenging game that makes full use of your computer's color and sound capabilities. Each game can be played through several levels. The Atari version has nine skill levels. This is a game that can be enjoyed by all age groups.

Jack is running across platforms and climbing down ladders to get to the bottom of the screen. Sounds easy enough, right?

There's just one problem: these platforms are not very sturdy at all, and at any time they can collapse in certain places. You must be ready to press the space bar causing Jack to jump. If your timing is right, Jack will clear the hole and land safely on his feet. If not, Jack will fall into the collapsed section of the platform.

If you are not quite quick enough on the space bar, you still have a chance to clear the hole. Here's how: If the space bar is pressed immediately after Jack gets over the hole, you can make a saving jump. However, Jack must be over the hole while in the air to get points for jumping the hole, so no points are scored for using a saving jump to get over a hole. This method can also be used to jump two holes in a row. Simply make a saving jump as described above for the first hole, and Jack will fly over the second hole (this scores points only for the second hole, however.)

Program 1: VIC-20 Version

```
0 M=3:T=150:D=5:X=25:P=61:POKE55,160:POK
    E56,29:S=36876:POKE36878,15:GOTO1
    0012
1 C=27:F%=5:FORI=7680TO8185:POKEI,59:NEX
    T
2 FORI=7702TO7723:POKEI,53:NEXT:FORI=781
    2TO7833:POKEI,53:NEXT:FORI=7900TO
    7921:POKEI,53:NEXT
3 POKE36879,C:FORI=8032TO8053:POKEI,53:N
    EXT:FORI=8142TO8163:POKEI,53:NEXT

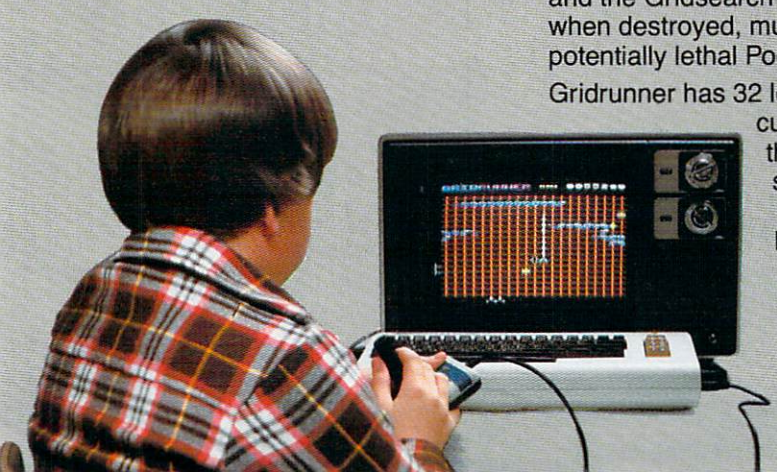
4 FORI=38400TO38884+21:POKEI,4:NEXT
5 FORI=38488TO38510+21:POKEI,F%:NEXT
6 FORI=38576TO38598+21:POKEI,F%:NEXT
7 FORI=38708TO38730+21:POKEI,F%:NEXT
8 FORI=38818TO38840+21:POKEI,F%:NEXT:GOS
    UB10020:FORI=1TO1000:NEXT
9 I=7790
10 IFI/2=INT(I/2)THENPOKEI-1,59:GOSUB110
11 IFI/2=INT(I/2)THENPOKEI,55:FORJ=1TOT:N
    EXT:GOTO14
13 POKEI-1,59:POKEI,56:FORJ=1TOT:NEXT:B=7
    812:GOSUB510
14 IFPEEK(197)=32THENGOSUB20
15 IFPEEK(I+22)=54THENPOKEI,59:GOTO30
16 IFPEEK(I+22)=60THEN500
17 I=I+1:IFI>7811THENI=7790:POKE7811,59
18 GOTO10
20 I=I-21:POKEI+21,59
21 IFPEEK(I+22)<>59ORPEEK(I+44)<>53THENSC
    =SC+X:POKEI-22,P:GOSUB112:POKEI-2
    2,59
23 POKEI,55:FORJ=1TOT:NEXT:I=I+23:IFI>781
    1THENI=7790:POKE7811,59
24 POKE7789,59:POKE7790,59
25 FORJ=1TOT:NEXT:POKEI-23,59:POKEI,55:RE
    TURN
30 I=7898
31 IFI/2=INT(I/2)THENPOKEI+1,59:GOSUB110
32 IFI/2=INT(I/2)THENPOKEI,58:FORJ=1TOT:N
    EXT:GOTO34
33 POKEI+1,59:POKEI,57:FORJ=1TOT:NEXT:B=7
    900:GOSUB510
34 IFPEEK(197)=32THENGOSUB40
35 IFPEEK(I+22)=54THENPOKEI,59:GOTO50
36 IFPEEK(I+22)=60THEN500
37 I=I-1:IFI<7878THENI=7898:POKE7878,59
38 GOTO31
40 I=I-23:POKEI+23,59
41 IFPEEK(I+22)<>59ORPEEK(I+44)<>53THENSC
    =SC+X:POKEI-22,P:GOSUB112:POKEI-2
    2,59
43 POKEI,58:FORJ=1TOT:NEXT:I=I+21:IFI<787
    8THENI=7898:POKE7878,59
44 POKE7856,59:POKE7855,59
45 FORJ=1TOT:NEXT:POKEI-21,59:POKEI,58:RE
    TURN
50 I=8010
51 IFI/2=INT(I/2)THENPOKEI-1,59:GOSUB110
52 IFI/2=INT(I/2)THENPOKEI,55:FORJ=1TOT:N
    EXT:GOTO54
53 POKEI-1,59:POKEI,56:FORJ=1TOT:NEXT:B=8
    032:GOSUB510
54 IFPEEK(197)=32THENGOSUB60
55 IFPEEK(I+22)=54THENPOKEI,59:GOTO70
56 IFPEEK(I+22)=60THEN500
57 I=I+1:IFI>8031THENI=8010:POKE8031,59
58 GOTO51
60 I=I-21:POKEI+21,59:IFPEEK(I)<>59THENSC
    =SC+300
61 IFPEEK(I+22)<>59ORPEEK(I+44)<>53THENSC
    =SC+X:POKEI-22,P:GOSUB112:POKEI-2
    2,59
63 POKEI,55:FORJ=1TOT:NEXT:I=I+23:IFI>803
    1THENI=8010:POKE8031,59
64 POKE8009,59:POKE8010,59
65 FORJ=1TOT:NEXT:POKEI-23,59:POKEI,55:RE
    TURN
70 I=8140
71 IFI/2=INT(I/2)THENPOKEI+1,59:GOSUB110
72 IFI/2=INT(I/2)THENPOKEI,58:FORJ=1TOT:N
    EXT:GOTO74
```

IS GRIDRUNNER™ UNBEATABLE?

No one, not even the author, has ever achieved the last Gridrunner. It is an extremely fast-paced arcade-quality game designed to test your coolness under fire and challenge your reflexes.

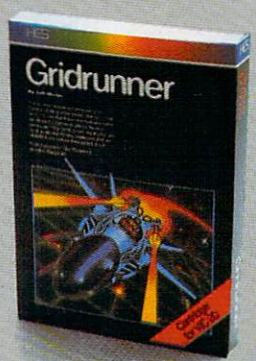
As the pilot of the Gridrunner, a combat ship, you must annihilate the various enemies traveling along the "Grid." High scores are possible only through the mastery of the patterns of the X/Y Zappers and the Gridsearch Droids which, when destroyed, mutate into potentially lethal Pods.

Gridrunner has 32 levels of difficulty (20 levels in the VIC 20 version). To this date, the 13th level has been the highest achieved.



Gridrunner is available for VIC 20, Commodore 64 and Atari 400/800.

Can you beat Gridrunner? See your local computer or games dealer and find out.



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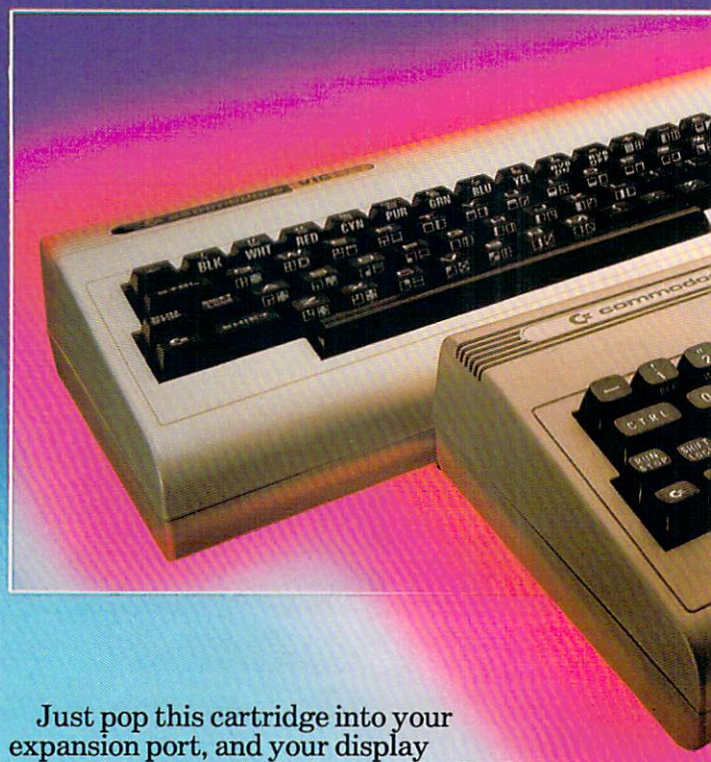
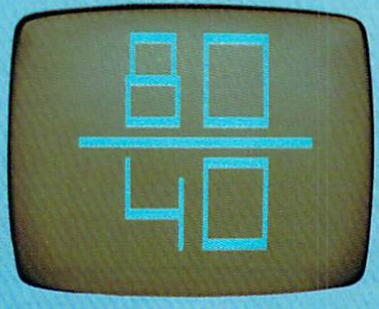


DATA 20's easy to buy, easy to install, easy to use peripherals are available for both VIC 20® and Commodore 64.® Our enhancements give you more power, more sophisticated capabilities and now...

Free software with any VIDEO PAK. WORD MANAGER, our exclusive word processing package is full of advanced features. Combined with our VIDEO PAK, it gives your VIC 20 or Commodore 64 capabilities found only in the most expensive word processing programs. Like full-function status display, and up and down scrolling, plus 13 advanced editing features including merging and block move. In addition, we've included complementary mailing list programs. All are written in machine language for fast execution and minimal memory requirements. They're self-documenting and exceptionally easy to use. A self-adhesive strip for function keys makes most commands one-key simple. So simple, in fact, that we've eliminated the need for time-consuming menus and prompts. WORD MANAGER is provided on tape—and can be loaded to disk. It's yours free with any VIDEO PAK you pick.



New! Our lowest priced VIC 20 VIDEO PAK ever. We've just introduced a highly cost-effective 8K version. Price it out!

Just pop this cartridge into your expansion port, and your display instantly goes to the industry-standard 24 lines, with a choice of 40 or 80 characters. Displayed this way, you'll know exactly what you're going to get on the printout. And you really increase the amount of data you can see on the screen. You also increase memory in the process—to 12K to handle more sophisticated functions. Our package includes a terminal emulator and screen print feature. Plus the free WORD MANAGER software package!

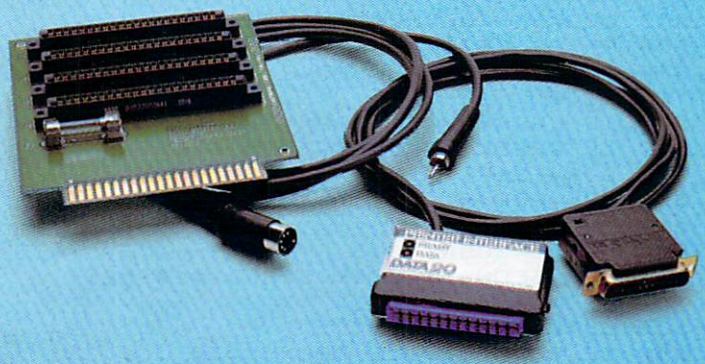
VIDEO PAK 80 for Commodore 64. Move up to the industry-standard 80-column format, and you'll wonder how you ever did without it! Use software control to go from 40 to 80 characters in monochrome—and back to 40 characters in color. With VIDEO PAK 80, you can take full advantage of the

FOR BOTH COMMODORES

terminal emulator mode and screen print feature with software we include. And this is a great package for word processing— particularly with our free WORD MANAGER software.

Z-80 VIDEO PAK brings complete CP/M® compatibility to your 64. This exciting peripheral gives you all the VIDEO PAK 80 features described above—plus! You see, our built-in microprocessor and software give you CP/M compatibility for any of the many programs formatted for the Commodore 1541® Disk Drive. The possibilities are truly awesome! And the WORD MANAGER software is free with your purchase.

VIDEO CABLE completes the installation. It's the easy way to connect your VIC 20 or Commodore 64 monitor to VIDEO PAK. And a must for 80-column use.



PRINTER INTERFACE in serial. Here's the perfect connection for your VIC 20 or Commodore 64. With our interface, you just plug in and go. We have a simple, yet sophisticated interface that offers flexible, continuous monitoring of data transfer functions—and virtually troubleshoots its own easy installation.

EXPANSION CHASSIS lets you use 4 cartridges at once. Run a series of compatible memory, software or game cartridges of any make on your VIC 20. Anything with the standard 22-pin edge connector. A built-in 500ma fuse protects your power supply.

MEMORY CARTRIDGE boosts VIC 20 brainpower to 20K. This super-reliable cartridge features the finest quality components, housed in a rugged plastic case.

Check out our AWESOME peripherals. Ask your dealer for a first-hand look at our extensive capabilities, high quality, and reasonable prices. Or send for a current catalog and price list. DATA 20 CORPORATION, 23011 Moulton Parkway, Suite B10, Laguna Hills, CA 92653.

DATA 20 CORPORATION

Price/Performance Peripherals

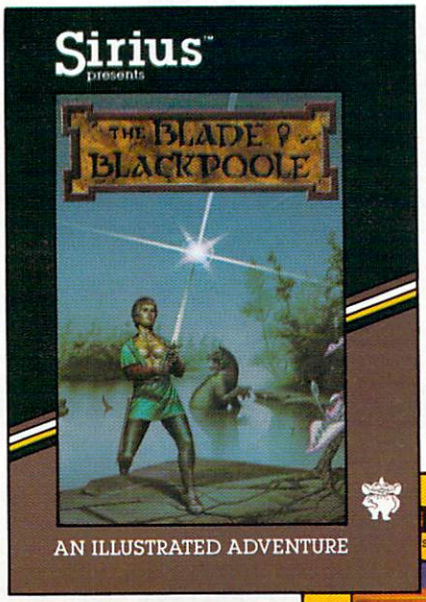
NOW WITH FREE SOFTWARE!

```
73 POKEI+1,59:POKEI,57:FORJ=1TOT:NEXT:B=8
   142:GOSUB510
74 IFPEEK(197)=32THENGOSUB80
75 IFPEEK(I+22)=54THENPOKEI,59:GOTO100
76 IFPEEK(I+22)=60THEN500
77 I=I-1:IFI<8120THENI=8140:POKE8120,59
78 GOTO71
80 I=I-23:POKEI+23,59
81 IFPEEK(I+22)<>59ORPEEK(I+44)<>53THENSC
   =SC+X:POKEI-22,P:GOSUB112:POKEI-2
   2,59
83 POKEI,58:FORJ=1TOT:NEXT:I=I+21:IFI<812
   0THENI=8140:POKE8120,59
84 POKE8098,59:POKE8097,59
85 FORJ=1TOT:NEXT:POKEI-21,59:POKEI,58:RE
   TURN
100 P=P+1:IFP=64THENP=61
101 D=D-1:T=T-50
102 X=X+50:IFX>125THENX=25:D=8:T=150:C=27:
   F%=5
103 IFX=75THENC=232:F%=0
104 IFX=125THENC=8:F%=7
105 GOTO2
110 POKES,140:FORY=1TO10:NEXT:POKES,0:RETU
   RN
111 POKES+1,190:FORY=1TO25:NEXT:POKES+1,0:
   RETURN
112 FORO=1TO15:POKES,200+O:NEXTO:POKES,0:R
   ETURN
113 FORO=20TO0STEP-1:POKES,230+O:FORY=1TO2
   5:NEXTY,O:POKES,0:RETURN
500 GOSUB113:M=M-1:IFM=0THEN502
501 P=61:X=25:D=6:C=27:T=150:F%=5:POKEI,59
   :GOTO2
502 POKE36869,240:PRINTCHR$(147);SPC(225);
   "GAME OVER!":PRINT:PRINT"YOUR SCO
   RE WAS ";SC
503 PRINT:PRINT"PLAY AGAIN?"
504 K=PEEK(197):IFK=32ORK=64THEN504
505 IFK=11THENRUN
506 END
510 IFINT(RND(1)*D)+1<>1THENRETURN
511 L=INT(RND(1)*21)+1:IFL=20ORL=1THEN511
512 POKEB+L,60:GOSUB111:RETURN
10000 DATA255,129,66,66,36,36,24,255
10002 DATA66,126,66,66,66,126,66,66
10003 DATA12,8,13,62,44,12,18,33
10004 DATA24,16,24,24,24,16,16,24
10005 DATA24,8,24,24,24,8,8,24
10006 DATA24,8,88,62,26,24,36,66
10007 DATA0,0,0,0,0,0,0,0
10008 DATA129,66,66,66,98,34,34,34
10009 DATA27,10,27,17,27,0,0,0
10010 DATA59,10,11,9,11,0,0,0
10011 DATA91,74,91,81,91,0,0,0
10012 RESTORE:FORI=7592TO7679:READA:POKEI,
   A: NEXT
10015 POKE36869,255
10016 GOTO1
10020 FORI=7832TO7898STEP22:POKEI,54:NEXT:
   FORI=7901TO8011STEP22:POKEI,54:NEXT
10021 FORI=8052TO8140STEP22:POKEI,54:NEXT:
   FORI=38552TO38618STEP22:POKEI,6:NEXT
10022 FORI=38621TO38731STEP22:POKEI,6:NEXT:
   FORI=38772TO38860STEP22:POKEI,6:NEXT
10023 POKE8143,54:POKE8165,54:POKE38863,6:
   POKE38885,6:RETURN
```

Program 2: Atari Version

```
100 REM ATARI JUMPING JACK
140 GRAPHICS 18:POSITION 7,6:? #6;"J
   UMPING":POSITION 8,7:? #6;"jack"
141 OPEN #1,4,0,"K"
142 DIFF=1:DL=PEEK(560)+256*PEEK(561
   )
145 FOR J=1 TO 10:FOR I=100 TO 112:P
   OKE DL,I:POKE 53274,PEEK(53770):
   SOUND 0,I+J-100,10,J:NEXT I:NEXT
    J
150 SOUND 0,0,0,0:CHSET=(PEEK(106)-8
   )*256:IF PEEK(CHSET+8)<>8 THEN G
   OSUB 1080
160 GRAPHICS 17:SETCOLOR 4,16*RND(0)
   ,12:POKE 756,CHSET/256:POSITION
   6,23:? #6;"LEVEL:";DIFF
162 IF DIFF>1 THEN 170
165 POSITION 4,0:? #6;"SPEED? [1-9]"
   ;:GET #1,A:SPEED=A-48:IF SPEED<1
    OR SPEED>9 THEN 165
167 COLOR 32:PLOT 4,0:DRAWTO 19,0
170 DIR=1:HOLE=7+128:LADDER=6+32+128
   :SETCOLOR 1,15,6:SETCOLOR 3,4,6
180 PR=0
190 FOR I=2 TO 22 STEP 4
200 COLOR 5+32:PLOT 0,I:DRAWTO 19,I
210 IF I>20 THEN 270
220 R=INT(RND(0)*14+4)+DIR
230 IF SGN(R-PR)<>DIR THEN 220
240 COLOR LADDER:PLOT R,I:DRAWTO R,I
   +4
250 PR=R
260 DIR=-DIR
270 NEXT I
280 COL=2
290 ROW=1
300 CHAR=1
310 OLDCOL=1
320 OLDROW=1
340 DIR=1
350 COLOR 32:PLOT OLDCOL,OLDROW
360 IF RND(0)>DIFF/10 THEN 430
370 R=INT(4*RND(0))*4+6
380 C=INT(RND(0)*19)+1
390 LOCATE C,R,A
400 IF A=LADDER THEN 430
410 COLOR HOLE:PLOT C,R
420 SOUND 0,100,12,8:FOR W=1 TO 10:N
   EXT W:SOUND 0,0,0,0
430 COLOR CHAR+2*(DIR<0):PLOT COL,RO
   W
440 SOUND 0,0,0,8:FOR W=1 TO 5:NEXT
   W:SOUND 0,0,0,0
450 IF ROW>20 THEN 990
460 OLDCOL=COL
470 OLDROW=ROW
480 COL=COL+DIR
490 IF COL>0 AND COL<20 THEN 540
500 COL=COL-DIR
510 ROW=ROW+4
520 DIR=-DIR
530 GOTO 350
540 LOCATE COL,ROW+1,CHECK
550 ST=PEEK(764)
560 IF ST<255 THEN POKE 764,255:GOTO
    640
570 IF CHECK=HOLE THEN 770
580 IF CHECK<>LADDER THEN 610
590 DIR=-DIR
600 ROW=ROW+4
610 CHAR=3-CHAR
620 SCORE=SCORE+0.5
625 FOR SLOW=1 TO (9-SPEED)*10:NEXT
   SLOW
630 GOTO 350
640 IF CHECK<>HOLE THEN 1030
```

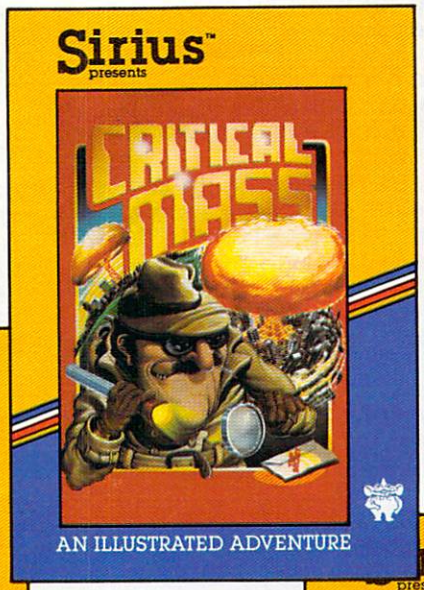
For Heroes Only!



Blade of Blackpoole

Step back in time and join the search for the magical sword of Myraglym. Travel cautiously on your journey for you will encounter dangerous serpents, spine-chilling evils and carnivorous plants that crave human flesh!

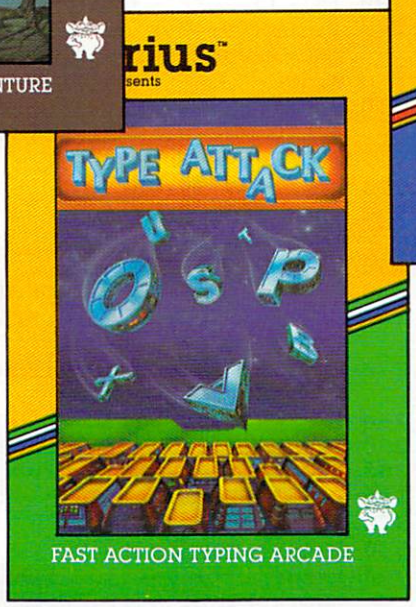
Avail. on disk for the Apple II, II + or IIe and Atari 800 or 1200 and Commodore 64.



Critical Mass

On Jan. 1st at 10:00 am, the U.N. received this message: "Good Morning, in exactly 9 days, the world's 5 largest cities will be destroyed by thermal nuclear weapons." At 10:03 am, you received this assignment: STOP . . . THIS . . . LUNATIC!

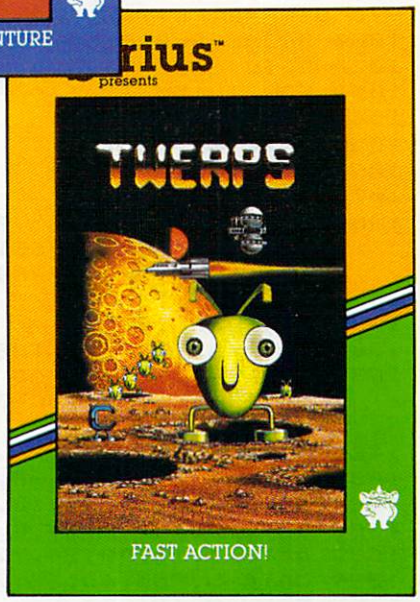
Avail. on disk for the Apple II, II + or IIe and Atari 800 or 1200 and Commodore 64.



Type Attack

The planet Lexicon is under attack! Letters of the alphabet are falling from the sky. To repel them, you must be able to type the letters faster than they can fall. Be quick! An entire civilization is depending on your skill.

Avail. on disk for the Apple II, II + or IIe and Atari 800 or 1200, IBM-PC and Commodore 64 and on cartridge for the VIC-20.



Twerps

The boldest space rescue ever! Defenseless Twerps are stranded on an asteroid. You, Captain Twerp, are to board a Twerp-craft, blast through the Orbiters, land safely and rescue your comrades. Beware of the Glingas and Twerp-eating Gleepnites!

Avail. on disk for the Apple II, II + or IIe and Atari 800 or 1200.

Pure Video Excitement!

For Your Atari 800 or 1200, Apple II, II + or IIe, Commodore 64, VIC-20 and IBM-PC

```
650 COLOR 32:PLOT OLDCOL,OLDROW
660 COLOR 1+2*(DIR<0):PLOT COL,ROW-1
670 FOR W=50 TO 0 STEP -1:SOUND 0,W,
    10,8:SOUND 0,W+10,10,8:NEXT W
700 COLOR 9+32:PLOT COL,ROW-1
710 SCORE=SCORE+25
720 FOR W=15 TO 0 STEP -1:SOUND 0,10
    ,10,W:SOUND 1,20,10,W:NEXT W
740 COLOR 32:PLOT COL,ROW-1
750 COL=COL+DIR
760 GOTO 490
770 IF PEEK(764)<255 THEN POKE 764,2
    55:GOTO 640
790 COLOR 32:PLOT OLDCOL,OLDROW
800 COLOR 10:PLOT COL,ROW
810 FOR I=100 TO 250
820 SOUND 0,I,10,8
830 NEXT I
840 COLOR 32:PLOT COL,ROW
850 COLOR 136:PLOT COL,ROW+1
860 FOR W=15 TO 0 STEP -0.5:SOUND 0,
    W,12,W:NEXT W
880 GRAPHICS 18:SETCOLOR 4,1,12
900 POSITION 2,4:? #6;"your score wa
    s:":POSITION 9-LEN(STR$(INT(SCOR
    E)))/2,6:? #6;INT(SCORE)
910 POSITION 1,10:? #6;"PLAY AGAIN?
    (Y/N):";
920 K=PEEK(764):IF K<>35 AND K<>43 T
    HEN 920
930 POKE 764,255
950 IF K=35 THEN 980
960 SCORE=0:DIFF=1
970 GOTO 160
980 END
990 DIFF=DIFF+1:SPEED=SPEED+0.5
1000 SCORE=SCORE+50
1020 GOTO 160
1030 FOR I=150 TO 140 STEP -1
1040 SOUND 0,I,10,4
1050 NEXT I
1060 SCORE=SCORE-25
1070 GOTO 580
1080 CHSET=(PEEK(106)-8)*256:FOR I=0
     TO 511:POKE CHSET+I,PEEK(57344
     +I):POKE 708+3*RND(0),PEEK(5377
     0):NEXT I
1081 RESTORE 1085
1082 READ A:IF A=-1 THEN RETURN
1083 FOR J=0 TO 7:READ B:POKE CHSET+
     A*8+J,B:POKE 708+3*RND(0),PEEK(
     53770):NEXT J
1084 GOTO 1082
1085 DATA 1,8,20,24,80,62,24,20,34
1086 DATA 2,8,20,24,18,124,152,36,72
1087 DATA 3,16,40,24,8,124,26,40,68
1088 DATA 4,16,40,24,72,62,25,36,18
1089 DATA 5,255,66,36,24,24,36,66,25
     5
1090 DATA 6,126,66,126,66,126,66,126
     ,66
1091 DATA 7,129,66,68,34,0,36,74,255
1092 DATA 8,189,90,84,34,0,36,74,255
1093 DATA 9,0,119,20,119,65,119,0,0
1094 DATA 10,0,28,93,42,28,28,20,34
1095 DATA -1
```

Program 3: C64 Version

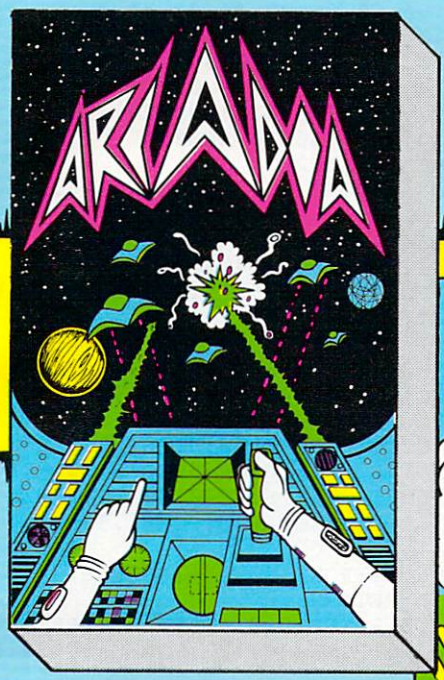
```
0 REM JUMPING JACK FOR 64
5 GOSUB3000:PRINT"{CLEAR}";"{11 RIGHT}IN
    ITIALIZING"
10 M=3:T=10:D=5:X=25:P=61:POKE55,16:POKE5
    6,64:S=54272:POKE53281,1:GOTO970
20 C=7:F%=5:FORI=1024TO2041:POKEI,59:NEXT

30 POKE53280,C:FORI=1064TO1103:POKEI,53:N
    EXT:FORI=1264TO1303:POKEI,53:NEXT

33 FORI=1424TO1463:POKEI,53:NEXT:POKE1425
    ,54:POKE1702,54:POKE1865,54
40 FORI=1664TO1703:POKEI,53:NEXT:FORI=186
    4TO1903:POKEI,53:NEXT
50 FORI=55296TO56176+39:POKEI,4:NEXT
60 FORI=55456TO55496+39:POKEI,F%:NEXT
70 FORI=55616TO55656+39:POKEI,F%:NEXT
80 FORI=55856TO55896+39:POKEI,F%:NEXT
90 FORI=56056TO56096+39:POKEI,F%:NEXT:GOS
    UB1000:FORI=1TO1000:NEXT
100 I=1224:POKE1302,54:POKE1425,54:POKE170
    2,54:POKE1865,54
110 IFI/2=INT(I/2)THENPOKEI-1,59:GOSUB720
120 IFI/2=INT(I/2)THENPOKEI,55:FORJ=1TOT:N
    EXT:GOTO140
130 POKEI-1,59:POKEI,56:FORJ=1TOT:NEXT:B=1
    264:GOSUB830
140 IFPEEK(197)=60THENGOSUB190
150 IFPEEK(I+40)=54THENPOKEI,59:GOTO240
160 IFPEEK(I+40)=60THEN760
170 I=I+1:IFI>1263THENI=1224:POKE1263,59
180 GOTO110
190 I=I-39:POKEI+39,59
200 IFPEEK(I+40)<>59ORPEEK(I+80)<>53THENSC
    =SC+X:POKEI-40,P:GOSUB740:POKEI-4
    0,59
210 POKEI,55:FORJ=1TOT:NEXT:I=I+41:IFI>126
    3THENI=1224:POKE1263,59:POKE1223,
    59
220 POKE1403,59:POKE1404,59
230 FORJ=1TOT:NEXT:POKEI-41,59:POKEI,55:RE
    TURN
240 I=1422
250 IFI/2=INT(I/2)THENPOKEI+1,59:GOSUB720
260 IFI/2=INT(I/2)THENPOKEI,58:FORJ=1TOT:N
    EXT:GOTO280
270 POKEI+1,59:POKEI,57:FORJ=1TOT:NEXT:B=1
    424:GOSUB830
280 IFPEEK(197)=60THENGOSUB330
290 IFPEEK(I+40)=54THENPOKEI,59:GOTO380
300 IFPEEK(I+40)=60THEN760
310 I=I-1:IFI<1384THENI=1422:POKE1384,59
320 GOTO250
330 I=I-41:POKEI+41,59
340 IFPEEK(I+40)<>59ORPEEK(I+80)<>53THENSC
    =SC+X:POKEI-40,P:GOSUB740:POKEI-4
    0,59
350 POKEI,58:FORJ=1TOT:NEXT:I=I+39:IFI<138
    4THENI=1422:POKE1384,59:POKE1344,
    59
360 POKE1344,59:POKE1343,59
370 FORJ=1TOT:NEXT:POKEI-39,59:POKEI,58:RE
    TURN
380 I=1624
390 IFI/2=INT(I/2)THENPOKEI-1,59:GOSUB720
400 IFI/2=INT(I/2)THENPOKEI,55:FORJ=1TOT:N
    EXT:GOTO420
410 POKEI-1,59:POKEI,56:FORJ=1TOT:NEXT:B=1
    664:GOSUB830
420 IFPEEK(197)=60THENGOSUB470
430 IFPEEK(I+40)=54THENPOKEI,59:GOTO520
440 IFPEEK(I+40)=60THEN760
450 I=I+1:IFI>1663THENI=1624:POKE1663,59:P
    OKE1623,59
460 GOTO390
470 I=I-39:POKEI+39,59:IFPEEK(I)<>59THENSC
    =SC+300
480 IFPEEK(I+40)<>59ORPEEK(I+80)<>53THENSC
```

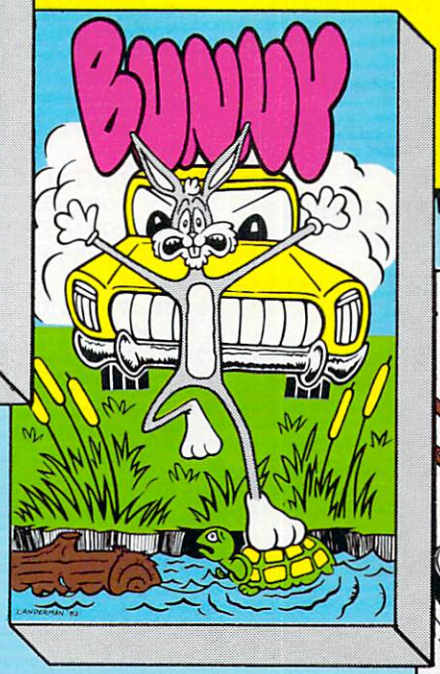
STAR TECH

VIC 20



Defend your home planet from the multi-colored aliens as they peel out of formation and mount a ferocious attack upon your base, weaving back and forth and firing their own deadly weapons. This program uses full color high resolution graphics and fantastic sound effects. Written entirely in machine code for a super fast action game. Requires the un-expanded VIC-20 computer and cassette.

$19.95



Guide the Bunny across the crowded highway, dodging speeding trucks and cars, carefully navigate across a wide, swift flowing, piranha infested river to the safety of a warren. Full use of High Resolution graphics. For the un-expanded VIC-20 computer with cassette and joystick.

$19.95

Three games in one package, Slalom, Down Hill and Giant Slalom. Each game has nine separate skill levels. Full high resolution graphics and sound. For the un-expanded VIC-20 with cassette.

$19.95

UN-EXPANDED

(VIC-20)

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```
    =SC+X:POKEI-40,P:GOSUB740:POKEI-4
    0,59
490 POKEI,55:FORJ=1TOT:NEXT:I=I+41:IFI>166
    3THENI=1624:POKE1663,59
500 POKE1641,59:POKE1624,59:POKE1623,59
510 FORJ=1TOT:NEXT:POKEI-41,59:POKEI,55:RE
    TURN
520 I=1862
530 IFI/2=INT(I/2)THENPOKEI+1,59:GOSUB720
540 IFI/2=INT(I/2)THENPOKEI,58:FORJ=1TOT:N
    EXT:GOTO560
550 POKEI+1,59:POKEI,57:FORJ=1TOT:NEXT:B=1
    864:GOSUB830
560 IFPEEK(197)=60THENGOSUB610
570 IFPEEK(I+40)=54THENPOKEI,59:GOTO660
580 IFPEEK(I+40)=60THEN760
590 I=I-1:IFI<1824THENI=1862:POKE1824,59
600 GOTO530
610 I=I-41:POKEI+41,59
620 IFPEEK(I+40)<>59ORPEEK(I+80)<>53THENSC
    =SC+X:POKEI-40,P:GOSUB740:POKEI-4
    0,59
630 POKEI,58:FORJ=1TOT:NEXT:I=I+39:IFI<182
    4THENI=1862:POKE1824,59
640 POKE1784,59:POKE1783,59
650 FORJ=1TOT:NEXT:POKEI-39,59:POKEI,58:RE
    TURN
660 P=P+1:IFP=64THENP=61
670 D=D-1:T=T-.1
680 X=X+50:IFX>125THENX=25:D=8:T=10:C=5:F%
    =5
690 IFX=75THENC=0:F%=0
700 IFX=125THENC=8:F%=7
710 GOTO30
720 POKES+4,17:POKES+5,132:POKES+6,132:POK
    ES+24,6
721 H0=28:L0=49:POKES+1,H0:POKES,L0:FORZ=1
    TO200:NEXT:GOSUB2000:RETURN
740 POKES+24,15:POKES+4,17:POKES+5,132:POK
    ES+6,132
741 FORH1=21TO126:POKES+1,H1:LI=181:POKES,
    L1:NEXT:GOSUB2000:RETURN
760 POKES+24,15:POKES+4,17:POKES+5,33:POKE
    S+6,132:H2=233
765 H2=H2-5:POKES+1,H2:L2=181:POKES,L2
766 POKEI,58:POKEI-40,59:POKEI+54272,0:I=I
    +40:IFI<1983THEN765
767 GOSUB2001
769 M=M-1:IFM=0THEN780:POKES+1,H2:L2=181:P
    OKES,L2:NEXT:GOSUB2001
770 P=61:X=25:D=6:C=27:T=10:F%=5:POKEI,59:
    GOTO30
780 POKE53272,21:PRINTCHR$(147);SPC(205);"
    {09 RIGHT}GAME OVER!":PRINT
785 PRINT"{DOWN}{11 RIGHT}YOUR SCORE WAS";
    SC
790 PRINT:PRINT"{DOWN}{13 RIGHT}PLAY AGAIN
    ?"
800 K=PEEK(197):IFK=60THEN800
810 IFK=25THENPRINT"{CLEAR}":RUN
820 IFK=39THENPRINT"{CLEAR}{10 DOWN}{08 RI
    RIGHT}GOODBYE!!";:FORW=1TO500:NEX
    T:PRINT"{CLEAR}":END
825 GOTO800
830 IFINT(RND(1)*D)+1<>1THENRETURN
840 L=INT(RND(1)*39)+1:IFL=20ORL=1THEN840
850 POKEB+L,60:GOSUB720:RETURN
860 DATA255,129,66,66,36,36,24,255
870 DATA66,126,66,66,66,126,66,66
880 DATA12,8,13,62,44,12,18,33
890 DATA24,16,24,24,24,16,16,24
900 DATA24,8,24,24,24,8,8,24
910 DATA24,8,88,62,26,24,36,66
920 DATA0,0,0,0,0,0,0,0
930 DATA129,66,66,66,98,34,34,34
940 DATA27,10,27,17,27,0,0,0
950 DATA59,10,11,9,11,0,0,0
960 DATA91,74,91,81,91,0,0,0,0
970 POKE53272,(PEEK(53272)AND240)+12
971 POKE56334,PEEK(56334)AND254
972 POKE1,PEEK(1)AND251
973 FORI=0TO511:POKEI+12288,PEEK(I+53248):
    NEXT
974 POKE1,PEEK(1)OR4
975 POKE56334,PEEK(56334)OR1
976 RESTORE:FORI=12288+53*8TO12288+64*8:RE
    ADA:POKEI,A:NEXT
990 GOTO20
1000 FORI=1302TO1422STEP40:POKEI,54:NEXT:FO
    RI=1425TO1625STEP40:POKEI,54:NEXT

1010 FORI=1702TO1862STEP40:POKEI,54:NEXT
1015 FORI=55574TO55694STEP40:POKEI,3:NEXT
1020 FORI=55697TO55897STEP40:POKEI,3:NEXT:F
    ORI=55974TO56134STEP40:POKEI,3:NE
    XT
1030 POKE1865,54:POKE1905,54:POKE56137,3:PO
    KE56177,3:RETURN
2000 POKES+4,0:POKES+5,0:POKES+6,0:RETURN
2001 POKES+6,15:POKES+4,129:POKES+5,132:POK
    ES+6,132
2002 H3=10:L3=143:POKES+1,H3:POKES,L3:FORT=
    1TO1000:NEXT:GOSUB2000:RETURN
3000 PRINT"{CLEAR}{02 DOWN}TO GET POINTS, Y
    OU MUST JUMP OVER HOLES SO THAT T
    HE MAN IS AT ";
3002 PRINT"THE HIGHEST        POSITION OVER ~
    THE HOLE."
3010 PRINT"{02 DOWN}THE NUMBER OF POINTS IN
    CREASES WITH THE NUMBER OF SCREEN
    S COMPLETED
3020 PRINT"{02 DOWN}25 PTS PER HOLE (1ST SC
    REEN)"
3025 PRINT"{02 DOWN}75 PTS PER HOLE (2ND SC
    REEN)"
3030 PRINT"{02 DOWN}125 PTS PER HOLE (3RD S
    CREEN)"
3040 PRINT"{03 DOWN}TO JUMP PRESS THE SPACE
     BAR"
3050 PRINT"PRESS SPACE BAR TO CONTINUE"
3060 GR=PEEK(197):IFGR<>60THEN3060
3070 RETURN
```

Program 4: TI-99/4A Version

```
100 REM TI JUMPING JACK
110 DIFF=1
120 RESTORE
130 RANDOMIZE
140 CALL CLEAR
150 GOSUB 1080
160 PRINT "LEVEL:";DIFF
170 DIR=1
180 PR=0
190 FOR I=2 TO 22 STEP 4
200 CALL HCHAR(I,1,96,32)
210 IF I>20 THEN 270
220 R=INT(RND*26+4)+DIR
230 IF (SGN(R-PR)<>DIR)THEN 220
240 CALL VCHAR(I,R,104,4)
250 PR=R
260 DIR=-DIR
270 NEXT I
280 COL=2
290 ROW=1
300 CHAR=112
310 OLDCOL=1
320 OLDROW=1
```

```
330 OLDCHAR=32
340 DIR=1
350 CALL HCHAR(OLDROW,OLDCOL,32)
360 IF RND>DIFF/10 THEN 430
370 R=INT(4*RND)*4+6
380 C=INT(RND*32)+1
390 CALL GCHAR(R,C,A)
400 IF A=104 THEN 430
410 CALL HCHAR(R,C,120)
420 CALL SOUND(100,-1,4)
430 CALL HCHAR(ROW,COL,CHAR-2*(DIR<
    0))
440 CALL SOUND(-5,-7,4)
450 IF ROW>20 THEN 990
460 OLDCOL=COL
470 OLDROW=ROW
480 COL=COL+DIR
490 IF (COL>0)*(COL<33)THEN 540
500 COL=COL-DIR
510 ROW=ROW+4
520 DIR=-DIR
530 GOTO 350
540 CALL GCHAR(ROW+1,COL,CHECK)
550 CALL KEY(0,K,ST)
560 IF ST THEN 640
570 IF CHECK=120 THEN 770
580 IF CHECK<>104 THEN 610
590 DIR=-DIR
600 ROW=ROW+4
610 CHAR=225-CHAR
620 SCORE=SCORE+.5
630 GOTO 350
640 IF CHECK<>120 THEN 1030
650 CALL HCHAR(OLDROW,OLDCOL,32)
660 CALL HCHAR(ROW-1,COL,112-2*(DIR
    <0))
670 CALL SOUND(5,250,10)
680 CALL SOUND(5,200,10)
690 CALL SOUND(5,300,10)
700 CALL HCHAR(ROW-1,COL,128)
710 SCORE=SCORE+25
720 CALL SOUND(-500,500,1,510,10,52
    0,20)
730 CALL SOUND(1,110,30)
740 CALL HCHAR(ROW-1,COL,32)
750 COL=COL+DIR
760 GOTO 490
770 CALL KEY(0,K,ST)
780 IF ST THEN 580
790 CALL HCHAR(OLDROW,OLDCOL,32)
800 CALL HCHAR(ROW,COL,116)
810 FOR I=1000 TO 1020
820 CALL SOUND(-1,I,0)
830 NEXT I
840 CALL HCHAR(ROW,COL,32)
850 CALL HCHAR(ROW+1,COL,121)
860 CALL SOUND(1000,-2,4,110,4)
870 CALL SOUND(1,110,1)
880 CALL CLEAR
890 CALL SCREEN(12)
900 PRINT "YOUR SCORE WAS:";INT(SCO
    RE)
910 PRINT :"PLAY AGAIN? (Y/N):";
920 CALL KEY(3,K,ST)
930 IF (K<>ASC("Y"))*(K<>ASC("N"))T
    HEN 920
940 PRINT CHR$(K)
950 IF K=ASC("N")THEN 980
960 SCORE=0
970 GOTO 110
980 END
990 DIFF=DIFF+1
1000 SCORE=SCORE+50
1010 CALL CLEAR
1020 GOTO 160
1030 FOR I=150 TO 140 STEP -1
1040 CALL SOUND(-1,I,1)
1050 NEXT I
1060 SCORE=SCORE-25
1070 GOTO 580
1080 REM INITITIALIZE GAME, CHARACT
     ERS
1090 READ A
1100 IF A=-1 THEN 1250
1110 READ A$
1120 CALL CHAR(A,A$)
1130 GOTO 1090
1140 DATA 96,FF422418182442FF
1150 DATA 104,7E427E427E427E42
1160 DATA 112,1028302478B82442
1170 DATA 113,102830A27C782448
1180 DATA 114,102818483C3A4884
1190 DATA 115,1028184A3C3C4824
1200 DATA 116,001C5D2A1C1C1422
1210 DATA 120,818142222400C3
1220 DATA 121,BDBD5A2224240OC3
1230 DATA 128,0077147741770000
1240 DATA -1
1250 FOR I=9 TO 13
1260 READ A
1270 CALL COLOR(I,A,1)
1280 NEXT I
1290 DATA 6,4,14,10,12
1300 CALL SCREEN(16)
1310 RETURN
```

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Atari's New Add-On Computer For VCS 2600 Game Machine

Tom R. Halfhill, Features Editor

A new add-on keyboard unit from Atari will turn the world's most popular video game machine into a home computer – for under $90.

Atari's announcement of a plug-in computer keyboard for the VCS 2600 game machine adds yet another contender to the growing field of sub- $100 home computers. But more than that, this may well be a move to capture the huge number of VCS owners who are considered prime candidates to buy a home computer.

Since 1977, when the VCS (Video Computer System) was first introduced, more than ten million have been sold – far more than any other game machine. That massive "installed base," as it's called by marketing people, represents a lucrative market for the new computer keyboard. What's more, by announcing the product so far in advance (the keyboard is not scheduled for delivery until September 1) perhaps Atari hopes that many of these ten million potential customers will put off buying a competing model in the meantime.

My First Computer

So how will the new computer stack up against the competition? Atari's early specifications indicate it will be a solid contender, unless new computers introduced this summer by competitors radically change the under-$100 market.

Atari's official name for the keyboard unit is "My First Computer." Expected to retail for under $90, My First Computer clamps onto the VCS piggyback-style, plugging into the game machine's cartridge slot. No other connections are needed. The marriage is more or less permanent, since the VCS can still be used as a game machine by plugging cartridges into an expansion slot on the side of the computer.

My First Computer's keyboard consists of 56 moving rubber keys, arranged typewriter-style (QWERTY). Although not quite a full-stroke typewriter keyboard, the partial-stroke rubber keys do have a better feel than the Atari 400's flat membrane keyboard. The rubber keys are very similar to those found on several other low-end home computers recently introduced (see "New Home Computers At The Winter Consumer Electronics Show," **COMPUTE!**, March 1983).

Standard features include 8K of Random Access Memory (RAM), expandable to 32K RAM; 16K of Read-Only Memory (ROM), which includes

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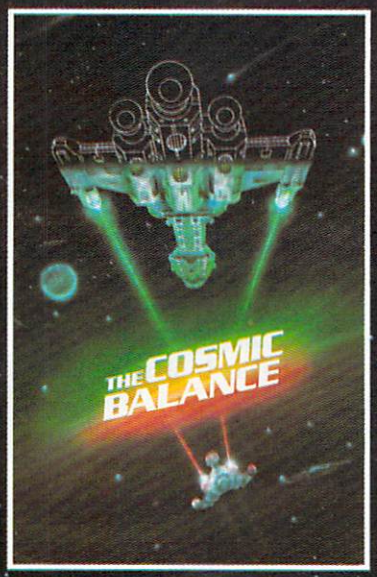

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an 8K BASIC programming language; upper- and lowercase characters; a 16-color display, with eight luminances (shades) per color, for a total of 128 hues; screen format of 32 columns by 24 rows; maximum graphics resolution of 192 by 160 pixels (screen dots); two sound generators; a built-in interface for storing programs on any standard cassette recorder; and an expansion slot for plugging in game cartridges, memory expanders, and peripherals.

Microsoft Strings

The new computer's Central Processing Unit – the microprocessor chip that is the central brain of a microcomputer – is the widely used 6502. This chip is also found in Atari's existing home computers, the 400, 800, and 1200XL, as well as in some competitors. However, My First Computer will not be software or hardware compatible with Atari's other computers. The 8K BASIC in the new computer will be a cross between the existing Atari BASIC and the more generally used Microsoft BASIC. The string-handling, for example, will conform more closely to Microsoft BASIC than Atari BASIC's nonstandard approach. Although design work on the BASIC and Operating System is not finished, one of Atari's goals is to include special statements for graphics and sound in the language, as found in Atari BASIC.

Since the existing Atari peripherals will not work with My First Computer, a new line of low-cost add-ons is being planned. This will include a printer and some type of fast mass storage device, either a minifloppy disk drive or some other alternative. Atari is not ruling out the possibility of a microfloppy disk drive or a stringy floppy wafer-tape drive, because it wants to keep the cost of the peripherals comparable to the cost of the computer. Atari's current disk drive for its 400/800/1200XL models retails for about $500.

"We don't see a lot of rationale in offering a $500 add-on for a base unit that will sell for under $90," says Bill Simmeth, project manager for My First Computer. "Some other types of technologies look attractive to us."

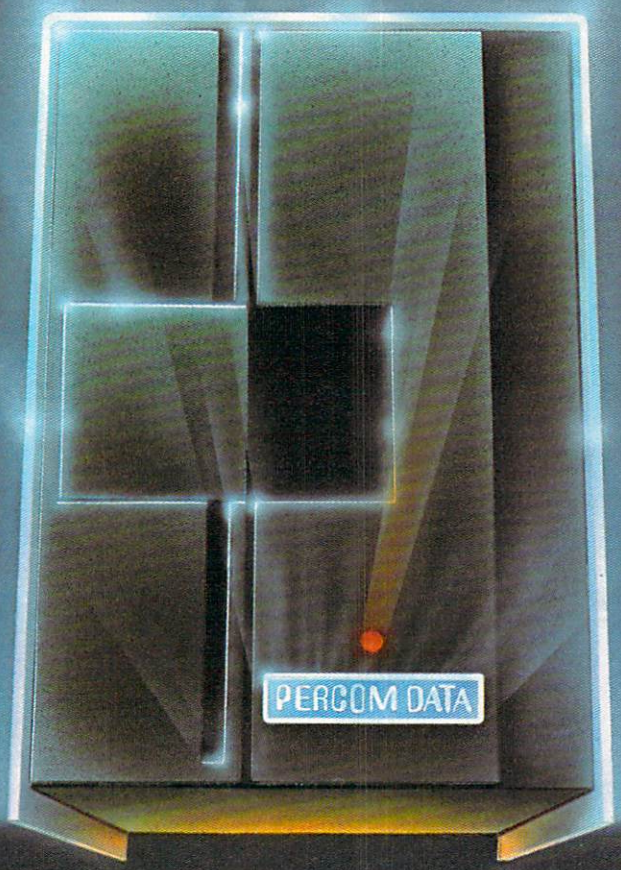
Graphics

Simmeth said it is still too early to say if My First Computer will have advanced graphics capabilities such as programmable characters and player/missile graphics (sprites). But he did say that it will have several graphics modes, that more than two voices will be possible through programming, and that the VCS's chips will be handling some graphics processing to relieve the 6502's workload. "It will be like a dual-processing system, similar to the [existing Atari] computers, although not exactly alike. People will not be buying just a toy. They're buying quite a nice, and a quite comparable, real computer."

Atari plans to introduce about 20 cartridges for My First Computer when it is delivered, including a new line of enhanced games and home application programs. Software may also be sold on cassettes.

Interestingly, Atari says it does not consider its main competition for the new computer to be the similar add-on keyboards for competing game machines, the $150 Mattel Intellivision and $170 Colecovision attachments. Instead, Atari is aiming its new model at home computers such as the $99 Timex/Sinclair, the new $99 Texas Instruments TI-99/2, and the Commodore VIC-20, which may drop below $100 by the time My First Computer is ready. To complicate this low-end market still further, later this year Atari may introduce a keyboard attachment for its newer, more advanced game machine, the 5200. However, no details of this project are being released.

Atari also says My First Computer will not compete with its own Atari 400, which is selling for less than $200. "My First Computer is the missing link between video games and computers," says Michelle Simpson, an Atari spokesperson. "We don't see it as competing with our own computers. We see them as different models, like the different models produced by a car company." ©



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One On One

Chris York

"One On One" is easy to learn, but not easy to master. Written originally for the Atari, it has been translated for VIC, 64, and Apple. The VIC and 64 versions include two skill levels and a suggestion for changing the object of the game.

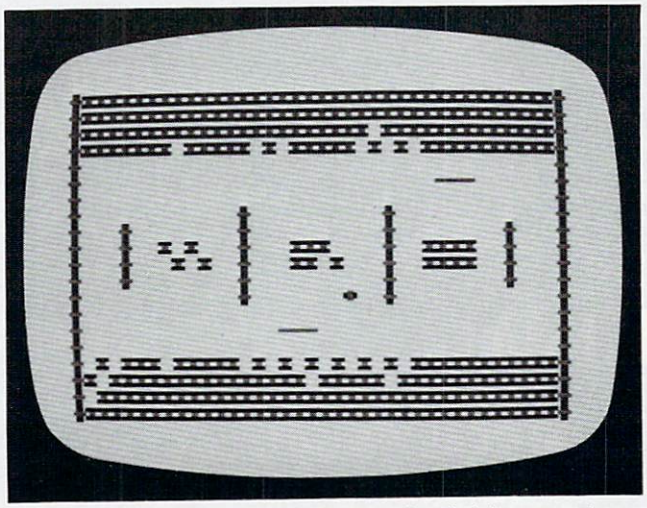
In "One On One," two players go head to head in an attempt to knock down the wall their opponent is protecting.

The Atari version can be played with joysticks, plugged into control ports one and two, or with paddles, plugged into port number one. In the game, player one tries to protect the wall at the top of the screen, and player two defends the wall at the bottom.

The player's paddle (horizontal line closest to the middle section of the screen) is used to intercept the ball before it hits his wall and destroys a section. When the ball hits either player's paddle, it bounces toward the opponent's wall. En route, the flight of the ball may be changed or impeded by barriers or additional sections of wall which serve to make the game faster and more exciting.

Eventually, one or both players will lose enough wall so that the ball can go through it. The first player to get the ball past his opponent's wall wins the game and receives an appropriate victory message.

One On One is easy to learn and challenging. You'll keep coming back to play it again and again.



A multicolored character mode is used to brighten up the screen in the Atari version of "One on One." (Other versions similar.)

Program 1: Atari Version

```
100 SCREEN=PEEK(88)+256*PEEK(89):GOT
    O 580
110 REM JOYSTICK SUBROUTINE
120 XOLD0=X0
130 IF STICK(0)=11 THEN X0=X0-3*SGN(
    X0-2)
140 IF STICK(0)=7 THEN X0=X0+3*SGN(3
    5-X0)
150 IF X0=XOLD0 THEN 170
160 POSITION XOLD0,7:PRINT "
    {3 SPACES}"
170 POSITION X0,7:PRINT P1$
180 XOLD1=X1
190 IF STICK(1)=11 THEN X1=X1-3*SGN(
    X1-2)
200 IF STICK(1)=7 THEN X1=X1+3*SGN(3
    5-X1)
210 IF X1=XOLD1 THEN 230
220 POSITION XOLD1,16:PRINT "
    {3 SPACES}"
230 POSITION X1,16:PRINT P1$
240 RETURN
250 REM PADDLE SUBROUTINE
260 XOLD0=X0
270 X0=35-INT(PADDLE(0)/6.75)
280 IF X0=XOLD0 THEN 300
290 POSITION XOLD0,7:PRINT "
    {3 SPACES}"
300 POSITION X0,7:PRINT P1$
310 XOLD1=X1
320 X1=35-INT(PADDLE(1)/6.75)
330 IF X1=XOLD1 THEN 350
340 POSITION XOLD1,16:PRINT "
    {3 SPACES}"
350 POSITION X1,16:PRINT P1$
360 RETURN
370 POSITION 6,0:PRINT "PRESS SPACEB
    AR TO START GAME"
380 POKE 764,255
390 IF PEEK(764)=33 THEN 410
400 GOSUB BLINE:GOTO 390
410 POSITION 6,0:FOR X=1 TO 32:PRINT
     " ";:NEXT X:POKE DL-1,4+64
420 SOUND 0,50,10,8:FOR X=1 TO 75
430 NEXT X:SOUND 0,0,0,0
440 BX=INT(8*RND(1))+16:BY=9:DX=1:DY
    =1
450 IF RND(0)<0.5 THEN DX=-1
460 IF RND(0)<0.5 THEN DY=-1:BY=14
470 POSITION BX,BY:PRINT " ";
480 BX=BX+DX:BY=BY+DY:POSITION BX,BY
    :PRINT "{T}";:REM BALL(CNTL-T)
490 IF L=88 AND OLDL=88 THEN 510
500 IF L=88 THEN SOUND 0,50,10,10:FO
    R X=1 TO 15:NEXT X:SOUND 0,0,0,0
    :DY=-DY
510 GOSUB BLINE:IF BY<2 OR BY>21 THE
    N 870
```

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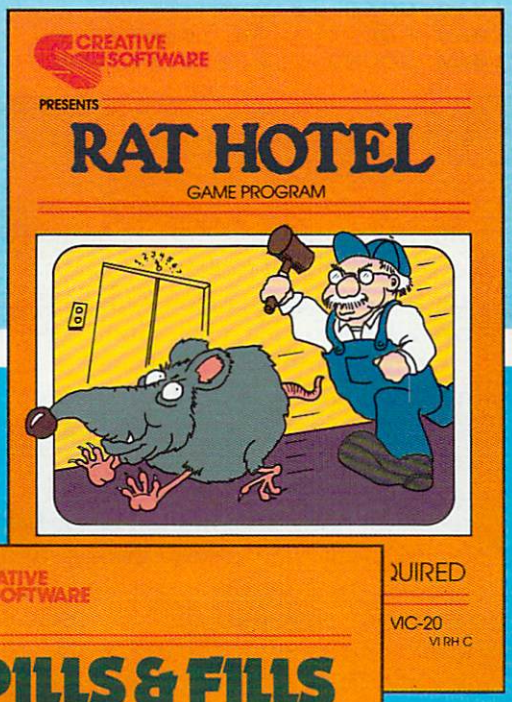

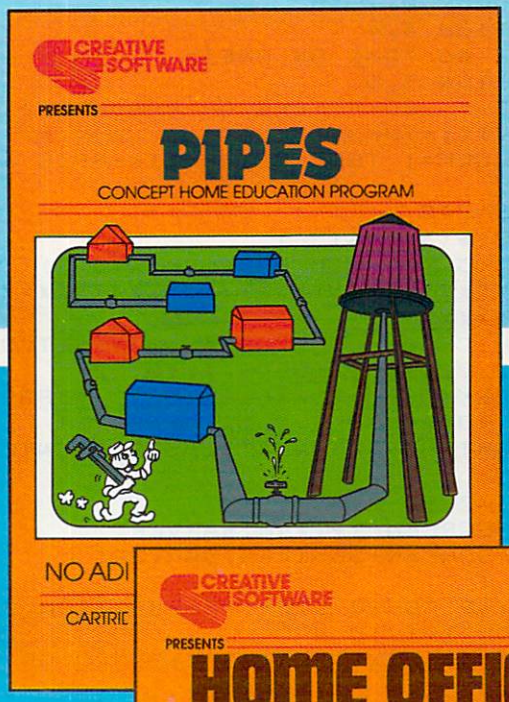

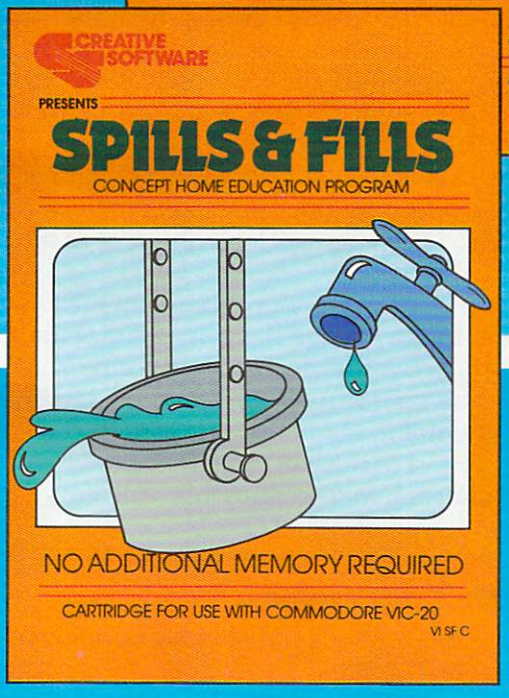

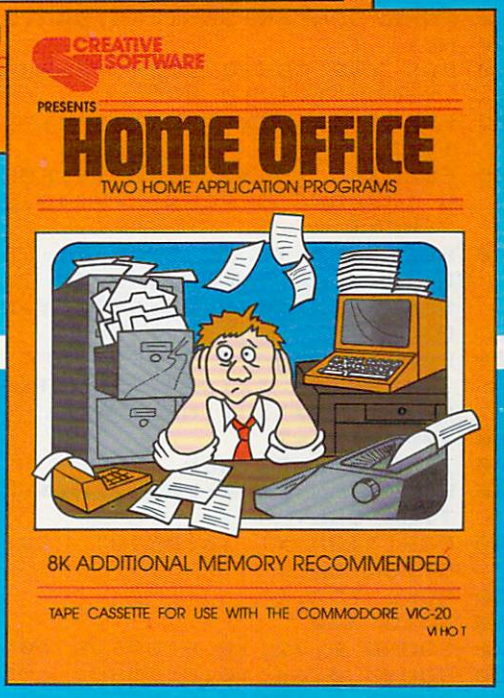

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```
520 OLDL=L
530 LOCATE BX+DX,BY+DY,L
540 IF L=32 THEN 470
550 IF L=19 THEN SOUND 0,100,10,10:F
    OR X=1 TO 15:NEXT X:SOUND 0,0,0,
    0:DX=-DX:GOTO 530
560 IF L=18 THEN SOUND 0,100,10,10:F
    OR X=1 TO 15:NEXT X:SOUND 0,0,0,
    0:DY=-DY
570 GOTO 470
580 GRAPHICS 2:SETCOLOR 2,0,0
590 SETCOLOR 0,7,10
600 POSITION 4,4
610 PRINT #6;"ONE ON ONE!"
620 POSITION 3,5
630 PRINT "  JOYSTICKS OR PADDLES (1
     OR 2)";:INPUT BLOCK
640 IF BLOCK=1 THEN BLINE=110:GOTO 6
    60
650 BLINE=240
660 DIM P1$(3),A$(36)
670 P1$="{3 R}":REM PADDLE(CNTL-R)
680 A$="XXXXXXXXXXXXXXXXXXXXXXXXXXXX
    XXXXXXXX"
690 GRAPHICS 0:SETCOLOR 4,0,12:SETCO
    LOR 2,2,10:SETCOLOR 1,15,10
700 DL=PEEK(560)+256*PEEK(561)+4:FOR
     I=2 TO 24:POKE DL+I,4:NEXT I
710 BARVERT=83:REM VERTICAL BAR(CNTL
    -Y)
720 FOR I=2 TO 21
730 POKE SCREEN+1+I*40,BARVERT
740 POKE SCREEN+38+I*40,BARVERT
750 NEXT I
760 FOR Y=2 TO 18 STEP 16:POSITION 2
    ,Y:FOR X=1 TO 4
770 PRINT A$:NEXT X:NEXT Y:SETCOLOR
    1,12,7
780 FOR X=5 TO 34 STEP 29:FOR Y=10 T
    O 13:POKE SCREEN+X+Y*40,83:NEXT
    Y:NEXT X
790 FOR X=14 TO 25 STEP 11:FOR Z=9 T
    O 12 STEP 3:FOR Y=Z TO Z+2:POKE
    SCREEN+X+Y*40,83:NEXT Y:NEXT Z:N
    EXT X
800 FOR X=8 TO 28 STEP 10:POSITION X
    ,11:PRINT "XXXX";:POSITION X,12:
    PRINT "XXXX";:NEXT X
810 X0=29:X1=2
820 IF BLOCK=2 THEN 370
830 POSITION X0,7:PRINT P1$:REM JOYS
    TICK ONLY
840 POSITION X1,16:PRINT P1$:REM JOY
    STICK ONLY
850 POKE 752,1
860 GOTO 370
870 SOUND 0,72,10,8:GOSUB 1050
880 SOUND 0,64,10,8:GOSUB 1050
890 SOUND 0,60,10,8:GOSUB 1050
900 SOUND 0,72,10,8:GOSUB 1050
910 SOUND 0,64,10,8:GOSUB 1050
920 SOUND 0,72,10,8:GOSUB 1050
930 WW=WW+1:IF WW<3 THEN 870
940 WW=0
950 POSITION BX,BY:PRINT " ";
960 POKE DL-1,2+64:POSITION 2,0
970 IF BY>21 THEN PRINT "!!!!!!VICTO
    RY GOES TO PLAYER 1!!!!!!";
980 IF BY<2 THEN PRINT "!!!!!!VICTOR
    Y GOES TO PLAYER 2!!!!!!";
990 FOR I=12 TO 13:POKE DL+I,2:NEXT
    I
1000 POSITION 2,11:PRINT "TO PLAY AG
     AIN, PRESS THE FIRE BUTTON":PRI
     NT "ON EITHER JOYSTICK. PRESS Q
      TO QUIT."
1010 IF STRIG(0)=0 OR STRIG(1)=0 THE
     N 690
1020 IF PTRIG(0)=0 OR PTRIG(1)=0 THE
     N 690
1030 IF PEEK(764)=47 THEN POKE 764,2
     55:GRAPHICS 0:PRINT "TYPE <NEW>
      TO ERASE PROGRAM.":END
1040 GOTO 1010
1050 FOR X=1 TO 10:NEXT X
1060 SOUND 0,0,0,0:RETURN
```

VIC Version

The VIC version uses game paddles plugged into the control port. It has two skill levels. At level one, all ball movement is at a 45 degree angle with respect to the X and Y axis. Level two allows the players to double the horizontal increment of the ball by striking it with a moving paddle. The subroutine from lines 160 to 220 determines if the paddle has changed from its last position. If the paddle position changes just before the ball strikes it, then the resulting horizontal motion of the ball becomes twice as fast. The vertical increment of the ball, however, always stays the same. Either player can slow the ball to the usual diagonal motion by allowing the ball to strike a stationary paddle.

The wall that each player must defend is generated with random brick colors in lines 420 to 440. The game will look different each time it is played.

If you become truly proficient at One On One, you might change the game so that the object is to break through the wall *behind* your paddle. This speeds up the action considerably, as you attempt to maintain control of the ball. Giving control of the ball to your opponent, of course, allows him to destroy his wall and defeat you even sooner.

Program 2: VIC Version

```
100 N1=1:N2=32:N3=81:N4=4:N5=248:N6=249:N7
    =132:N8=352:N9=2
110 CL=37154:P5=37152:P4=37151:M1=0:M2=23:
    M3=102:M4=220:M5=160:M6=15.93:G=1
    8:M8=16
120 GOTO 340
130 L5=PEEK(SCREEN+X+(Y+DY)*C):IF L5=N5 OR
     L5=N6 THEN DX=-DX:DY=-DY:RETURN
140 IF PEEK(SCREEN+X+DX+Y*C)=M3 THEN DX=-D
    X:RETURN
150 DY=-DY:RETURN
160 IF DX=-2 THEN DX=-1
170 IF DX=2 THEN DX=1
180 IF Y+DY=M8 THEN 210
190 X0=G-INT(PEEK(P0)/M6):IF X0<>L0 THEN D
    X=2*DX
```

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```
200 RETURN
210 X1=G-INT(PEEK(P1)/M6):IF X1<>L1 THEN D
    X=2*DX
220 RETURN
230 X0=G-INT(PEEK(P0)/M6):IF X0=L0 THEN RE
    TURN:REM PADDLE MOVEMENT
240 V=SCREEN+N7+L0:POKE V,N2:POKE V+A,N1
250 POKE V+N1,N2:POKE V+N1+A,N1
260 V=SCREEN+N7+X0:POKE V,N5:POKE V+A,N4
270 POKE V+N1,N5:POKE V+N1+A,N4:L0=X0:RETU
    RN
280 X1=G-INT(PEEK(P1)/M6):IF X1=L1 THEN RE
    TURN
290 V=SCREEN+N8+L1:POKEV,N2:POKE V+A,N1
300 POKEV+N1,N2:POKE V+A+N1,N1
310 V=SCREEN+N8+X1:POKE V,N6:POKE V+A,N4
320 POKE V+N1,N6:POKE V+N1+A,N4:L1=X1:RETU
    RN
330 POKE V1,15:POKES1,S5:FORI=1TO30:NEXT:P
    OKEV1,0:POKES1,0:RETURN
340 POKE 36879,31:PRINT"{CLEAR}"
350 PRINT"{08 DOWN}{05 RIGHT}ONE ON ONE!"
360 PRINT:PRINT:INPUT"{04 RIGHT}LEVEL 1 OR
     2";LV
370 SCREEN=256*PEEK(648):A=30720:X=RND(0)
380 IF PEEK(648)=16 THEN A=33792
390 V1=36878:S1=36876:P0=36872:P1=36873:C=
    22:X0=2:X1=18
400 DEFFNA(U)=SCREEN+X+C*Y:DEFFNC(U)=FNA(U
    )+A:DEFFNB(U)=INT(U*RND(1))+2
410 PRINT"{CLEAR}"
420 FOR Z=1TO18STEP 17
430 FOR Y=ZTO Z+3:FOR X=2 TO 19:POKE FNA(0
    ),160
440 POKE FNC(0),FNB(6):NEXT:NEXT:NEXT
450 FORZ=0TO20STEP20:FORX=ZTOZ+1:FORY=0TO2
    2:POKE FNA(0),102:POKE FNC(0),2
460 NEXT:NEXT:NEXT
470 FORZ=6TO13STEP7:FORX=ZTOZ+2:FORY=10TO1
    2:POKEFNA(0),102
480 POKE FNC(0),2:NEXT:NEXT:NEXT
490 GOSUB 260:GOSUB 310
500 PRINT"{UP}{02 RIGHT} PRESS {GRN}S{BLK}
     TO START";
510 GET A$:IF A$="S" THEN 530
520 GOSUB 230:GOSUB 280:GOTO 510
530 FOR I=1 TO 17:PRINT" {02 LEFT}";:FORJ=
    1 TO50:NEXT:NEXT
540 REM START GAME
550 X=11:Y=11:DX=1:DY=1
560 IF RND(1)<.5 THEN DX=-1
570 IF RND(1)<.5 THEN DY=-1
580 GOTO 660
590 POKE FNA(0),N2:POKE FNC(0),N1:L6=PEEK(
    SCREEN+X+DX/2+(DY+Y)*C)
600 IFABS(DX)=2ANDL6<>M3ANDL6<>N5ANDL6<>N6
    THEN 620
610 X=X+DX:Y=Y+DY:GOTO 630
620 X=X+DX/2:Y=Y+DY:POKEFNA(0),N2:POKEFNC(
    0),N1:X=X+DX/2
630 POKE FNA(0),N3:POKE FNC(0),N4:IF Y>4 A
    ND Y<18 THEN FL=0
640 IF(L=M5ANDOLDL=M5)OR(L=M5ANDFL=1)THEN ~
    S5=M5:GOSUB 330:GOTO 660
650 IF L=M5 THEN S5=M5:GOSUB 330:DY=-DY:IF
     Y<5ORY>17 THEN FL=1
660 GOSUB 230:GOSUB 280:IF Y=M1 OR Y=M2 TH
    EN 740
670 OLDL=L
680 L=PEEK(SCREEN+X+DX+(Y+DY)*C)
690 IF L=N2 THEN 590
700 IFL=M3THEN S5=M4:GOSUB330:GOSUB 130:GO
    TO 680
710 IF(L=N5ORL=N6)ANDLV=1THEN S5=M4:GOSUB ~
    330:DY=-DY
720 IF(L=N5ORL=N6)ANDLV=2THEN S5=M4:GOSUB ~
    330:GOSUB 160:DY=-DY:GOTO 680
730 GOTO 590
740 IF Y=M2 THEN PRINT"{HOME}{02 RIGHT}!!P
    LAYER 1 WINS!!!"
750 IF Y=M1 THEN PRINT"{HOME}{02 RIGHT}!!P
    LAYER 2 WINS!!!"
760 GOSUB 830
770 PRINT"{12 DOWN}{RIGHT}PRESS FIRE BUTTO
    N TO":PRINT"{RIGHT}PLAY AGAIN,{GR
    GRN}Q{BLK} TO QUIT"
780 POKE CL,127:P=PEEK(P5)AND128
790 FR=-(P=0):POKE CL,255:P=PEEK(P4):FL=-(
    (PANDI6)=0)
800 IF FL=1 OR FR=1 THEN 340
810 GET A$:IF A$<>"Q" THEN 780
820 PRINT"{CLEAR}":END
830 POKEV1,15:FORI=230TO252STEP2:POKE36875
    ,I:FORJ=1TO50:NEXT:NEXT
840 POKE 36875,0:POKE V1,0:RETURN
```

CBM-64 Version

The Commodore 64 version of One On One is designed to be played using two joysticks. Since barriers are placed in symmetrical positions in the central portion of the screen, the ball may rebound four or five times before reaching an opponent. This provides for a more challenging defensive strategy and a faster moving game. If you would like to adapt this program for use with paddles, substitute these lines:

```
11 AL=(36-(INT(F2/8.5)+3))
   THEN 17
19 F2=PEEK(54297):GOTO10
51 AR=(36-(INT(F1/8.5)+3))
   THEN 57
59 F1=PEEK(54298):GOTO 50
```

Program 3: CBM-64 Version

```
0 REM:ONE ON ONE FOR CBM-64
1 POKE646,1
2 PRINT"{REV}{CLEAR}{11 RIGHT}{10 DOWN} ~
    ONE ON ONE!!!{OFF}";
3 PRINT"{REV}{17 LEFT}{03 DOWN}PRESS SPA
    CE TO PLAY{OFF}";
4 POKE53281,0:IFPEEK(197)<>60THEN4
5 GOTO100
9 AL=15:GOTO19
10 ODDAL=AL
11 AL=AL+F2:IFAL=ODDALTHEN17
12 IFAL<4 THENAL=3
13 POKEG+ODDAL,32:POKEG+ODDAL+1,32:POKEG+
    ODDAL+2,32:POKEG+ODDAL+3,32
14 IFAL>=33THENAL=33
15 POKEG+AL,120:POKEG+AL+1,120:POKEG+AL+2
    ,120:POKEG+AL+3,120
16 POKEG+AL+D,7:POKEG+AL+D+1,7:POKEG+AL+2
    +D,7:POKEG+AL+3+D,7
17 RETURN
```

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```
19 ON((PEEK(56321)AND12)/4)GOTO20,30,40:
20 F2=3:GOTO10
30 F2=-3:GOTO10
40 F2=0:GOTO10
49 GOTO59
50 ODDAR=AR
51 AR=AR+F1
52 IFAR<4 THENAR=3
53 POKEF+ODDAR,32:POKEF+ODDAR+1,32:POKEF+
   ODDAR+2,32:POKEF+ODDAR+3,32
54 IFAR>=33THENAR=33
55 POKEF+AR,121:POKEF+AR+1,121:POKEF+AR+2
   ,121:POKEF+AR+3,121
56 POKEF+AR+D,7:POKEF+AR+D+1,7:POKEF+AR+2
   +D,7:POKEF+AR+3+D,7
57 RETURN
59 ON((PEEK(56320)AND12)/4)GOTO60,70,80:
60 F1=3:GOTO50
70 F1=-3:GOTO50
80 F1=0:GOTO50
100 B=1026:E=1060:D=54272:POKE53281,1:POKE
   53280,1:PRINT"{CLEAR}";:C=1226:F=
   1260
102 F=1024+40*6:SCR=1024:G=1024+40*14
110 FORL=1TO4:B=B+40:E=E+40
120 FORI=BTOE:POKEI,160:POKEI+D,(8*RND(1))
   +2:NEXT
130 NEXT:IF Z=1THEN150
140 B=1626:E=1660:Z=1:GOTO110
150 FORS=1024TO1877STEP40:POKES,127:POKES+
   37,127:POKES+D,0:POKES+37+D,0:NEX
   T
151 FORS=1025TO1877STEP40:POKES,127:POKES+
   37,127:POKES+D,0:POKES+37+D,0:NEX
   T
160 REM SCREEN & BACKGROUND
165 FORC=1TO30STEP4:POKE1428+C,90:POKE1428
   +C+D,0:NEXT
171 POKEG+15,120:POKEG+15+1,120:POKEG+15+2
   ,120:POKEG+15+3,120
172 POKEG+15+D,7:POKEG+15+D+1,7:POKEG+15+2
   +D,7:POKEG+15+3+D,7
173 POKEF+15,121:POKEF+15+1,121:POKEF+15+2
   ,121:POKEF+15+3,121
174 POKEF+15+D,7:POKEF+15+D+1,7:POKEF+15+2
   +D,7:POKEF+15+3+D,7
180 Y=11:DX=1:DY=1:X=11
190 IFRND(1)<.5THENDX=-1
200 IFRND(1)<.5THENDY=-1
201 AR=15:AL=15
208 POKE1024+X+40*Y,32:POKE1024+X+40*Y+D,0
209 X=X+DX:Y=Y+DY:POKE1024+X+40*Y,81:POKE1
   024+X+40*Y+D,8
235 IFL=160ANDOLDL=160THEN245
237 IFL=160THENDY=-DY:GOSUB500
245 GOSUB49:GOSUB19:IFY=0ORY=23THEN990
250 OLDL=L
260 L=PEEK(SCR+X+DX+(Y+DY)*40)
270 IFL=32THEN208
280 IFL=127THENDX=-DX:GOSUB500:GOTO260
290 IFL=121ORL=120ORL=90THENDY=-DY:GOSUB50
   0
300 GOTO208
500 S=54272:FORQ=STOS+24:POKEQ,0:NEXT:POKE
   S+5,88:POKES+24,15:POKES+1,10
510 POKES,143:FORRD=1TO50:NEXT:RETURN
990 POKE646,0
1000 IFY<1THENPRINT"{12 RIGHT}{09 DOWN}{
   REV}PLAYER 1 WINS!!{OFF}":GOTO250
   0
1010 FORA=1TO30:GETA$:NEXT
2000 IFY>22THENPRINT"{11 RIGHT}{09 DOWN}{
   REV}PLAYER 2 WINS!!{OFF}":GOTO250
   0
2010 FORA=1TO30:GETA$:NEXT
2500 PRINT"{10 RIGHT}{12 DOWN}{REV}PLAY AGA
   IN? Y OR N{OFF}"
2510 IFPEEK(197)=25THEN2515
2511 IFPEEK(197)=39THEN2520
2512 GOTO2510
2515 IFPEEK(197)=25THENPOKE646,1:RUN
2520 END
```

Apple Version

On the Apple, One On One is played with the paddles and has two skill levels. At level one, all ball movement is strictly 45 degrees with respect to the X and Y axis. After a short period of play, you'll probably be ready to move on to level two, where the ball angle can be altered.

At level two, the flight of the ball can be changed from the usual diagonal motion by moving the paddle just prior to the moment the ball strikes it. If this is successfully accomplished (as detected in lines 18 to 28), the X increment of the ball is doubled so that the ball moves twice as fast horizontally. Vertical ball movement, on the other hand, remains the same. In order to return to normal ball motion, the ball must strike a stationary paddle.

An especially pleasing feature of the Apple version is the random choice of wall colors each time a new game is played. This is carried out in the short subroutine at line 30.

A different sort of game can be played if you try to break through the wall behind you rather than defend it. The player who maintains control of the ball longer will ultimately break through his wall more quickly.

Program 4: Apple Version

```
10  GOSUB 2000: GOTO 50
12  IF  SCRN( X,Y + DY) = 1 THEN DX =  -
    DX:DY =  - DY: RETURN
13  IF  SCRN( X + DX,Y) = 15 THEN DX =
    - DX: RETURN
14 DY =  - DY: RETURN
18  IF DX =  - 2 THEN DX =  - 1
19  IF DX = 2 THEN DX = 1
22  IF Y + DY = R1 THEN 26
23 X0 =  INT ( PDL (0) / M6) + 2: IF X0
    <  > L0 THEN DX = 2 * DX
25  RETURN
26 X1 =  INT ( PDL (1) / M6) + 2: IF X1
    <  > L1 THEN DX = DX * 2
28  RETURN
30 D =  INT ( RND (1) * 13) + 2: IF D =
    DL OR D = 13 THEN 30
40  RETURN
50 M6 = 7.73:X0 = 2:X1 = 34:R0 = 7:R1 = 32
```

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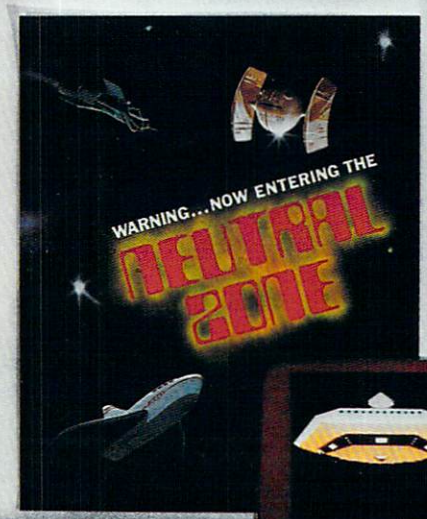

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```
110  GOTO 1000
112  REM  PADDLE 0 SUBROUTINE
115 X0 =  INT ( PDL (0) / M6) + 2: IF X
     0 = L0 THEN  RETURN
120  COLOR= 0: HLIN L0,L0 + 3 AT R0
130  COLOR= 1: HLIN X0,X0 + 3 AT R0
140 L0 = X0: RETURN
145  REM  PADDLE 1 SUBROUTINE
150 X1 =  INT ( PDL (1) / M6) + 2: IF X
     1 = L1 THEN  RETURN
155  COLOR= 0: HLIN L1,L1 + 3 AT R1
160  COLOR= 1: HLIN X1,X1 + 3 AT R1
170 L1 = X1: RETURN
250  FOR I = 1 TO 5:A =  PEEK ( - 16336
     ): NEXT I: RETURN
260  RETURN
280  POKE 768,1: POKE 769,10: CALL 770:
      RETURN
1000  TEXT : HOME : VTAB 11: HTAB 10:
     FLASH : PRINT "O N E    O N    O N E
     !": NORMAL
1010  VTAB 17: PRINT  SPC( 13);"LEVEL 1
      OR 2 ";: INPUT LV: IF LV > 2 OR L
     V < 1 THEN 1010
1020  HOME : GR : PRINT : PRINT : PRINT
     : PRINT : FOR Z = 1 TO 35 STEP 34:
      FOR Y = Z TO Z + 3
1030  GOSUB 30
1035  COLOR= D:DL = D
1040  HLIN 2,37 AT Y: NEXT Y: NEXT Z
1043  FOR Z = 8 TO 28 STEP 10: FOR Y =
     19 TO 21: GOSUB 30: COLOR= D:DL =
     D
1045  HLIN Z,Z + 4 AT Y: NEXT Y: NEXT Z
     : COLOR= 15
1048  FOR I = 0 TO 38 STEP 38: VLIN 1,3
     8 AT I: VLIN 1,38 AT I + 1: NEXT I
     : IF LV = 1 THEN 1056
1049  FOR I = 7 TO 32 STEP 25: VLIN 17,
     23 AT I: VLIN 17,23 AT I + 1: NEXT
     I
1050  FOR X = 13 TO 26 STEP 13: FOR Y =
     11 TO 23 STEP 12: VLIN Y,Y + 5 AT
     X: VLIN Y,Y + 5 AT X + 1: NEXT Y:
     NEXT X: GOTO 1059
1056  FOR I = 5 TO 35 STEP 30: VLIN 17,
     23 AT I: NEXT I
1057  FOR X = 14 TO 26 STEP 12: FOR Y =
     11 TO 24 STEP 13: VLIN Y,Y + 5 AT
     X: NEXT Y: NEXT X
1059  COLOR= 1: GOSUB 130: GOSUB 160
1060  PRINT  SPC( 8);"PRESS THE FIRE BU
     TTON ON": PRINT  SPC( 4);"PADDLE 0
      OR 1 TO START THE GAME"
1070 P0 =  PEEK ( - 16287):P1 =  PEEK (
      - 16286): IF P0 > 127 OR P1 > 127
      THEN 1090
1080  GOSUB 115: GOSUB 150: GOTO 1070
1090  PRINT : PRINT : PRINT : PRINT : REM
      CLEAR TEXT WINDOW
1100  REM  GAME ROUTINE
1110 X =  INT ( RND (1) * 9) + 17:Y = 2
     3:DX = 1:DY = 1
1120  IF  RND (1) < .5 THEN DX =  - 1
1130  IF  RND (1) < .5 THEN DY =  - 1:Y
      = 17
1135  GOTO 1180
1140  COLOR= 0: PLOT X,Y: IF  ABS (DX) =
     2 AND ( SCRN( X + DX / 2,Y + DY) <
      > 15 AND  SCRN( X + DX / 2,Y + DY
     ) <  > 1) THEN  PLOT X + DX / 2,Y +
     DY
1150 X = X + DX:Y = Y + DY: COLOR= 13: PLOT
     X,Y: IF Y > 4 AND Y < 35 THEN FL =
     0
1160  IF (L < 15 AND L > 1 AND OLDL < 1
     5 AND OLDL > 1) OR (L < 15 AND L >
     1 AND FL = 1) THEN  GOSUB 250: GOTO
     1180
1170  IF L < 15 AND L > 1 THEN  GOSUB 2
     50:DY =  - DY: IF Y < 5 OR Y > 34 THEN
     FL = 1
1180  GOSUB 115: GOSUB 150: IF Y = 0 OR
     Y = 39 THEN 1250
1190 OLDL = L
1200 L =  SCRN( X + DX,Y + DY)
1210  IF L = 0 THEN 1140
1220  IF L = 15 THEN  GOSUB 280: GOSUB
     12: GOTO 1200
1230  IF L = 1 AND LV = 1 THEN  GOSUB 2
     80:DY =  - DY
1235  IF L = 1 AND LV = 2 THEN  GOSUB 2
     80: GOSUB 18:DY =  - DY: GOTO 1200

1240  GOTO 1140
1250  REM  WINNER
1270  IF Y = 39 THEN  PRINT  SPC( 5);"!
     !!VICTORY GOES TO PLAYER 1!!!"
1280  IF Y = 0 THEN  PRINT  SPC( 5);"!!
     !VICTORY GOES TO PLAYER 2!!!"
1290  FOR I = 1 TO 1000: NEXT I
1300  PRINT : PRINT  SPC( 5);"PRESS A P
     ADDLE BUTTON TO PLAY": PRINT  SPC(
     5);"AGAIN, Q TO QUIT";
1310  POKE  - 16368,0:P0 =  PEEK ( - 16
     287):P1 =  PEEK ( - 16286): IF P0 >
     127 OR P1 > 127 THEN 1000
1320  IF  PEEK ( - 16384) =  ASC ("Q") +
     128 THEN 1400
1330  GOTO 1310
1400  POKE  - 16368,0: TEXT : HOME : END

2000  REM  SOUND ROUTINE
2010  FOR I = 770 TO 795: READ M: POKE
     I,M: NEXT
2020  DATA  172,01,03,174,01,03,169,04,
     32,168,252,173,48,192,232,208,253,
     136,208,239,206,0,03,208,231,96
2030  RETURN
```

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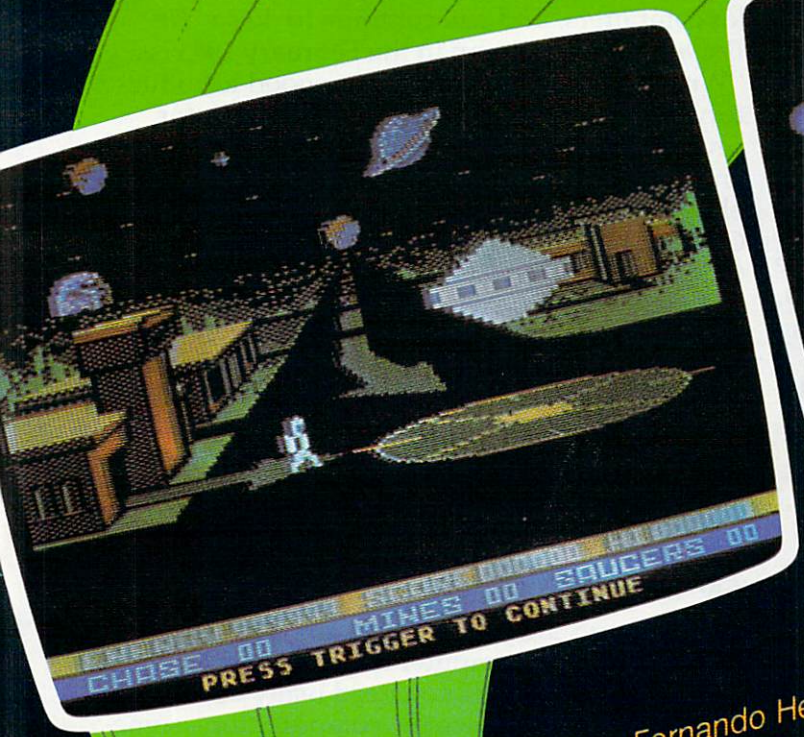
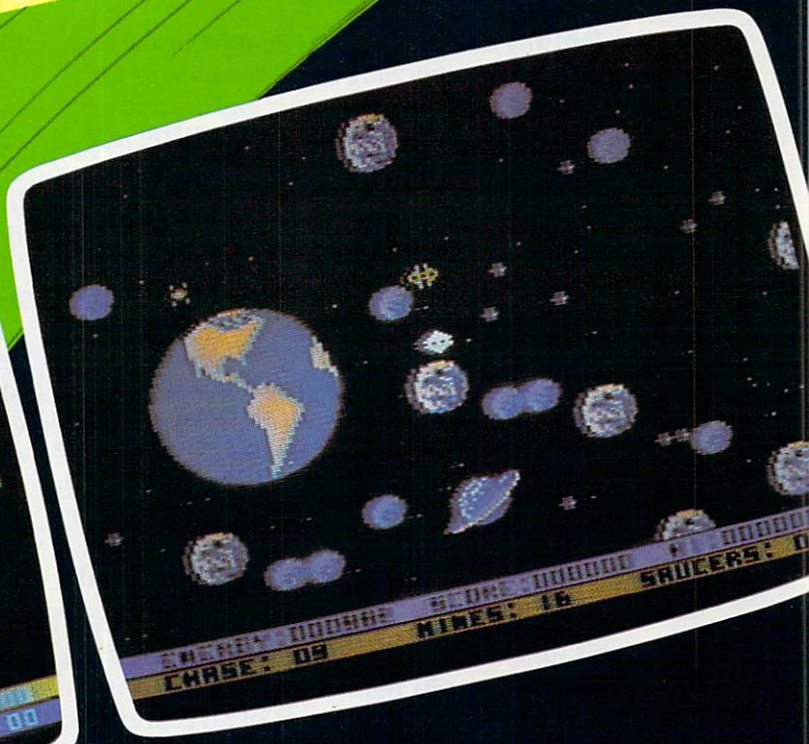
Totally Awesome!





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Questions Beginners Ask

Tom R. Halfhill, Features Editor

Are you thinking about buying a computer for the first time, but don't know anything about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, **COMPUTE!** *will tackle some of the most common questions that we are asked by beginners.*

Q I own an Atari 400 computer and 410 recorder, and I'm very interested in programming. Lately I've been experimenting with the different graphics modes. I can draw pictures on the screen, but I don't understand how to move them around with the game controllers (joysticks, paddles, and keyboard). What command makes the joystick move the picture? If you could just explain how to use the game controllers, I would be very grateful.

A Although this particular question comes from a 14-year-old reader with an Atari, it is a common one asked by new users of all brands of computers. How can I animate objects on the screen with the game controllers? Unfortunately, there is no simple answer.

First, it's important to understand that *the game controllers by themselves do nothing to animate objects on the screen.* Animation is up to your program. All that a game controller does is change a number in a memory location somewhere inside the computer. That number indicates the status of the controller, such as which way a joystick is deflected, or how far a paddle knob is turned, or which key is pressed on a keyboard.

Except for returning this number, a game controller does absolutely nothing else in the way of animation. A program reads this number, uses it to figure out what action the user desires, and then responds accordingly, thereby achieving animation. This is not an easy task for beginning programmers. Many beginners are dismayed when they discover that animation is far more difficult than just plugging in a joystick and typing in a command or two that will move their pictures around.

That's why most home computer manuals and instruction books barely cover the subject. You must be on solid ground with the fundamentals of programming before attempting something like animation.

To learn these more advanced techniques, you'll have to read many computer magazines and books. **COMPUTE!** has published numerous articles on animation for the Atari and other popular computers, and will continue to do so. *The Beginner's Page* column in the February 1983 issue, "Writing An Arcade Game," is a good introductory article. It includes example programs for several computers to demonstrate one method of animation: repeatedly drawing and erasing an object in screen memory. Other good sources are *COMPUTE!'s First Book Of Atari Graphics* and *COMPUTE!'s First Book Of VIC.*

Q I'm shopping around for my first home computer, and I see many ads in magazines and newspapers for low-priced computers. But when I visit the store, it seems like the sales people always try to sell me on numerous accessories and other things that end up costing more than the computer. How many accessories do I really need to get started? Isn't the computer itself enough?

A Chances are you will end up buying more than just the computer to get started. But how many accessories you need really depends on what you plan to use the computer for – something that should be foremost in your mind as you shop.

A computer by itself is more useful than a stereo receiver without speakers, a turntable, a tape deck, and records. But there is an analogy here. To make a computer really useful you need *software*, programs to make it run. Among the most popular uses for home computers are entertainment and education. This means you'll need game programs, educational programs, and so on. You can write programs yourself, copy them from **COMPUTE!**, or buy commercial software. But whatever you do, you'll at least need a tape player.

You'll need some way to load the programs into the computer. Some programs are built into plug-in cartridges which require no additional equipment. But most programs come on cassette tapes or disks. Loading a disk requires a disk drive, which costs $350 to $600. That's why most people start out with cassettes, which are far less expen-

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sive. A few computers – the Timex/Sinclair T/S 1000, for instance – work with an ordinary portable cassette recorder, which you may already own. Others require a special cassette recorder, which can cost $65 to $90.

Most people end up buying a starter system that includes the computer, a tape recorder, a few programs on cartridges or cassettes, and often some game controllers (joysticks or paddles). It's a good idea to hold off on buying additional equipment until you're better able to tell what you'll need. Later, you can add a printer, disk drive, additional memory, telephone modem, or other accessories as you want them. ©

COMPUTERS AND COMPOSITION

Joan Vesper

As people in schools, businesses, and homes receive more and more papers and letters written by computer rather than by typewriter or pen, they may feel that the cursor has passed them by and that writing as they know it has irretrievably changed. Students in particular will notice the perfectly-formatted papers that a few of their classmates are turning in. Here are the pros and cons of word processing as reflected in an informal survey at three colleges.

Last year, on an extended visit to Boston (Silicon Valley East), I counted myself among computer greenhorns, and I wondered what it takes to write "on-line," and if it's worth the effort. To find out the answers, I visited three Boston-area colleges (Babson, Harvard, and Massachusetts Institute of Technology) and talked with students and staff who regularly compose at terminals. In addition to interviewing computer-users at the colleges, I interviewed David Winder, assistant overseas news editor of *The Christian Science Monitor*, who has two years' full-time experience writing and editing on-line. Most of the interviews took place at campus terminal centers – large rooms equipped with several keyboards and matching screens where students drop in to use a terminal much as they might rent a typewriter. One Babson student, Linda Bailey, was interviewed in her office at Intelligent Devices, Inc., a computer-related company she and her husband started in 1979.

As these people talked about using computers to write, it became clear that:

1. Most do not use a computer during the *prewriting stage*.
2. Some do, but some do not, use it during the *writing stage*, depending on individual composing habits and on cost and availability of computers.
3. Almost all prefer to use a computer for *revising* and making final drafts.

Their reflections on using the computer at each of these stages help clarify what computers can and cannot do for writers.

Prewriting

None of the computer-users interviewed employs a terminal for jotting down notes days before he or she writes the first draft of a paper. (A special case is Jayne West, consultant and programmer analyst at MIT, who also writes stream-of-consciousness poetry on the computer.) However, some use the computer for data analysis at this early stage. For example, David Meltzer, an English major at Harvard, used the computer before writing a term paper on Byron's *Don Juan* by counting the ratio of Byron's use of the personal pronoun "I" to the poet's use of the proper noun "Don Juan." Because of the preponderance of the word "I," Meltzer concluded that the poem is highly autobiographical.

Writing

"It's just as hard to sit down to compose in front of a blank screen as a blank sheet of paper," Meltzer observes. For this and other reasons, only the most enthusiastic computer users in this survey, a group of undergraduates on MIT's Student Information Processing Board (SIPB) who guide other MIT students in the use of MIT's terminals, use computers to write out first drafts of papers. Steeped in technology and having free access to state-of-the-art equipment, SIPB "hackers" (computer enthusiasts) compose at a terminal by preference.

But most of those interviewed do not turn to the computer to write a draft until after they have gone through the "diagramming and scratching-out phase." Others postpone their approach to the computer even longer. Whether or not writers compose on paper or at the terminal at this stage in the writing process involves two considerations: individual writing habits and computer availability. The habits include what hardware these people have used in the past for composing, how fast they think while writing, and how much disorder they can tolerate. Regarding hardware, users say either they have always composed at a keyboard – typewriter or terminal – or they have always composed with pencil or pen.

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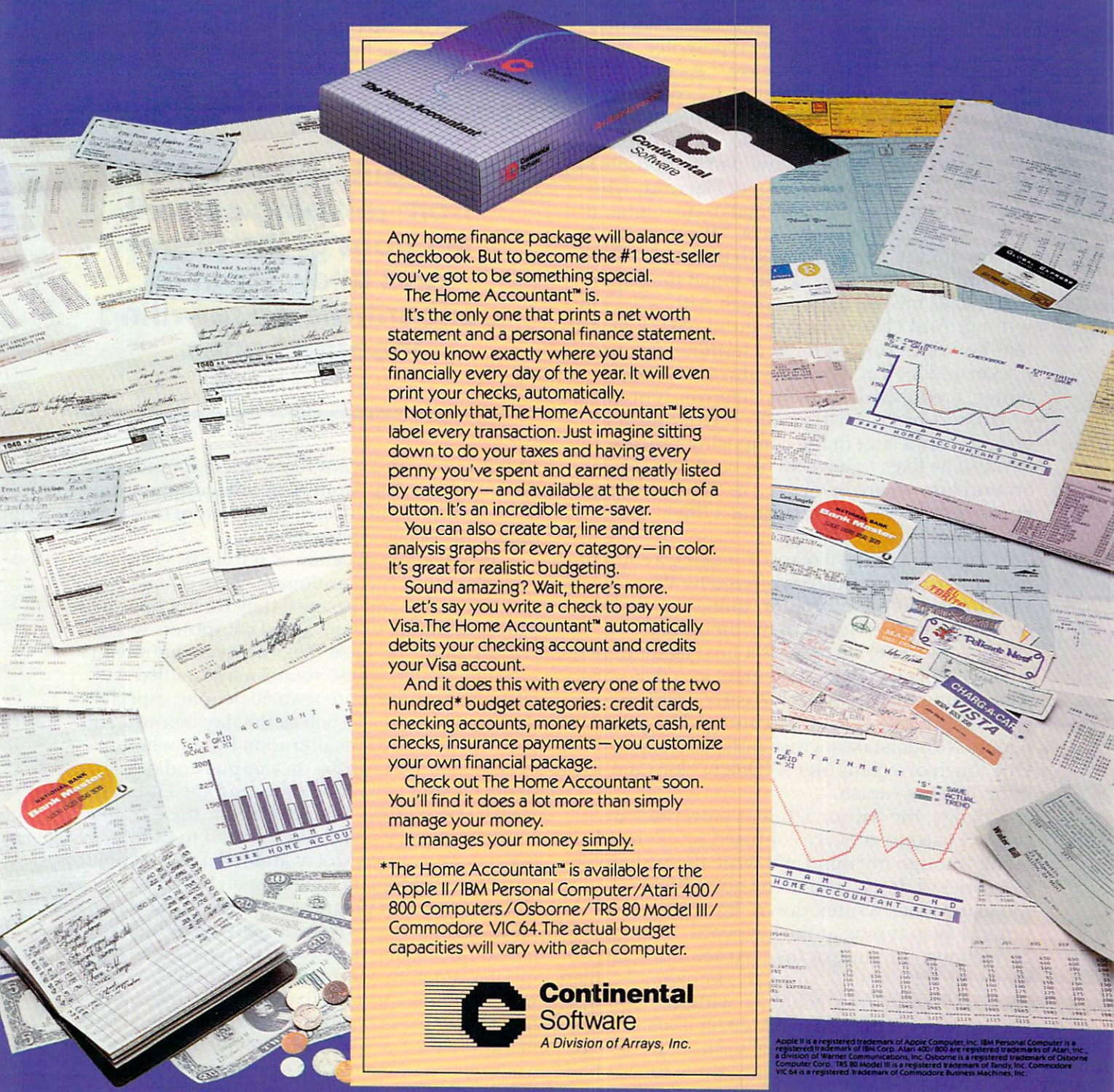

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In the first group is Bill York, an MIT undergraduate, who says he composed on a typewriter until he was a freshman at MIT, but has since written everything on the computer. "I never use a typewriter unless nothing else is available, like when I go home for vacations," he says. Jeff Schiller, another MIT undergraduate, concurs: "I was always a composer at the typewriter, so the transition to computer was easy." As members of the SIPB, both students meet many computer-users who compose with pencil or pen. "They did in the past, and they still do," they observe.

In this category of yellow-pad composers is Mary Phelan, a text processor at Harvard, who uses the computer only for final drafts. "I handwrite my drafts first," she says. "It's the way I've always done it." She explains that for her, "There's something about being able to touch the paper that makes me feel more in touch with what I'm writing. And I like to carry around what I've written. You can't very well put a terminal in your pocket and look at it on the subway." Another writer, Fred Pickel, who characterizes himself as a "cut-and-paste artist," puts off working at a terminal until later in the composing process because he likes to have all his work spread out around him where he can see it. "The computer limits your vision to one page at a time," he points out.

Another personal reason for using a computer during the writing stage is offered by Winder, who finds that the computer, unlike a typewriter or a pen, can keep up with his thoughts.

Tolerance for disorder is a final factor of personal composing style that enters into decisions about using the computer for early drafts. Some of those interviewed are discouraged by piles of papers with mistakes, cross-outs, and arrows. One touch of a computer's "Delete" key and such impediments vanish.

Bailey, the Babson student-entrepreneur, says, "I used to get very confused by all the ideas going through my mind. I'd write them all down in a series of drafts, and then I got confused seeing too many ideas written down. But with a computer, I keep typing at the keyboard, not making corrections, thinking of the next sentence and not worrying if I've said it correctly, knowing I can go back and remove any sentence without making a sloppy mess of the paper." Meltzer is also affected by the appearance of what he writes: "It used to be that when I wrote a sentence three times I had a mess. The computer eliminates such eyesores."

There is also the cost and availability factor. This is easy for the non-user to overlook, but it is very important in practice. Fortunate in this regard are computer owners, such as Bailey, who has four terminals in her company office. Students at colleges which supply free computer accounts for both computer-related courses *and* independent projects, such as writing assignments, are also lucky. Students who have to pay out-of-pocket for computer time are sometimes cut off from a desirable tool. "My budget isn't big enough to use the terminal for anything but final drafts," says Pickel, an MIT doctoral student. As more and more people become sophisticated in the use of computers and want to use them for independent work, administrators of college computing services foresee more fees and/or more restrictions on use of college equipment.

Computers free writers from retyping correct sections of the paper and allow them to concentrate on rewriting incorrect ones.

Besides cost, location of terminals is another consideration. As mentioned, some people write drafts in longhand because they do not have computers at home. Others avoid computers when writing drafts because they can't concentrate in a terminal center. These rooms may be filled with 50 machines and more than 50 people, especially during rush times – such as the day before a big paper is due, the late afternoon hours when evening students arrive on campus and day students haven't yet gone home, and the end of the term. At Harvard's Science Center, the terminal room "gets very noisy and it's hard to think," math majors Bruce Molay and Jeff Tecosky point out. Hilary Hodgson, working on her M.A. in city and regional planning, adds that Harvard students sometimes have to sign up 24-hours ahead for a terminal. Of course, even alone in a quiet room with a terminal all to oneself, a writer may face interruptions in the form of messages from other users flashing across the screen. This is the situation at SIPB, whose members belong to associations of users who keep each other posted via the display screen on subjects of mutual interest.

In every case, users agree that the day a person plans to write a paper is *not* the day he should learn how to operate the computer. Most problems occur in simply getting the paper into the machine. After that, the computer is generally an advantage

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– unless the main computer is "down" (its memory is filled to capacity or it is being repaired), or you can't get a printer.

Revising

After the writer has a first draft, most agree that a computer is preferable (with a few minor drawbacks) to typewriter or pen for the rest of the composing process.

First, drawbacks. On a short paper, the effort of getting into the machine – logging on and creating a file with a list of specifications for formatting – isn't worth it, even with the revision capabilities of the computer, according to two Babson users. Also, the time lag between keyboarding a revision and seeing it on screen – sometimes as long as 30 seconds – is frustrating, says Schiller. The lag, he explains, is due to time sharing, or, as he jokes, "ITS" – incompatible time sharing – where as many as 73 users may be plugged into the same computer. "There's a lot of competition for the attention of the machine," Pickel explains.

Another problem, when editing by computer is the time it takes for the cursor, or pointer, to move to the characters on the screen that the user wants to change. "My eye and a red pencil can move faster," says Winder. He adds that seeing only a screen's length of a story (120-150 words) instead of the entire work is a handicap when he wants to move around chunks of copy, and particularly when he is searching for a lead that may be buried deep in the story. Another drawback occurs when a professor specifies the type of paper he wants students to use in an assignment, such as bond with a certain rag content. To remove from the computer standard paper with tractor edges and feed in special paper is expensive and time consuming.

[Editor's Note: Mercifully, these delays and frustrations do not apply to word processing on personal computers.]

In spite of these drawbacks, most users agree that computers make their greatest contribution during the revising stage: they free the writer from retyping correct sections of a paper and allow him or her to concentrate on rewriting incorrect ones. "After you learn how to use the computer – and there is a learning curve – it takes about one-third the time to edit as it would by typewriter, because with a computer, you retype only the things you want to change," Schiller observes. But he cautions that the computer is a "two-edged sword" in this respect. While it allows a better final product, it also creates demand for a better final product. That is, as professors catch on to the computer's abilities, "they may make you revise small sections of a paper that earlier they would have let pass."

An added benefit of the computer during the revising stage is noted by a group of Harvard users who find that a computer is great for group work. Each member can feed his or her revisions into the machine, and then the group can request multiple copies.

Furthermore, the computer allows relatively fine strokes in the revising process. For example, some programs have spelling glossaries which store correct spellings of a few thousand words, including specialized words the user might add. The computer displays spellings in a composition that deviate slightly from the words on this list and displays correctly spelled alternatives that the user may have intended. The user selects the correct spelling, and the computer automatically inserts this spelling throughout.

Evasion Of Displeasure

Another fine stroke is the computer's ability to *word count*. Meltzer says he reviews his essays in this way as a check on style. For example, in an essay on Emily Dickinson, whose poetry he does not like, he found he often used phrases beginning with "of" instead of possessive nouns. "It was an evasion of displeasure," he concluded, since the "of" construction was less direct.

While the computer can analyze text word for word, as it does when it checks spelling or word frequency, it cannot yet work at the level of syntax. "So if your problem is Baroque sentence structure, you're out of luck," says Love. But he's quick to add that a group of MIT professors is working on the application of computers to the analysis of grammar.

Capping the triple ability of the computer in the revising stage – it minimizes retyping, it's good for group work, and it allows word for word analysis – is the bonus that makes computer compositions irresistible for many writers and their readers: the final product can be 100% typographically accurate, with justified right-hand margins, and printed in a variety of type fonts. ©

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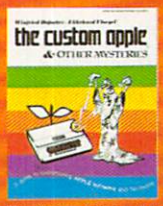

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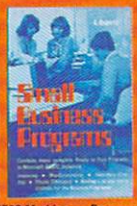

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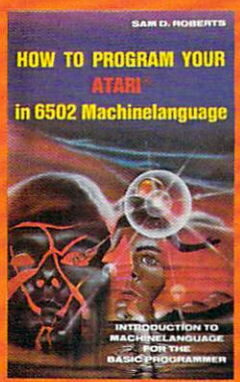

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Deflector

Frank J. Tyniw

You'll find that this game is quite a brainteaser. Strategically placing your Deflector and predicting a bouncing ball's trajectory is no easy task. If you like realtime strategy, Deflector's dynamically changing playfield will provide hours of challenging fun. (Versions for the unexpanded VIC, Atari 400/800, and Apple II.)

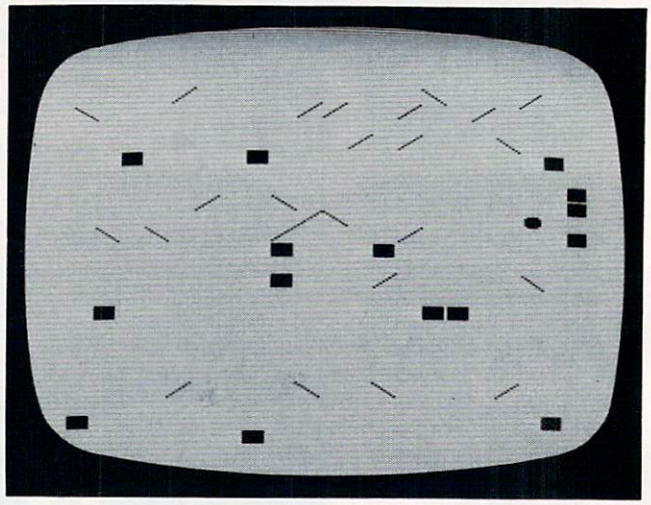
This is an adaptation for the 5K or 8K VIC of Fred Dunlap's Deflection program (from Vol. I, Number 3, *PET User Notes*). The idea of the game is simple. A ball bounces from side to side or from top to bottom of the screen. Pressing the left arrow key above the control key will print a slash in front of the ball's path, deflecting it 90 degrees. The F1 key will print a backslash (\). Your goal is to deflect the ball into the square targets, using as few slashes as possible to achieve the highest score.

Scoring is ten points for every block hit, minus one point for every slash used and minus five points for every slash on the screen if you hit the panic button. The panic button is the British pound sign (£). If you get too many slashes on the screen or deflect yourself into a corner, hitting the panic button will remove all slashes, subtract five points per slash, and resume the game.

The subroutine at 63000 is a useful utility you may want to include in other programs. When the program starts, it asks "adjust screen? (y/n)". The screen will switch to a black border and white background, and color bars for fine tuning your set. The cursor control keys will move the entire screen up, down, left, or right to adjust for your TV.

Press D when done adjusting, and the program asks if you want instructions. Then it will ask for number of targets. The program then will select random screen locations for the targets (160-200). Lines 700-990 handle the score display and rerun lines. Lines 4300-6210 are the sound routines. This program works on the unexpanded VIC or with the 3K cartridge suggested modifications.

Instead of a block for a target, you could use programmable character functions. The targets could be germs or political symbols, or instead of a ball you could use up, down, left, and right darts, arrows, anything.



A typical game of "Deflector," VIC version. (Other versions use similar character graphics.)

Program 1: VIC Version

```
10 PRINT"{CLEAR}":TR=208:J=3:BC=36879:VO=
   BC-1:S4=BC-2:S3=BC-3:S2=BC-4:S1=BC-5
20 GOSUB63000:POKEBC,93:V=15
122 PRINT"{DOWN}INSTRUCTIONS? (Y/N)
123 GETV$:IFV$=""THEN123
125 IFV$="Y"THENGOSUB1000
130 PRINT"{CLEAR}"CHR$(142)
140 K=0:T=0:CL=5
142 INPUT"{DOWN}HOW MANY TARGETS";J:J=ABS(
   J)
144 IFJ>506THENPRINT"TOO MANY!":GOTO142
146 IFJ<10ORJ>200THENPRINT"{DOWN}BRAVE, AR
   EN'T YOU?"
155 FORI=1TO1000:NEXT:PRINT"{CLEAR}":GOSUB
   7000
157 SS=7680:SR=38400
160 FORI=1TOJ
170 A=INT(506*RND(1))
180 IFPEEK(SS+A)=TRTHEN170
185 POKES2,0:POKES3,0
190 POKESS+A,TR:POKESR+A,6:GOSUB4300
200 NEXTI
205 POKES2,0:POKES3,0
210 A=INT(506*RND(1))
230 U=A+SS
240 DI=1:IFRND(1)>.5THENDI=-1
300 GETX$
310 IFX$<>""THEN600
320 NE=U+DI
330 IFABS(DI)=1THEN430
340 IFDI>0THEN380
350 IFNE<SSTHENDI=-DI:GOSUB6000:GOTO320
355 A=NE
360 IFPEEK(A)=77THENDI=-1:NE=NE-1
370 IFPEEK(A)=78THENDI=1:NE=NE+1
375 GOTO530
```

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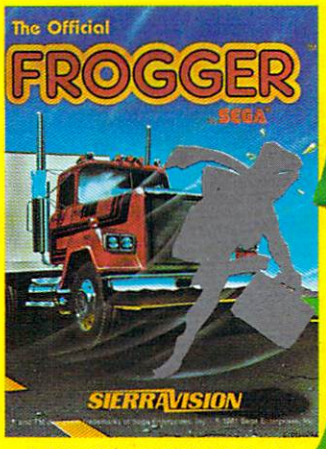

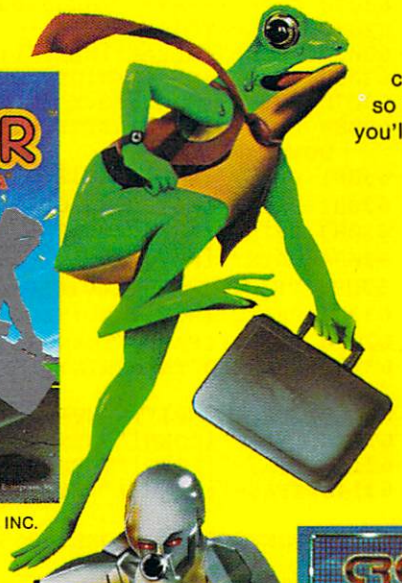

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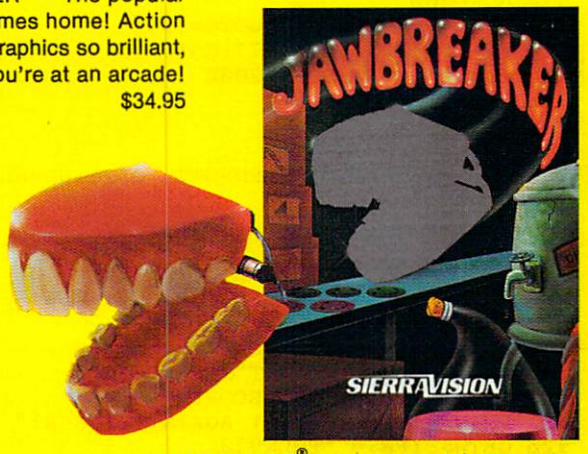

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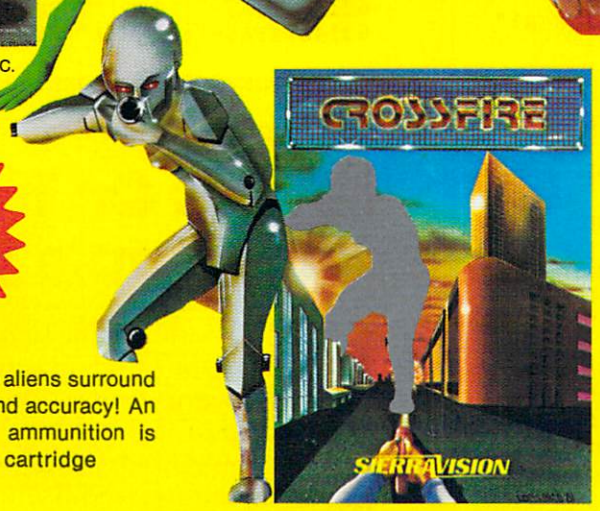

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```
380 IFNE>SS+506THENDI=-DI:GOSUB6000:GOTO320
390 A=NE
400 IFPEEK(A)=77THENDI=1:NE=NE+1
410 IFPEEK(A)=78THENDI=-1:NE=NE-1
420 GOTO530
430 IFDI>0THEN490
440 IFNE-22*INT(NE/22)=1THENDI=-DI:GOSUB62
    00:GOTO320
450 A=NE
460 IFPEEK(A)=77THENDI=-22:NE=NE+DI
470 IFPEEK(A)=78THENDI=22:NE=NE+DI
480 GOTO530
490 IFNE-22*INT(NE/22)=2THENDI=-DI:GOSUB62
    00:GOTO320
500 A=NE
510 IFPEEK(A)=77THENDI=22:NE=NE+DI
520 IFPEEK(A)=78THENDI=-22:NE=NE+DI
530 POKEU,32
540 IFPEEK(NE)=32THENPOKENE,81:U=NE:GOTO30
    0
550 IFPEEK(NE)=TRTHENK=K+1:SC=SC+10
552 IFPEEK(NE)=TRTHENGOSUB5000
555 POKENE,170:U=NE:FORI=1TO25:NEXT
560 IFK=JTHEN700
570 GOTO300
600 IFX$="←"THENA=78:GOTO630
610 IFX$="{F1}"THENA=77:GOTO630
615 IFX$="£"THENGOSUB2000
616 IFX$="Q"THEN990
620 GOTO320
625 GOSUB4600
630 IFPEEK(U+DI)=32THENPOKEU+DI,A:SL=SL+1:
    SC=SC-1
640 GOTO300
700 REM
712 PRINT"{CLEAR}":POKEBC,125
715 IFSC>HSTHENHS=SC:PRINT"{REV} NEW ";
716 PRINT"HIGH SCORE:"HS"{LEFT} "
720 PRINT"{DOWN}IT TOOK"SL"SLASHES
730 PRINT"{DOWN}TO HIT"J"TARGETS"
905 PRINT"{DOWN}YOUR SCORE";SC
910 PRINT"{02 DOWN}TRY AGAIN?(Y OR N)"
920 GETW$:IFW$=""THEN920
925 IFW$="N"THEN990
926 SL=0:SC=0
930 PRINT:PRINT"HOW MANY TARGETS";:INPUTJ
940 J=ABS(INT(J))
960 PRINT"{CLEAR}":POKEBC,93:GOSUB7000:K=0
    :T=0:GOTO155
990 PRINT"{CLEAR}":POKEBC,27:END
1000 PRINT"{CLEAR}"
1010 PRINTCHR$(14);"  THE OBJECT OF THIS
1015 PRINT"{DOWN}GAME IS TO DEFLECT THE
1020 PRINT"{DOWN}{UP}BALL INTO THE BOXES BY

1025 PRINT"{DOWN}{UP}USING _ AND F1 KEYS
1030 PRINT"{DOWN}TO PRINT DIAGONALS IN
1035 PRINT"{DOWN}ITS PATH. IF YOU GET
1040 PRINT"{DOWN}STUCK IN A LOOP USE
1045 PRINT"{DOWN}THE \ KEY AS A PANIC
1050 PRINT"{DOWN}BUTTON.
1085 PRINT"{03 DOWN}HIT ANY KEY...
1090 GETB$:IFB$=""THEN1090
1100 PRINT"{CLEAR}{DOWN}SCORING IS 10 POINT
    S
1110 PRINT"{DOWN}PER BLOCK HIT, ONE
1120 PRINT"{DOWN}POINT SUBTRACTED FOR
1130 PRINT"{DOWN}EVERY SLASH YOU LAY,
1140 PRINT"{DOWN}AND -5 FOR EVERY SLASH
1150 PRINT"ON THE SCREEN IF YOU
1160 PRINT"{DOWN}HIT THE PANIC BUTTON.
1170 PRINT"{04 DOWN}HIT ANY KEY TO START.."

1180 GETA$:IFA$=""THEN1180
1190 RETURN
2000 FORI=SSTOSS+506
2010 IFPEEK(I)<>77ANDPEEK(I)<>78THEN2030
2020 GOSUB4300:POKES2,0:POKES3,0:SC=SC-5:PO
    KEI,32
2030 NEXTI
2040 RETURN
4300 SO=INT(RND(1)*100)+129
4310 POKEVO,V:POKES3,SO:POKES2,SO:FORT1=1TO
    35:NEXTT1:RETURN
5000 POKEVO,V:FORS=128TO250STEP10
5010 POKES4,S
5020 NEXTS
5030 POKEVO,0:POKES4,0:RETURN
6000 POKEVO,V:POKES3,250:FORII=1TO25:NEXTII
    :POKES3,0:POKEVO,0:RETURN
6200 POKEVO,V:POKES3,245:FORII=1TO25:NEXTII
    :POKES3,0:POKEVO,0
6210 RETURN
7000 FORI=38400TO38905:POKEI,6:NEXT:RETURN
63000 REM SCREEN ADJUSTMENT
63010 POKE36879,24:PRINT"{CLEAR}":H=PEEK(368
    64):V=PEEK(36865)
63020 PRINT"ADJUST SCREEN? (Y/N)"
63030 GETA$:IFA$=""THEN63030
63040 IFA$="Y"GOTO63060
63050 PRINT"{CLEAR}{BLK}";:RETURN
63060 PRINT"{02 DOWN}USE THE CRSR KEYS TO
63070 PRINT"{DOWN}MOVE SCREEN AND THE
63080 PRINT"{DOWN}LETTER D WHEN DONE{02
    DOWN}
63081 PRINT"{REV}{RED}RED                    "
63082 PRINT"{REV}{CYN}CYAN                   "
63083 PRINT"{REV}{PUR}PURPLE                 "
63084 PRINT"{REV}{GRN}GREEN                  "
63085 PRINT"{REV}{BLU}BLUE                   "
63086 PRINT"{REV}{YEL}YELLOW                 "
63090 GETA$:IFA$=""THEN63090
63100 IFA$="D"THENPRINT"{CLEAR}{BLK}";:RETUR
    N
63110 IFA$="{UP}"THENV=V-1:IFV<0THENV=0
63120 IFA$="{DOWN}"THENV=V+1:IFV>40THENV=40
63130 IFA$="{LEFT}"THENH=H-1:IFH<0THENH=0
63140 IFA$="{RIGHT}"THENH=H+1:IFH>17THENH=17

63150 POKE36864,H:POKE36865,V:GOTO63090
```

Notes On The Atari And Apple Versions

For the Atari, use the two keys with slashes on them (the plus key and the question mark) to place your slashes. The ball will deflect at a 90 degree angle. When the game begins, you should hold down [SELECT] and the screen will start to fill with targets. Let go when you think you have enough.

For the Apple, enter the number of targets you want to play with. Very few or very many targets makes for a difficult game. Use the left and right arrow keys to lay down slashes.

For either the Atari or Apple, use the ESCape key as the panic button if your ball gets trapped.

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Program 2: Atari Version

```
100 REM  DEFLECTOR-ATARI VERSION
110 GRAPHICS 1:POKE 756,226:SETCOLOR
     4,16*RND(0),12:POKE 708,PEEK(71
    2)
120 LEFT=7:RIGHT=6:POKE 752,1:? "
    {TAB}{DOWN}PRESS SELECT FOR TARG
    ETS";
130 BALL=148:TARGET=192:COLOR TARGET
140 IF PEEK(53279)=5 THEN RX=INT(12*
    RND(0)+4):RY=INT(15*RND(0)+4):LO
    CATE RX,RY,Z:IF Z=32 THEN PLOT R
    X,RY:NUM=NUM+1
150 IF PEEK(53279)<>6 THEN 140
160 VX=0:VY=1:BX=9:BY=11:GRAPHICS 17
    +32:POKE 756,226:SETCOLOR 4,16*R
    ND(0),12:POKE 708,PEEK(712)
170 IF BX<2 OR BX>18 OR BY<2 OR BY>2
    2 THEN VX=-VX:VY=-VY:BX=BX+VX:BY
    =BY+VY
175 LOCATE BX,BY,OLD:IF OLD=32 THEN
    COLOR BALL:PLOT BX,BY
177 IF OLD=TARGET THEN NBX=BX:NBY=BY
    :GOTO 600
180 NBX=BX+VX:NBY=BY+VY:IF PEEK(764)
    =28 THEN GOSUB 3000
190 LOCATE NBX,NBY,Z:IF Z=32 AND PEE
    K(764)<255 THEN 500
200 IF Z=32 THEN GOSUB 700:BX=NBX:BY
    =NBY:GOTO 170
210 IF PEEK(764)=28 THEN GOSUB 3000
215 IF Z=LEFT THEN 1000
220 IF Z=RIGHT THEN 2000
230 IF Z=TARGET THEN COLOR 32:PLOT N
    BX,NBY:GOTO 600
500 REM MAKE A SLASH!
505 IF PEEK(764)<>6 AND PEEK(764)<>3
    8 OR BX<2 OR BX>18 OR BY<2 OR BY
    >22 THEN 170
510 IF PEEK(764)=6 THEN COLOR LEFT:T
    =VY:VY=VX:VX=T
520 IF PEEK(764)=38 THEN COLOR RIGHT
    :T=VY:VY=-VX:VX=-T
521 POKE 764,255:LOCATE BX,BY,Z:IF Z
    =TARGET THEN 600
522 IF Z=LEFT OR Z=RIGHT THEN 210
525 PLOT BX,BY:BX=BX+VX:BY=BY+VY:SL=
    SL+1:LOCATE BX,BY,Z:IF Z=TARGET
    THEN 600
530 GOTO 170
600 COLOR 32:PLOT BX,BY:HIT=HIT+1:FO
    R W=15 TO 0 STEP -1:SOUND 0,W,12
    ,W:NEXT W:Z=32:IF HIT<NUM THEN 2
    00
610 GRAPHICS 2+16:POSITION 5,0:? #6;
    "GAME OVER":? #6:? #6
620 ? #6;"{3 SPACES}targets ";NUM:?
    #6
630 ? #6;"{3 SPACES}slashes ";SL:? #
    6
640 ? #6;"{4 SPACES}SCORE ";INT(NUM*
    100/SL)-ESC:? #6
645 IF ESC THEN ? #6;"  -penalty ";E
    SC
650 ? #6:? #6;"  PRESS RETURN"
660 IF PEEK(764)<>12 THEN 660
670 POKE 764,255:RUN
700 LOCATE BX,BY,Z:IF Z=TARGET THEN
    600
705 IF Z<>LEFT AND Z<>RIGHT THEN COL
    OR 32:PLOT BX,BY
710 RETURN
999 GOTO 999
1000 FOR W=14 TO 0 STEP -2:SOUND 0,3
     0,10,W:SOUND 1,34,10,W:NEXT W
1010 T=VY:VY=VX:VX=T:GOSUB 700:BX=NB
     X+VX:BY=NBY+VY
1020 LOCATE BX,BY,Z:IF Z=LEFT OR Z=R
     IGHT THEN 210
1025 IF Z=TARGET THEN 600
1030 GOTO 170
2000 FOR W=14 TO 0 STEP -2:SOUND 0,2
     0,10,W:SOUND 1,24,10,W:NEXT W
2010 T=VY:VY=-VX:VX=-T:GOSUB 700:BX=
     NBX+VX:BY=NBY+VY
2020 LOCATE BX,BY,Z:IF Z=LEFT OR Z=R
     IGHT THEN 210
2025 IF Z=TARGET THEN 600
2030 GOTO 170
3000 P=PEEK(712):FOR W=15 TO 0 STEP
     -0.5:Z=PEEK(53770):POKE 708,Z:P
     OKE 712,Z:SOUND 0,100,0,W:NEXT
     W
3010 SCR=PEEK(88)+256*PEEK(89):FOR I
     =0 TO 479:A=PEEK(SCR+I):POKE SC
     R+I,159
3020 POKE SCR+I,A*(A<70 OR A>71 OR A
     =1):NEXT I:POKE SCR+I-2,0
3030 POKE 708,P:POKE 712,P:POKE 764,
     255:ESC=ESC+1:RETURN
```

Program 3: Apple II Version

```
100  REM  APPLE DEFLECTOR
110  TEXT : HOME
115  DIM XL%(23): FOR I = 0 TO 7:Z = 12
     8 * I:XL%(I) = Z + 1024:XL%(I + 8)
      = Z + 1064:XL%(I + 16) = Z + 1104
     : NEXT
117  DEF  FN A(V) = XL%(BY) + BX: DEF  FN
     P(V) =  PEEK ( FN A(0))
120 LEFT = 156:RIGHT = 175: INPUT "HOW
     MANY TARGETS? (1-720):";A$:NUM =  ABS
     ( INT ( VAL (A$)))
125  IF NUM < 1 OR NUM > 720 THEN  RUN

130 BALL = 174:TG =  ASC ("$")
135  HOME
140  FOR I = 1 TO NUM
145 BX =  INT (35 *  RND (1)) + 3:BY =
      INT (19 *  RND (1)) + 3
150  IF  FN P(V) <  > 160 THEN 145
160  POKE  FN A(V),TG: NEXT
165 VX = 0:VY =  - 1:BX = 19:BY = 11
170  IF BX < 2 OR BX > 38 OR BY < 2 OR
     BY > 22 THEN VX =  - VX:VY =  - VY
     :BX = BX + VX:BY = BY + VY
175  IF  FN P(V) = 160 THEN  POKE  FN A
     (V),BALL
177  IF  FN P(V) = TG THEN NX = BX:NY =
     BY: GOTO 600
180 NX = BX + VX:NY = BY + VY:Z =  PEEK
     (XL%(NY) + NX)
190  IF Z = 160 AND  PEEK ( - 16384) >
     128 THEN 500
200  IF Z = 160 THEN  GOSUB 700:BX = NX
     :BY = NY: GOTO 170
210  IF  PEEK ( - 16384) = 155 THEN  GOSUB
     3000
215  IF Z = LEFT THEN 1000
220  IF Z = RIGHT THEN 2000
```

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```
230  IF Z = TG THEN  POKE XL%(NY) + NX,
     160: GOTO 600
500  REM  MAKE A SLASH!
505 A =  PEEK ( - 16384) - 128: POKE  -
     16368,0: IF A <  > 8 AND A <  > 21
      OR BX < 2 OR BX > 38 OR BY < 2 OR
     BY > 22 THEN 170
510  IF A = 8 THEN CH = LEFT:T = VY:VY =
     VX:VX = T
520  IF A = 21 THEN CH = RIGHT:T = VY:V
     Y =  - VX:VX =  - T
521  IF  FN P(V) = TG THEN 600
522  IF ( FN P(V) = LEFT) OR ( FN P(V) =
     RIGHT) THEN 210
525  POKE  FN A(V),CH:BX = BX + VX:BY =
     BY + VY:SL = SL + 1: IF  FN P(V) =
     TG THEN 600
530  GOTO 170
600  POKE  FN A(V),160:HIT = HIT + 1:Z =
     160: IF HIT < NUM THEN 200
610  HOME : FLASH : FOR I = 1 TO 24: PRINT
      TAB( 39): PRINT : NEXT
615  VTAB 3: INVERSE : PRINT  TAB( 15);
     "GAME OVER"; TAB( 39): PRINT : PRINT

620  PRINT : PRINT : PRINT  TAB( 6);"TA
     RGETS ";NUM; TAB( 39): PRINT
630  PRINT : PRINT : PRINT  TAB( 6);"SL
     ASHES ";SL; TAB( 39): PRINT
640  PRINT : PRINT  TAB( 8);: NORMAL : PRINT
     "SCORE "; INT (NUM * 100 / SL) - E
     SC;: INVERSE : PRINT  TAB( 39): PRINT

650  IF ESC THEN  PRINT : PRINT  TAB( 5
     );"-PENALTY ";ESC; TAB( 39): PRINT
     : PRINT
660  PRINT : PRINT : PRINT : PRINT  TAB(
     13);"PRESS ";: NORMAL : PRINT "RET
     URN";: NORMAL : INVERSE : PRINT  TAB(
     38);: GET A$: NORMAL
670  RUN
700 Z =  FN P(V): IF Z = TG THEN 600
705  IF (Z <  > LEFT) AND (Z <  > RIGHT
     ) THEN  POKE  FN A(V),160
710  RETURN
999  GOTO 999
1000 T = VY:VY = VX:VX = T: GOSUB 700:B
     X = NX + VX:BY = NY + VY
1010 Z =  FN P(V): IF (Z = LEFT) OR (Z =
     RIGHT) THEN 210
1020  IF Z = TG THEN 600
1030  GOTO 170
2000 T = VY:VY =  - VX:VX =  - T: GOSUB
     700:BX = NX + VX:BY = NY + VY
2020 Z =  FN P(V): IF (Z = LEFT) OR (Z =
     RIGHT) THEN 210
2030  GOTO 170
3000  FOR I = 0 TO 23: FOR J = 0 TO 39
3010 P = XL%(I) + J:A =  PEEK (P): POKE
     P,159
3020  IF (A = LEFT) OR (A = RIGHT) OR (
     A = BALL) THEN A = 160
3030  POKE P,A: NEXT : NEXT :ESC = ESC +
     1: RETURN
```

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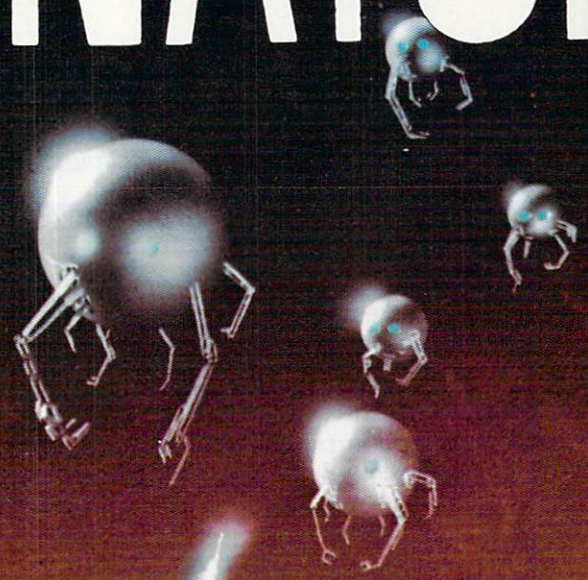

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CROSSWORDS

William Loercher

This program will construct crossword puzzles for you on a VIC, TI, PET/CBM, Atari, or Apple. There is an option to have a printed copy made of the final puzzle.

If you've ever tried to make your own crossword puzzles, you know the procedure is very time-consuming. I have designed crossword puzzles for my students in chemistry and have spent many hours toiling over fitting the correct words in their correct spaces. Procedures such as these are ideally suited for the microcomputer. This program can be run on either the 40- or 80-column PET. As written, the program will run on the 40-column screen. By deleting lines 100 and 110 and removing the word "REM" in lines 130 and 140, you can run the program on the 80-column PET.

About The Program

Lines 180-450 may be deleted if necessary since they only put a unique title on the screen.

Line 460 asks for the number of words you want to use in the puzzle. Using the maximum number makes a better puzzle, but it requires more time to complete.

Line 470 asks for the number of vertical words to be placed at random on the screen. These words are placed so that none are next to each other or on the outer border. An asterisk precedes and ends each word.

Line 480 asks if you want the results printed, assuming you have a printer. If not, you can copy the results by hand.

Line 490 dimensions the words into an array of words and an array of lengths of words. The number of words you choose to place in your "dictionary" beginning at line 2000 is limited only by computer memory.

Lines 510-520 print on the screen 23 rows of 39 blocks to be used as the test field.

Lines 530-610 test the field for proper positions and print the vertical words.

Lines 620-890 test the field for horizontal words and POKE them on the screen if the proper conditions are met.

Lines 920-970 enable the printer to make a copy of the puzzle as it appears on the screen.

Lines 980-990 are the subroutine for choosing a random screen position.

Line 1000 is a time delay for the title program.

Lines 1020-1030 are used to choose a random word from the array to be displayed on the screen.

See Program 6 for the DATA statements to be added to the program.

Lines 2010-2110 are the DATA statements containing the words used in the puzzle. If you want, you could substitute your own words for mine.

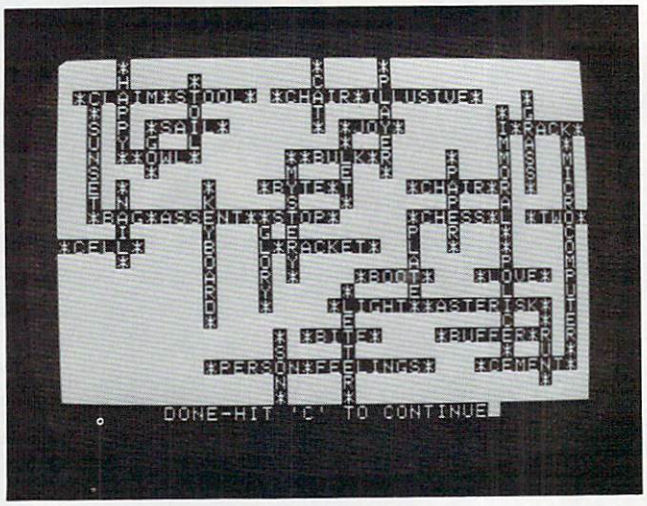
Suggested Improvements

After completing the program, I thought of other ways to improve it. First, after all 23 rows are tested (Z=23), you could write another section to the main program that tests the columns for word fits. This should result in a better puzzle.

Second, you could keep track of the words that fit a given location in another array and then choose the longest word from that list. If any of you come up with something interesting, write me.

If you do not like typing your own programs, I will send you a taped copy of the PET version only. Send $3, a cassette tape, and an SASE mailer to:

William Loercher
314 W. High St.
Manheim, PA 17545



A puzzle takes shape in the Apple version of "Crosswords." (Other versions similar).

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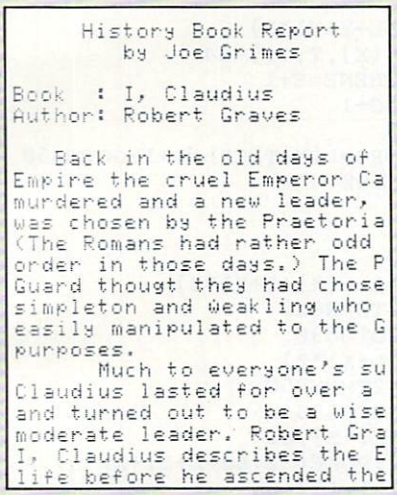
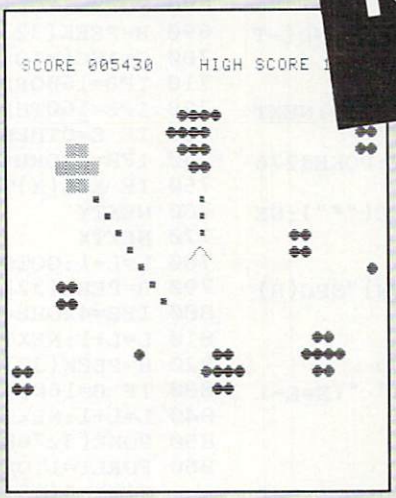


```
        History Book Report
           by Joe Grimes

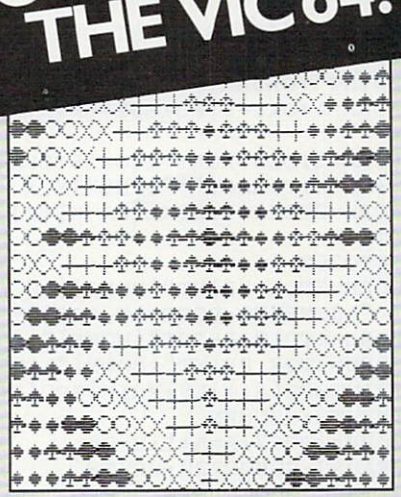
Book   : I, Claudius
Author: Robert Graves

   Back in the old days of
Empire the cruel Emperor Ca
murdered and a new leader,
was chosen by the Praetoria
(The Romans had rather odd
order in those days.) The P
Guard thougt they had chose
simpleton and weakling who
easily manipulated to the G
purposes.
      Much to everyone's su
Claudius lasted for over a
and turned out to be a wise
moderate leader. Robert Gra
I, Claudius describes the E
life before he ascended the
```

Write and print my letters, homework—just about anything. With *Word Processor* software that comes with the printer.



Create my own custom computer games. The printer set includes the new *First Book of VIC:* it's full of great game ideas.



Show off my computer graphics creations. Software includes *Kaleidoscope* and *Sketch Pad* graphics programs.

```
1 REM*VIC SQUIGGLE*
2 REM*FROM VIC 1001 USER'S
3 REM*TYPED AND DEBUGGED BY
7 C$="
9 PRINT"
10 DATA"
20 DATA1,0,5,6
30 DATA0,1,4,3
40 DATA3,6,2,0
50 DATA4,5,0,2
60 DIMA$(5),B(5,5)
70 FORI=0TO5
80 READA$(I)
90 NEXT
100 FORI=1TO4
110 FORJ=1TO4
120 READB(J,I)
130 NEXT
140 NEXT
190 T1=1
200 T2=1
210 X=20
```

Learn to write my own VIC 20 applications. With hard copy program listings that help me debug my programs.

```
Recipe 334

CHEESE BERRY PIE

Ingredients

     2 Pks (3 oz. ea.) cream
     1/3 cup powdered sugar
     1/3 cup sour cream
     2 tsp grated orange pee
     Baked 9-inch pie shell
     2 - 3 cups whole fresh
     strawberries/raspberrie
     1/2 cup strawberry/raspb
     preserves, sieved

Procedure

   Soften cheese.  Beat in s
sour cream and orange peel.
in pie shell.  Top with ber
to glaze.  Chill.  If you l
```

Keep the family's favorite recipes on a VIC 20 cassette. Now Mom can't pretend that she lost the recipe for cheeseberry pie.

UL

Alphacom™

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Program 1: PET/CBM Version (40 or 80 Column Screen)

```
100 EA=33767:X1=40:A=8:A2=16:F1=15:F2=25:L
    W=33569:OP=33224:WL=33374
110 A7=1000:B1=20
120 REM LINES 100,110 ARE FOR 40-COLUMN PE
    T
130 REM EA=34767:X1=80:A=31:A2=39:F1=30:F2
    =50:LW=34369:OP=33687:WL=33997
140 REM A7=2000:B1=0
150 REM LINES 120,130 ARE FOR 80-COLUMN PE
    T
160 POKE 59468,12:PRINT CHR$(142):X=RND(-T
    I)
170 PRINT"{CLEAR}"
180 FORX=1TOX1-1:POKE32768+X,ASC("*"):NEXT
    X
190 FORX=1TO25:FORY=1TOX1STEPX1-2:POKE3276
    8+X1*X+Y,ASC("*"):NEXTY,X
200 FORX=2TOX1-1:POKE(EA-X1+X),ASC("*"):NE
    XTX
210 GOTO260
220 FORB=1TOA:PRINT"{HOME}{20 DOWN}"SPC(B)
    " "A$:NEXTB:POKE LW,ASC("*")
230 FORC=1TO10:PRINT"{HOME}";
240 FORD=1TOE:PRINT"{DOWN}";:NEXTD
250 PRINTSPC(A+1)A$:PRINTSPC(A+1)" ":E=E-1
    :NEXTC:RETURN
260 FORF=1TO17:A=A+1:E=20
270 READA$:GOSUB220:NEXTF
280 DATA C,R,O,S,S,W,O,R,D, , ,P,U,Z,Z,L,E
290 FORX=1TO3000:NEXT
300 GOTO360
310 FORB=1TOA2-1:PRINT"{HOME}{20 DOWN}"SPC
    (B)" "A$:NEXTB
320 POKE LW,ASC("*")
330 FORC=1TO13-F:PRINT"{HOME}";
340 FORD=1TOE:PRINT"{DOWN}";:NEXTD
350 PRINTSPC(A2)A$:PRINTSPC(A2)" ":E=E-1:N
    EXTC:POKE OP,15:RETURN
360 FORF=1TO7:E=20
370 READA$:GOSUB310:NEXTF
380 DATA P,R,O,G,R,A,M
390 FORX=1TO19:READA$
400 IFA$="0"THEN430
410 POKE WL+X,ASC(A$)-64
420 GOTO440
430 POKE WL+X,32
440 GOSUB1000:NEXT
450 FORX=1TO2000:NEXT:PRINT"{CLEAR}"
460 INPUT"{03 DOWN}HOW MANY WORDS (MAX:110
    )";N
470 PRINT"{02 DOWN}HOW MANY VERTICAL WORDS
     (";F1;"-";F2;"WORKS WELL)";:INPU
    T K
480 INPUT"{02 DOWN}RESULTS ON SCREEN OR PR
    INTER (S OR P)";S$
490 DIM N$(N),L(N)
500 FOR X=1TON:READN$(X):L(X)=LEN(N$(X)):N
    EXT:PRINT"{CLEAR}"
510 FORJ=1TO23
520 FOR I=1 TO X1-1:PRINT"{REV} {OFF}";:NE
    XT I:PRINT" ";:NEXT J
530 FOR Z=1TOK:E=0:GOSUB1020:REM PUT IN  V
    ERTICAL WORDS
540 GOSUB 980:REM GET A RANDOM POSITION
550 FORX=0TOL(R)+1:B=PEEK(P+X1*X):C=PEEK(P
    -1+X1*X):D=PEEK(P+1+X1*X)
560 IFB<>160ORC<>160ORD<>160THENX=L(R)+1:N
    EXT X:GOTO 540
570 E=E+1
580 NEXTX:IFE=L(R)+1THENE=0
590 POKE(P),42:REM PLACE * ON EITHER SIDE
    OF WORD
600 FOR X=1TOL(R):POKE(P+X1*X),ASC(MID$(N$
    (R),X,1))-64
610 NEXT:POKE(P+X1*X),42:N$(R)="0":NEXTZ:R
    EM GET ANOTHER WORD
620 Z=0
630 Z=Z+2:L=0
640 IF Z>23THEN900
650 FORX=1TON:E=0:G=0
660 IFN$(X)="0"ORL+L(X)+2>X1-1THENNEXTX
670 IFX>NTHEN630
680 FORY=1TOL(X)
690 B=PEEK(32768+L+Y+X1*Z)
700 C=ASC(MID$(N$(X),Y,1))-64
710 IFB=160ORB=CTHENE=E+1
720 IFB=160THENG=G+1
730 IF E=0THEN770
740 IFB=32ORB=42ORG=L(X)THENL=L+1:GOTO650
750 IF E=L(X)THEN790
760 NEXTY
770 NEXTX
780 L=L+1:GOTO650
790 B=PEEK(32768+L+L(X)+1+X1*Z)
800 IFB=42ORB=160THEN820
810 L=L+1:NEXTX:GOTO630
820 B=PEEK(32768+L+X1*Z)
830 IF B=160ORB=42THEN850
840 L=L+1:NEXTX:GOTO630
850 POKE(32768+L+X1*Z),42
860 FORL1=1TOL(X):POKE(32768+L+L1+X1*Z),AS
    C(MID$(N$(X),L1,1))-64
870 H=100:J=0:M=59459
880 POKEM,J:POKEM,H:POKEM,J
890 NEXTL1:POKE(32768+L+L1+X1*Z),42:N$(X)=
    "0":L=L+L1:GOTO650
900 IF S$="P"THEN920
910 GOTO 1190
920 OPEN4,4
930 FORX=1TO24:B=B1:FORY=1TOX1:IFY>1THENB=
    0
940 A=PEEK(32768-(X1+1)+Y+X1*X):IFA=32ORA=
    42ORA=160THENA=166
950 B$=CHR$(A+64)
960 PRINT#4,SPC(B)B$;:IFY=X1THENPRINT#4
970 NEXTY,X:CLOSE4:GOTO 1190
980 U=INT(RND(1)*A7)
990 P=32768+U:RETURN
1000 FORY=1TO200:NEXT:RETURN
1010 DATAB,Y,0,W,I,L,L,I,A,M,0,L,O,E,R,C,H,
    E,R
1020 R=INT(RND(1)*N)+1:IFN$(R)="0"THEN1020
1030 RETURN
1190 PRINT"{REV}DONE{OFF}-HIT {REV}C{OFF} T
    O CONTINUE";
1200 GET F$:IF F$="" THEN 1200
1210 PRINT"{CLEAR}":END
1220 REM BE SURE TO INCLUDE LINES 2000-2110
```

Program 2: VIC Version

```
100 X=RND(0)
110 POKE 36879,25
120 PRINT"{CLEAR}"
130 PRINT"{03 DOWN}{RIGHT}HOW MANY WORDS"
140 INPUT" (MAX:110)";N
150 PRINT"{02 DOWN}{RIGHT}HOW MANY VERTICA
    L"
160 PRINT" WORDS (10-15 WORKS"
170 INPUT" WELL)";K
180 PRINT"{02 DOWN}{RIGHT}RESULTS ON SCREE
    N OR"
190 INPUT" PRINTER (S OR P)";S$
200 DIM N$(N),L(N)
```

The game that puts space games in perspective. Zaxxon™, one of the most popular arcade games of 1982, is now available for use with your home computer system.

Zaxxon™ technology and creativity present a 3-dimensional-like playfield which sets Zaxxon™ apart from other computer games.

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Imagine yourself the pilot, attacking the enemy fortress–climbing, diving, strafing to score points and extra fuel. The enemy fights back with a barrage of missiles and gunfire. Then you face a fleet of enemy fighters in a gripping dogfight of altitude strategy and flying skill. Survive this battle and the enemy's fortress, defended with laser barriers, then you've earned the ultimate challenge; a blazing confrontation with the powerful robot, armed with a lethal homing missile.

Zaxxon™ is the one game that you must see to believe. You have to play it to feel its impact. If you're ready to face the challenge, check with your local software dealer or send check or money order with $2.00 postage/handling. California residents add 6½% sales tax. Available on cassette or diskette. Suggested retail price $39.95.

Available in January on Atari®, February on Apple® and Radio Shack® Color, and April on TI 99/4A™ and NEC 6000™.

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COMPUTER SOFTWARE

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(213) 701-5161

```
210 FOR X=1TON:READN$(X):L(X)=LEN(N$(X)):N
    EXT:PRINT"{CLEAR}"
220 FORI=1TO22
230 PRINT"{REV}                          ":NEXT

240 FOR Z=1TOK:E=0:GOSUB710:REM PUT IN  VE
    RTICAL WORDS
250 GOSUB 690:REM GET A RANDOM POSITION
260 FORX=0TOL(R)+1:B=PEEK(P+22*X):C=PEEK(P
    -1+22*X):D=PEEK(P+1+22*X)
270 IFB<>160ORC<>160ORD<>160THENX=L(R)+1:N
    EXT X:GOTO 250
280 E=E+1
290 NEXTX:IFE=L(R)+1THENE=0
300 POKE(P),42:REM PLACE * ON EITHER SIDE ~
    OF WORD
310 FOR X=1TOL(R):POKE(P+22*X),ASC(MID$(N$
    (R),X,1))-64
320 NEXT:POKE(P+22*X),42:N$(R)="0":NEXTZ:R
    EM GET ANOTHER WORD
330 Z=0
340 Z=Z+2:L=0
350 IF Z>22THEN590
360 FORX=1TON:E=0:G=0
370 IFN$(X)="0"ORL+L(X)+2>21THENNEXTX
380 IFX>NTHEN340
390 FORY=1TOL(X)
400 B=PEEK(7680+L+Y+22*Z)
410 C=ASC(MID$(N$(X),Y,1))-64
420 IFB=160ORB=CTHENE=E+1
430 IFB=160THENG=G+1
440 IF E=0THEN480
450 IFB=32ORB=42ORG=L(X)THENL=L+1:GOTO360
460 IF E=L(X)THEN500
470 NEXTY
480 NEXTX
490 L=L+1:GOTO360
500 B=PEEK(7680+L+L(X)+1+22*Z)
510 IFB=42ORB=160THEN530
520 L=L+1:NEXTX:GOTO340
530 B=PEEK(7680+L+22*Z)
540 IF B=160ORB=42THEN560
550 L=L+1:NEXTX:GOTO340
560 POKE(7680+L+22*Z),42
570 FORL1=1TOL(X):POKE(7680+L+L1+22*Z),ASC
    (MID$(N$(X),L1,1))-64
580 NEXTL1:POKE(7680+L+L1+22*Z),42:N$(X)="
    0":L=L+L1:GOTO360
590 IF S$="P"THEN610
600 GOTO 850
610 OPEN4,4
620 FORX=1TO23:C$="                      ":F
    ORY=1TO22:IFY>1 THEN C$=""
630 A=PEEK(7657+Y+22*X):IFA=32ORA=42ORA=16
    0THENA=166
640 B$=CHR$(A+64)
650 PRINT#4,C$+B$;:IFY=22THENPRINT#4
660 NEXTY,X:CLOSE4:GOTO 850
670 GET F$:IF F$="" THEN 670
680 PRINT"{CLEAR}":END
690 U=INT(RND(1)*506)
700 P=7680+U:RETURN
710 R=INT(RND(1)*N)+1:IFN$(R)="0"THEN710
720 RETURN
850 PRINT"{REV}DONE{OFF}-HIT {REV}C{OFF} T
    O CONT";
860 GET F$:IF F$="" THEN
870 PRINT"{CLEAR}":END
880 REM BE SURE TO INCLUDE LINES 2000-2110
```

Program 3: Atari Version

```
70 OPEN #1,4,0,"K:"
80 SL=PEEK(88)+256*PEEK(89):REM DETE
   RMINE SCREEN MEMORY STARTING LOCA
   TION
100 OPEN #5,9,0,"E:"
110 DIM OUTPUT$(10),A$(19)
120 POSITION 2,0:FOR I=1 TO 36:PRINT
    "*";:NEXT I
140 FOR Y=1 TO 23:FOR X=2 TO 37 STEP
    35:POSITION X,Y:PRINT "*";:NEXT
    X:NEXT Y
160 POSITION 2,23:FOR I=1 TO 36:PRIN
    T "*";:NEXT I
165 POKE 752,1
170 A=10:FOR F=1 TO 16:A=A+1:E=18:RE
    AD A$
180 FOR B=3 TO A:POSITION B,19:PRINT
    " ";A$:NEXT B
182 FOR C=1 TO 10:POSITION 0,0
184 FOR D=1 TO E:PRINT "{DOWN}";:NEX
    T D
186 POKE 85,(A+1):PRINT A$:POKE 85,(
    A+1):PRINT " ":E=E-1:NEXT C:NEXT
    F
190 FOR X=1 TO 1000:NEXT X
200 A=18:FOR F=1 TO 7:E=18:READ A$:F
    OR B=3 TO A-1:POSITION B,19:PRIN
    T " ";A$:NEXT B
220 FOR C=1 TO 13-F:POSITION 0,0:FOR
    D=1 TO E:PRINT "{DOWN}";:NEXT D
230 POKE 85,A:PRINT A$:POKE 85,A:PRI
    NT " ":E=E-1:NEXT C:POKE SL+378,
    47:NEXT F
240 FOR X=1 TO 19:READ A$:IF A$="0"
    THEN 270
250 POSITION X+8,13:PRINT A$
260 GOTO 280
270 POSITION X+8,13:PRINT " "
280 FOR Y=1 TO 100:NEXT Y:NEXT X
290 REM FOR I=1 TO 2000:NEXT I
295 GRAPHICS 0:POKE 752,0
300 POSITION 3,3:PRINT "HOW MANY WOR
    DS (MAX:110)";:INPUT N
310 POSITION 3,7:PRINT "HOW MANY VER
    TICAL WORDS (15-25 WORKS  WELL)"
    ;:INPUT K
320 POSITION 3,11:PRINT "RESULTS ON
    SCREEN OR PRINTER":PRINT " (S OR
    P)";:INPUT OUTPUT$
325 POSITION 11,17:POKE 752,1:PRINT
    "...PLEASE WAIT..."
330 DIM N$(20*(N+1)),L(N),T$(20):REM
    ALLOWS WORD LENGTHS TO 20 CHARA
    CTERS
340 FOR X=1 TO N:READ T$:L(X)=LEN(T$
    ):N$(X*20+1,X*20+L(X))=T$:NEXT X
    :GRAPHICS 0
350 POKE 752,1:FOR I=0 TO 22:FOR J=0
    TO 38:POSITION J,I:PRINT "■";:N
    EXT J:NEXT I
360 FOR Z=1 TO K:E=0
410 R=INT(RND(0)*N)+1:IF N$(R*20+1,R
    *20+1)="0" THEN 410
420 U=INT(RND(0)*960)
430 P=SL+U
440 FOR X=0 TO L(R)+1:B=PEEK(P+40*X)
    :C=PEEK(P-1+40*X):D=PEEK(P+1+40*
    X)
450 IF B<>128 OR C<>128 OR D<>128 TH
    EN X=L(R)+1:NEXT X:GOTO 420
460 E=E+1
470 NEXT X:IF E=L(R)+1 THEN E=0
480 POKE P,10:REM PLACE * ON EITHER
    SIDE OF WORD
485 T$=N$(R*20+1,R*20+L(R))
490 FOR X=1 TO L(R):POKE (P+40*X),AS
```

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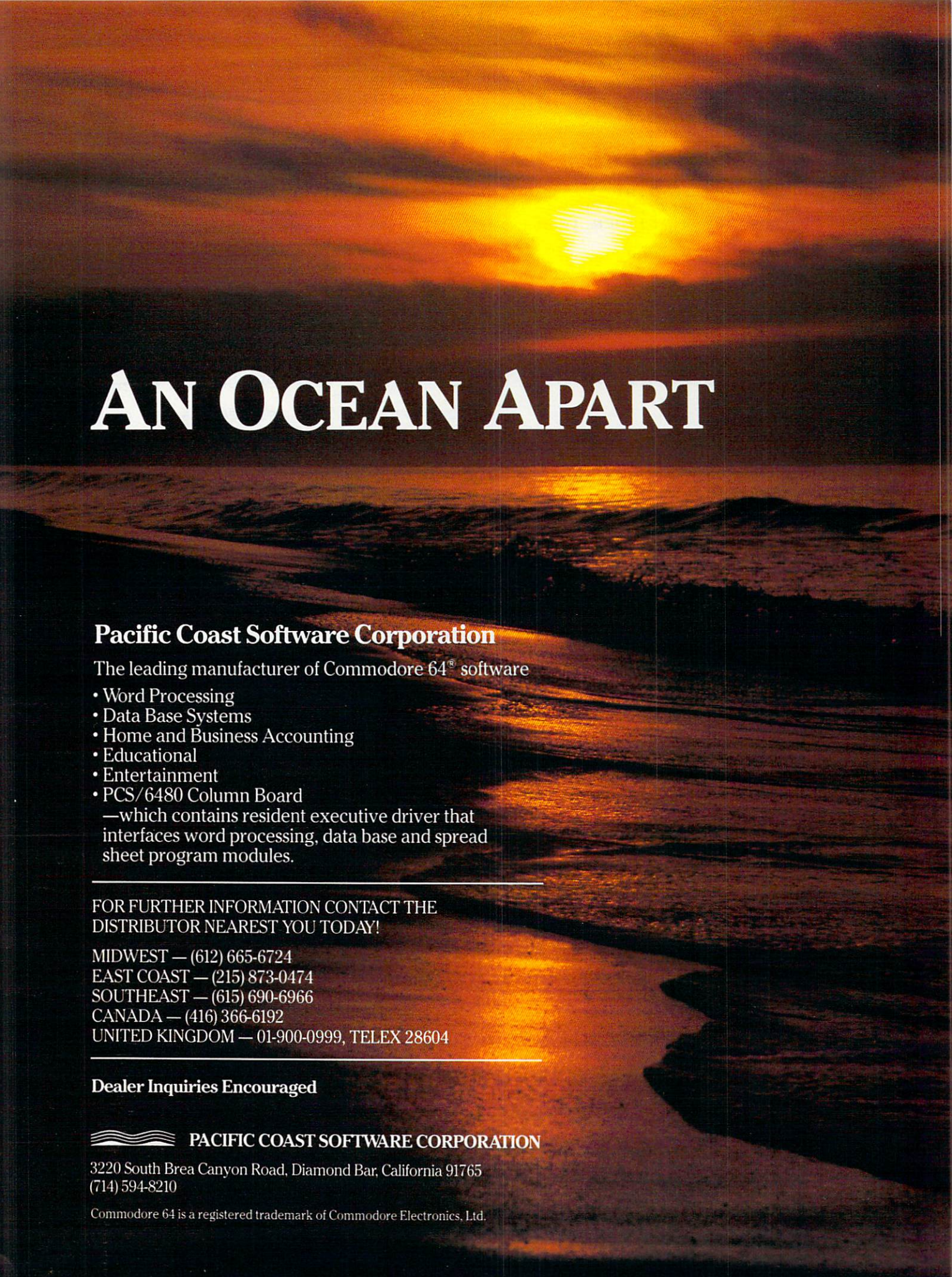
```
    C(T$(X,X))-32
500 NEXT X:POKE (P+40*X),10:N$(R*20+
    1,R*20+1)="0":NEXT Z:REM GET ANO
    THER WORD
510 Z=0
520 Z=Z+2:L=0
530 IF Z>23 THEN 800
540 FOR X=1 TO N:E=0:G=0
550 IF N$(X*20+1,X*20+1)="0" OR L+L(
    X)+2>39 THEN NEXT X
560 IF X>N THEN 520
580 T$=N$(X*20+1,X*20+L(X))
590 FOR Y=1 TO L(X)
600 B=PEEK(SL+L+Y+40*Z)
610 C=ASC(T$(Y,Y))-32
620 IF B=128 OR B=C THEN E=E+1
630 IF B=128 THEN G=G+1
640 IF E=0 THEN 690
650 IF B=0 OR B=10 OR G=L(X) THEN L=
    L+1:GOTO 540
670 IF E=L(X) THEN 710
680 NEXT Y
690 NEXT X
700 L=L+1:GOTO 540
710 B=PEEK(SL+L+L(X)+1+40*Z)
720 IF B=128 OR B=10 THEN 740
730 L=L+1:NEXT X:GOTO 520
740 B=PEEK(SL+L+40*Z)
750 IF B=128 OR B=10 THEN 770
760 L=L+1:NEXT X:GOTO 520
770 POKE (SL+L+40*Z),10
775 T$=N$(X*20+1,X*20+L(X))
780 FOR L1=1 TO L(X):POKE (SL+L+L1+4
    0*Z),ASC(T$(L1,L1))-32
790 NEXT L1:POKE (SL+L+L1+40*Z),10:N
    $(X*20+1,X*20+1)="0":L=L+L1:GOTO
     540
800 IF OUTPUT$="P" THEN 820
810 GOTO 1060
820 DIM L$(40):POSITION 0,0:POKE 82,
    0
830 FOR LINE=1 TO 23
840 INPUT #5,L$
850 LPRINT ,,,L$
860 NEXT LINE
870 GOTO 1060
880 DATA C,R,O,S,S,W,O,R,D, ,P,U,Z,Z
    ,L,E
890 DATA P,R,O,G,R,A,M
900 DATA B,Y,0,W,I,L,L,I,A,M,0,L,O,E
    ,R,C,H,E,R
1060 PRINT "(4 SPACES)DONE-HIT 'C' T
     O CONTINUE";
1070 GET #1,D:GRAPHICS 0:END
1080 REM BE SURE TO INCLUDE LINES 20
     00-2110
```

Program 4: TI-99/4A Version

```
100 GOTO 230
110 REM HORIZONTAL PRINTER
120 FOR I=1 TO LEN(H$)
130 LETTER=ASC(SEG$(H$,I,1))
140 CALL HCHAR(ROW,COL+I,LETTER)
150 NEXT I
160 RETURN
170 REM VERTICAL PRINTER
180 FOR I=1 TO LEN(V$)
190 LETTER=ASC(SEG$(V$,I,1))
200 CALL VCHAR(ROW+I,COL,LETTER)
210 NEXT I
220 RETURN
230 RANDOMIZE
240 CALL CLEAR
250 FOR I=2 TO 23 STEP 21
260 CALL HCHAR(I,2,42,30)
270 NEXT I
280 FOR I=2 TO 31 STEP 29
290 CALL VCHAR(2,I,42,21)
300 NEXT I
310 H$="CROSSWORD  PUZZLE"
320 ROW=10
330 COL=8
340 GOSUB 120
350 V$="PROGRAM"
360 ROW=7
370 COL=15
380 GOSUB 180
390 H$="by WILLIAM LOERCHER"
400 ROW=14
410 COL=5
420 GOSUB 120
430 FOR DELAY=1 TO 750
440 NEXT DELAY
450 CALL CLEAR
460 INPUT "HOW MANY WORDS (MAX:110)
    ?":N
470 PRINT
480 PRINT
490 PRINT "HOW MANY VERTICAL WORDS"
500 INPUT "(15-20 WORKS WELL)?":K
510 PRINT
520 PRINT
530 PRINT "RESULTS ON SCREEN OR PRI
    NTER"
540 INPUT "(S OR P)?":S$
550 DIM N$(110),L(110)
560 FOR X=1 TO N
570 READ N$(X)
580 L(X)=LEN(N$(X))
590 NEXT X
600 CALL CLEAR
610 CALL COLOR(1,1,16)
620 REM PUT IN EDGE CHAR
630 CALL VCHAR(1,32,31,24)
640 CALL HCHAR(24,1,31,31)
650 FOR Z=1 TO K
660 E=0
670 R=INT(RND*N)+1
680 IF N$(R)="0" THEN 670
690 ROW=INT(RND*23)+1
700 COL=INT(RND*29)+3
710 FLAG=0
720 FOR X=0 TO L(R)+1
730 IF ROW+X>23 THEN 670
740 CALL GCHAR(ROW+X,COL,B)
750 CALL GCHAR(ROW+X,COL-1,C)
760 CALL GCHAR(ROW+X,COL+1,D)
770 IF (B=32)*(C=32)*(D=32)THEN 810
780 FLAG=1
790 X=L(R)+1
800 GOTO 820
810 E=E+1
820 NEXT X
830 IF FLAG=1 THEN 690
840 IF E<>L(R)+1 THEN 860
850 E=0
860 CALL HCHAR(ROW,COL,42)
870 FOR X=1 TO L(R)
880 CALL HCHAR(ROW+X,COL,ASC(SEG$(N
    $(R),X,1)))
890 NEXT X
900 CALL HCHAR(ROW+X,COL,42)
910 N$(R)="0"
920 NEXT Z
930 Z=0
940 Z=Z+2
```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```
950 M=1
960 IF Z>23 THEN 1370
970 FOR X=1 TO N
980 E=0
990 G=0
1000 IF (N$(X)="0")+((M+L(X)+2)>31)
     THEN 1260
1010 FOR Y=1 TO L(X)
1020 CALL GCHAR(Z,M+Y,B)
1030 C=ASC(SEG$(N$(X),Y,1))
1040 IF (B<>32)*(B<>C)THEN 1060
1050 E=E+1
1060 IF B<>32 THEN 1080
1070 G=G+1
1080 IF E=0 THEN 1140
1090 IF (B<>31)*(B<>42)*(G<>L(X))TH
     EN 1120
1100 M=M+1
1110 GOTO 970
1120 IF E=L(X)THEN 1190
1130 NEXT Y
1140 LOC=2
1150 GOTO 1260
1160 LOC=0
1170 M=M+1
1180 GOTO 970
1190 CALL GCHAR(Z,M+L(X)+1,B)
1200 IF (B=42)+(B=32)THEN 1230
1210 M=M+1
1220 GOTO 1260
1230 CALL GCHAR(Z,M,B)
1240 IF (B=32)+(B=42)THEN 1290
1250 M=M+1
1260 NEXT X
1270 IF LOC=2 THEN 1160
1280 GOTO 940
1290 CALL HCHAR(Z,M,42)
1300 FOR L1=1 TO L(X)
1310 CALL HCHAR(Z,M+L1,ASC(SEG$(N$(
     X),L1,1)))
1320 NEXT L1
1330 CALL HCHAR(Z,M+L1,42)
1340 N$(X)="0"
1350 M=M+L1
1360 GOTO 970
1370 IF S$="P" THEN 1460
1380 H$="DONE-HIT c TO CONTINUE"
1390 ROW=24
1400 COL=4
1410 GOSUB 120
1420 CALL KEY(3,F,ST)
1430 IF ST=0 THEN 1420
1440 CALL CLEAR
1450 END
1460 OPEN #1:"RS232"
1470 FOR ROW=1 TO 23
1480 FOR COL=2 TO 31
1490 CALL GCHAR(ROW,COL,X)
1500 PRINT #1:CHR$(X);
1510 NEXT COL
1520 PRINT #1:CHR$(13)
1530 NEXT ROW
1540 CLOSE #1
1550 GOTO 1380
1560 REM BE SURE TO INCLUDE LINES 20
     00-2110
```

Program 5: Apple Version

```
100  TEXT : HOME
110  HTAB 2: FOR X = 1 TO 38: PRINT "*"
     ;: NEXT X
120  VTAB 1: FOR Y = 2 TO 23: FOR X = 2
      TO 39 STEP 37: VTAB Y: HTAB X: PRINT
     "*";: NEXT X,Y
130  HTAB 2: VTAB 24: FOR I = 1 TO 38:PRINT
     "*";: NEXT I
140 A = 11: FOR F = 1 TO 16:A = A + 1:E
      = 18: READ A$
150  FOR B = 3 TO A: VTAB 19: HTAB B:PRINT
     " "A$: NEXT B
160  FOR C = 1 TO 10: HTAB 1
170  FOR D = 1 TO E: VTAB D + 1: NEXT D

180  HTAB A + 1: PRINT A$: HTAB A + 1: PRINT
     " ":E = E - 1: NEXT C: NEXT F
190  FOR X = 1 TO 2000: NEXT
200 A = 19: FOR F = 1 TO 7:E = 18: READ
     A$: FOR B = 3 TO A - 1: VTAB 19: HTAB
     B: PRINT " "A$: NEXT B
210  VTAB 19: PRINT " *"
220  FOR C = 1 TO 13 - F: HTAB 1: FOR D
      = 1 TO E: VTAB D + 1: NEXT D
230  HTAB A: PRINT A$: HTAB A: PRINT "
     ":E = E - 1: NEXT C: POKE 1210,143
     : NEXT F
240  FOR X = 1 TO 19: READ A$: IF A$ =
     "0" THEN 270
250  VTAB 14: HTAB X + 9: PRINT A$
260  GOTO 280
270  VTAB 14: HTAB X + 9: PRINT " "
280  FOR Y = 1 TO 200: NEXT Y: NEXT X
290  FOR I = 1 TO 2000: NEXT : HOME
300  VTAB 4: INPUT "HOW MANY WORDS (MAX
     :110)?";N
310  VTAB 7: INPUT "HOW MANY VERTICAL W
     ORDS (15-25 WORKS    WELL)?";K
320  VTAB 10: INPUT "RESULTS ON SCREEN
     OR PRINTER (S OR P)?";S$
330  DIM N$(N),L(N)
340  FOR X = 1 TO N: READ N$(X):L(X) =
      LEN (N$(X)): NEXT X: HOME
350  INVERSE : FOR I = 1 TO 23: FOR J =
     1 TO 39: HTAB J: VTAB I: PRINT " "
     ;: NEXT J: NEXT I: NORMAL
360  DIM XL%(23): FOR I = 0 TO 7
370 XL%(I) = 1024 + 128 * I
380 XL%(I + 8) = 1064 + 128 * I
390 XL%(I + 16) = 1104 + 128 * I: NEXT I
400  FOR Z = 1 TO K:E = 0
410 R =  INT ( RND (1) * N) + 1: IF N$(
     R) = "0" THEN 410
420 ROW =  INT ( RND (1) * 23):COL =  INT
     ( RND (1) * 40)
430 P = XL%(ROW) + COL
440  FOR X = 0 TO L(R) + 1:B =  PEEK (X
     L%(ROW + X) + COL):C =  PEEK (XL%(
     ROW + X) + COL - 1):D =  PEEK (XL%
     (ROW + X) + COL + 1)
450  IF B <  > 32 OR C <  > 32 OR D <  >
     32 THEN X = L(R) + 1: NEXT X: GOTO
     420
460 E = E + 1
470  NEXT X: IF E = L(R) + 1 THEN E = 0

480  POKE P,170: REM  PLACE * ON EITHER
      SIDE OF WORD .
490  FOR X = 1 TO L(R): POKE (XL%(ROW +
     X) + COL), ASC ( MID$ (N$(R),X,1))
      + 64
500  NEXT : POKE (XL%(ROW + X) + COL),1
     70:N$(R) = "0": NEXT Z: REM  GET A
     NOTHER WORD
510 Z = 0
520 Z = Z + 2:L = 0
530  IF Z > 23 THEN 770
540  FOR X = 1 TO N:E = 0:G = 0
```

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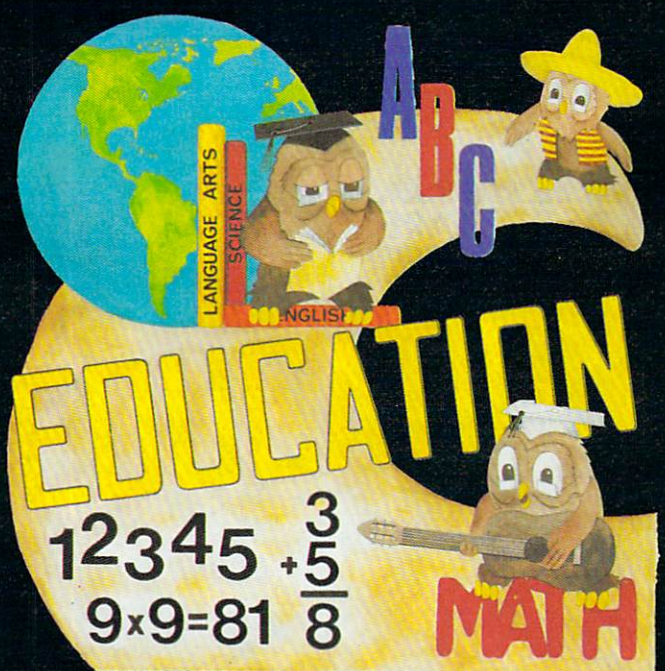

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```
550  IF N$(X) = "Ø" OR L + L(X) + 2 > 3
     9 THEN  NEXT X
560  IF X > N THEN 520
570  FOR Y = 1 TO L(X)
580 B =  PEEK (XL%(Z) + L + Y)
590 C =  ASC ( MID$ (N$(X),Y,1)) + 64
600  IF B = 32 OR B = C THEN E = E + 1
610  IF B = 32 THEN G = G + 1
620  IF E = Ø THEN 660
630  IF B = 160 OR B = 170 OR G = L(X) THEN
     L = L + 1: GOTO 540
640  IF E = L(X) THEN 680
650  NEXT Y
660  NEXT X
670 L = L + 1: GOTO 540
680 B =  PEEK (XL%(Z) + L + L(X) + 1)
690  IF B = 170 OR B = 32 THEN 710
700 L = L + 1: NEXT X: GOTO 520
710 B =  PEEK (XL%(Z) + L)
720  IF B = 32 OR B = 170 THEN 740
730 L = L + 1: NEXT X: GOTO 520
740  POKE (XL%(Z) + L),170
750  FOR L1 = 1 TO L(X): POKE (XL%(Z) +
     L + L1), ASC ( MID$ (N$(X),L1,1)) +
     64
760  NEXT L1: POKE (XL%(Z) + L + L1),17
     Ø:N$(X) = "Ø":L = L + L1: GOTO 540

770  IF S$ = "P" THEN 790
780  GOTO 1030
790  PR# 1: PRINT  CHR$ (9)"255N"
800  FOR X = Ø TO 23:B = 20: FOR Y = Ø TO
     39: IF Y > Ø THEN B = Ø
810 A =  PEEK (XL%(X) + Y): IF A = 160 OR
     A = 170 OR A = 32 THEN A = 237
820 B$ =  CHR$ (A - 64)
830  PRINT  SPC( B)B$;: IF Y = 39 THEN
      PRINT
840  NEXT Y: NEXT X: PR# Ø: PRINT : GOTO
     1030
850  DATA  C,R,O,S,S,W,O,R,D, ,P,U,Z,Z,
     L,E
860  DATA  P,R,O,G,R,A,M
870  DATA  B,Y,Ø,W,I,L,L,I,A,M,Ø,L,O,E,
     R,C,H,E,R
1030  PRINT "          DONE-HIT 'C' TO CO
     NTINUE";
1040  GET F$: HOME : END
1050  REM  BE SURE TO INCLUDE LINES 200
     Ø-2110
```

Program 6: DATA Statements To Be Added To Each Version

```
2000 REM NUMBER OF WORDS = 110
2010 DATA ASSENT,ASTERISK,BAG,BITE,BOOT,BUF
     FER,BULK,CELL,CEMENT,CLAIM
2020 DATA CAT,PERSON,CHAIR,CAN,PAPER,NUMBER
     ,OWL,PLATE,CIRCLE,PENCIL,LIGHT
2030 DATA VICTORY,LETTER,DOORWAY,SAIL,LOVE,
     MOTHER,SON,DAUGHTER,CAR,HAPPY,WIN
     G
2040 DATA TOMORROW,TRUCK,BUSY,FEELINGS,SUNS
     ET,BRIGHT,SUMMER,PAINT,MOVIE,CHES
     S
2050 DATA TENNIS,NET,BALL,RACKET,COURT,PLAY
     ER,OFFICIAL,BOOTH,SCORE,POINT,THE

2060 DATA PINS,RACK,NEEDLES,CHAIR,STOOL,CEI
     LING,SOUND,PROFESSOR,TEACHER,SCHO
     OL
2070 DATA COMPUTE,KEYBOARD,BYTE,BIT,STOP,GO
     ,END,MICROCOMPUTER,SOLUTION,FINE
2080 DATA ROOM,SAD,JOY,PEACE,BOATING,RIVER,
     LAKE,SWIMMING,BOARD,GRASS,TOIL,TR
     EE
2090 DATA EGG,EXHALE,GLORY,ILLUSIVE,IMMORAL
     ,DESK,LET,LEVEL,MYSTERY,MYSELF,RU
     N
2100 DATA NAIL,TWO,MUTE,OFF,OFFER,PALM,PANE
     L,PENNY,CENT,DOLLAR,POLL,POLICE,H
     ELP
2110 DATA RENDER
```

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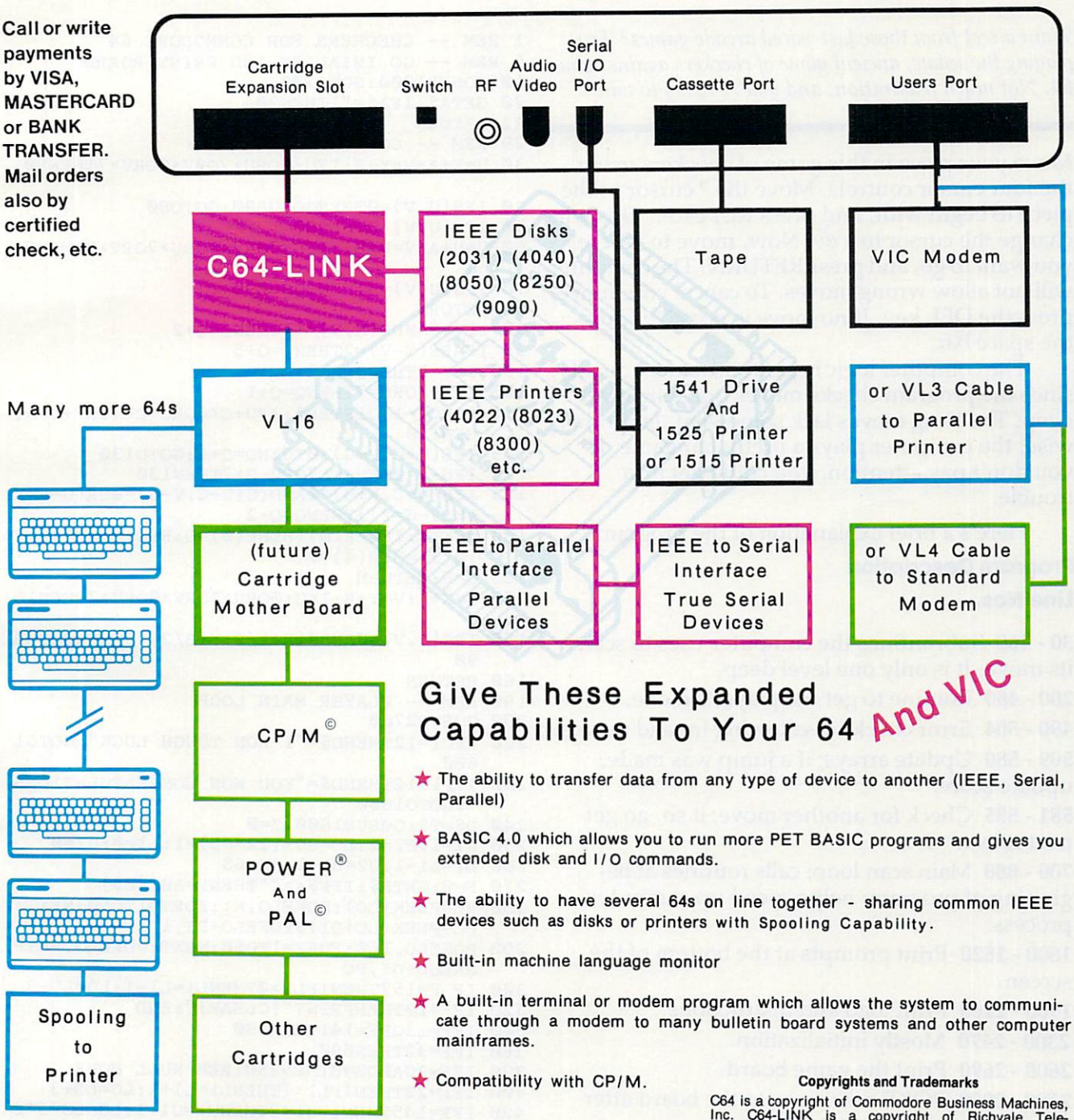

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Contact your local Commodore Dealer or RTC.

Checkers For The Commodore 64

Lester W. Cain

Want a rest from those fast-paced arcade games? Try playing the sedate, ancient game of checkers against your 64. Not much frustration, and you're likely to win.

Move your piece in this game of checkers using the four cursor controls. Move the ? cursor to the piece to begin with, and press RETURN. This will change the cursor to a @. Now, move to where you want to go, and press RETURN. The computer will not allow wrong moves. To cancel your move, press the DEL key. If no move is possible, press the space bar.

The computer logic is not tournament quality, since the program checks moves only one level deep. The King moves lack somewhat, but, otherwise, the computer plays a pretty fair game. If you don't pay attention, you could get into trouble.

Here's a brief explanation of the program.

Program Description

Line Nos.

30 - 160 Subroutines the computer uses to scan its move. It is only one level deep.

200 - 480 Routine to get the player's move.

490 - 504 Error checks disallowing invalid moves.

509 - 580 Update arrays; if a jump was made, update score.

581 - 585 Check for another move; it so, go get next move.

700 - 880 Main scan loop; calls routines at beginning of program; helps speed up computer process.

1800 - 1820 Print prompts at the bottom of the screen.

1900 - 2160 Print logo and instructions.

2300 - 2470 Mostly initialization.

2600 - 2690 Print the game board.

2700 - 2850 POKE new array to the board after every move.

2870 - 3000 Update the scores.

```
1 REM -- CHECKERS FOR COMMODORE 64
5 REM -- GO INIALIZE AND PRINT BOARD
10 GOSUB1900:GOTO200
20 GETA$:IFA$=""THEN20
22 RETURN
29 REM -- COMPUTERS SCAN
30 U=X+A:V=Y+B:IFU<0ORU>7ORV<0ORV>7THEN80

40 IFS(U,V)=0THENGOSUB90:GOTO80
50 IFS(U,V)<0THEN80
60 U=U+A:V=V+B::IFU<0ORV<0ORU>7ORV>7THEN8
   0
70 IFS(U,V)=0THENGOSUB90
80 RETURN
90 IFV=0ANDS(X,Y)=-1THENQ=Q+2
95 IFABS(Y-V)=2THENQ=Q+5
100 IFY=7THENQ=Q-2
105 IFY=0ORU=7THENQ=Q+1
110 FORC=-1TO1STEP2:IFU+C<0ORU+C>7ORV+G<0T
   HEN130
115 IFS(U+C,V+G)<0THENQ=Q+1:GOTO130
120 IFU-C<0ORU-C>7ORV-G>7THEN130
125 IFS(U+C,V+G)>0AND(S(U-C,V-G)=0OR(U-C=X
   ANDV-G=Y))THENQ=Q-2
130 NEXTC:IFQ>R(0)THENR(0)=Q:R(1)=X:R(2)=Y
   :R(3)=U:R(4)=V
135 Q=0:RETURN
150 U=X+A:V=Y+B:IFU<0ORU>7ORV<0ORV>7THEN16
   0
155 IFS(U,V)=0ANDS(X+A/2,Y+B/2)>0THENGOSUB
   90
160 RETURN
199 REM -- PLAYER MAIN LOOP
200 GOSUB2700
220 IFC1=12THEND$="I WON TOUGH LUCK":GOTO1
   600
230 IFP1=12THEND$="YOU WON CONGRATULATIONS
   ":GOTO1600
240 D$=T$:GOSUB1800:Z=0
250 F1=1:F2=2:LO=SU+(22*CD)+1:L1=0:U1=0
260 L2=L1-1:U2=U1-1:KI=63
270 F=0:GETF$:IFF$<>""THENF=ASC(F$)
280 PE=PEEK(LO):POKELO,KI:FORT=1TO50:NEXT:
   PC=PEEK(LO+DI):POKELO+DI,1
290 POKELO,160:FORT=1TO50:NEXT:POKELO,PE:P
   OKELO+DI,PC
300 IF F=157THENIFL1>0THENL1=L1-1:LO=LO-3
320 IFF=19THENPRINT"{CLEAR}":END
340 IFF=13ORF=141THEN490
360 IFF=32THEN690
370 IFF=20ANDZ=0THEN250:REM NULL MOVE
400 IFF=29THENIFL1<7THENL1=L1+1:LO=LO+3
420 IFF=145THENIFU1<7THENU1=U1+1:LO=LO-3*C
   D
460 IFF=17THENIFU1>0THENU1=U1-1:LO=LO+3*CD
```

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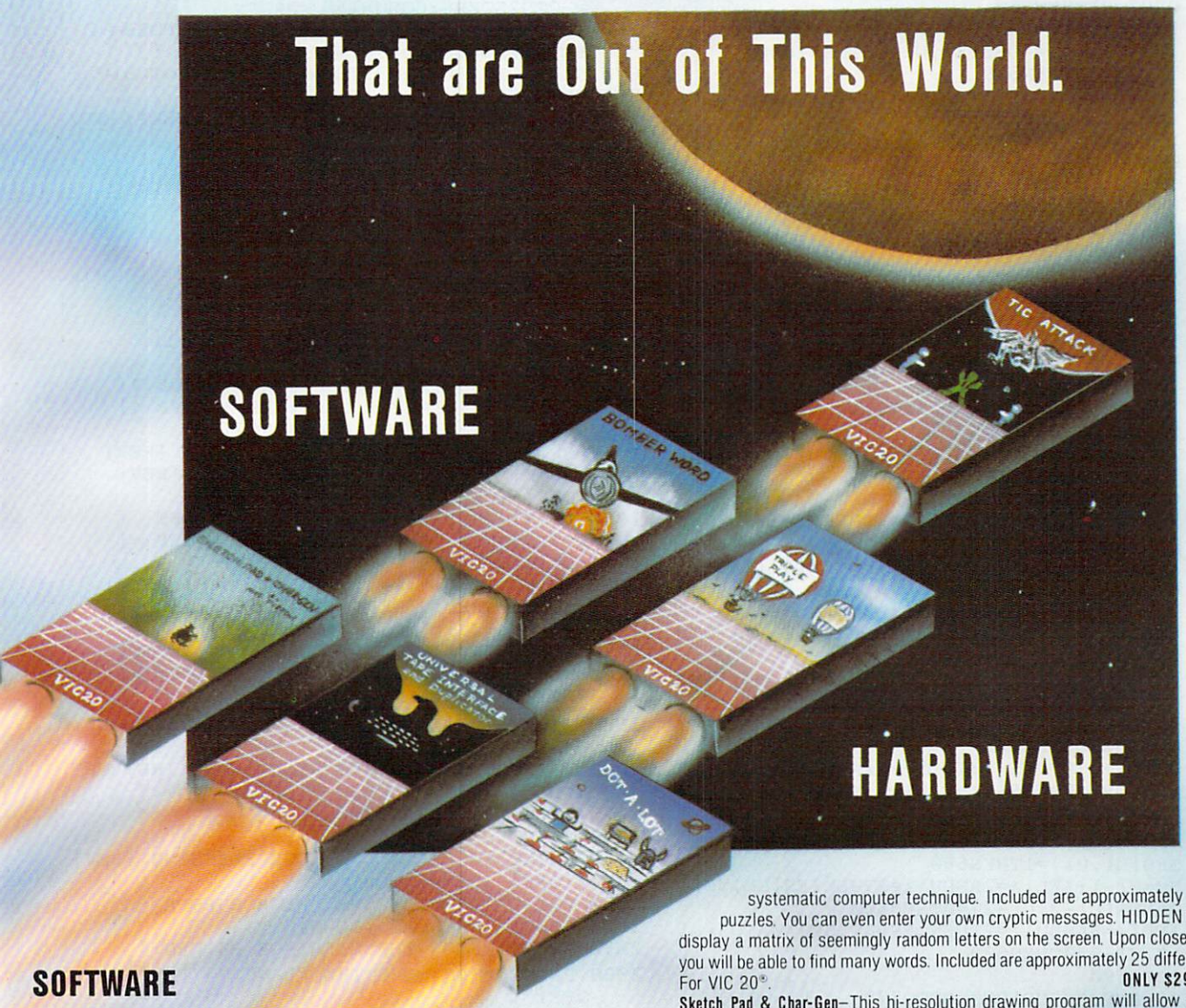

SOFTWARE

Word Wizard For The Vic 20®–(Requires at least 8K memory expansion) A user friendly WORD PROCESSOR with optional joystick control. Easy edit and string manipulation commands that follow the standard format. Full use of function keys for ease of use. 100% machine language with Delete Word, Search functions and Full Justification. Use VIC Graphic printer, or any centronics compatible printer connected to the user port. On Tape (supports disk). **$34.95.**

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```
480 GOTO270
490 POKE198,0:R1(F1)=L1::R1(F2)=U1:IFL2=L1
    ORU2=U1THEN630
491 IFS(L1,U1)=0ANDKI=63THEN1040
492 IFS(L1,U1)=4ORS(L1,U1)<0THEN1040
493 IFKI<>63THEN509
494 LM=L1-1:UP=U1+1:IFL1>=1ANDU1<=6THENIFS
    (LM,UP)=0THEN509
495 LP=L1+1:IFL1<=6ANDU1<=6THENIFS(LP,UP)=
    0THEN509
496 IFS(L1,U1)=1THEN499
497 UM=U1-1:IFL1>=1ANDU1>=1THENIFS(LM,UM)=
    0THEN509
498 IFL1<=6ANDU1>=1THENIFS(LP,UM)=0THEN509

499 IFL1>=2ANDU1<=5THENIFS(LM,UP)<0ANDS(L1
    -2,U1+2)=0THEN509
500 IFL1<=5ANDU1<=5THENIFS(LP,UP)<0ANDS(L1
    +2,U1+2)=0THEN509
501 IFS(L1,U1)=1THEN1040
502 IFL1>=2ANDU1>=2THENIFS(LM,UM)<0ANDS(L1
    -2,U1-2)=0THEN509
503 IFL1<=5ANDU1>=2THENIFS(LP,UM)<0ANDS(L1
    +2,U1-2)=0THEN509
504 GOTO1040:REM ERROR
509 KI=0:L2=L1:U2=U1:IFF1=1THENF1=3:F2=4:G
    OTO270
530 E=R1(1):H=R1(2):A=R1(3):B=R1(4):IFS(E,
    H)=4ORS(A,B)<>0THEN1040
540 IFABS(E-A)>2ORABS(H-B)>2THEN1040
560 S(A,B)=S(E,H):S(E,H)=0:IFABS(E-A)<>2TH
    EN660
570 S((E+A)/2,(H+B)/2)=0:P1=P1+1:F2=4:F1=3
    :Z=1:R1(1)=R1(3):R1(2)=R1(4)
575 IFB=7THENS(A,B)=2
580 GOSUB2700:KI=35
581 LM=L1-1:UP=U1+1:IFL1>=2ANDU1<=5THENIFS
    (LM,UP)<0ANDS(L1-2,U1+2)=0THEN600
582 LP=L1+1:IFL1<=5ANDU1<=5THENIFS(LP,UP)<
    0ANDS(L1+2,U1+2)=0THEN600
583 IFS(L1,U1)=1THEN690
584 UM=U1-1:IFL1>=2ANDU1>=2THENIFS(LM,UM)<
    0ANDS(L1-2,U1-2)=0THEN600
585 IFL1<=5ANDU1>=2THENIFS(LP,UM)<0ANDS(L1
    +2,U1-2=0THEN600
586 GOTO690
600 D$=AM$:GOSUB1800:GOTO270
630 A1=R1(F1):B1=R1(F2)
640 IFS(A1,B1)<>0ORABS(A1-A)<>2ORABS(B1-B)
    <>2THEN1040
650 E=A:H=B:A=A1:B=B1:GOTO560
660 IFB=7THENS(A,B)=2
690 GOSUB2700:REM UPDATE BOARD
699 REM COMPUTERS TURN
700 D$=MT$:GOSUB1800
720 RM(0)=INT(.25+(7*RND(1))):FORI=1TO7
730 RM=INT(.25+(7*RND(1))):FORJ=0TOI-1:IFR
    M(J)=RMTHENJ=I-1:NEXTJ:GOTO730
740 NEXTJ:RM(I)=RM:NEXTI
750 FORXI=0TO7:X=RM(XI):FORY=0TO7:IFS(X,Y)
    >-1THEN780
760 IFS(X,Y)=-1THENFORA=-1TO1STEP2:B=G:GOS
    UB30:NEXTA
770 IFS(X,Y)=-2THENFORA=-1TO1STEP2:FORB=-1
    TO1STEP2:GOSUB30:NEXTB,A
780 NEXTY,XI
790 IFR(0)=-99THENP1=12:GOTO230:REM LOOSE
800 R(0)=-99
810 IFR(4)=0THENS(R(3),R(4))=-2:GOTO830
820 S(R(3),R(4))=S(R(1),R(2))
830 S(R(1),R(2))=0:IFABS(R(1)-R(3))<>2THEN
    200
840 S((R(1)+R(3))/2,(R(2)+R(4))/2)=0:C1=C1
    +1
850 X=R(3):Y=R(4):IFS(X,Y)=-1THENB=-2:FORA
    =-2TO2STEP4:GOSUB150
860 IFS(X,Y)=-2THENFORA=-2TO2STEP4:FORB=-2
    TO2STEP4:GOSUB150:NEXTB
870 NEXTA:IFR(0)<>-99THENR(0)=-99:GOTO810
880 GOTO200
1040 D$=C$:GOSUB1800:FORT=1TO2000:NEXT:GOTO
    220
1600 GOSUB1800:FORI=1TO5000:NEXT
1610 D$="WANT TO PLAY AGAIN":GOSUB1800
1620 GOSUB20:IFA$="Y"THENRUN
1630 PRINT"THANKS FOR PLAYING":END
1800 D$="          "+D$+"          "
1810 PRINT"{HOME}";:FORI=1TO24:PRINT"{DOWN}—
    ";:NEXT
1820 PRINTRT$;D$;:RETURN
1900 PRINT"{CLEAR}{03 DOWN}":RT$="{11
    RIGHT}"
1930 PRINTRT$;"{REV} {OFF}#{REV} {OFF}#{
    REV} {OFF}#{REV} {OFF}#{REV} {OFF}#{
    REV} {OFF}#{REV} {OFF}#{REV} "
1940 PRINT"{OFF}";RT$;"%{REV} {OFF} {REV}
     {OFF} {REV} {OFF} {REV} {OFF} {REV}
    {OFF} {REV} {OFF} {REV} {OFF}'"
1950 PRINTRT$;"{REV}C{OFF} {REV}H{OFF} {
    REV}E{OFF} {REV}C{OFF} {REV}K{OFF} {
    REV}E{OFF} {REV}R{OFF} {REV}S"
1960 PRINT"{OFF}";RT$;"%{REV} {OFF} {REV}
     {OFF} {REV} {OFF} {REV} {OFF} {REV}
    {OFF} {REV} {OFF} {REV} {OFF}'"
1970 PRINTRT$;"{REV} {OFF}${REV} {OFF}${
    REV} {OFF}${REV} {OFF}${REV} {OFF}${
    REV} {OFF}${REV} {OFF}${REV} "
1980 INPUT"{03 DOWN}{03 RIGHT}NAME PLEASE";
    PL$
2000 PRINT"{05 DOWN}{03 RIGHT}WANT INSTRUCT
    IONS (Y/N)":GOSUB20
2020 IFA$<>"Y"THEN 2300
2030 PRINTCHR$(14)
2040 PRINT"{CLEAR}{DOWN}MOVE FLASHING {REV}
    ?{OFF} TO MAN YOU"
2050 PRINT"WANT TO MOVE, WITH CURSOR
2060 PRINT"CONTROLS.{DOWN}"
2070 PRINT"PRESS THE CARRIAGE RETURN."
2080 PRINT"THEN MOVE THE FLASHING {REV}@{
    OFF}"
2090 PRINT"TO WHERE YOU WANT TO GO."
2100 PRINT"PRESS CARRIAGE RETURN.{DOWN}"
2110 PRINT"IF YOU HAVE ANOTHER MOVE"
2120 PRINT"MOVE THIS MAN AND FOLLOW"
2130 PRINT"WITH A CARRIAGE RETURN.{DOWN}"
2140 PRINT"IF YOU DO NOT HAVE A MOVE"
2150 PRINT"PRESS SPACE BAR TO SKIP"
2160 PRINT"A TURN.{DOWN}":PRINT"HOME ENDS G
    AME."
2300 SC=1027:CC=80:SU=SC:CD=CC/2:DI=54272
2340 Z1=87:Z2=102:Z3=81:Z4=32:RC=2:BC=0
2350 PRINT"{04 DOWN}{03 RIGHT}{REV}";PL$;"{
    OFF} DO YOU WISH RED OR BLACK?{OFF} "
2360 GOSUB20:IFA$<>"R"ANDA$<>"B"THEN2360
2370 IFA$="B"THEN Z1=102:Z2=87:Z3=32:Z4=81:
    RC=0:BC=2
2380 A=SU:B=A+(3*CD)+3:DIMS(8,8),R1(4),R(4)

2390 DATA1,4,1,4,0,4,-1,4,4,1,4,0,4,-1,4,-1
    ,15
2400 FORI=0TO7:FORJ=0TO7:READX:IFX=15THEN24
    20
2410 S(I,J)=X:GOTO2430
2420 RESTORE:READS(I,J)
2430 NEXTJ,I
2440 T$="YOUR TURN":C$="{REV}TRY AGAIN{OFF}
```

```
    ":MT$="MY TURN":AM$="ANOTHER MOVE
    "
2450 C6$="C-64":SR$="{28 RIGHT}"
2460 POKE53281,15:PRINTCHR$(142)
2470 G=-1:R(0)=-99
2600 PRINT"{CLEAR}";:RT$="{03 RIGHT}":R$=CH
    R$(28)+"    ":B$=CHR$(144)+"    "
2610 FORI=1TO4:FORJ=1TO3:PRINTRT$;
2620 FORL=1TO4:PRINT"{REV}";R$;B$;:NEXT:PRI
    NT"{OFF}":NEXT
2630 FORK=1TO3:PRINTRT$;
2640 FORL=1TO4:PRINT"{REV}";B$;R$;:NEXT:PRI
    NT
2650 NEXTK,I:PRINT"{BLK}";
2660 PRINT"{HOME}{02 DOWN}";SR$;C6$;" ";PL$
    :I=SU+3*CD+27:J=SU+3*CD+32
2680 POKEI,Z2:POKEI+DI,RC:POKEJ,Z1:POKEJ+DI
    ,BC
2690 RETURN
2699 REM UPDATE BOARD
2700 D1=SU+CD+1:FORJ=7TO0STEP-1:FORI=0TO7
2710 IFS(I,J)=0THENPOKED1,160:POKED1+DI,0:G
    OTO2850
2720 IFS(I,J)=1THENPOKED1,Z1:POKED1+DI,RC:G
    OTO2850
2730 IFS(I,J)=-1THENPOKED1,Z2:POKED1+DI,BC:
    GOTO2850
2740 IFS(I,J)=2THENPOKED1,Z3:POKED1+DI,RC:G
    OTO2850
2750 IFS(I,J)=-2THENPOKED1,Z4:POKED1+DI,BC:
    GOTO2850
2850 D1=D1+3:NEXT:D1=D1+96:NEXT
2860 REM -- UPDATE SCORE
2870 PRINT"{HOME}{05 DOWN}";SR$;C1;"    ";P1
3000 RETURN                                  ©
```

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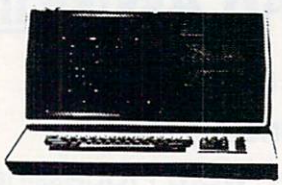

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Programming Multicolor Characters On The VIC

Bill McDannell

If you know how to create standard programmable characters, you can create four-color characters and multicolor graphics. Here's how to select colors for the screen, border, character, and auxiliary colors. For the unexpanded VIC.

In order to understand the creation of multicolor characters on the VIC-20, you must first have a working knowledge of standard programmable characters. You can easily pick this information up from the *Programmer's Reference Manual*, or from some excellent articles in past issues of **COMPUTE!**.

For standard programmable characters, drawing is done using an eight by eight grid. Each point on the grid represents one bit, which is turned either on or off by designating a value of one or zero for the bit.

You can use as many as four colors in one character when using multicolor graphics. Since you must designate one of four color choices, rather than simply on or off, you cannot program each individual bit. However, if adjacent bits are combined to produce a piece of information, you have four choices:

1. Both bits off (00)
2. First bit off, second on (01)
3. First bit on, second off (10)
4. Both bits on (11)

You now have the four possibilities necessary to designate four colors, but you have them at the sacrifice of horizontal resolution. Since it takes two bits to specify a color, you will be able to specify only four individual blocks of color across one horizontal line of your character (as opposed to the eight blocks available with a standard character). You still have eight vertical rows available.

Available Colors

Each possible two-bit value corresponds to a specific selectable color.

00 = screen color
01 = border color
10 = character color
11 = auxiliary color

For border and character colors, you have the choice of the eight standard VIC colors. For screen and auxiliary colors, you can choose from the 16 colors depicted in the screen and border color chart in the back of your owner's manual. More about selecting individual colors later.

First, let's see how we designate our four initial choices. The figure shows the same programmable character in both standard and multicolor mode. Notice that the numerical value of each horizontal byte is the same. The DATA statements you use to create each character are identical. The difference is that in the multicolor mode, each pair of bits is combined and read as one nybble to identify the appropriate color group.

Getting Into Multicolor

Accessing multicolor mode and setting the desired character color are done simultaneously. For standard characters, you POKE the appropriate screen location to the desired color using the numbers zero (black) through seven (yellow). To go into multicolor mode, you simply add eight to the desired color value. This both selects your character color and sets that particular character to multicolor mode. For example, POKEing screen location 38400 to a value of 15 would both change the character color in the upper left corner of the screen to yellow, and turn on the multicolor mode in that space.

Setting border and screen colors is done the same as always: by POKEing 36879 to the desired value from the color chart in your user's manual (POKE 36879,9 will give you a black screen and a white border).

The choice of auxiliary color is made, believe it or not, in the same memory location you use to control volume, with a POKE to location 36878.

There are 256 possible values for this POKE location (0-255), and each of the consecutive 16 values corresponds to one of the 16 available colors, in descending order, from the chart.

In other words, any value between zero and 15 POKEd into location 36878 will produce an auxiliary color of black. Values 16 through 31 will produce white, and so forth. This creates a slight problem when we're writing a program where we want to control both volume and multicolor graphics. We can solve it with this formula:

```
POKE 36878, A * 15 + V
```

A is the number of the desired color (0 is black, 1 is white, etc.), and V is the desired volume.

That's what you need to know to create multicolor graphics. The rest of the operation is identical to creating standard graphics.

These two programs illustrate how to use multicolor characters. The first program creates a four-color spaceship and moves it down the screen. The spaceship is drawn using two separate characters and POKEing them side by side.

The second program is a coloring game my children seem to love. It allows you to choose the colors in which the character will be drawn. I created the character using a grid that is five characters wide and five deep, and which yields a 20 x 40 area of programmable blocks. The screen and border colors are set to black and white by the program. You select the auxiliary color and three different areas of character color. Because character color blocks are set individually, a multicolor figure consisting of more than one character can be programmed to more than four colors. In this case, I could have selected up to 28 different colors for the figure. Six were sufficient.

Program 1: Four-Color Spaceship

```
10 PRINT"{CLEAR}"
100 POKE36869,255
105 POKE36879,61
110 FORI=7168TO7679:POKEI,PEEK(I+25600):NE
    XT
130 FORI=7176TO7191
150 READA:POKEI,A:NEXT
154 X=7690:C=30720
155 POKEX,1:POKEX+C,10:POKEX+1,2:POKEX+C+1
    ,10
156 FORT=1TO80:NEXT:POKEX,32:POKEX+1,32
157 X=X+22:IFX>8185THEN154
158 GOTO155
160 DATA8,2,5,23,85,93,85,40,32,128,80,212
    ,85,117,85,40
```

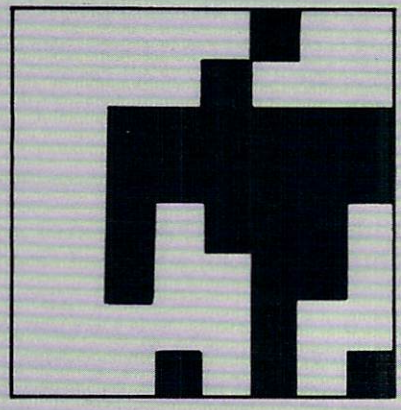
Program 2: Coloring Game

```
10 PRINT"{CLEAR}"
20 PRINT"{10 DOWN}   JUST A MINUTE..."
110 FORI=7168TO7679:POKEI,PEEK(I+25600):NE
    XT
120 FORI=7176TO7375
130 READA:POKEI,A:NEXT
139 POKEX+89,10:POKEX+89+C,10
140 DATA48,252,239,235,235,235,232,232,235
```

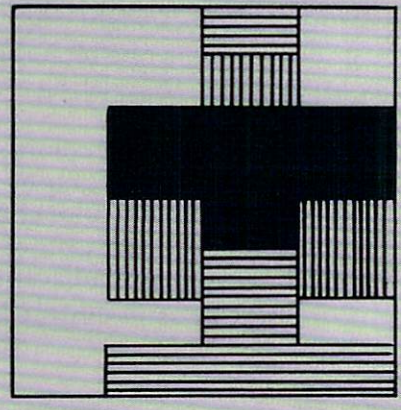
Draw

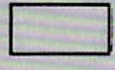
128	64	32	16	8	4	2	1	
0	0	0	0	0	1	0	0	=4
0	0	0	0	1	0	0	0	=8
0	0	1	1	1	1	1	1	=63
0	0	1	1	1	1	1	1	=63
0	0	1	0	1	1	1	0	=46
0	0	1	0	0	1	1	0	=38
0	0	0	0	0	1	0	0	=4
0	0	0	1	0	1	0	1	=21

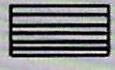
Standard



Multicolor




=screen color


=border color


=character color


=auxiliary color

Same programmable character in both standard and multicolor mode.

Standard VIC 20

no additional memory needed

(CG008) Alien Panic $12.95
Race against time as your guy digs holes to trap aliens in 4 floor laddered, brick construction site. Requires joystick.

(CG096) Antimatter Splatter $24.95
This game is as good as its name. Another pure machine code game, this one is fast! The alien at the top of the screen is making a strong effort to rid the world of humankind by dropping anti-matter on them. The splatter cannon and you are our only hope as more and more antimatter falls. Joystick again is optional equipment.

(CG026) Collide $12.95
"Vic" controls one, you the other as cars go opposite directions on 4 lane track. Requires joystick.

(CG094) Exterminator $24.95
Recently scoring a rating of 10 out of a possible 10 this game was praised as "one of the best I've seen on any computer" by a prominent reviewer in a leading magazine. The idea is to shoot a centipede before it overuns you, the problem being every time you hit it, it divides into two separate shorter ones. Several other little creatures bounce around during this struggle. All of them lethal. 100% machine language makes the rapid fire action very smooth. A joystick is optional, but as always, recommended, (a trac ball is also very nice!).

(CG054) Krazy Kong $12.95
Three screens, a gorilla, barrels, and changing difficulty levels help to make this one of our most popular. Joystick optional.

(CG098) Racefun $19.95
Extensive use of multicolored character capabilities of the "Vic" make this one very appealing to the eye. Fast all machine language action, quick response to the stick or keyboard controlled throttle, combine with the challenge of driving in ever faster traffic to make it appeal to the rest of the body. Joystick controlling is an option.

(CG058) Rescue From Nufon $12.95
Must find 30 hostages in this 100 room, 5 story, alien infested, graphic adventure game. A continual big seller. Keyboard only (n. = north w = west etc.)

(CG068) The Catch . . . $12.95
Another all machine language game based on the principle that one person with one joystick guiding one catch/shield can catch everything that one alien can throw at one. The action comes slowly at first but by the fourth wave you'll be aware of . . . "The Catch" . . .

Expanded Memory Vic 20 Games

(CG090) Defender On Tri $19.95
Pilot a defender style ship on mission to save trapped scientists from a fiery fate (they are aboard an alien vessel deep in the gravity well of sol). Excellent graphics. Short scene setting story in the instructions. "Defender On Tri" requires at least 3K added memory.

(CG092) 3D Man $19.95
The maze from probably the most popular arcade game ever, with perspective altered from over-head to eye level. The dots, the monsters, the power dots, the side exits, the game is amazing. "3D Man" requires at least 3K added memory.

(CG088) Space Quest $19.95
Our first 8K memory expander game and its a beauty. The scene (a short story is included) is far in the future, a time when man's knowledge has reduced an entire galaxy into a mapped series of quadrants. This game has stratagy (you plot your own hyperspace jumps on Galaxy map), action (against a starry background you find yourself engaged in a dogfight, laser style), exploration (you must fly your ship deep into caverns to pick up necessary fuel). "Space Quest" requires at least 8K memory expansion and a joystick.

Commodore 64

(CG602) 3D-64, Man $19.95
This available on the expanded "Vic 20" game, has been completely rewritten for the 64 and uses sprites, sounds, and other features not available on the "Vic". This one requires a joystick.

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```
,235,235,59,59,15,3
141 DATA3,3,3,3,3,3,1,5,21,22,21,21,21,21,
    5,5,1,1,0,0,0,0,0,0,0
142 DATA0,0,252,255,3,60,255,255,245,213,2
    13,213,217,234,230
143 DATA231,255,255,255,255,252,92,84,85,8
    5,149,165,138,128,96,96
144 DATA88,88,89,22,5,5,1,1,0,0,0,0,0,255,
    255,255,255,255,255,125,125,125,1
    25,125
145 DATA255,255,255,255,195,0,65,65,0,65,8
    5,85,85,170,20,20
146 DATA40,170,170,85,170,85,85,85,85,0,0,
    63,255,192,60,255
147 DATA255,95,87,87,87,103,171,155,219,25
    5,255,255,255,63,53,21
148 DATA85,85,86,90,162,2,9,9,37,37,101,14
    8,80,80,64,64,0
149 DATA12,63,251,171,235,235,43,43,235,23
    5,235,236,236,240,192
150 DATA192,192,192,192,192,192,64,80,84,1
    48,84,84,84,84,80,80,64,64,0,0,0,
    0,0,0,0
151 PRINT"{CLEAR}{05 DOWN}HELLO, THERE! MY
     NAME {DOWN}IS FRED, THE SEE-THRU
     {DOWN}MOUSE. WHAT'S YOURS"
152 PRINT:INPUTN$
153 PRINT"{CLEAR}{02 DOWN}WELL,"N$
154 PRINT"{DOWN}I HAPPEN TO LIVE IN   {DOW
    DOWN}YOUR COMPUTER. THEY   {DOWN}
    CALL ME A SEE-THRU"
155 PRINT"{DOWN}MOUSE BECAUSE I'M     {DOW
    DOWN}INVISIBLE!"
156 PRINT"{DOWN}BUT YOU CAN SEE ME BY {DOW
    DOWN}PAINTING ME DIFFERENT {DOWN}
    COLORS. JUST PRESS THE"
157 PRINT"SPACE BAR TO BEGIN."
158 GETB$:IFB$=""THEN158
159 IFB$=" "THEN161
160 GOTO158
161 PRINT"{CLEAR}{DOWN}FIRST LET'S COLOR M
    Y  {DOWN}FACE. PICK A NUMBER."
162 PRINT"{DOWN}1=RED       8=LT.OR."
163 PRINT"{DOWN}2=CYAN      9=PINK"
164 PRINT"{DOWN}3=PURPLE   10=LT.CYAN"
165 PRINT"{DOWN}4=GREEN    11=LT.PUR."
166 PRINT"{DOWN}5=BLUE     12=LT.GRN."
167 PRINT"{DOWN}6=YELLOW   13=LT.BLUE"
168 PRINT"{DOWN}7=ORANGE   14=LT.YEL."
171 PRINT:INPUTC$:D=VAL(C$)+2
172 IFD<3ORD>16THEN161
173 PRINT"{CLEAR}{DOWN}THANK YOU, "N$
174 PRINT"{DOWN}NOW HOW ABOUT MY EARS":GOS
    UB185
175 PRINT"{CLEAR}{DOWN}VERY GOOD! NOW MY E
    YES":GOSUB185
176 PRINT"{CLEAR}OKAY, "N$
177 PRINT"{DOWN}ONE LAST TIME TO COLOR{DOW
    DOWN}MY MOUTH.":GOSUB185:GOTO193
185 PRINT"{DOWN}1=BLACK":PRINT"{DOWN}2=WHI
    TE":PRINT"{DOWN}3=RED":PRINT"{DOW
    DOWN}4=CYAN"
186 PRINT"{DOWN}5=PURPLE":PRINT"{DOWN}6=GR
    EEN":PRINT"{DOWN}7=BLUE":PRINT"{D
    DOWN}8=YELLOW"
187 Y=Y+1:PRINT:INPUTH$(Y):H(Y)=VAL(H$(Y))
188 IFH(Y)<1ORH(Y)>8ANDY=1THENY=0:GOTO173
189 IFH(Y)<1ORH(Y)>8ANDY=2THENY=1:GOTO175
190 IFH(Y)<1ORH(Y)>8ANDY=3THENY=2:GOTO176
191 H(Y)=H(Y)+7
192 RETURN
193 PRINT"{CLEAR}{DOWN}OKAY,"N$
194 PRINT"{DOWN}HERE WE GO. IF YOU    {DOW
    DOWN}WANT TO CHANGE MY     {DOWN}
    COLORS, PRESS THE"
195 PRINT"{DOWN}SPACE BAR.":PRINT"{DOWN}AN
    D WHEN YOU WANT TO  {DOWN}QUIT, P
    RESS E."
196 PRINT"{DOWN}BUT TO SEE ME AS YOU  {DOW
    DOWN}JUST PAINTED ME, PRESS{DOWN}
    ANY KEY BUT THOSE TWO."
197 GETF$:IFF$=""THEN197
198 IFF$=" "THENY=0:POKE36869,240:POKE3687
    9,27:GOTO161
199 IFF$="E"THEN250
200 PRINT"{CLEAR}":POKE36869,255
201 PRINT"{CLEAR}":POKE36869,255
202 POKE36879,9
210 POKE36878,D*15+1
220 X=7887:C=30720
221 FORA=1TO2
222 FORB=0TO20STEP5
223 POKEX,B+A:POKEX+C,H(1)
224 X=X+1
225 NEXTB
226 X=X+17:NEXTA
227 FORA=3TO5
228 FORB=0TO20STEP5
229 POKEX,B+A:POKEX+C,H(3)
230 X=X+1:NEXTB
231 X=X+17:NEXTA
232 POKE7888+C,H(2):POKE7889+C,H(2):POKE79
    10+C,H(2):POKE7911+C,H(2)
233 POKE7890+C,H(2):POKE7912+C,H(2)
234 GOTO197
250 POKE36869,240:POKE36879,27
260 PRINT"{CLEAR}{09 DOWN}SO LONG,"N$"!"
```

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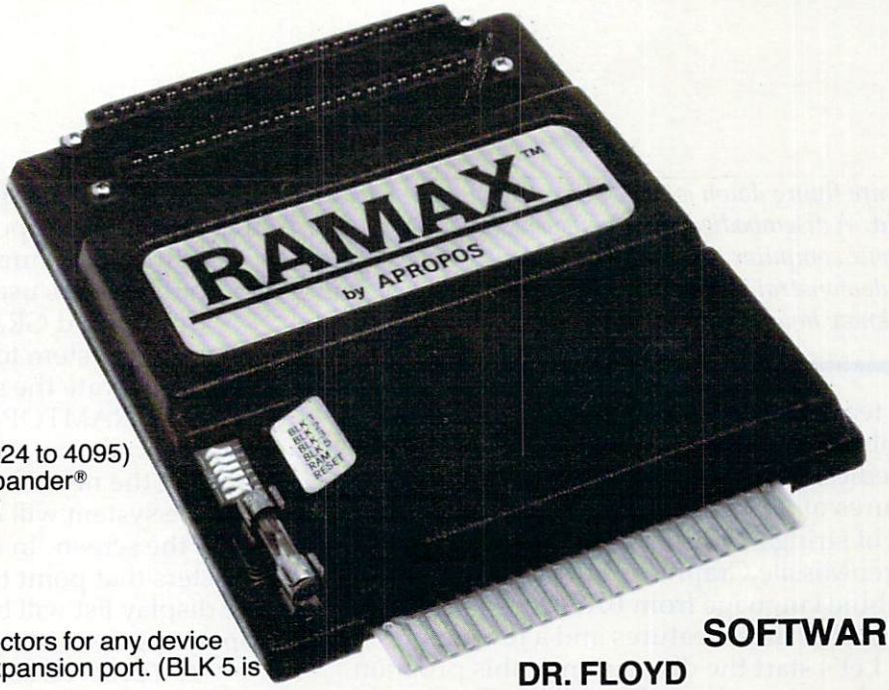

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APROPOS TECHNOLOGY

Atari Starshot

Matthias M. Giwer

You are flying down a trench bisecting an artificial world. A disembodied voice whispers in your ear, "Turn off your computer – BASIC is too slow." As this game will demonstrate, Atari BASIC can *be fast enough if you know how to speed it up.*

The features in the Atari computer give it a graphics potential that approaches that available in dedicated graphics-oriented computers. And, features of Atari BASIC allow very fast manipulation of strings, Direct Memory Access for the Player/Missile Graphics, and the direct call of machine language from BASIC. This game combines all of these features and a few others.

Let's start the discussion of this program with the subroutine at line 30000. The first thing to do is to enable the Player/Missile Graphics.

Appendix A of the *Atari Hardware Manual* gives a detailed example of how to do this. This method only works when there is nothing on the screen. As soon as you write to the screen, this method fails. The usual approach is to reserve enough pages for the screen RAM, the Player/Missile graphics pages, etc. All in all, to use Player/Missile Graphics with GRAPHICS 7, you wind up reserving 32 pages and, in the process, taking care of the computer rather than letting the Operating System (OS) take care of you. Here is how to do it right.

RAMTOP

Contained in register 106 is the number of pages of RAM available to you for your use after everything needed for the system has been accounted for. What we want to do is to change this number so that RAM is protected for the Player/Missile Graphics pages. This is accomplished by POKE 106, PEEK(106)-16. This puts a number into that register that is 16 pages less than the number the Operating System determines upon powering up the computer or upon system reset. But just POKEing a new number does nothing until the computer makes use of it.

The second GRAPHICS 7 call causes the Operating System to make use of this new RAMTOP to relocate the screen RAM and the display list below RAMTOP. If you do not make this graphics call, you will find that the screen memory is above the new, lower protected memory limit, and the system will crash at the first attempt to scroll the screen. In other words, your system registers that point to the first screen byte, and the display list will be above RAMTOP. The Operating System cannot handle this.

You proceed as normal but much more cleanly now that you have lowered the effective top of your RAM and made the Operating System reorganize itself around that new maximum RAM with the second graphics call. Lines 30204 and 30206 are the enabling POKEs for Player/Missile Graphics as described in many articles and in *De Re Atari*. Line 30208 is the POKE to tell the Operating System where to find the start of the Player-Missile data. The start of this data is now simply RAMTOP.

With Player/Missile Graphics set up this way, you can forget about what the rest of the system is doing and treat it just as though Player/Missile Graphics were not in use. The Operating System *will* take care of you.

Player Definition

The next routine of interest is at line 30236. (This is the machine language routine published in the February 1982 issue of **COMPUTE!**.) It provides relocation of the four players at machine language speeds by means of two POKEs and, since the routine is executed during the vertical blanking time, the motion appears to be continuous. The

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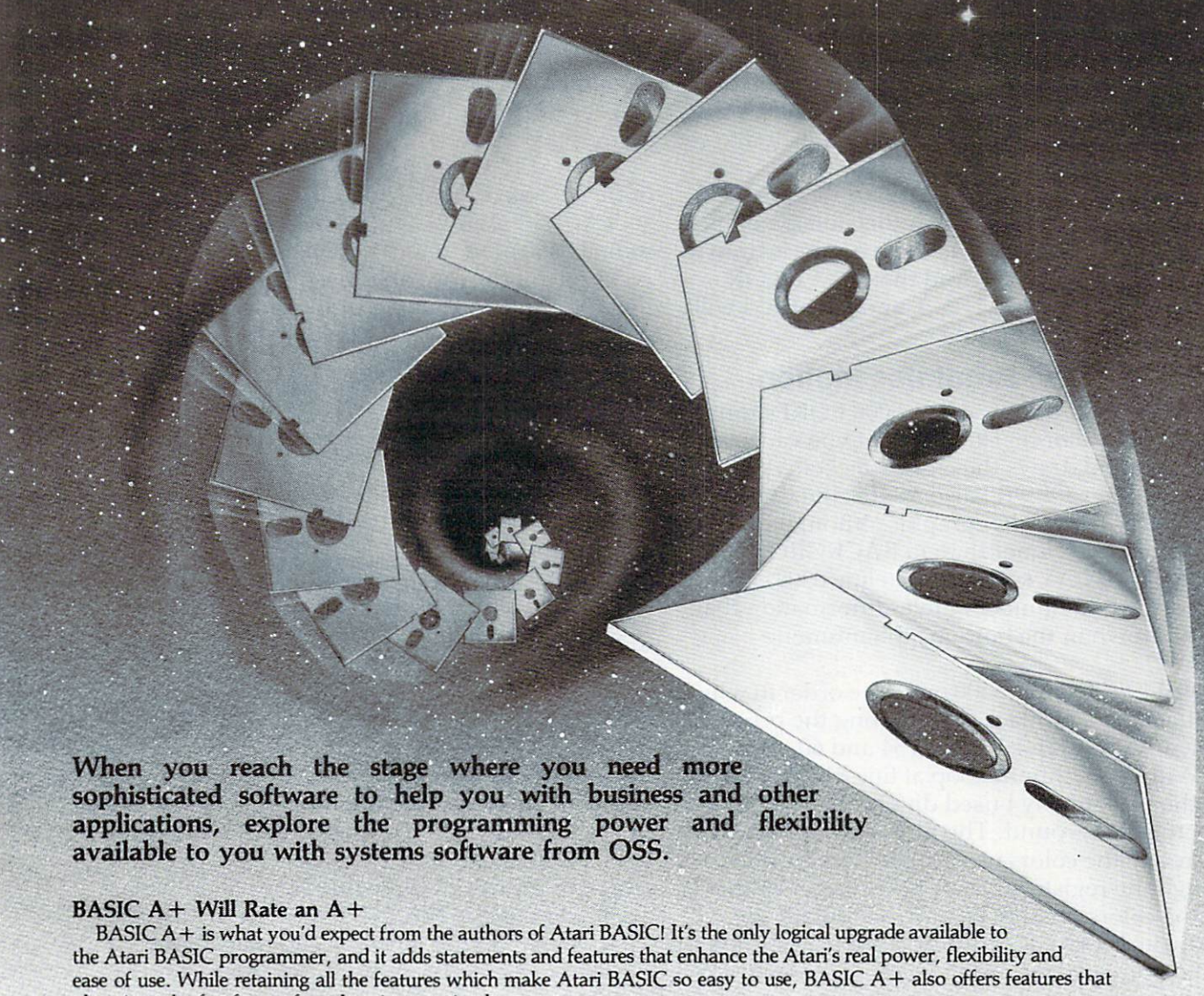

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rest of the 30000 lines define the players. Note that the RESTORE in line 30310 makes Player 3 the same as Player 2, although it is defined as a different color in line 30230.

Now let's jump to lines 100-120 – we will get to the earlier lines later. These lines are the definitions that will be used for named subroutines later. The use of named subroutines is a desirable feature that greatly aids program development.

Lines 1890-1930 are both the one-time calls and those such as DISPLAY that are needed to set up the game at the start.

The subroutine at line 10000 draws the background in the way that makes this illusion of motion possible. Note that each set of lines is drawn with a different COLOR and that the COLOR numbers rotate 1, 2, 3, 1, 2, 3, and so forth. I will get back to this in a minute.

Color Rotation Simulates Motion

The START subroutine at line 5000 POKEs numbers into the color registers so that you can see the screen and draws the eight attackers. You will note also that COLOR J also rotates the COLOR assigned to the attacker graphic although in a more complex manner than in BACKGROUND.

The DISPLAY subroutine at line 6300 controls the scoring and number of lives information that will be shown in the bottom alphanumeric window.

ASELECT at line 6500 picks the order in which the attackers will attack from among the predefined ATTACK1-4$ in lines 54 and 60.

Within the infinite loop at line 2100 you'll find the reason why I used different COLORs to draw the background. The four statements in line 2110 rotate the colors used in the background through the registers in a "bucket brigade" manner; the colors seem to be moving toward you. Given the drawn background, it appears as though you are moving forward through the trench. This illusion of motion requires the use of three different colors as a minimum. If there were only two colors, they would appear to flicker back and forth rather than move. The instructions in this line will be used in almost every subroutine so that this illusion of motion is maintained.

This technique is useful in many applications – you can simulate many kinds of motion. If you were to reverse the order of the instructions, you would have the illusion of going backwards. Line 2120 is simply a short delay.

Another line that you will find throughout the program is first used at line 5017. A=74+PADDLE(0)/ 2.92 is the equation that limits the motion of Player 0 on the screen. 74 is the farthest left X location that Player 0 can move to. The range of values for the PADDLE(0) is 0 to 228. Dividing this range of values by 2.92 converts the largest value of 228 to the rightmost location of Player 0 and makes the full left-to-right motion of the Player a full turn of the PADDLE. This equation is also put into every subroutine where the program execution takes a noticeable amount of time in order to simulate continuous motion.

The subroutine MOVE at line 5100 is a loitering loop that waits a random number of loops until the first attack begins. When the number 50 is reached, program execution jumps to SELECT at line 5200.

The SELECT subroutine picks the sequence of the attackers from ATTACK1$ through ATTACK4$. ATTACK$ for the first wave was initially called in line 1930. This routine randomly picks one of the four attack sequences defined in lines 54 and 60. An attempt to read the ninth element in this string is TRAPped to line 5211 which redraws the attackers and starts over.

Note this use of the TRAP instruction. It is not meant simply to avoid a program crash, but rather to perform an integral program function. Rather than a RAM and time-consuming test or loop, one simple statement is used.

Lines 5215-5240 erase the chosen attacker, position Player 1 over the erased attacker, and give some warning sounds. Line 5241 calls the subroutine JOIN at line 5800. This routine adds together the strings which are used to define the X and Y positions of Player 1 as it moves from its initial position to its attack position.

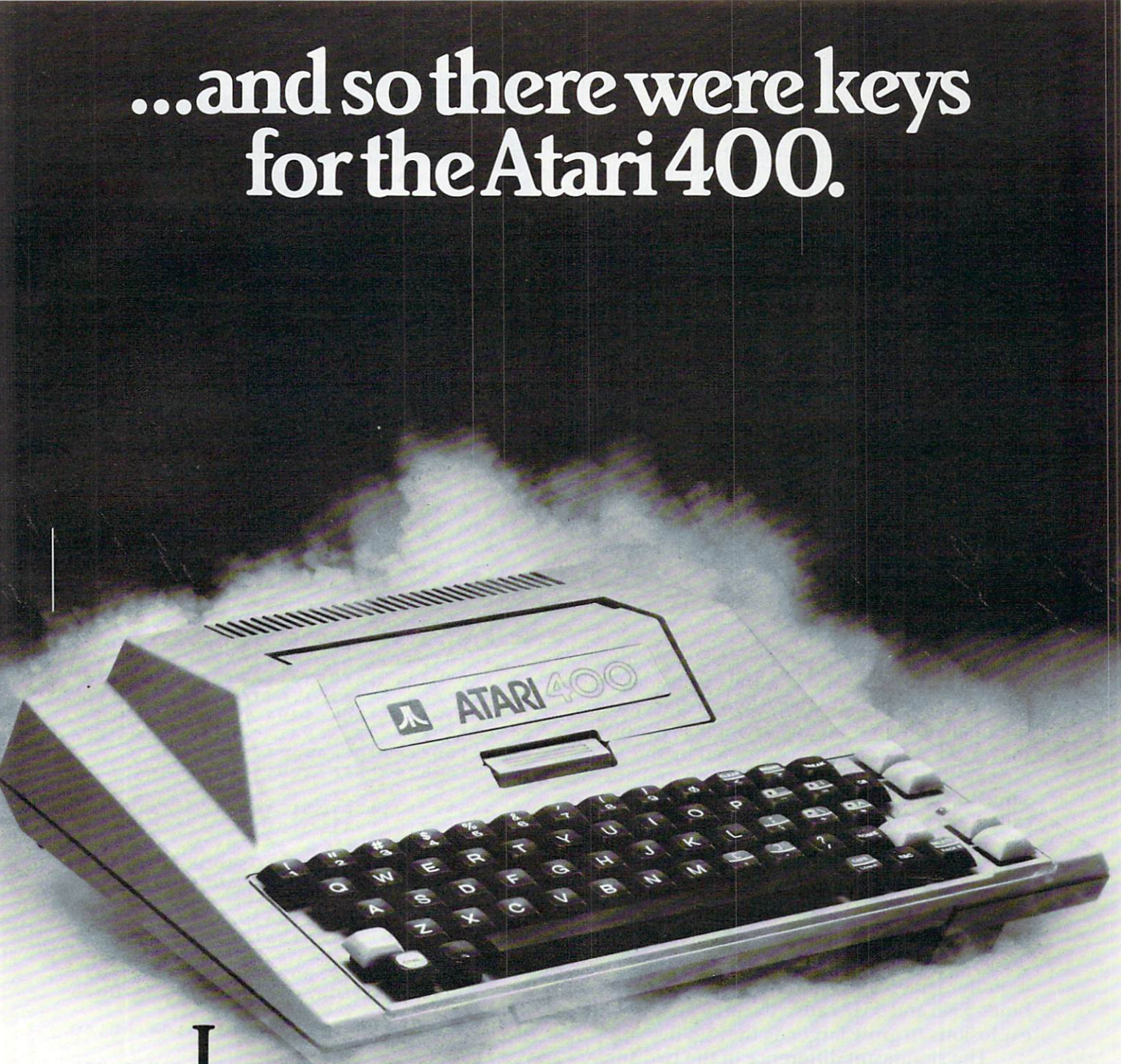
Special TRAPs

The strings are the AX1$ and AY1$ through AX8$ and AY8$ that were defined back in the beginning of the program. These are the X and Y coordinates to be POKEd into PLX+1 and PLY+1. They are stored as groups of three numbers. These values are read in lines 5260-5270. Note that by using TRAP here I do not have to keep track of the number of elements in the string. And again instead of some test or loop, a simple statement is used. These strings are merely added together. No matter what the sequence of the attack, the last pattern is always the same, and the last set of numbers in the string is always the same.

The ATTACK subroutine at line 5300 is where the shooting occurs. The first call is for the subroutine PATTERN at line 5600. This subroutine chooses among five possible X position patterns and five possible Y position patterns. These are the rest of the strings defined in the beginning of the program. This independent choice of X and Y patterns permits a total of 25 different attack patterns.

In line 5315, the X and Y values for this attack motion are read out in groups of three. In this case, the TRAP is used to jump back to the PATTERN subroutine call to pick another pair of

...and so there were keys for the Atari 400.



In the beginning there was the membrane keyboard.

So it was to be done that Inhome Software would create a full-stroke keyboard for the Atari 400 Home Computer and it would be called the B Key 400, and would sell for $119.95 U.S. funds.

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INHOME

ADVANCING THE PROGRESS

strings when the end of the STRING is reached. This gives continuously varying motion to the attacker.

Lines 5324 and 5325 change the size of the attacker as it comes "closer" or goes "farther away." F and G are flags that control the firing and motion of the missiles. It is worth examining how these flags function.

F controls the attacker's missile firing. Other than its housekeeping function, the primary purpose of the IF F=0 is to fix the X and Y location at the moment of firing so that the motion is calculated only from this point. After F is set to 1, these statements are no longer executed. If they were, the missile would weave back and forth in X and Y in unison with the attacker. Behind the F=1 flag are the calculations that determine whether the missile passes to the left or to the right. The G flag performs a similar program function.

Lines 5350 and 5352 check for missile-to-player collisions and direct action to the appropriate subroutine. Line 5355 clears the collision registers.

HITYOU, HITME, HITUS

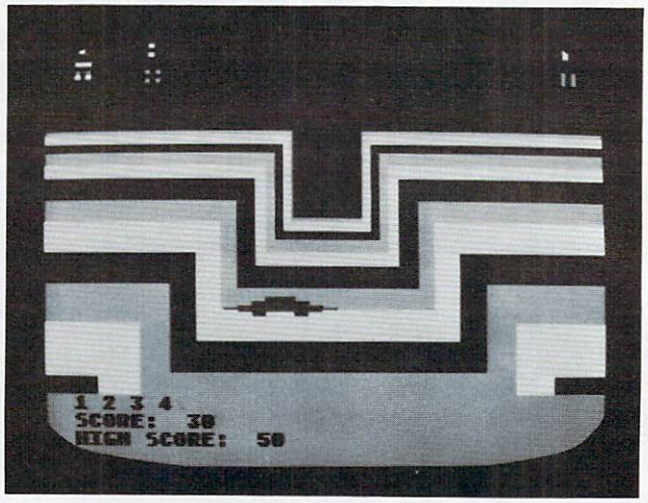
The HITYOU, HITME, and HITUS subroutines introduce Players 2 and 3 as the explosions. In HITYOU and HITME, these two players are sequentially put in the same location as the hit player. This sequence is controlled by the TT variable. Note that the two explosion shapes are the same but of different colors. Also, when they are called, they are placed one Y position different. The purpose is to give some illusion of a dynamic explosion.

Lines 5440 and 5540 move the hit player and explosions off the screen. The logical truth statements determine whether the hit player was to the left or right of center when hit and then move it off the screen to the left or right as appropriate. Lines 5545 and 5547 cause the attacker and the explosions to grow larger as they go by.

The significant difference in the two subroutines is that in HITYOU there is an additional collision test in line 5560. This requires you to get out of the way of the hit player as it rolls off the screen. If you don't, you are also destroyed, and both players roll off the screen. This is controlled by the HITUS subroutine. Being hit by the attacker's missile and by the damaged attacker causes you to lose one life.

Good Practice

This is a quick review of a fairly complex program. It exploits many of the Atari's features. The method of reserving the Player/Missile Graphics pages by moving RAMTOP lets the machine take care of you and perhaps completes the official Atari version of how to turn on the function.



Flowing colors create the illusion of 3-D movement in "Starshot."

```
40 J=66:PX=5
50 DIM ATTACK$(8),AX5$(J),AY5$(J),AX
   $(3*J),AY$(3*J),APX1$(J),APY1$(J)
   ,APX$(J),APY$(J)
51 DIM AX4$(J),AY4$(J),APX2$(J),APY2
   $(J),APX3$(J),APY3$(J),APX4$(J),A
   PY4$(J),APX5$(J),APY5$(J)
52 DIM AX3$(J),AY3$(J),AX2$(J),AY2$(
   J),AX6$(J),AY6$(J),AX7$(J),AY7$(J
   ),AY8$(J),AX8$(J),AX1$(J),AY1$(J)
53 DIM PLAYER$(10),ATTACK1$(8),ATTAC
   K2$(8),ATTACK3$(8),ATTACK4$(8)
54 ATTACK2$="37628415":ATTACK3$="286
   47135":ATTACK4$="47618325"
60 ATTACK1$="54637281":PLAYER$="1 2
   3 4 5"
61 AX5$="13613613513413313213113012912812712612412212112112212312412512612
   6"
62 AY5$="03803703503403403403503703904104304504704905205605906206506807107
   4"
63 AX4$="11812012212412612813013213413413213012812612612612612612612612612
   6"
64 AY4$="03603403203002803003203403704004305005706307007608208007807607507
   4"
65 AX6$="15615415215014814614414214013813 6"
66 AY6$="03803603403303403603804004204003 8"
67 AX2$="07808008208408608809009209409609 8"
68 AY2$="03804204404604805005204904604203 8"
69 AX1$="05806006206406606807007207407607 8"
70 AY1$="03803503103503804204604804604203 8"
71 AX3$="09810010210410610811011211411611 8"
72 AY3$="04004404804604404204003803603703 8"
73 AX7$="17617417217016816616416216015815 6"
74 AY7$="03803603403203003303603904204003 8"
75 AX8$="19619419219018818618418218017817 6"
76 AY8$="04004404804604404204003803
```

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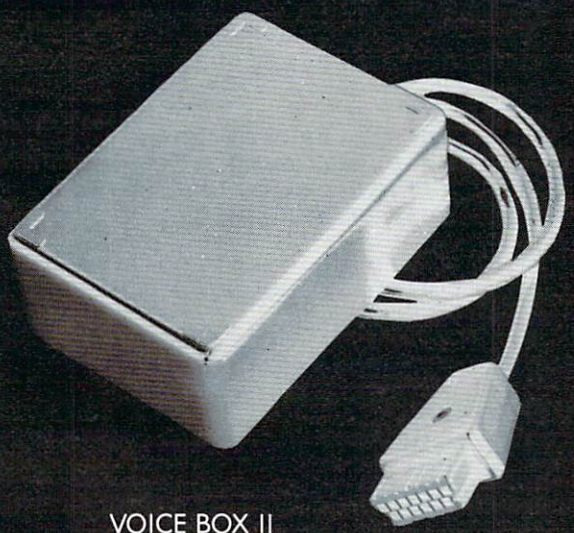
INCORPORATE THE SINGING HUMAN FACE
INTO YOUR PROGRAMS AND GAMES



VOICE BOX II
Speech & Singing Synthesizer

The New **VOICE BOX II** for **ATARI** plugs into the serial port of the **ATARI** 400/800 with sound coming out of the TV/monitor. 48K DISK is required. It has all of the features of the original **VOICE BOX** plus many exciting new hardware and software features:

- The ability to sing with voice and 3 part music.
- A library of 30 famous songs.
- A comprehensive music system that allows the user to easily enter or modify new songs.
- Software that can convert the bottom two rows of the **ATARI** keyboard into a piano with a range of 3½ octaves using the shift and control keys.
- Programmable musical sound effects such as tremolo, vibrato, glissando and click track.
- A singing *human* face with lip-sync animation designed by Jerry White.
- A talking or singing ***ALIEN*** face with software that allows the user to change the face and 8 mouth patterns as he sees fit.
- The ability to speak with inflection and feeling.
- Can speak in a foreign language with correct foreign spelling as input.
- A talk and spell program by Ron Kramer. Users can program any vocabulary for this spelling game. In fact, this program can even speak in a foreign language like French, where the user must spell the correct word in English, or vice versa.
- **GREEN GOBLINS**–A talking arcade game by John Wilson.
- Random Sentence Generator–An amusing grammar game that helps teach school children to identify parts of speech and recognize a variety of sentence structures.
- **NUMBER SPEAK**–A subroutine by Scott Matthews that converts up to a 9 digit number into normal English pronunciation. Ideal for building your own math games.
- **STUD POKER**–A talking poker game by Jerry White.
- The screen never blanks out while talking or singing.
- Singing or speaking subroutines can be incorporated into your programs, requiring as little as 100 bytes of RAM plus 5 bytes for each word.
- Entries into the $5000 talking or singing game contest can be written using the **VOICE BOX II**–send for contest information.
- Price $169.00 includes **VOICE BOX II** and all of the above software.
- Inquire about our discounts for educational institutions.

To order by mail send a check or money order to the ALIEN GROUP for $169. Then, try the VOICE BOX II for 10 days, and if it isn't the finest value you've ever seen in a computer peripheral, the most challenging and provocative addition you've ever made to your system, return it in its original condition for a full refund.

THE ALIEN GROUP
27 West 23rd Street (212) 741-1770
New York, NY 10010

ALSO AVAILABLE AT LEADING COMPUTER STORES THROUGHOUT THE WORLD.

```
    036038"
83  APX1$="126120114110110114120126132138142142138132126120114110114120126"
84  APY1$="074077082090095100104105107091121141121091071051041000950900820077"
85  APX2$="126128130134138142142136130124121118110107104107110118120124126128"
86  APY2$="074079084086088094100106110114110108106100094087080080080078076075"
87  APX3$="126130134138142146142138134130126126130134138142144142138134130126"
88  APY3$="074074074074074082086090098106114120114106098090086082074074074074"
89  APX4$="126134142134126118110110126134142134126118110110126134142132126126"
90  APY4$="074078082086092086082078074078082086092096092088084080076072072074"
91  APX5$="126132138144150156162156150144138132126120116110104098104110116126"
92  APY5$="074070068070074080084090096102106102096092086082078076074070072074"
100 BACKGROUND=10000:START=5000:MOVE=5100:SELECT=5200:ATTACK=5300:HITME=5400:HITYOU=5500
110 PATTERN=5600:RESET=5700:JOIN=5800:HITUS=5900
120 XSCR=6000:YSCR=6100:LOSS=6200:DISPLAY=6300:RESET2=6400:ASELECT=6500
1890 GOSUB 30000
1900 GOSUB BACKGROUND
1910 GOSUB START
1920 GOSUB DISPLAY
1930 GOSUB ASELECT
2000 REM CONTROL LOOP
2100 FOR IJK=1 TO 2 STEP 0
2110 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
2120 Q=SIN(1)
2130 GOSUB MOVE
2900 NEXT IJK
5000 REM START
5005 POKE 708,10:POKE 709,0:POKE 710,56:POKE PLY,150:POKE 53761,132:REM 709,152
5010 FOR I=1 TO 8
5011 FOR J=0 TO 2
5016 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5017 A=74+PADDLE(0)/2.92:POKE PLX,A:POKE 53760,A-33
5019 COLOR J*I:IF J*I=4 OR J*I=0 OR J*I=8 OR J*I=12 OR J*I=16 THEN COLOR 1
5020 PLOT 20*I-10,J:DRAWTO 20*I-11,J
5021 COLOR J*I:IF J*I=4 OR J*I=0 OR J*I=8 OR J*I=12 OR J*I=16 THEN COLOR 2
5022 PLOT 20*I-8,J+3:DRAWTO 20*I-12,J+3
5025 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5033 COLOR J*I:IF J*I=4 OR J*I=0 OR J*I=8 OR J*I=12 OR J*I=16 THEN COLOR 3
5034 PLOT 20*I-8,J+6:DRAWTO 20*I-9,J+6:PLOT 20*I-12,J+6:DRAWTO 20*I-11,J+6
5036 NEXT J:NEXT I
5090 RETURN
5100 REM MOVE
5105 FOR IJK=1 TO 2 STEP 0
5110 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5111 A=SIN(1)
5120 A=74+PADDLE(0)/2.92:POKE PLX,A:POKE 53760,A-33
5130 RR=RR+1:IF RR=50 THEN GOSUB SELECT:RR=INT(40*RND(0)):POKE 53763,0:POKE 53761,132
5185 NEXT IJK
5190 RETURN
5200 REM SELECT
5205 JJJ=JJJ+1
5210 TRAP 5211:R=VAL(ATTACK$(JJJ,JJJ)):COLOR 0:GOTO 5215:TRAP 40000
5211 GOSUB START:JJJ=0:GOTO 5205
5215 FOR J=0 TO 2
5220 PLOT 20*R-10,J:DRAWTO 20*R-11,J
5223 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5224 A=74+PADDLE(0)/2.92:POKE PLX,A:POKE 53760,A-33
5225 PLOT 20*R-8,8-J:DRAWTO 20*R-9,8-J:PLOT 20*R-12,8-J:DRAWTO 20*R-11,8-J
5230 NEXT J
5235 PLOT 20*R-8,3:DRAWTO 20*R-12,3:PLOT 20*R-8,5:DRAWTO 20*R-12,5
5236 POKE PLX+1,36+20*R:POKE PLY+1,38:PLOT 20*R-8,4:DRAWTO 20*R-12,4
5238 FOR Z=250 TO 50 STEP -50:FOR X=15 TO 0 STEP -5:SOUND 3,Z,8,X:NEXT X
5239 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5240 NEXT Z
5241 GOSUB JOIN
5249 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP:POKE 53763,134
5250 A=86+PADDLE(0)/2.92:POKE PLX,A:POKE 53760,A-33
5255 FOR J=1 TO 200
5260 TRAP 5280:X=VAL(AX$(J*3-2,J*3)):Y=VAL(AY$(J*3-2,J*3)):POKE PLX+1,X:POKE PLY+1,Y:TRAP 40000:POKE 53762,Y-20
5265 TEMP=PEEK(710):POKE 710,PEEK(709):POKE 709,PEEK(708):POKE 708,TEMP
5266 A=74+PADDLE(0)/2.92:POKE PLX,A:POKE 53760,A-33
5270 NEXT J
5280 GOSUB ATTACK:GOSUB RESET
5290 RETURN
5300 REM ATTACK
5305 GOSUB PATTERN
5310 FOR J=1 TO 200
5315 TRAP 5305:X=VAL(APX$(J*3-2,J*3)):Y=VAL(APY$(J*3-2,J*3)):TRAP 4
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     0000
5321 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5322 A=74+PADDLE(0)/2.92:POKE PLX,A:
     POKE 53760,A-33
5324 IF Y>94 THEN POKE 53257,1:POKE
     53258,1
5325 IF Y<94 THEN POKE 53257,0:POKE
     53258,0
5330 POKE PLX+1,X:POKE PLY+1,Y:POKE
     53762,Y-20
5333 IF F=0 THEN M1P=MYPMBASE+777+Y:
     POKE 53253,X:POKE M1P,12:M1PO=M
     1P:T=MYPMBASE+907+Y:XT=X
5335 IF F=0 THEN F=1:POKE 53765,207:
     POKE 53764,100
5337 IF F=1 THEN M1P=M1P+7:XT=(-1.5+
     XT)*(XT<128)+(1.5+XT)*(XT>128):
     POKE 53253,XT:POKE M1P,12:POKE
     M1PO,0
5338 IF F=1 THEN M1PO=M1P:POKE 53765
     ,160:IF M1P>T-50 THEN F=0:POKE
     M1PO,0
5339 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5340 IF G=0 THEN IF PTRIG(0)=0 THEN
     MOP=MYPMBASE+768+150:PT=80+PADD
     LE(0)/2.29:POKE MOP,3:G=1:POKE
     53252,PT
5342 IF G=1 THEN MOPO=MOP:TO=MOP-70:
     G=2:POKE 53765,15:POKE 53764,50
5347 IF G=2 THEN MOP=MOP-7:PT=(3.5+P
     T)*(PT<128)+(-3.5+PT)*(PT>128):
     POKE MOP,3:POKE MOPO,0
5349 IF G=2 THEN POKE 53252,PT:MOPO=
     MOP:POKE 53765,160:IF MOP<TO TH
     EN G=0:POKE MOPO,0
5350 IF PEEK(53256)=2 THEN GOSUB HIT
     YOU
5352 IF PEEK(53257)=1 THEN GOSUB HIT
     ME:POKE MOPO,0:POKE M1PO,0
5355 POKE 53278,0
5375 NEXT J
5380 POKE PLX,PADDLE(0):POKE PLY,148
5395 RETURN
5400 REM HITME
5405 POKE 53761,15:POKE MOPO,0:POKE
     M1PO,0:RR=0
5410 FOR J=1 TO 200
5412 IF TT=0 THEN POKE 53258,3:POKE
     PLY+2,144+RR:POKE PLX+2,A:POKE
     PLX,A:POKE PLY,148+RR:TT=1
5413 IF TT=1 THEN POKE 53259,3:POKE
     PLY+3,144+RR:POKE PLX+3,A:POKE
     PLX,A:POKE PLY,148+RR:TT=0
5415 TRAP 5410:X=VAL(APX$(J*3-2,J*3)
     ):Y=VAL(APY$(J*3-2,J*3)):TRAP 4
     0000
5421 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5424 IF Y>94 THEN POKE 53257,1:POKE
     53258,1
5425 IF Y<94 THEN POKE 53257,0:POKE
     53258,0
5427 POKE PLX+1,X:POKE PLY+1,Y:POKE
     53762,Y+20
5430 IF TT=0 THEN POKE 53258,3:POKE
     PLY+2,144+RR:POKE PLX+2,A:POKE
     PLX+3,0:TT=1
5431 IF TT=0 THEN POKE 53258,3:POKE
     PLY+2,144+RR:POKE PLX+2,A:POKE
     PLX,A:POKE PLY,148+RR:TT=1
5432 IF TT=1 THEN POKE 53259,3:POKE
     PLY+3,144+RR:POKE PLX+3,A:POKE
     PLX,A:POKE PLY,148+RR:TT=0
5435 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5440 RR=(RR+7):A=(A+7)*(A>128)+(A-7)
     *(A<127):IF A<0 THEN J=201
5441 POKE 53760,RR
5442 IF A<0 OR A>255 THEN J=201
5444 IF 144+RR>255 THEN J=201
5490 NEXT J:GOSUB YSCR
5495 POKE PLY+2,229:POKE PLY+3,229:P
     OKE 53761,0
5497 RETURN
5500 REM HITYOU
5505 POKE 53763,15:POKE MOPO,0:POKE
     M1PO,0:RR=0:POKE MOP,0:POKE M1P
     ,0
5510 FOR J=1 TO 200
5531 IF TT=0 THEN POKE PLY+2,Y-10:PO
     KE PLX+2,X:POKE PLY+1,Y:POKE PL
     X+1,X:POKE PLX+3,0:TT=1
5532 IF TT=1 THEN POKE PLY+3,Y-9:POK
     E PLX+3,X:POKE PLY+1,Y:POKE PLX
     +1,X:POKE PLX+2,0:TT=0
5534 A=74+PADDLE(0)/2.92:POKE PLX,A:
     POKE 53762,Y:POKE 53760,41+PADD
     LE(0)/2.92
5540 Y=Y+7:X=(X+3.5)*(X>128)+(X-3.5)
     *(X<128)
5545 IF Y>94 THEN POKE 53257,1:POKE
     53258,1:POKE 53259,1
5547 IF Y>130 THEN POKE 53257,3:POKE
      53258,3:POKE 53259,3
5550 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5560 IF PEEK(53260)<>0 THEN GOSUB HI
     TUS
5582 IF Y>255 THEN J=201
5584 IF X>255 OR X<0 THEN J=201
5590 NEXT J:GOSUB XSCR
5595 POKE PL2+2,0:POKE PLX+3,0:POKE
     53763,0
5597 RETURN
5600 REM SELECT PATTERN
5610 R=INT(5*RND(0))+1
5621 IF R=1 THEN APX$=APX1$
5622 IF R=2 THEN APX$=APX2$
5623 IF R=3 THEN APX$=APX3$
5624 IF R=4 THEN APX$=APX4$
5625 IF R=5 THEN APX$=APX5$
5626 TEMP=PEEK(710):POKE 710,PEEK(70
     9):POKE 709,PEEK(708):POKE 708,
     TEMP
5630 R=INT(5*RND(0))+1
5641 IF R=1 THEN APY$=APY1$
5642 IF R=2 THEN APY$=APY2$
5643 IF R=3 THEN APY$=APY3$
5644 IF R=4 THEN APY$=APY4$
5645 IF R=5 THEN APY$=APY5$
5690 RETURN
5700 REM RESET
5710 F=0:G=0:POKE 53257,0:POKE PLX+1
     ,0
5790 RETURN
5800 REM JOIN
5810 IF R=1 THEN AX$=AX1$:AX$(LEN(AX
     $)+1)=AX2$:AX$(LEN(AX$)+1)=AX3$
     :AX$(LEN(AX$)+1)=AX4$
5812 IF R=1 THEN AY$=AY1$:AY$(LEN(AY
     $)+1)=AY2$:AY$(LEN(AY$)+1)=AY3$
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    :AY$(LEN(AY$)+1)=AY4$
5815 IF R=2 THEN AX$=AX2$:AX$(LEN(AX
    $)+1)=AX3$:AX$(LEN(AX$)+1)=AX4$
5817 IF R=2 THEN AY$=AY2$:AY$(LEN(AY
    $)+1)=AY3$:AY$(LEN(AY$)+1)=AY4$
5820 IF R=3 THEN AX$=AX3$:AX$(LEN(AX
    $)+1)=AX4$
5822 IF R=3 THEN AY$=AY3$:AY$(LEN(AY
    $)+1)=AY4$
5825 IF R=4 THEN AX$=AX4$:AY$=AY4$
5830 IF R=5 THEN AX$=AX5$:AY$=AY5$
5835 IF R=6 THEN AX$=AX6$:AX$(LEN(AX
    6$)+1)=AX5$
5837 IF R=6 THEN AY$=AY6$:AY$(LEN(AY
    6$)+1)=AY5$
5840 IF R=7 THEN AX$=AX7$:AX$(LEN(AX
    $)+1)=AX6$:AX$(LEN(AX$)+1)=AX5$
5842 IF R=7 THEN AY$=AY7$:AY$(LEN(AY
    $)+1)=AY6$:AY$(LEN(AY$)+1)=AY5$
5845 IF R=8 THEN AX$=AX8$:AX$(LEN(AX
    $)+1)=AX7$:AX$(LEN(AX$)+1)=AX6$
    :AX$(LEN(AX$)+1)=AX5$
5847 IF R=8 THEN AY$=AY8$:AY$(LEN(AY
    $)+1)=AY7$:AY$(LEN(AY$)+1)=AY6$
    :AY$(LEN(AY$)+1)=AY5$
5890 RETURN
5900 REM HITUS
5905 POKE 53763,15:POKE MOPO,0:POKE
    M1PO,0:RR=0:POKE MOP,0:POKE M1P
    ,0
5910 FOR J=1 TO 200
5931 POKE PLY+2,Y-10:POKE PLX+2,X:PO
    KE PLY+1,Y:POKE PLX+1,X
5932 POKE PLY+3,Y-10:POKE PLX+3,A:PO
    KE PLY,Y:POKE PLX,A
5940 Y=Y+7:X=(X+3.5)*(X>128)+(X-3.5)
    *(X<128):A=(A+3.5)*(A>112)+(A-3
    .5)*(A<112)
5950 TEMP=PEEK(710):POKE 710,PEEK(70
    9):POKE 709,PEEK(708):POKE 708,
    TEMP
5982 IF Y>255 THEN J=201
5984 IF X>255 OR X<0 THEN J=201
5990 NEXT J:GOSUB YSCR
5995 POKE PL2+2,0:POKE PLX+3,0:POKE
    53763,0
5997 RETURN
6000 REM XSCR
6010 SCORE=SCORE+10
6080 GOSUB DISPLAY
6090 RETURN
6100 REM YSCR
6120 PLAYER$(2*PX-1,2*PX-1)=" "
6125 PX=PX-1
6130 IF PX=0 THEN GOSUB LOSS
6180 GOSUB DISPLAY
6190 RETURN
6200 REM LOSS
6210 IF SCORE>HSCR THEN HSCR=SCORE
6220 GOSUB RESET2
6280 GOSUB DISPLAY
6290 RETURN
6300 REM DISPLAY
6305 POKE 53258,0:POKE 53259,0
6310 ? PLAYER$
6320 ? "SCORE:   ";SCORE
6330 ? "HIGH SCORE:   ";HSCR
6340 IF PX=0 THEN ? " PUSH TRIGGER F
    OR ANOTHER GAME";
6350 IF PX=0 THEN IF PTRIG(0)=1 THEN
     6350:GOSUB RESET2:GOSUB ASELEC
    T
6360 ? PLAYER$
6362 ? "SCORE:   ";SCORE
6364 ? "HIGH SCORE:   ";HSCR
6390 RETURN
6400 REM RESET2
6410 SCORE=0:PLAYER$="1 2 3 4 5"
6430 PX=5
6490 RETURN
6500 REM ASELECT
6510 ZZ=INT(4*RND(0))+1
6520 IF ZZ=1 THEN ATTACK$=ATTACK1$
6522 IF ZZ=2 THEN ATTACK$=ATTACK2$
6524 IF ZZ=3 THEN ATTACK$=ATTACK3$
6526 IF ZZ=4 THEN ATTACK$=ATTACK4$
6590 RETURN
10000 REM BACKGROUND
10005 FOR I=0 TO 3:POKE 708+I,0:NEXT
     I
10007 COLOR 3:PLOT 0,20:DRAWTO 70,20
    :DRAWTO 70,40:DRAWTO 90,40:DRA
    WTO 90,20:DRAWTO 159,20
10010 COLOR 1:FOR I=1 TO 2
10020 PLOT 0,20+I:DRAWTO 70-I,20+I:D
    RAWTO 70-I,40+I:DRAWTO 90+I,40
    +I:DRAWTO 90+I,20+I:DRAWTO 159
    ,20+I:NEXT I
10040 COLOR 2:FOR I=1 TO 2
10050 PLOT 0,22+I:DRAWTO 68-I,22+I:D
    RAWTO 68-I,42+I:DRAWTO 92+I,42
    +I:DRAWTO 92+I,22+I:DRAWTO 159
    ,22+I:NEXT I
10060 COLOR 3:FOR I=1 TO 3
10070 PLOT 0,24+I:DRAWTO 66-I,24+I:D
    RAWTO 66-I,44+I:DRAWTO 94+I,44
    +I:DRAWTO 94+I,24+I:DRAWTO 159
    ,24+I:NEXT I
10080 COLOR 1:FOR I=1 TO 3
10090 PLOT 0,27+I:DRAWTO 63-I,27+I:D
    RAWTO 63-I,47+I:DRAWTO 97+I,47
    +I:DRAWTO 97+I,27+I:DRAWTO 159
    ,27+I:NEXT I
10100 COLOR 2:FOR I=1 TO 5
10110 PLOT 0,30+I:DRAWTO 60-I,30+I:D
    RAWTO 60-I,50+I:DRAWTO 100+I,5
    0+I:DRAWTO 100+I,30+I:DRAWTO 1
    59,30+I:NEXT I
10120 COLOR 3:FOR I=1 TO 5
10130 PLOT 0,35+I:DRAWTO 55-I,35+I:D
    RAWTO 55-I,55+I:DRAWTO 105+I,5
    5+I:DRAWTO 105+I,35+I:DRAWTO 1
    59,35+I:NEXT I
10140 COLOR 1:FOR I=1 TO 7
10150 PLOT 0,40+I:DRAWTO 50-I,40+I:D
    RAWTO 50-I,60+I:DRAWTO 110+I,6
    0+I:DRAWTO 110+I,40+I:DRAWTO 1
    59,40+I:NEXT I
10160 COLOR 2:FOR I=1 TO 7
10170 PLOT 0,47+I:DRAWTO 43-I,47+I:D
    RAWTO 43-I,67+I:DRAWTO 117+I,6
    7+I:DRAWTO 117+I,47+I:DRAWTO 1
    59,47+I:NEXT I
10180 COLOR 3:FOR I=1 TO 9
10190 PLOT 0,54+I:DRAWTO 36-I,54+I:D
    RAWTO 36-I,74+I:DRAWTO 124+I,7
    4+I:DRAWTO 124+I,54+I:DRAWTO 1
    59,54+I:NEXT I
10200 COLOR 1:FOR I=1 TO 12
10210 PLOT 0,63+I:DRAWTO 27-I,63+I:D
    RAWTO 27-I,83+I:DRAWTO 133+I,8
    3+I:DRAWTO 133+I,63+I:DRAWTO 1
    59,63+I:NEXT I
10220 COLOR 2:FOR I=1 TO 20
10230 PLOT 0,75+I:DRAWTO 14,75+I:PLO
    T 159,75+I:DRAWTO 145,75+I:NEX
    T I
10300 RETURN
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30000 REM *****PM SETUP*****
30010 GRAPHICS 7:POKE 106,PEEK(106)-
      16:GRAPHICS 7:POKE 752,1:REM *
      ****16 PAGE RESERVE*****
30020 ? :? :? "{9 SPACES}PREPARE FOR
       COMBAT"
30204 POKE 53277,3:REM *****GRACTL P
      LAY&MISS*****
30206 POKE 559,62:REM *****DMACTL,1L
      INE,PLAY,MIS,NORM FIELD*****
30208 POKE 54279,PEEK(106):REM *****
      PMBASE IS NOW RAMTOP*****
30210 POKE 53256,3:POKE 53257,0:POKE
       53258,0:POKE 53259,0:REM ****
      *PLAY SIZES*****
30212 POKE 623,33:REM *****PRIORITY
      PL OVER PF*****
30214 MYPMBASE=256*PEEK(106):REM ***
      **NEW PM BASE*****
30230 POKE 704,134:POKE 705,24:POKE
      706,46:POKE 707,54:POKE 1788,(
      PEEK(106)+4):REM *****START OF
       PM DATA*****
30232 POKE 710,52:POKE 709,58:POKE 7
      11,29:POKE 712,0
30236 REM *****VBLANK INTERUPT ROUTI
      NE*****
30238 FOR I=1536 TO 1706:READ A:POKE
       I,A:NEXT I
30240 FOR I=1774 TO 1787:POKE I,0:NE
      XT I
30242 DATA 162,3,189,244,6,240,89,56
      ,221,240,6,240,83,141,254,6,10
      6,141
30244 DATA 255,6,142,253,6,24,169,0,
      109,253,6,24,109,252,6,133,204
      ,133
30246 DATA 206,189,240,6,133,203,173
      ,254,6,133,205,189,248,6,170,2
      32,46,255
30248 DATA 6,144,16,168,177,203,145,
      205,169,0,145,203,136,202,208,
      244,76,87
30250 DATA 6,160,0,177,203,145,205,1
      69,0,145,203,200,202,208,244,1
      74,253,6
30252 DATA 173,254,6,157,240,6,189,2
      36,6,240,48,133,203,24,138,141
      ,253,6
30254 DATA 109,235,6,133,204,24,173,
      253,6,109,252,6,133,206,189,24
      0,6,133
30256 DATA 205,189,248,6,170,160,0,1
      77,203,145,205,200,202,208,248
      ,174,253,6
30258 DATA 169,0,157,236,6,202,48,3,
      76,2,6,76,98,228,0,0,104,169
30260 DATA 7,162,6,160,0,32,92,228,9
      6
30262 S=USR(1696)
30276 PLX=53248:PLY=1780:PLL=1784
30278 POKE PLL,9:POKE PLL+1,8:POKE P
      LL+2,26:POKE PLL+3,26
30282 FOR I=MYPMBASE+1024 TO MYPMBAS
      E+1032:READ A:POKE I,A:NEXT I:
      REM *****DEFENDER PLAYER 0****
      *
30283 DATA 24,24,60,60,126,255,126,3
      6,36
30285 FOR I=0 TO 7:READ A:POKE MYPMB
      ASE+1280+I,A:NEXT I:REM *****A
      TTACKER PLAYER 1*****
30287 DATA 204,204,204,252,252,48,48
      ,48
30299 REM *****EXPLOSION PLAYER 2***
      **
30300 FOR I=MYPMBASE+1280+256 TO MYP
      MBASE+256+1305:READ A:POKE I,A
      :NEXT I
30305 DATA 24,36,80,52,90,52,105,93,
      170,237,181,106,253,94,171,246
      ,173,85,44,90,116,44,52,44,24,
      8
30309 REM *****EXPLOSION PLAYER 3***
      **
30310 RESTORE 30305:FOR I=MYPMBASE+1
      280+512 TO MYPMBASE+1305+512:R
      EAD A:POKE I,A:NEXT I
30590 RETURN
32000 SAVE "D:STARSHOT.7":STOP
32001 LIST "D2:STARSHOT.7":STOP
```

Atari CX85 Numerical Keypad

Charles Brannon, Program Editor

The new Atari CX85 Numerical Keypad is an add-on, ten-key number pad (adding-machine style) with seven additional function keys. Its primary use is to make it easier to type in numbers. The Keypad was originally developed for use with the *Bookkeeper* software package, but is now available separately.

Seventeen-Key "Joystick"

The keypad plugs into the second joystick port. Using it from your program could be pretty tricky, except that Atari provides a *handler* program that reads the keypad like a joystick and causes it to respond like the built-in keyboard. With the handler program, you can immediately use the keypad in almost any program, including those you write in BASIC. It's especially valuable for VisiCalc, where you are constantly working with numbers. The handler program is provided only on disk.

To use the keypad, you boot the handler diskette *first*, then insert your applications disk (such as VisiCalc). The handler loads into a usually unused area of memory ($0600, page six). This conflicts with some programs, especially machine language routines that also need page six. The handler disk also contains the assembler source code of the handler and an alternate version of it that lets you define your own function keys.

It's a well-made peripheral. It has an extra-wide zero key and a raised bump on the "5" key; both are accounting standards. The keys have a nice feel, similar to the Atari 800 keyboard. The underside of the unit has three notches to let you position the cord conveniently. One of its best features is one-touch cursor control provided by default on the four "definable function" keys. It also has a minus key, decimal, and RETURN key (labeled ENTER). The unit is light, but it won't tip over.

Function Keys

To change the key values returned by the keypad, you can use the POKE command in BASIC to change locations using an alternate form of the handler program. You load the alternate handler from DOS, exit to BASIC with SYSTEM RESET, and POKE in replacement values. If you POKE in a value of 255, the function keys will behave like the console keys START, SELECT, and OPTION.

You could change the four function keys to arithmetic symbols for a four-function calculator program. Or, for typing in program listings, you could change the period key (or the ENTER key) to a comma, and you'd have a high-speed way of entering DATA statements. A keyboard overlay is provided to let you label the functions.

If you want to change the keypad's functions drastically, or relocate the handler in memory, you can modify the provided source code (machine language). The source code was written with the Atari Macro Assembler (AMAC), so you'll need the Program/Text Editor and AMAC to edit it (both are available from APX, the Atari Program Exchange).

Documentation

The Numerical Keypad comes with two manuals: a user guide and technical notes. The user guide is adequate for setting up and using the keypad for its primary uses.

The technical notes are a laudable attempt to provide the intermediate to advanced user with solid information. A schematic of the keypad is even provided, along with theory of operation, suggested changes, and a listing of the handler routine. Since the VIC and Commodore 64 use an Atari-compatible joystick port, the technical notes may even permit you to adapt this versatile peripheral to the Commodore computers.

CX85 Numerical Keypad
Atari, Inc.
1196 Borregas Avenue
Sunnyvale, CA 94086
$124.95

Atari's new plug-in keypad.

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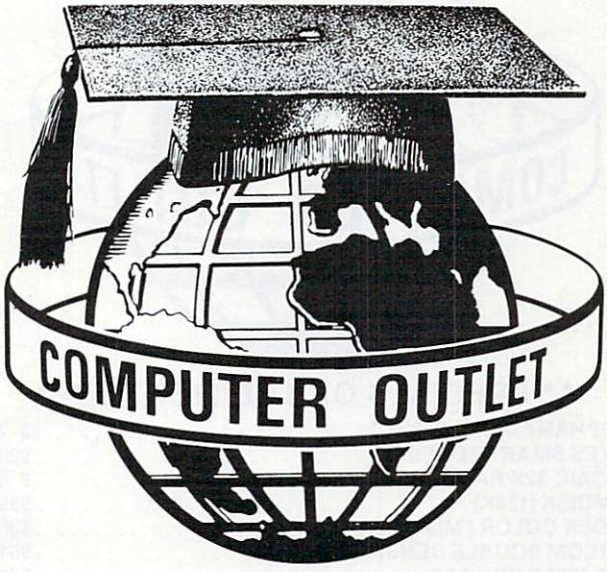

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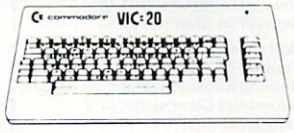

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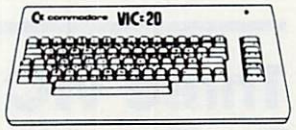

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Three VIC Cartridge Games By Creative Software

Harvey B. Herman

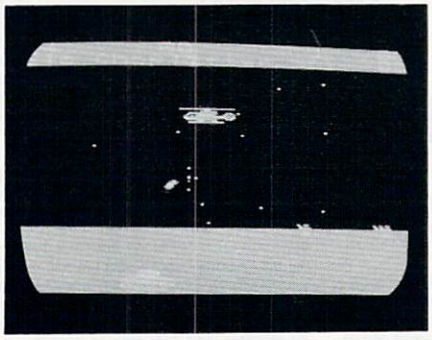
Choplifter

The objective of *Choplifter* is to save lives, specifically the lives of hostages trapped behind enemy lines. Points are scored only when the helicopter you are piloting brings men back to home base. Destroying the enemy is secondary – you do what is necessary to insure the safe arrival of your men.

The pre-game demo has some clever graphics – the "i" in Tom Griner (he's the programmer) waves at you, as the hostages do later. At this point, you are given the option of changing the default colors by successive pressing of any function key (not documented).

When the game begins, your helicopter is on its home base. Lift up with the joystick and fly left toward enemy lines. Watch the three-dimensional star background and front-line pass behind and below, respectively. Listen to the realistic chopper noises.

The hostages are either trapped in houses or are frantically running around on the ground waving to you. Set the chopper down carefully, and the hostages will climb aboard (16 max). If you accidentally land on one, you hear a plaintive "blink."



Evading the hostile tank, the helicopter attempts to rescue the waving hostages (lower right) in the VIC version of Choplifter.

Lift off and return them to base.

Sounds easy? Not quite. There are hazards to watch out for, like enemy tanks, jets, and killer satellites. The enemy is out to get your chopper, and you must either avoid them or destroy them with your cannon. A perfect score results when you have returned all 64 men to base in the three missions allowed.

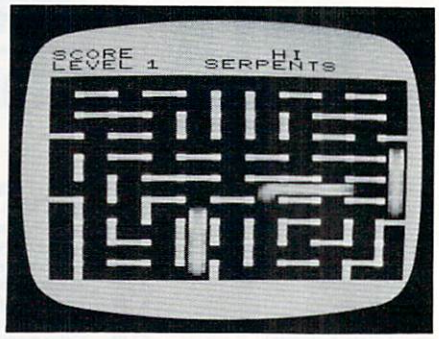
I usually lose too many men, but my kids seem to have mastered the game fairly quickly. Although the game's action noticeably slows when too many hostages or enemies are in the field of view, this game is fun and challenging.

Serpentine

I played this game on an Apple once, and the VIC version appears to be identical. You are a blue segmented serpent moving in an irregular maze. Your twists and turns are controlled by a joystick. Hostile red segmented serpents are after you and will eat you if you're careless. You survive by creeping up on them from the rear or side, and snipping off their segmented tails.

When the evil serpent is red, you cannot attack from the front or you will be eaten (lose a turn). But if you snip off enough of a red serpent, it turns green, and you are free to attack it from any direction. In fact, at that time a successful frontal attack awards your blue serpent an extra segment. Similarly, extra segments are given when you eat frogs, which hop around randomly on the maze, or the eggs laid by enemy serpents.

There are several complications and strategies which make the game more interesting. A red snake will turn green when



The swiftly creeping serpents are a blur as they flee through the maze in Serpentine.

it has fewer segments than your blue snake and back again when it has more. When snakes lay eggs, they lose a segment. If a head-on collision with a green snake is imminent and your snake decides to lay an egg, you might find yourself face-to-face with an angry red one.

My kids enjoyed this game more than the other two, and I was able to pick up a strategy tip from watching them play. They sometimes delay the clearing of all red snakes from the board until their blue snake lays an egg. Assuming a frog doesn't get the egg (frogs love eggs), they get an extra turn after the board is cleared.

The game uses color, music, and sound effectively. Tension builds when the game gets more difficult as successive screens are cleared, but the points go up proportionally. One kid suggested a speed-up button to help escape tight spots, even if it cost penalty points. Overall, we found it exciting and engaging.

Trashman

In principle, this game is very similar to *Pac-Man*. You are at the controls of a garbage truck riding around town (a maze), collecting trash (dots), and emptying trash cans (energizers). Both activities score points, and the object of the game is to clear successive screens and achieve as high a score as possible. Giant flies are continually molesting your truck, and you must evade them or lose a turn.

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After a trash can is emptied, the flies change color, and for a short time it is safe to counterattack. But don't wait too long, or they will revert to their original color and revert to their essential nastiness.

This game offers a choice of difficulty (or bonus) levels at the start, and my kids appreciate this feature. They consistently play at the highest level, but have not lost interest yet. The game has good sound effects and well-drawn, animated flies, especially at the beginning and when the flies are caught and sent back to home base. I also liked the idea of a random bonus which appears about halfway through a screen to liven things up a little. The joystick is optional for this program, but recommended.

Among these three games, we liked *Serpentine* the best, then *Trashman*, then *Choplifter*. Personal taste will be the deciding factor, so try them out before you purchase, if possible. But if you are an inveterate game player, you'll probably enjoy all of these VIC cartridges; they're among the better ones we've seen.

Choplifter
Serpentine
Trashman

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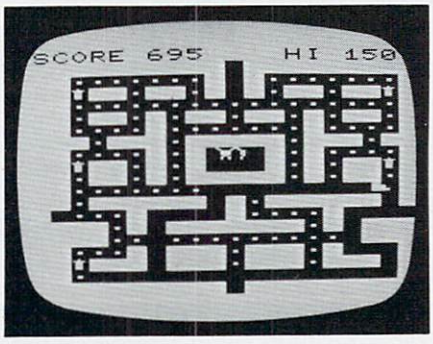

Players must negotiate a maze to pick up garbage in Trashman.

Hescount For PET/CBM And VIC

Steve Leth

One of the facilities available on many mainframe computer systems is a program profiler – a utility that monitors the execution of a program and counts how many times each statement is executed. This information can be used in a number of ways to assist in the development of a new program or the modification of an old one. For instance, statements in a program that are executed many times are prime candidates for various time-saving techniques. Speeding up a line that is executed a thousand times will have a much greater effect on a program's total run time than doing the same thing to a line that is executed only once. We'll see more of this in an example later on.

Profiler information can also be used for general program testing and debugging. Finding the cause of an endless loop is a lot easier when you know exactly which statements are part of the loop. Another area of program development that is often ignored is the testing of seldom-used paths through a program's logic. Many a "well-tested" program contains large stretches that were never executed during its debugging stages. A profiler lets you find these unexecuted statements and devise input or other conditions that will force them to be executed.

Simple To Use

"OK, sounds great. But I don't have a mainframe, I've got a VIC!" Yes, I know, and so do the people at Human Engineered Software, who have developed *Hescount*, a BASIC program profiler for all versions of Commodore PET/CBM and VIC.

For the most part, using *Hescount* is pretty simple: you load it by running a BASIC loader program. As usual, the loader resets the top-of-memory pointer so *Hescount* won't be destroyed by running your program. Next, you load the BASIC program you want profiled and type "SYS 0".

Hescount will now set up the program so that its execution can be monitored by hooking into the zero-page CHARGET routine and reserving memory space for the line counts. You just run the program as usual. While your program is running, *Hescount* will keep track of how many times each line is executed, placing this count in the space it reserved during the initial setup.

Because *Hescount*'s monitoring takes up some time, your program will run about 20 percent slower than usual. When the program is finished, the line counts must be extracted from *Hescount*'s internal format and put someplace where you can access them. To do this, you enter "SYS 0" again. This time, *Hescount* will take the line numbers and the counts and place them in a two-dimensional array named UQ%. The number of elements in UQ% will be stored in UQ%(0,0), the numbers of the executed lines in UQ%(0,i), and the number of times that line was executed in UQ%(1,i).

Hescount also unhooks itself from the CHARGET routine and returns your program to its normal state. Now you can take the data stored in the array UQ% and list it on the screen or printer or save it on disk for later analysis.

How *Hescount* Works

Let's look at an example to see just what *Hescount* shows us about a program. Program 1, called "Dice," is a short program that calculates the odds of each number that can result when two dice are rolled. Just to make the program a little more general, I've set it up to handle the "odd"

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dice, with other than six sides, used in many role-playing games. Table 1 shows the output for a pair of ten-sided dice. Notice that it took 223 jiffies (just under four seconds) for the program to run.

If we run Dice under *Hescount*, and then enter SYS 0 to collect the line counts into the array UQ%, the results can be printed using the routine that starts at line 1000 in Dice. This output is shown in Table 2: a table of line numbers and how many times each one was executed. We can see that there are only two points in Dice worth trying to speed up: lines 40 and 50, which execute 100 times each, and lines 70 and 80, which execute 19 times each. We can pick up a little speed by combining lines 20 through 50 into one line. (See Program 2.)

However, most of the time saving came from moving the expression "(S↑2)" from inside the FOR loop to line 55. The run time is now down to 149 jiffies (about two and a half seconds); any other changes I could think of just made the run times longer. Although this example is trivial (it's pretty obvious which statements will execute the most), you can see how this whole process would be very effective with a large program.

A Few Limitations

If you are getting the impression that I like *Hescount*, you're right. It is useful, reasonably simple to use, and very nicely documented. The manual that comes with it is easy to read and quite complete. There are actually two manuals, totaling 25 pages. The first is a *User Manual*, which describes how to load and use *Hescount* and how to access the line counts. A demo program, included on the tape or disk, acquaints you with *Hescount*'s operation.

The second book is the more technically oriented *Program Manual*. This manual contains

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Program 1: Dice

```
1 REM ********* DICE *********
2 REM ** UNMODIFIED PROGRAM **
5 INPUT"□NUMBER OF SIDES";S
6 TI$="000000"
7 PRINT:PRINT"THERE ARE"S*2"POSSIBLE COMBINATONS":PRINT
10 DIMC(2*S)
20 FORI=1TOS
30 FORJ=1TOS
40 C(I+J)=C(I+J)+1
50 NEXT:NEXT
60 FORI=2TO2*S
70 PRINTI,C(I),C(I)/(S*2)
80 NEXT
85 PRINT
90 PRINT"EXECUTION TOOK";TI;"JIFFIES"
100 END
1000 DEFFNZ(A)=A-(A<0)*65563
1010 OPEN4,4:PRINT#4,"LINE      TIMES EXECUTED"
1020 FORI=1TOUQ%(0,0)
1030 PRINT#4,FNZ(UQ%(0,I)),FNZ(UQ%(1,I)):NEXT:CLOSE4
```

Program 2: Modified Dice

```
1 REM ******* DICE *******
2 REM ** MODIFICATION #3 **
5 INPUT"□NUMBER OF SIDES";S
6 TI$="000000"
7 PRINT"THERE ARE"S*2"POSSIBLE COMBINATONS"
10 DIMC(2*S)
30 FORI=1TOS:FORJ=1TOS:C(I+J)=C(I+J)+1:NEXT:NEXT
55 S1=S*2
60 FORI=2TO2*S
70 PRINTI,C(I),C(I)/S1
80 NEXT
90 PRINT"EXECUTION TOOK"TI"JIFFIES"
100 END
1000 DEFFNZ(A)=A-(A<0)*65563
1010 OPEN4,4:PRINT#4,"LINE      TIMES EXECUTED"
1020 FORI=1TOUQ%(0,0)
1030 PRINT#4,FNZ(UQ%(0,I)),FNZ(UQ%(1,I)):NEXT:CLOSE4
```

Table 1:
Output Of A Pair Of Ten-Sided Dice

NUMBER OF SIDES? 10
THERE ARE 100 POSSIBLE COMBINATIONS

2	1	.01
3	2	.02
4	3	.03
5	4	.04
6	5	.05
7	6	.06
8	7	.07
9	8	.08
10	9	.09
11	10	.1
12	9	.09
13	8	.08
14	7	.07
15	6	.06
16	5	.05
17	4	.04
18	3	.03
19	2	.02
20	1	.01

EXECUTION TOOK 223 JIFFIES

Table 2:
Results Of Line Counts

LINE	TIMES EXECUTED
1	1
2	1
5	1
6	1
7	1
10	1
20	1
30	10
40	100
50	100
60	1
70	19
80	19
85	1
90	1
100	1
1000	0
1010	0
1020	0
1030	0

information on how to customize *Hescount*, how it works "under the hood," and also includes a complete assembly listing.

Of course, *Hescount* does have a few kinks. The means of accessing the line counts is somewhat clumsy but it is well explained. *Hescount* also has some limitations involving mixed BASIC/machine language programs, some odd types of FOR/NEXT loops, and utilities that also use the CHARGET routine (such as Skyles Electric Works' *Disk-O-Pro*). Fortunately, all these problems are minor and are discussed in the documentation. Versions for PET/CBM ROMs 2, 3, and 4 and the VIC-20 are included, along with a short demo program. All in all, *Hescount* is a good program to add to your software development toolkit.

Hescount
Human Engineered Software
71 Park Lane
Brisbane, CA 94005
$23.95 Tape
$26.95 Disk

Micro-Systems' VIE Cartridge VIC To IEEE Interface

Karl Kelley

Have you wanted to add the disk drive for your other Commodore computer to your VIC? If you are like many Commodore owners, you may have already owned a 4016, 4032, or 8032 PET/CBM computer along with a disk drive and a printer.

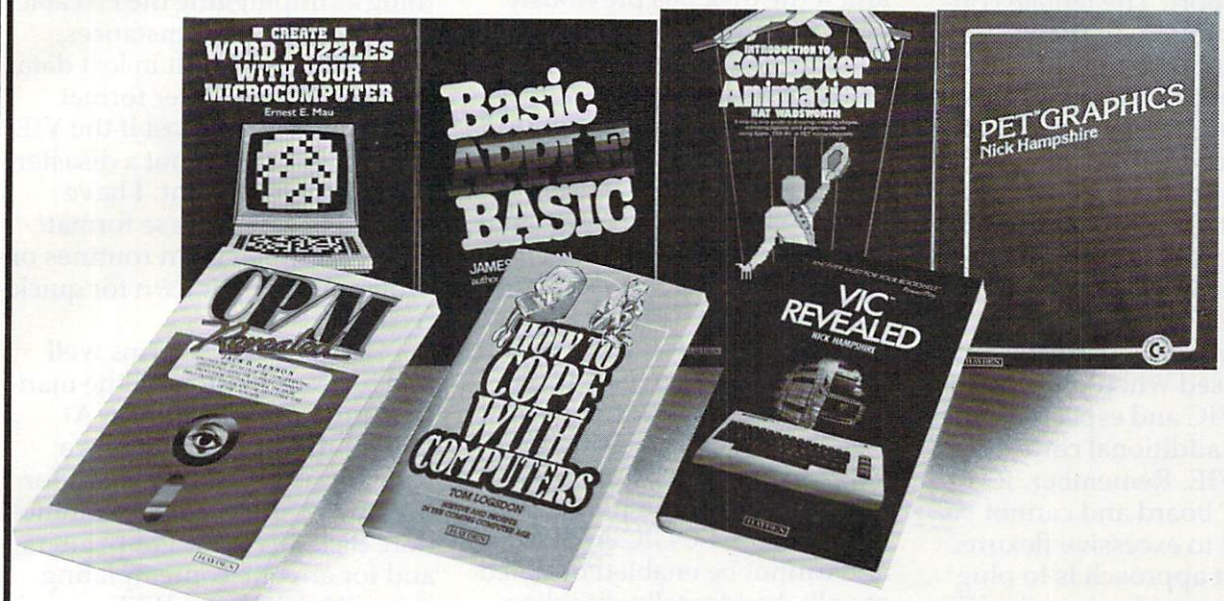
Micro-Systems Development, Inc. is marketing an interface cartridge which converts the user port to IEEE protocol and allows direct access to IEEE devices of all kinds. My particular interest right now is the IEEE disk drives and printers manufactured by Commodore – the ones I already own.

I ordered the VIE Cartridge from Micro-Systems, and as soon as I received it, I opened the durable plastic case to check out the insides.

Inside were four chips and a female edge connector, mounted

Hayden

HAYDEN...*the source*



***New!* VIC™ Revealed** (Hampshire) An invaluable probe of the VIC's hardware capabilities. It covers the 6502 microprocessor, VIC systems software, video interface chip, I/O ports and I/O processing and functions, as well as outstanding VIC features such as its programming power, superior game and graphics capability, and unique I/O capabilities that are not even explained in Commodore manuals. Also contains a complete instruction set for the 6502, as well as options for using machine code subroutines in VIC basic programs. **#1058, $12.95**

***New!* CP/M™ Revealed** (Dennon) Intended for CP/M users interested in improving their skills, this is a guide to the CP/M operating system: the console monitor (CCP), the system manager (BDOS), and the input/output driver package (CBIOS). Provides a clear understanding of the data structure of the CP/M disk and other essentials for using CP/M effectively. Covers buying CP/M, booting up, logging in, changing memory size, mapping disk space, calling all programs, and more. **#5204, $13.95**

***New!* Basic Apple™ BASIC** (Coan) A complete guide to Applesoft BASIC. Takes you from beginning concepts, such as entering data and obtaining output, and planning programs, to more advanced topics such as numeric and string arrays, and sequential and random access files. Alternate techniques for programming in Apple Integer BASIC are also covered, as well as low-resolution and high-resolution graphics. **#5626, $12.95**

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***New!* How to Cope With Computers** (Logsdon) An entertaining, yet informative discussion of the impact of computers on our daily lives and the future of our society. Includes a brief history of the computer, explanations of hardware and software, and an introduction to programming in BASIC. Provides an overview of computer career opportunities. **#5193, $7.95**

Introduction to Computer Animation (Wadsworth) Now you can produce amazing computer graphics — even if you can't draw a straight line. Learn how to draw lines and shapes, make graphs, draw pictures, and even do animation with such popular microcomputers as the Apple II, TRS-80, and the PET. This book takes a step-by-step approach to learning how to use low-resolution graphics, including many program listings that illustrate graphic techniques using a minimum of mathematics. The author also shows how color and sound can be used in such programs as creating a deck of cards, making a clown wink his eye, and "coaching" an interactive football game. **#6279, $9.95**

PET™ Graphics (Hampshire) Officially approved by Commodore for use with the PET. Instructs the PET user on how to program graphics displays. Contains a collection of BASIC and machine-language subroutines that enable the PET owner to write more efficient programs. Provides a wide range of normally unavailable graphic functions. **#1051, $18.75**
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on a good quality, solder-dipped printed circuit board with two male edge connectors. The large edge connector plugs into the VIC user port. The female connector mounted on the PC board is a straight through extension of the user port lines. This means that use of the VIE cartridge does not restrict one from later expansion. The smaller male edge connector is that sorely needed IEEE port designed to mate with Commodore's P/I cable.

Note: Though the device is extremely well constructed, care *must* be used when plugging it into the VIC and especially when plugging additional cartridges into the VIE. Remember, it is only a PC board and cannot be subjected to excessive flexure. The safest approach is to plug the other cartridge into the VIE before plugging the VIE into the VIC.

The instructions consist of one typewritten page with a brief explanation of the device and instructions for enabling/disabling the interface software. The instructions are entirely adequate.

Once installed, the interface can be enabled via

```
SYS40000
```

This actuates the approximately 1K EPROM onboard software. Once enabled, the interface can be disabled by any one of the following:

```
"RESTORE"
Software BRK
VIC Power Off
SYS64850 (the exit routine)
```

Recall that VIC BASIC is really a modification of PET BASIC 3.0 and does not contain the direct disk commands of BASIC 4.0 such as DLOAD, DSAVE, etc. So users who have become "dependent" on BASIC 4.0 will have to re-learn the syntax of disk operations from the earlier BASICs. For example, to save a program under the name TESTPROG on drive 1, execute the following:

```
OPEN1,8,15,"I1":SAVE
"TESTPROG",8:CLOSE1
```

Of course, initialization is not required on the 8050 drives, and if the disk has previously been initialized, the OPEN and CLOSE statements are not necessary.

File handling is straightforward and identical to PET BASIC 3.0. Again, BASIC 4.0 users will miss the random file commands available in BASIC 4.0, but fortunately, the RANDOM 1.0 program (in BASIC) on the Commodore DEMO disk can be copied directly for use on the VIC-20.

There are a few things to watch out for while using the VIE. On the larger Commodore machines, the IEEE port is part of the MAIN LOGIC ASSEMBLY and cannot be enabled/disabled at will. Accidentally disabling the VIE when files are OPENed on the disk or printer can cause loss of data. The convenience of the RESTORE (warm start) key is now an albatross. If you are doing disk operations and hit the RESTORE key (disabling the VIE) while disk files are OPEN, you have accomplished the same thing as unplugging the P/I cable. Under certain circumstances, this could also result in lost data.

Likewise, printer format commands will be lost if the VIE is disabled. This is not a disaster, but it is inconvenient. I have learned to set off these format/control commands in routines or programs on their own for quick recovery.

The device performs well and in accordance with the manufacturer's specifications. At $79.95, the VIE Cartridge is a valuable addition to the VIC for users who already own Commodore disk drives and/or printers, and for anyone contemplating using the VIC as an IEEE controller.

Micro-Systems Development, Inc.
11105 Shady Trail, Suite 103
Dallas, TX 75229
$79.95

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All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

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TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

Dungeons of Death — Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure ($14.95 tape, $19.95 disk), this is a giveaway.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

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Microteach Teacher's Aide For The Atari

Mike Kinnamon

Since I am a teacher, many educational programs are brought to me by well-meaning computer users and salespeople, who believe that I can immediately put them to use in my classroom. Unfortunately, some of these programs do not lend themselves to practical classroom applications. They tend to be either too broad or repetitive, too much like drills.

Microteach Teacher's Aide (48K, two disk drives) is not in that category; it is a welcome solution to the problem of tailoring computer-assisted education.

With this program, a teacher with no knowledge of computer languages can create computer-based lessons that deal specifically with a particular curriculum. A teacher may write courses and assign them to individuals or groups of students, keeping a record of each student's progress readily available.

To use *Teacher's Aide*, you first format a blank diskette, using your standard Atari Disk Operating System. This becomes your courseware disk. Next, place the *Teacher's Aide* in drive number one and your newly created courseware disk into drive number two. Reboot the entire system without BASIC; Optimized System Services' BASIC A+ is used by the program on disk number one.

The program's features are numerous and quite varied. Mastering its many modules will take several sessions, but the end result is well worth the time. A teacher can enter the edit mode and easily create a unit of study categorized into sections and chapters which coincide with the textbook being used in the classroom. You can re-edit an existing chapter or section for an alternate or improved use. You can dissect any individual chapter or section and create advanced or remedial editions of a given lesson. Each courseware diskette can be assigned a volume number, thereby creating an entire year's curriculum in any sequence and of any breadth.

Each TV screen is treated as a page of a textbook. The teacher has the options of color of pages and timed or untimed pages. The entire page, section, or chapter can be listed to the printer, giving the student a hard copy for study notes, homework, or tests.

Flexible Options

Questions may be presented to the student during or after each lesson. Several types of questions (multiple choice, fill-in-the-blank, true-false, or yes-no) can be used in any order, in each lesson. Each question can be timed or untimed, and assigned a weighted point value at the teacher's discretion. If the student answers a question incorrectly, the teacher may assign a page, section, or chapter to be reviewed by the student in order to better assure a minimum competency of the lesson. A student's responses thus determine the rate at which he or she progresses through the lesson.

The computer will keep a complete, detailed record of each student's performance. The teacher may review a student's status at any time and view the chapters, sections, and pages completed by each student. Scores on the questions are available with such details as number of times attempted before a correct answer was entered and the weighting value of each question. The teacher may list all students on a given disk, assign chapters to particular students, set up a new student file, or delete an old file by entering the report/review module of the program.

The editing commands are thorough, allowing the teacher to create new pages, edit old ones, insert or delete a page, and step forward or backward a page at a time.

Only graphics mode 0 (the standard text mode) can be used with this program, which is somewhat disappointing, but I know a few teachers who have spent the time to create high-resolution graphics to adorn the text. With a little imagination and creative endeavor, a teacher can use the keyboard graphics characters with pleasing results. Since each page is static, no animation of the graphics is possible. This prevents a dynamic presentation, which may limit the program's usefulness in primary classrooms.

The major advantage of *Teacher's Aide* is that absolutely no knowledge of programming or computer language is required. This is a real blessing for those teachers who have wanted to use computers in their curriculum but haven't had time to become proficient programmers. Test and grade management, a major consumer of a teacher's time, is greatly simplified with this program. The validity of any test question can be easily determined in a matter of minutes, greatly improving a curriculum's instructional value and a test's ability to measure learning. I would highly recommend this program. It requires an Atari 400/800 and two disk drives.

Microteach Teacher's Aide
Compumax
P.O. Box 1139
Palo Alto, CA 94301
$195

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A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in **COMPUTE!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type COMPUTE!'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

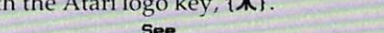
3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type COMPUTE!'s Programs" elsewhere in the magazine.)

We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** *due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on the CAPUTE! page, usually within eight weeks. If you have specific questions about items or programs which you've seen in* **COMPUTE!**, *please send them to Ask The Readers, P.O. Box 5406, Greensboro, NC 27403.*

How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: 
Enter these characters with the Atari logo key, {🡅}.

When you see	Type	See
{CLEAR}	ESC SHIFT <	Clear Screen
{UP}	ESC CTRL -	Cursor Up
{DOWN}	ESC CTRL =	Cursor Down
{LEFT}	ESC CTRL +	Cursor Left
{RIGHT}	ESC CTRL *	Cursor Right
{BACK S}	ESC DELETE	Backspace
{DELETE}	ESC CTRL DELETE	Delete character
{INSERT}	ESC CTRL INSERT	Insert character
{DEL LINE}	ESC SHIFT DELETE	Delete line
{INS LINE}	ESC SHIFT INSERT	Insert line
{TAB}	ESC TAB	TAB key
{CLR TAB}	ESC CTRL TAB	Clear tab
{SET TAB}	ESC SHIFT TAB	Set tab stop
{BELL}	ESC CTRL 2	Ring buzzer
{ESC}	ESC ESC	ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T .

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {■} means to enter a reverse-field heart with CTRL-comma, {5■} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC

Generally, any PET/CBM/VIC program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor-down key; {3DOWN} would mean to press the cursor-down key three times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen. Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

Sometimes in a program listing, especially within quoted text when a line runs over into the next line, it is difficult to tell where the first line ends. How many times should you type the SPACE bar? In our convention, when a line breaks in this way, the ~ symbol shows exactly where it broke. For example:

```
100 PRINT "TO START THE GAME  ~
    YOU MAY HIT ANY OF THE KEYS
    ON YOUR KEYBOARD."
```

shows that the program's author intended for you to type two spaces after the word *GAME*.

All Commodore Machines

Clear Screen	{CLEAR}	Cursor Left	{LEFT}
Home Cursor	{HOME}	Insert Character	{INST}
Cursor Up	{UP}	Delete Character	{DEL}
Cursor Down	{DOWN}	Reverse Field On	{RVS}
Cursor Right	{RIGHT}	Reverse Field Off	{OFF}

VIC/CBM 64 Conventions

Set Color To Black	{BLK}	Function Two	{F2}
Set Color To White	{WHT}	Function Three	{F3}
Set Color To Red	{RED}	Function Four	{F4}
Set Color To Cyan	{CYN}	Function Five	{F5}
Set Color To Purple	{PUR}	Function Six	{F6}
Set Color To Green	{GRN}	Function Seven	{F7}
Set Color To Blue	{BLU}	Function Eight	{F8}
Set Color To Yellow	{YEL}	Any Non-implemented Function	{NIM}
Function One	{F1}		

To enter any color code, hold down CTRL and press the appropriate color key. Use CTRL-9 for RVS on and CTRL-0 for RVS off.

8032/Fat 40 Conventions

Set Window Top	{SET TOP}	Erase To Beginning	{ERASE BEG}
Set Window Bottom	{SET BOT}	Erase To End	{ERASE END}
Scroll Up	{SCR UP}	Toggle Tab	{TGL TAB}
Scroll Down	{SCR DOWN}	Tab	{TAB}
Insert Line	{INST LINE}	Escape Key	{ESC}
Delete Line	{DEL LINE}		

When you see an underlined character in a PET/CBM/VIC program listing, you need to hold down SHIFT as you enter it. Since the VIC-20 and Commodore 64 have fewer keys than the PET/CBM, some graphics are grouped with other keys and have to be entered by holding down the Commodore key. If you see any of the symbols in the left column underlined in a listing, hold down the Commodore key and enter the symbol in the right column. Just use SHIFT to enter all other underlined characters.

!	K	←	*	1	E
"	I	↑	PI	2	R
#	T	.	S	3	W
$	@	–	Z	4	H
%	G	=	X	5	J
'	M	<	C	6	L
&	#	>	V	7	Y
\	–	,	D	8	U
;	F	/	P	9	I
?	B	*	N	@	SHIFT*
(	£	+	Q	[	SHIFT+
)	SHIFT-£	0	A	]	SHIFT–

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

TRS-80 Color Computer

No special characters are used, other than lowercase. When you see letters printed in inverse video (white on black), press SHIFT-0 to enter the characters, and then press SHIFT-0 again to return to normal uppercase typing.

Texas Instruments 99/4

No special control characters are used. Enter all programs with the ALPHA lock on (in the down position). Release the ALPHA lock to enter lowercase text.

Timex TS-1000, Sinclair ZX-81

Study your computer manual carefully to see how to enter programs. Do not type in the letters for each command, since your machine features single-keystroke entry of BASIC commands. You may want to switch to the FAST mode (where the screen blanks) while entering programs, since there will be less delay between lines. (If the blanking screen bothers you, switch to the SLOW mode.)

KMMM Pascal for PET/CBM/C64 $85

A subset of standard Pascal with extensions.
- Machine language Pascal Source Editor with cursor oriented window mode.
- Machine Language P-Code Compiler
- P-Code to machine language transfer for optimized object code.
- Run-time package
- Floating point capability
- User manual and sample programs

Requires 32K Please specify configuration.

EARL for PET (disk file based) $65

Editor, Assembler, Relocater, Linker

Generates relocatable object code using MOS Technology mnemonics. Disk file input (can edit files larger than memory). Links multiple object programs as one memory load. Listing output to screen or printer. Enhanced editor operates in both command mode and cursor oriented "window" mode.

RAM/ROM for PET/CBM

4K or 8K bytes of soft ROM with optional battery backup.

RAM-ROM is compatible with any large keyboard machine. Plugs into one of the ROM sockets above screen memory to give you switch selected write protectable RAM.

Use RAM/ROM as a software development tool to store data or machine code beyond the normal BASIC range. Use RAM/ROM TO LOAD A ROM image where you have possible conflicts with more than one ROM requiring the same socket. Possible applications include machine language sort (such as SUPERSORT), universal wedge, Extramon, etc.

RAM/ROM — 4K	$75
RAM/ROM — 8K	90
Battery Backup Option	20

SUBSORT for PET/CBM $35

Excellent general purpose machine language sort routine.

THE WHOLE PET CATALOG $9

A two year 320 page compendium of the Midnite Software Gazette for Commodore computer users. Contains 500 reviews of commercial products, 700 education programs (reviewed and organized by course), 200 reviews of free games, info on over 1800 free programs, list of PET and VIC user groups, and many pages of helps and hints.

SuperGraphics 2.0

NEW Version with TURTLE GRAPHICS

SuperGraphics, by John Fluharty, provides a 4K machine language extension which adds 35 full featured commands to Commodore BASIC to allow fast and easy plotting and manipulation of graphics on the PET/CBM video display, as well as SOUND Commands. Animations which previously were too slow or impossible without machine language subroutines now can be programmed directly in BASIC. Move blocks (or rocketships, etc.) or entire areas of the screen with a single, easy to use BASIC command. Scroll any portion of the screen up, down, left or right. Turn on or off any of the 4000 (8000 on 8032) screen pixels with a single BASIC command. In high resolution mode, draw vertical, horizontal, and diagonal lines. Draw a box, fill a box, and move it around on the screen with easy to use BASIC commands. Plot curves using either rectangular or polar co-ordinates (great for Algebra, Geometry and Trig classes.)

The SOUND commands allow you to initiate a note or series of notes (or even several songs) from BASIC, and then play them in the background mode without interfering with your BASIC program. This allows your program to run at full speed with simultaneous graphics and music.

Seven new TURTLE commands open up a whole new dimension in graphics. Place the TURTLE anywhere on the screen, set his DIRECTION, turn him LEFT or RIGHT, move him FORWARD, raise or lower his plotting pen, even flip the pen over to erase. Turtle commands use angles measured in degrees, not radians, so even elementary school children can create fantastic graphic displays.

Specify machine model (and size), ROM type (BASIC 3 or 4)

SuperGraphics (disk or tape)	$40
SuperGraphics in ROM ($A000 or $9000)	$55

Volume discounts available on ROM version for schools.

FLEX-FILE NEW VERSION 2

for PET/CBM Computers

FLEX-FILE is a set of flexible, friendly programs to allow you to set up and maintain a data base. Includes versatile Report Writer and Mail Label routines, and documentation for programmers to use Data Base routines as part of other programs.

RANDOM ACCESS DATA BASE

Record size limit is 256 characters. The number of records per disk is limited only by record size and free space on the disk. File maintenance lets you step forward or backward through a file, add, delete, or change a record, go to a numbered record, or find a record by specified field (or partial field). Field lengths may vary to allow maximum information packing. Both subtotals and sorting may be nested up to 5 fields deep. Any field may be specified as a key. Sequential file input and output, as well as file output in WordPro and PaperMate format is supported. Record size, fields per record, and order of fields may be changed easily.

MAILING LABELS

Typical mail records may be packed 3000 per disk on 8050 (1400 in 4040). Labels may be printed any number wide, and may begin in any column position. There is no limit on the number or order of fields on a label, and complete record selection via type code or field condition is supported.

REPORT WRITER

Flexible printing format, including field placement, decimal justification and rounding. Define any column as a series of math or trig functions performed on other columns, and pass results such as running total from row to row. Totals, nested subtotals, and averages supported. Complete record selection, including field within range, pattern match, and logical functions can be specified.

FLEX-FILE 2 by Michael Riley $110

Please specify equipment configuration when ordering.

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- auto repeat key.
- sample programs.
- standard size screens (16 lines by 64 characters).
- 150 screens per diskette on 4040, 480 screens on 8050.
- ability to read and write BASIC sequential files.
- introductory manual.
- reference manual.

Runs on any 16K or 32K PET/CBM (including 8032) with ROM 3 or 4, and CBM disk drive. Please specify configuration when ordering.

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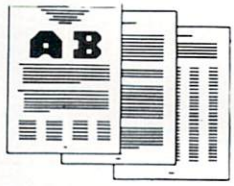
Simple metacompiler for creating compacted object code which can be executed independently (without the FORTH system).

PageMate 60 COMMAND WORD PROCESSOR

by Michael Riley



Paper-Mate is a full-featured word processor for Commodore computers. Page-Mate incorporates 60 commands to give you full screen editing with graphics for all 16K or 32K machines (including 8032), all printers, and disk or tape drives. Many additional features are available (including most capabilities of WordPro 3).

For writing text, Page-Mate has a definable keyboard for operator flexibility. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

Page-Mate text editing includes floating cursor, scroll up or down, page forward or back, and repeating insert and delete keys. Text block handling includes transfer, delete, append, save, load, and insert.

All formatting commands are imbedded in text for complete control. Commands include margin control and release, column adjust, 9 tab settings, variable line spacing, justify text, center text, and auto print form letter (variable block). Files can be linked so that one command prints an entire manuscript. Auto page, page headers, page numbers, pause at end of page, and hyphenation pauses are included.

Unlike most word processors, CBM graphics as well as text can be used. Page-Mate can send any ASCII code over any secondary address to any printer.

Page-Mate functions with all Commodore machines with at least 16K, with any printer, and either cassette or disk.

To order Page-Mate, please specify machine and ROM type.

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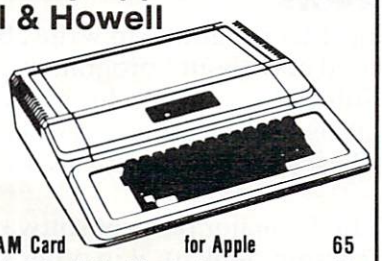

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Software For Toddlers

Fred D'Ignazio, Associate Editor

I first started working with children and computers back in the early 1970s. I was a programmer for a large computer time-sharing company, and I took a briefcase computer terminal with me to elementary school classrooms around the District of Columbia. We dialed up the main computer on the telephone and plugged it into the terminal.

I wrote all the programs that I demonstrated to the kids. That's because there wasn't anything else out there.

Sure, there was CAI (Computer-Assisted Instruction) *courseware* available. But that was mostly for older kids, and it was very expensive. I operated my little computer-literacy project on a shoestring. CAI materials were over my students' heads and beyond the reach of my wallet.

Then came the flood of personal computers. But still no inexpensive software for children in preschool through early elementary school. Parents and teachers who wanted software had to write it themselves. Or they could find an occasional listing in a computer magazine.

Now, suddenly all this is changing. People have finally realized that even the smallest kids can use computers to have fun and to learn.

And computers are appearing in people's homes by the millions. By the *millions*.

Thousands upon thousands of the families who now have computers also have little kids. These kids represent an enormous market for software. Software companies and traditional publishing companies are leaping into this market by the dozens. All of a sudden we are being deluged by programs for little kids.

Software Reviews

In future columns, I will continue to write about the computer friend and about "programming languages" for little kids (see my column last month.) But I will also devote part of each column to reviewing the best of the new software for little kids.

If you don't find a major piece of software reviewed in my column, look for it in other **COMPUTE!** columns (such as in Glenn Kleiman's or David Thornburg's column or in the Reviews section of each issue.) Or write me directly (Fred D'Ignazio, 2117 Carter Road, SW, Roanoke, VA 24015). I'll get the software and respond to you personally. If it merits review, I'll also include it in a forthcoming column.

E.T. On Your Computer

Everybody is going computer. Everything that now appears in a book, in the comics, in the movies, or on TV will soon be loaded into a computer. Within the next few years, we will see all our kids' heroes and superheroes, myths, fairy tales, and favorite characters appear electronically on personal computers. Big Bird, Strawberry Shortcake, and Papa Smurf will all be computerized. So will Batman, Wonder Woman, and

---

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer *(Creative Computing),* Chip Mitchell: The Case of the Stolen Computer Brains *(Dutton/Lodestar), and* R2-D2's Question and Answer Book About Computers *(Random House).*

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in **COMPUTE!**.

NEW MULTI-USER SOFTWARE LETS THE WHOLE FAMILY SHARE IN THE JOY OF LEARNING.

Is the personal computer doing all it can to help our children learn?

To some degree, no, although it's not fair to blame it entirely on the computer. After all, computers are only as good as their software.

How can we improve this situation?

A solution already exists. But first, some background.

Where personal computers fail.

For years, studies have shown that children learn more efficiently in group situations. Peer groups, for example, motivate slower learners to persevere. Groups of older and younger children encourage divergent thinking. Even the simple "group" of a parent and child promotes faster acceptance of new ideas by combining education with trust and confidence.

But personal computers and their programs are designed to be personal. One computer, one child. It's hard for anyone else to be part of the learning experience, even you.

At least not until today.

A simple solution.

When two educational researchers, Dr. Matilda Butler and Dr. William Paisley, observed this problem they proposed an interesting, yet simple, solution. Instead of writing programs that shut out brothers, sisters, friends, and parents, why not give everyone the opportunity to share learning simultaneously. This one idea sparked an entire line of unique educational programs and gave birth to a new company, Edupro.

Software that shares.

With Edupro's Microgroup™ computer programs, up to eight players work at solving math, language, social studies, or science problems which are presented as contests, races, and puzzles. The players work together, either competitively or cooperatively, as they race against time, each other, or both.

The *Math-Race* program, for example, converts your computer into an electronic race track where children compete to answer math problems and advance toward the finish line. *Picture-Play* encourages everyone to create pictures together, teaching both spatial relationships and the value of cooperation. And *Team-Work* combines both cooperation and competition by pitting two teams (of up to four players) against each other in a race to solve word and number puzzles.

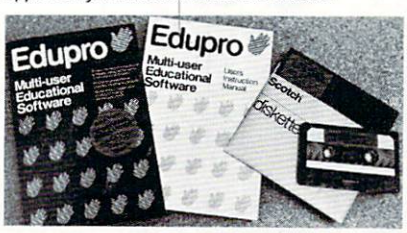
For the first time, your personal computer can bring all the benefits of group learning into your home. With a little assist from Edupro.

Designed for the simplest computers.

These unique programs run on the Atari 400 or 800, two of the world's most popular home computers. Remember, these aren't game cartridges, they're full *computer programs*, designed by educators. All are available on floppy disk or cassette, and each one requires the minimum amount of computer memory (16K for cassette, 24K for disk). That means the simplest Atari computer can let your children share the learning experience with up to seven additional friends. Joysticks required for *Word-Draw*, *Math-Hunt*, and *Picture-Play*; paddles required for *Word-Race*, *Math-Race*, and *Team-Work*.

Trust your own experience.

At the fall 1982 Computer-Using Educators Conference hundreds of educators witnessed hands-on demonstrations of our programs. Many of them said that this was a most effective way to judge their potential. But we want to offer you an even better opportunity. One those educators missed.



We want you and your children to experience this new way to learn. So choose one or more programs on either disk or cassette. Try them yourself. Watch your children get more excited about learning. Enjoy the thrill of sharing the experience with them. We know of no other software that can turn a personal computer into a tool for sharing the joy of learning.

Fill out the order form and see the results for yourself.

I want to share the joy of learning with my children. Please send me the programs I've indicated below. I understand that each program is available on either disk or cassette (my choice) and comes with a complete set of instructions and catalog listing over 50 programs. Plus a coupon good for a 10% discount on my next order.

Quantity	Program Description	# of Disk	# of Cassette
	STORYBOOK FRIENDS: Ages 5–9		
_____	WORD-DRAW: Storybook People and Places	_____	_____
_____	MATH-HUNT: Number Relationships	_____	_____
	AMERICAN THEMES: Ages 8–13		
_____	TEAM-WORK: Social Studies	_____	_____
_____	MATH-HUNT: American Years: Multiplication and Division	_____	_____
	THE WORLD AROUND US: Ages 12–Adult		
_____	WORD-DRAW: Science	_____	_____
_____	MATH-RACE: Powers and Roots	_____	_____
	JUST FOR FUN: All Ages		
_____	PICTURE-PLAY	_____	_____
Total #			**Total Amount $**
_____	programs on disk @ $24.95 each		_____
_____	programs on cassette @ $19.95 each		_____
_____	Picture-Play, disk @ $19.95		_____
_____	Picture-Play, cassette @ $14.95		_____
	CA residents add sales tax		_____
	Postage and handling		$2.50
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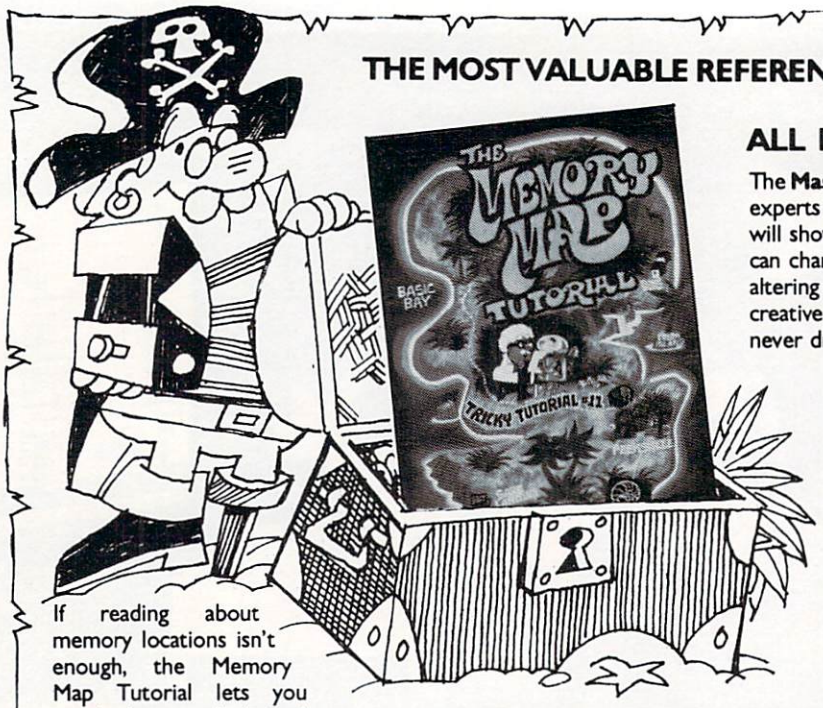

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The **Master Memory Map™** is a guide for beginners and experts to the hidden treasures of your computer. We will show you hundreds of memory locations that you can change using PEEK and POKE statements. By altering the contents of these locations you can really get creative with your computer. Fascinating things you never dreamed you could do are now possible. We explain the locations controlling Player Missile Graphics, Sound Effects, the GTIA chip, Display Lists and more. There are also hints on speeding up BASIC programs and using memory more efficiently, just to name a few. The ATARI version of the MMM will also include pages of information on the 1200XL. Put some magic into your programs with our Master Memory Map...

For ATARI - $12.95
For Commodore 64 - $14.95
For VIC-20 - $9.95

If reading about memory locations isn't enough, the Memory Map Tutorial lets you watch them work. It is the perfect companion to the Master Memory Map. We discuss in detail over 30 of the most important memory locations and their functions...16K tape or disk required. $29.95 for ATARI computers.

"The book just oozes good information and is truly one of the great values for the Atari."

Gordon Banks, Huntsville Users Group

EDUCATIONAL SOFTWARE, inc.

DIGGING AROUND FOR SOME NEW GAMES?

Other guys will sell you Bezerk™, Space Invaders™, and Tutti Frutti™ for a total price of almost a HUNDRED BUCKS! Our new User Exchange offers this three pack of similar arcade games for only $24.95. Included are Aliens and Survive for 16K tape or 32K disk users and Robot Attack requiring 32K.

DIGGERBONK (© 1982, Steve Robinson) An arcade-style game with a continuously scrolling maze that never repeats itself. Guide your digger upward before it gets carried off the bottom of the screen while battling Orange Whirlers, Pulsing Greenies, Twinklers, Bombs, Purple Gurples, the ever-nasty Aqua Chasers, and a menacing fog! For all ages. $29.95

Have you ever wondered what kind of pets they used to keep way back when? This game takes you back to Morocco in the 9th century to try and win a pet snake from Sheba, a very wily snake charmer. All you have to do is guide your new friend through 7 levels of feeding. This game is written in BASIC and machine language so it can be listed - and you can see how an arcade game is developed! Requires 16K tape or 32K disk. $24.95

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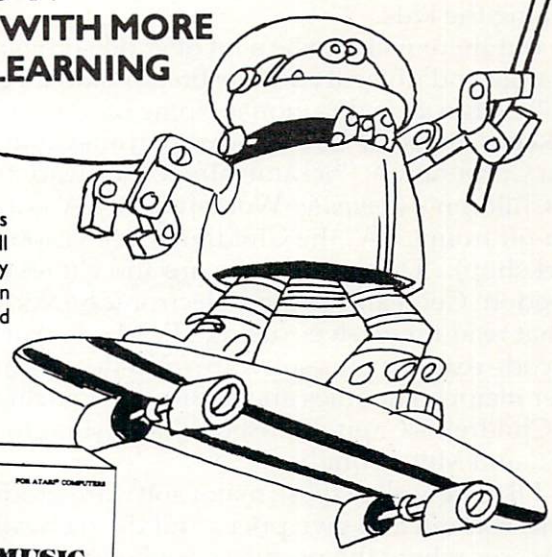
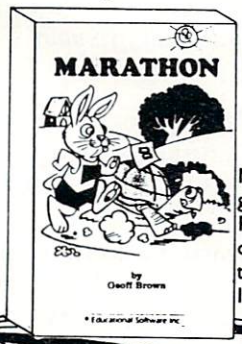


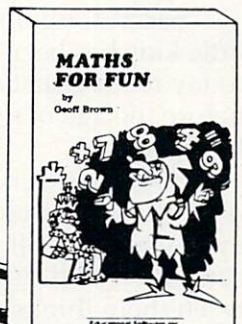
Music Major: An extensive program designed to teach the fundamentals of music in a serious yet lighthearted manner. It gives you comprehensive lessons on such topics as note counting, key signatures, note recognition, measure practice and a sample Beethoven quiz. Parents and teachers can add to or modify the quizzes.
32K Tape or Disk required..$39.95

KIDS #1: Kids ages 4 to 10 can find lost treasures on a small island, do a math quiz, or talk to their Atari.
16K Tape or 24K Disk $14.95

Kids #2: A collection of 3 games designed to help your child's spelling skills. Includes a spelling bee, the Scrambler and Touch. For Kids 4 to 10.
16K Tape or 24K Disk $14.95



Marathon: Build mathematical skills using a challenging race against the computer or an opponent. Race through different levels of difficulty but watch out...one wrong move and your opponent can take the lead.
16K Tape or 24K Disk and joystick required..$19.95



Maths for Fun: Use inventive math games to make learning those ho-hum excercises fun.
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NEW from EDUCATIONAL SOFTWARE:

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PROGRAM EXCHANGE
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Cat in the Hat. So will R2-D2 and E.T.

Some of this new software will be junk: dull, of little educational value, using the big names (like E.T. or the Smurfs) only for the purpose of hooking the kids.

But there will also be a lot of good software. Its range and diversity will be breathtaking. And it will be fun *and* educational. Some of the new packages include *PLATO* software from Control Data Corporation; "Sesame Street" software from the Children's *Computer* Workshop (CCW is a spin-off from CTW, the Children's Television Workshop); "Dr. Seuss" software and games from Theodore Geiss and Coleco; electronic books from TI that read themselves (using TI's Magic Wand™ bar code reader); plus software from dozens of other major companies and institutions, including the Children's Capitol Museum in Washington, D.C., and Milton Bradley.

I'll review all of these major software products in this column and give prices and the names and addresses where the products can be obtained.

An Unparalleled Opportunity

The flood of programs for little kids is the cutting edge of the computer revolution. Programs for older kids and for adults will also have a powerful impact. But the impact on little kids will be the greatest.

Why? First, because they are little kids. Computers will be among the first things they see. Computer-assisted learning will be part of their earliest learning experience. It will affect *what* they learn and *how* they learn. It will shape kids' feelings about learning in general.

Second, up until now, most learning by little kids has been informal. Very few children today receive sustained, cumulative instruction before the age of five, when they are enrolled in kindergarten.

Soon all this is going to change. Four-year-olds, three-year-olds, two-year-olds, and kids even younger will sit down in front of their family computers and run exciting, fun programs that teach them things they otherwise wouldn't learn until they were twice as old. Or even older.

Third, much of this learning will be noninstitutional and extracurricular. Educational TV programs like *Sesame Street* made a stab at turning the home into a "learning center." Now computers and the new "toddler" software will make this possible. Formal learning at home will skyrocket. And it will be largely self-sustained and unsupervised. Parents will encourage their kids to run the programs. But the kids will either do it or not. The amount of learning that takes place will depend mostly on the kids themselves and on the quality of the software they are exposed to.

When this class of computer-literate kids enters the public school system, watch out. Each kid will test out at a different grade level *on different subjects*. The strain on public schools will be enormous. Parents will pressure schools to continue the individualized instruction that the children began at home on their computers. The schools will have to respond. Whether they want to or not, the public schools, from kindergarten up, will be forced to computerize their curriculums extensively. Otherwise, the teachers will be overwhelmed by too many kids operating at too many levels.

Millions of our youngest children will soon be exposed to computer software embodying all sorts of values.

What will be the outcome of all these changes in terms of children's values and the overall quality of their development? Millions of our youngest children will soon be exposed to computer software embodying all sorts of values. These values will affect the children's emotional disposition, their learning ability, and their social and spiritual development.

Little kids are especially vulnerable to new values. Their character still has not fully formed. And yet what supervision are these kids likely to get when they sit down at their computer and run these programs? What control will parents, and even teachers, have on the shape and scope of their kids' development?

I will deal with these important questions and others like them in future columns. Also, I'd like to hear from you readers. What are *your* views?

The Learning Center

What is the best way to teach little kids? Is it drill? Simulation? Invention? Discovery? Games? Or some combination?

The programs now appearing for children are based on one or more of the above learning philosophies. When you are selecting software for your kids, it's good to know which philosophy (or methodology) the software uses.

For each of the various philosophies, there are several good software packages. Drill is perhaps the oldest form of computer instruction. In recent years, drill programs have been maligned because they are said to be unimaginative, they don't take full advantage of the computer, and "they program kids, rather than the other way around."

The Light Pen at the Right Price:

Shown actual size.

$29.95 Each

SPECIAL INTRODUCTORY OFFER!

Less is more. This maxim has never been more true than now with the introduction of our new Edumate Light Pen. This affordable and reliable tool was originally designed and developed for use with our Learning Center educational software—however, it is the perfect accessory for your Atari 400/800, VIC-20 or Commodore 64, regardless of application. Response has been so overwhelming that we now announce a new price schedule for quantity orders:

1-4—$29.95 each

5-24—$20.97 each 25-99—$19.48 each

100 and more—$17.97 each

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But drill programs have a place, especially when they are fun and exciting, and when they teach new facts and concepts.

One drill-type package I recommend is *The Learning Center*, written by Bruce Mitchell. Bruce and his wife Diane run the Small World kindergarten and preschool in Durham, North Carolina. Diane is one of Small World's teachers. Bruce and Diane also have two young sons. Bruce's programs are based on experiences with his sons, one of whom had a learning disability, and on several years experience with kids at Small World.

The programs are divided into three areas: Special Skills, Math and Number Skills, and Language Skills. The Special Skills section covers identification of colors, color names, and shape recognition and differentiation. The Math and Number Skills section covers counting, number recognition, addition and subtraction, and ones and tens. The Language Skills section includes programs for alphabet recognition, letter sequence, and symbol discrimination.

Children can interact with the programs using the computer keyboard or an inexpensive light pen sold by *The Learning Center*'s distributor, the Programmer's Institute. The programs are very friendly and easy to use. They are appropriate even for the youngest, non-reading children. My three-year-old, Eric, likes them a lot – especially the "Count with Me" program that lets him "count the monsters."

My only criticism is that the color program is sometimes not responsive to the light pen. I learned that this can be corrected by turning up my monitor's contrast control. The problem is present only in the Atari version and will be corrected with a new, more sensitive Atari light pen soon to be available from Programmer's Institute.

The Learning Center programs cost $74.95 for a cassette and $79.95 for a diskette. I have the version that runs on the Atari 400/800. I understand they also run on the VIC, the Commodore 64, the TRS-80 Model I, Model III, and Color Computer, the Apple, and the TI-99/4A.

The Edumate™ light pen costs $34.95. To find out more about the light pen and *The Learning Center* package, contact:

The Programmer's Institute
P.O. Box 3191
Chapel Hill, NC 27514
919-967-0861

KinderComp

Two other excellent software packages are *KinderComp* and *Rhymes & Riddles*, distributed by Spinnaker Software Corporation of Cambridge, Massachusetts. Both packages employ several teaching philosophies. They are so attractive and fun to use that they have captivated my entire family, including three-year-old Eric, seven-year-old Catie, and their parents.

Each package is $29.95. They are available for the Atari computers, the Apple II+ (48K, DOS 3.3) and IIe, and the IBM PC. Contact:

Spinnaker Software Corporation
215 First Street
Cambridge, MA 02142
617-868-4700

KinderComp was written by Doug Davis for his daughter Amy. The name makes it sound like a collection of arithmetic programs, but it is really six programs that teach a diverse group of numerical and alphabet-oriented skills.

One of the programs is called "Draw." It can be used by even the youngest children (say, kids under two). To work the program, the child twists a joystick and creates multicolored, musical pictures on the display screen.

My three-year-old had no problem using Draw to create all sorts of shapes. When I asked him to tell me what he was drawing, I was boggled. "Up here, Daddy," he said, "is an upside-down two. Over here is a house. These are steps. This is the roof. This here is the room where the doggie lives. This is a hotel. That's a big swimming pool. Over here is the fire escape. This green stuff is Hulk Grass. It's bigger than the hotel."

Draw is a super program because of its visual and auditory feedback, because it's so easy to use, and because it stimulates a child's manual dexterity, creativity, and artistic skills.

The other *KinderComp* programs are more focused and less open-ended. But they are original and exciting. "Scribble" amplifies and animates a child's random scribbles. "Names" turns a child's name into a fascinating sound and light show. (Boy, was I jealous when Eric turned his name into a hilarious musical cartoon. I never got that kind of reinforcement with my name "Fred.")

"Sequence" helps kids learn number sequence; "Letters" teaches them lowercase letters and the location of letters on the keyboard; and "Match" is a great pattern-matching game.

Both the *Learning Center* programs from Programmer's Institute and *KinderComp* from Spinnaker are valuable for the *specific* skills they teach young children. But they are equally valuable as "doorways" for children to enter the world of computers. Even the youngest children can use the computer for fun, purposeful activities that *they* control. They learn the computer keyboard. They learn how to manipulate and respond to material on the display screen. They learn how to operate the computer and run programs.

Computer skills still baffle and intimidate a large number of adults. People once believed that mastery of these skills required a college educa-

tion. Yet *The Learning Center* and *KinderComp* teach these skills to little kids who are still running around in diapers.

An important aspect of toddler software is the way it reinforces children's response – that is, the way it responds to kids' right and wrong answers. Both *The Learning Center* (*LC*) and *KinderComp* (*KC*) score high in this category. For right answers, *LC* gives a happy face and a happy tune; *KC* gives a happy face with a wink. For wrong answers, *LC* gives a sad face and a toot; *KC* gives a sad face crying a big tear.

I like both packages' responses to wrong answers because they are quickly over and do not intimidate a child. I like *KC*'s response very much because the computer doesn't show disapproval or anger when the child errs. Instead it becomes *sad*.

KC is good also because it gives the child hints when he is wrong, and eventually gives him the right answer. But after the child gets an answer wrong, he is not rewarded for later getting it right. This confused my son Eric. When he didn't get a happy face on the screen for an answer at which he had worked especially hard, he wilted a little bit.

On the other hand, *KC* is especially good because it lets the child follow his progress with a string of pluses (+) on the screen (one "plus" for each correct answer). And the child gets a special reward for answering a series of questions correctly. This feature made a big hit with Eric.

Last, I also recommend *Rhymes & Riddles*, another package from Spinnaker. *R&R* was written by a husband and wife team. The format is "updated, nonviolent Hangman." On the screen appear a bunch of dashes. The dashes represent missing letters. The child tries to guess the letters. By guessing all the letters, a child builds either 1) a nursery rhyme, 2) the answer to a riddle (Sample riddle: Why can't bikes stand up? Answer: Because they are *two* tired.), or 3) a famous saying.

If a child doesn't guess the right letters after a certain number of tries, she doesn't see some poor little man or woman get hanged. Instead, she builds a sad face, and the program displays the correct letters.

All three games (*The Learning Center*, *KinderComp*, and *Rhymes & Riddles*) help kids learn the computer keyboard, the letters of the alphabet, and the spelling of different words. The kids' learning is reinforced with colorgraphics pictures and musical segments taken from nursery rhymes and the children's songs.

Kids' Computer Magazines

Software for kids isn't the only thing that's happening. There are also a growing number of kids' computer magazines. Three good ones that I recommend are:

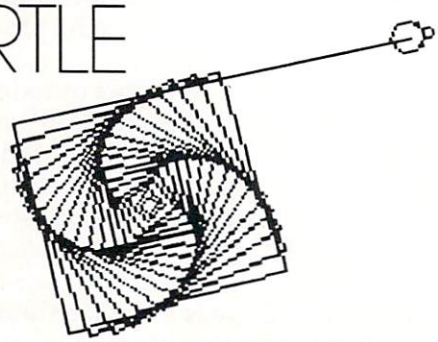
CompuKids ($16/year; $9/half-year) P.O. Box 874, Sedalia, MO 65301. Call (toll-free) 800-822-KIDS. Wide range of articles, tutorials, interviews, stories, puzzles, and games for kids just getting started in computers. Elementary school and junior high. Also, CompuKids Computer Club (for an additional $8/year).

Enter ($12.95/year) Children's Television Workshop, One Lincoln Plaza, New York, NY 10023. Call 212-595-3456. Like *CompuKids*, a wide range of articles, stories, puzzles, games, etc. Glossy, full-color format patterned after CTW's *Sesame Street* and *3-2-1 Contact* magazines. For kids seven and up.

Turtle News and *Logo Newsletter* (Kids $9/year; Adults $25/year) Young Peoples' Logo Association, 1208 Hillsdale Drive, Richardson, TX 75081. Call 214-783-7548. Focus on Logo, PILOT, and Turtle Graphics programming, but also features articles and programs in BASIC. Education, entertainment, and material to help kids with special needs. For kids seven and up.

All three of these magazines encourage kids to contribute articles, stories, and programs. ©

FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

Robots Are Turtles, Too

With the continuing development of excellent turtle graphics environments on every computer with a halfway decent display, it is easy to lose sight of the fact that the turtle was originally a computer-controlled robot. The power and ease of turtle graphics have allowed the screen-based progeny to totally eclipse their mechanical forebears.

While Friends of the Turtle supports and encourages the use of mechanical turtles such as the Big Trak and the Terrapin Turtle, we haven't received many comments from the users of these devices. Because of the recent entry of the Heath and Androbot robots (see this month's *Computers And Society* column), I think it is about time for us to make it clear that we will grow even more aggressive in our support of turtles – both mechanical and screen-oriented.

Although people who use turtles often share a common programming language, the interests of people who use one type of turtle are different from those who use the other. The speed, precision, color, and available complexity of a display turtle present challenges of a different sort from those of a mechanical, imprecise, and (relatively) slow robot. Where the user of screen turtles might be interested in the creation of landscapes, the user of a robot may be more interested in solving mazes.

Both people may use the same language (e.g., Logo) and computer system, but each has a different set of objectives. We want this column to be a comfortable home to *all* turtle users. You can help make it one by sharing your applications with us.

For example, one marvelous application for the Big Trak was developed by Katie Thornburg for use with school children between second and sixth grades. She uses several dozen pieces of 1 x 4 inch wood cut into 13-inch lengths (the length corresponding to one forward unit of Big Trak motion). She places these pieces of wood on a 4 x 8-foot sheet of pegboard to create a maze that each child must "program" his or her way out of.

By having the constraints of a maze (rather than a more general problem, such as moving in a square path), the children are highly motivated to create error-free programs. Additional challenges can be created by having two teams race against each other, or by having each of two teams construct a maze to be solved by the other team. This inexpensive addition to the Big Trak has greatly increased the value of this tool in the computer classroom.

Turtles At The CES

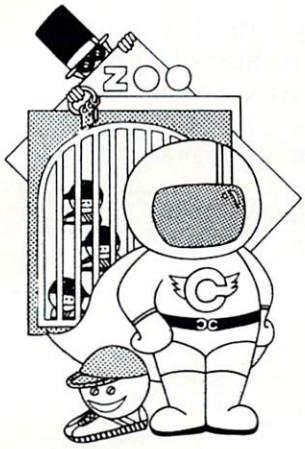
There were at least three things I saw at the Winter Consumer Electronics Show that are of value to friends of the turtle. The first of these was the introduction of the Mattel Aquarius computer (currently selling for under $170) with an under $100 Logo cartridge. While the graphics resolution on this computer isn't tremendous, I was impressed by the fact that Mattel's Logo was developed by The LISP Company. Since Logo is a user-friendly version of LISP (*LIS*t *P*rocessing), I felt comforted to know that this would not be a pure turtle graphics package passing itself off as Logo.

The second delight was a preview of a forthcoming turtle graphics package for the Commodore 64 from HES. I am very impressed with this program. Once I get a copy, I will review it in this column.

The third development of interest was the introduction of a new company, Androbot. This company, founded by Atari founder Nolan Bushnell, introduced a computer-operated robot named TOPO and a self-contained android named B.O.B. (Brains On Board). TOPO is described in this month's *Computers And Society* column, so I won't say any more about it here.

B.O.B. is a thoroughly engaging creation programmed to "seek" people out and initiate "conversations" with them. To help with this task, B.O.B. sports five Polaroid ultrasonic position sensors to map the environment, and two IR

NEXA presents

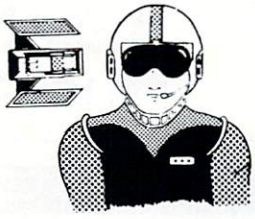


Captain Cosmo is an exciting fast-action video arcade game. It can be played by 1 to 4 players and has 99 skill levels. Try it and you can't let go!

Requires Atari 400/800 with 32K Joysticks, and a Disk Drive.

Delta Squadron is a strategic war game that really puts you in the pilot's seat. With this game you will experience the thrill and excitement of a real space pilot. **Delta Squadron** is a "must" for all strategic game enthusiasts, and a change of pace for those who wants a challenge!

Requires 64K Apple II with DOS 3.3 and paddle.



Superbowl Football is a realistic football game. You can design your own plays and has thousands of defensive and offensive plays. This is the ultimate in computer football games.

Requires Atari 400/800 with 48K, a Disk Drive and Joysticks.

We revolutionize our packaging designs to be convenient, compact, durable, and to protect the diskettes from dust and moisture.

Ask for us at your local stores or your distributor.

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THE PDI PRESCHOOL CHALLENGERS

Each of the PDI Preschool Challengers develops critical pre-reading skills in the 3-6 year old— shape and letter recognition, number concepts, listening skills, spacial relationship, classification and eye/hand coordination.

At the same time, they fascinate and delight the child hour after hour with lovable, interactive playmates.

All PDI Preschool Challengers feature brilliant graphics, color, music and exciting sound effects, and some have voice narrations.

Available 16K ATARI (Cassette w/joystick) and 24K ATARI (Disk w/joystick) Preschool IQ Builder 1 available on 32K APPLE (Disk).

THE ADVENTURES OF OSWALD
Using the joystick, your child helps Oswald climb, run and jump through two different adventures. Includes "Oswald and the Golden Key" in which Oswald eludes a pesky ghost.

SAMMY THE SEA SERPENT
Features three story adventure games in which Sammy gets into a lot of tight spots—including finding his way back to the sea.

HERE COMES VIOLET
Violet (her name *and* color!) has a real problem—she's the cutest monster ever seen, *BUT* she wants to be ugly so she can scare people. A delightful interactive adventure.

PRESCHOOL IQ BUILDER 1
A stimulation program in two parts.
a. Decide if pairs of figures are similar or not.
b. Match the letter on the screen with the correct one on the keyboard.

PRESCHOOL IQ BUILDER 2
The face on the screen sings a happy song when the correct match is made between letters, numbers, symbols or words. 6 levels of difficulty.

Available at leading stores or direct from PDI.

PDI

Program Design, Inc, 11 Idar Court, Greenwich, CT 06830

sensors to find people (and other warm bodies such as stoves, spotlights, etc.). These sensors feed information to a central computer that uses three 8088 processors with up to 3 M bytes of RAM.

What makes B.O.B. so interesting is its potential to dynamically program itself. In principle, B.O.B. can make a map of a room and develop an optimal path for performing some task, such as vacuuming a rug.

B.O.B. charmed everyone who saw it – especially when it became clear that no one knew exactly what B.O.B. was going to do next, or how it was going to get out of a jam.

Androids using adaptive programming techniques represent the next generation of robots. If you write programs using a list processing language such as Logo, you have all the tools you need to develop adaptive programs yourself.

Robots can (and will) be very sophisticated in the near future. But they are a lot of fun as well. So don't forget that Friends of the Turtle is a place for ideas on both screen and mechanical turtles.

Let me hear from you!

Friends of the Turtle
P.O. Box 1317
Los Altos, CA 94022

Sinclair/Timex
Guess That Animal

Ralph Kennedy

This article adapts a previously published **COMPUTE!** *program to the Sinclair ZX-81. It is also a brief tutorial on the special features of the ZX-81's BASIC, showing how you can reload programs without losing data previously saved. The program requires 16K.*

This is an adaption for the Sinclair ZX-81 of Daniel Hastie's "Guess that Animal!" program, which appeared in the August 1982 issue of **COMPUTE!**. The 16K RAM pack is required.

The most significant difference between Hastie's versions (for PET and Atari) and the ZX-81 version is that no data tapes are used. The ZX-81 is not equipped to read or write such tapes, but it does save all variables and arrays when it saves programs. This means that if you play the game for a while and then save the program, it will be more "knowledgeable" when it is reloaded than it was in its pristine state.

Saving The Program

Incidentally, on those occasions when you have no need of a record of the values of the variables in a program you are saving, you can save an amount of time roughly proportional to the amount of memory set aside for variables and arrays simply by entering CLEAR before saving the program.

When you have typed this program into your ZX-81 and have assured yourself that all is well with it, enter CLEAR and save the program once so that you have on tape a reasonably quick-loading version without variables. Later, after you've played the game for some time and want to save program and data, simply respond with a N to the question "Would you like to try again?" and you will then see instructions on saving the data.

A version saved in accordance with these instructions will begin running automatically when it is loaded back into the computer. If you save the program by stopping it and entering SAVE, be sure to start it using GOTO START when you reload. Using RUN will wipe out all the data you spent so much time saving and loading.

ZX-81 BASIC Special Features

Two rather nice features of the ZX-81's BASIC are exploited in this program to aid in documentation and in ease of use. These are (1) its acceptance of long variables (with all characters being significant), and (2) its acceptance of such commands as GOTO MEMCHECK, GOSUB TRUNCATE, etc.

These features enable a programmer to write a well-documented program with fewer REM statements than would otherwise be needed, since lines like 467 GOTO MEMCHECK are reasonably self-documenting. They also make possible the use, mentioned above, of GOTO START to start a program without losing data or, when CONT doesn't work, to get back into a stopped program at the right place and without losing data.

Finally, these special features enable the programmer during debugging to use such commands as LIST GET or LIST ASK to list sections of the program where problems are suspected. All this can be quite handy for those whose memory for numbers leaves something to be desired. Just be sure that the first thing your program does is define the relevant variables, and you're in business.

Note: Underlined characters should be entered in *inverse video.*

```
10 PRINT "IF YOU HAVE USED RUN, ALL BUT S
   TARTER DATA HAVE BEEN LOST."
20 PRINT
30 PRINT "PRESS BREAK, RELOAD, AND USE GO
   TO START IF YOU WANT TO USE OLD D
   ATA."
40 PRINT
50 PRINT AT 10,0;"IF YOU ENTER AN ANIMAL ~
   OR A QUESTION INCORRECTLY,"
60 PRINT "YOU CAN CORRECT YOUR MISTAKE BY
    ENTERING ""S"" IMMEDIATELY."
70 PRINT "YOU WILL THEN BE GIVEN A CHANCE
    TO MAKE A NEW ENTRY."
80 PRINT AT 21,0;"PRESS N/L TO START."
85 PAUSE 3E4
90 FAST
100 REM *GUESS THAT ANIMAL*
110 REM
170 REM **READ STARTER DATA**
180 GOSUB 900
240 REM ** START GAME **
250 CLS
260 PRINT "THINK OF AN ANIMAL, AND I WILL ~
   TRY TO GUESS IT."
280 PRINT AT 21, 0; "PRESS N/L WHEN READY.
   "
290 PAUSE 3E4
```

```
295 CLS
300 REM ** SET UP ANSWER STRING AND POINTE
    R **
310 LET C$=""
320 FOR Z=1 TO NS
322 GOSUB ASK
324 NEXT Z
328 REM SEARCH FOR MATCH
330 LET K=LEN C$
333 FOR I= NS+1 TO N
337 IF T$(I, TO K) =C$ THEN GOTO 350
340 NEXT I
341 REM NO MATCH FOUND
342 GOTO 450
344 REM MATCH FOUND
350 LET Z=I
352 LET I=N
354 NEXT I
360 GOSUB ASK
362 GOTO 330
365 REM
440 REM
450 REM *GUESSED IT OR GIVE UP*
460 IF A$="Y" THEN PRINT G$
465 IF A$="Y" THEN GOTO 700
467 GOTO MEMCHECK
470 PRINT "I GIVE UP, WHAT IS IT?"
475 INPUT M$
480 IF M$ ="" THEN GOTO 475
482 IF LEN M$>=35 THEN PRINT "TOO LONG. MO
    DIFY NAME"
483 IF LEN M$>=35 THEN GOTO 475
485 PRINT "          ";M$
490 PRINT
495 LET H$=Q$(Z)(7 TO )
497 GOSUB CLEAR SCREEN
500 PRINT "WHAT WOULD BE A GOOD QUESTION T
    O TELL THAT FROM "; H$
520 INPUT N$
521 IF N$="S" THEN GOTO 5010
523 IF N$="" THEN GOTO 520
525 IF LEN N$>45 THEN PRINT "QUESTION IS T
    OO LONG. TRY ANOTHER"
527 IF LEN N$>45 THEN GOTO 520
530 IF N$(LEN N$)< > "?" THEN LET N$=N$+"?
    "
532 GOSUB CLEAR SCREEN
533 PRINT N$
535 PRINT
540 PRINT "WHAT WOULD BE THE ANSWER FOR ";
     M$;"?";" ";
550 GOSUB GET
560 LET R$=INKEY$
565 IF R$< >"S" AND R$< > "Y" AND R$ < > "
    N" THEN GOTO 550
567 IF R$="S" THEN GOTO 5040
570 PRINT ("YES" AND R$="Y")+("NO" AND R$=
    "N")
575 PAUSE 60
580 PRINT
600 REM
610 REM * REPLACE FINAL GUESS WITH NEW QUE
    STION *
625 LET Q$(Z)=N$
650 REM * ADD OLD AND NEW FINAL GUESSES *
655 LET X$=T$(Z)
660 GOSUB TRUNCATE
665 LET T$(N+1)=T$(Z, TO K)+"Y"
670 LET T$(N+2)=T$(Z, TO K)+"N"
675 LET Q$(N+1)="IS IT "+(M$ AND R$="Y")+(
    H$ AND R$="N")+"?"
680 LET Q$(N+2)="IS IT "+(M$ AND R$="N")+(
    H$ AND R$="Y")+"?"
690 LET N=N+2
695 GOSUB CLEAR SCREEN
700 PRINT "WOULD YOU LIKE TO TRY AGAIN?"
710 GOSUB GET
740 LET A$=INKEY$
750 IF A$="Y" THEN GOTO 250
760 IF A$< >"N" THEN GOTO 710
800 CLS
810 PRINT "READY TAPE RECORDER FOR SAVE."
820 PRINT
830 PRINT "PRESS PLAY AND RECORD, AND THEN
     N/L TO SAVE PROGRAM AND DATA."
840 PAUSE 4E4
850 SAVE "GUESS THAT ANIMAL"
860 CLS
870 GOTO 240
900 REM ** INITIALIZE VARIABLES WITH START
    ER DATA **
905 CLEAR
910 DIM T$(101,20)
920 DIM Q$(101,45)
930 LET START=240
940 LET ASK=1350
950 LET TRUNCATE=1510
960 LET CLEAR SCREEN=2000
970 LET MEMCHECK=2510
980 LET GET=3010
1010 LET N=11
1020 LET NS=3
1030 LET T$(1)="S"
1040 LET T$(2)="S"
1050 LET T$(3)="S"
1060 LET T$(4)="NNN"
1070 LET T$(5)="NNY"
1080 LET T$(6)="NYN"
1090 LET T$(7)="NYY"
1100 LET T$(8)="YNN"
1110 LET T$(9)="YNY"
1120 LET T$(10)="YYN"
1130 LET T(11)="YYY"
1140 LET Q$(1)="DOES IT HAVE FOUR FEET?"
1150 LET Q$(2)="IS IT DOMESTIC?"
1160 LET Q$(3)="DOES IT EAT MEAT?"
1170 LET Q$(4)="IS IT A WORM?"
1180 LET Q$(5)="IS IT AN EAGLE?"
1190 LET Q$(6)="IS IT A CHICKEN?"
1200 LET Q$(7)="IS IT A MAN?"
1210 LET Q$(8)="IS IT AN ELEPHANT?"
1220 LET Q$(9)="IS IT A WOLF?"
1230 LET Q$(10)="IS IT A COW?"
1240 LET Q$(11)="IS IT A DOG?"
1250 LET G$="GOOD, I GUESSED IT."
1280 RETURN
1290 REM
1295 REM
1349 REM PRINTS QUESTIONS AND GETS ANSWERS
1350 GOSUB CLEAR SCREEN
1360 PRINT Q$(Z);" ";
1370 GOSUB GET
1410 LET A$=INKEY$
1420 IF A$="Y" OR A$="N" THEN GOTO 1440
1430 GOTO 1370
1440 LET C$=C$+A$
1450 PRINT ("YES" AND A$="Y")+("NO" AND A$=
    "N")
1460 RETURN
1470 REM
1480 REM
1500 REM TRUNCATE (FINDS LAST NONSPACE)
```

```
1510 FOR K=1 TO LEN X$
1520 IF X$(K)=" " THEN GOTO 1540
1530 NEXT K
1540 LET K=K-1
1550 RETURN
1999 REM CLEAR SCREEN WHEN FULL
2000 IF PEEK 16442<=5 THEN CLS
2010 RETURN
2020 REM
2500 REM MEMCHECK
2510 GOSUB CLEAR SCREEN
2520 IF N<=99 THEN GOTO 470
2530 CLS
2540 PRINT "NO ROOM FOR NEW ANIMALS."
2550 PRINT AT 5,10; "MENU"
2560 PRINT AT 10, 0; "1. ERASE CURRENT ANI
    MALS AND START OVER."
2570 PRINT "2. CONTINUE PLAYING WITH CURRE
    NT FILE."
2580 PRINT "3. SAVE CURRENT FILE."
2590 PRINT "4. FINISH."
2600 PRINT AT 21,0; "ENTER OPTION NUMBER."
2610 LET A$=INKEY$
2630 IF A$="1" THEN GOTO 180
2640 IF A$="2" THEN GOTO START
2650 IF A$="3" THEN GOTO 800
2660 IF A$="4" THEN STOP
2670 GOTO 2610
3000 REM WAIT TO GET SINGLE CHARACTER FROM
      KEYBOARD
3010 SLOW
3020 IF INKEY$< >"" THEN GOTO 3020
3030 IF INKEY$ = "" THEN GOTO 3030
3040 FAST
3050 RETURN
3060 REM
3070 REM
5000 REM CORRECTIONS
5010 CLS
5015 PRINT "ENTER NEW ANIMAL."
5020 INPUT M$
5030 GOTO 482
5040 CLS
5042 PRINT "ENTER NEW QUESTION."
5045 FAST
5050 INPUT N$
5060 GOTO 525
```

VIC Kaleidoscope

Alan W. Poole

Try VIC Kaleidoscope. You'll find the colors and music mesmerizing. And you can freeze the display and turn the sound off as you please. For any size VIC.

This program produces an endless display of colorful patterns, along with "music" related to the pattern being drawn. If you see a design that is especially pleasing, press the space bar to freeze the picture. Press the space bar again to restart the kaleidoscope. Press the S key to turn the sound on or off.

Variables

A: Used in the MOD function and used as the address to plot a square

B: Used in the MOD function

C: Color number

CC: Color number for border

I, J: Loop counters

K$: Key pressed

N: Number of function being used to calculate coordinates of points

R: Random number

S: Kaleidoscope stopped flag. 1 = kaleidoscope going, 0 = kaleidoscope stopped

S1: Speaker address

SA: Screen memory starting address

SD: Sound flag. 1 = sound on, 0 = sound off

X, Y: Position to plot a square

```
20 GOSUB5000
97 REM
98 REM *** MAIN LOOP ***
99 REM
100 FORI=0TO999999
110 FORJ=0TO10
120 ONNGOSUB500,550,600,650,700,750
129 REM PLOT POINTS
130 A=SA+22*Y+X:POKEA,160:POKEA+30720,C
140 A=SA+22*(21-Y)+X:POKEA,160:POKEA+30720
    ,C
150 A=SA+22*Y+21-X:POKEA,160:POKEA+30720,C
160 A=SA+22*(21-Y)+21-X:POKEA,160:POKEA+30
    720,C
170 A=SA+22*X+Y:POKEA,160:POKEA+30720,C
180 A=SA+22*X+21-Y:POKEA,160:POKEA+30720,C
190 A=SA+22*(21-X)+Y:POKEA,160:POKEA+30720
    ,C
200 A=SA+22*(21-X)+21-Y:POKEA,160:POKEA+30
    720,C
205 GETK$:IFK$="S"THENSD=1-SD:IFSD=0THENPO
    KEV,0
210 IFSD=0THEN230
220 POKES1,128+(X+Y)*2.8:POKEV,15
230 IFK$=" "THENS=1-S
235 IFS=0THENPOKEV,0:GETK$:GOTO230
239 REM RANDOMLY CHANGE COLOR, FUNCTION, A
    ND BORDER
240 IFRND(1)<.1THENC=INT(RND(1)*8)
270 IFRND(1)<.07THENN=INT(RND(1)*6+1)
275 IFRND(1)<.065THENGOSUB1000
280 NEXT:NEXT:END
497 REM
498 REM *** FUNCTIONS TO CALCULATE POINTS ~
    ***
499 REM
500 B=15:X=FNMOD(ABS(I-SGN(J-6)*(J+2)))
510 B=21:Y=FNMOD(J*J+2*J+7)
520 RETURN
550 B=18:X=FNMOD(I*J)
560 B=12:Y=FNMOD(ABS(ABS(I-ABS(2*I-2*J))))
570 RETURN
600 B=20:X=FNMOD(I)
610 B=20:Y=FNMOD(J)
620 RETURN
650 B=12:X=FNMOD(ABS(Y-J))
660 B=20:Y=FNMOD(ABS(2*J-ABS(I-ABS(2*I-J))
    )+RND(1)*3)
670 RETURN
700 B=16:X=FNMOD(ABS(I-SGN(J-10)*J))
710 B=21:Y=FNMOD(I*J)
720 RETURN
750 B=22:X=FNMOD(ABS(3*J-ABS(2*I-ABS(2*I-J
    ))))
760 B=22:Y=FNMOD(ABS(2*J-ABS(2*X-ABS(2*X-J
    ))))
770 RETURN
997 REM
998 REM *** CHANGE BORDER COLOR ***
999 REM
1000 CC=INT(RND(1)*7)
1010 POKE36879,PEEK(36879)AND248ORCC
1020 POKE646,CC
1029 REM CHANGE 23RD ROW TO MATCH BORDER
1030 PRINT"{HOME}{22 DOWN}";
1040 PRINT"{REV}                    ";
1045 POKESA+505,160:POKESA+31225,CC
1050 RETURN
4997 REM
4998 REM *** INITIALIZATION ***
4999 REM
5000 PRINT"{HOME}{CLEAR}":POKE36879,8
5010 PRINTTAB(5)"{RED}K{CYN}A{PUR}L{GRN}E{
    BLU}I{YEL}D{WHT}O{RED}S{CYN}C{PUR}O{G
    RN}P{BLU}E"
5020 PRINT:PRINT:PRINT"{GRN}PRESS SPACE
    BAR TO FREEZE KALEIDOSCOPE"
5025 PRINT:PRINT"PRESS SPACE BAR AGAIN TO
    CONTINUE"
```

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```
5030 PRINT:PRINT"PRESS S TO TURN OFF   SOUN
    D"
5035 PRINT:PRINT"PRESS S AGAIN TO TURN SOUN
    D BACK ON"
5040 PRINT"{Ø4 DOWN}"
5050 PRINT"{WHT}PRESS RETURN TO BEGIN";
5060 GETK$:R=RND(1):IFK$<>CHR$(13)THEN5060
5070 R=RND(R*1000)
5080 SD=1:S=1:N=INT(RND(1)*5+1):C=INT(RND(1
    )*7+1)
5090 PRINT"{CLEAR}"
5100 SA=4*(PEEK(36866)AND128)+64*(PEEK(3686
    9)AND112)
5110 S1=36876:V=36878
5120 DEFFNMOD(A)=INT((A/B-INT(A/B))*B+.Ø5)*
    SGN(A/B)
5130 RETURN                                  ©
```

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Instant Commodore 64 Art

Bob Urso

Both of these Commodore 64 graphics programs – one random, the other user-controlled – create impressive, handsome designs.

Anyone seeing your 64 while you're running one of these two programs might think that you've just looted the Museum of Modern Art. Each program lets you create colorful and expressive graphics on your Commodore 64.

Program 1 is a totally random graphics routine. Color, direction, and symbol selection are done in lines 30-89. POKEing in the symbol and updating its position for the next cycle are handled by line 90. Lines 95 and 96 limit the design to the screen area.

The time (line 11) is set at 1000 to clear the screen after it fills up a bit. You can increase T to let your design become more complicated; or you can eliminate lines 11 and 99-120, and the graphics will fill your screen until the next power outage.

The second program is called "Sketch-0"; it lets *you* do the designing. You can change the colors by pressing the color keys without having to press CONTROL. The symbol select keys are grouped to the left so that they do not interfere with your direction selection keys.

You can move in eight directions, allowing for diagonal, as well as horizontal and vertical, lines. Once you press a direction key, the design will continue to print in that direction until it reaches the edge of the screen, or until you press any of the other keys to stop it.

It's doubtful that you'll ever make a Rembrandt jealous, but you should be more than rewarded for the short time it takes to type these programs.

Program 1: Random Graphics Routine

```
10 REM RANDOM  DOODLE
11 T=1000
15 PRINT"{CLEAR}"
17 POKE53280,0:POKE53281,0
20 P=1024+INT(RND(1)*999)+1:G=P+54272
30 Z=INT(5*RND(1))+1
40 IFZ=1THENS=81
41 IFZ=2THENS=64
42 IFZ=3THENS=84
43 IFZ=4THENS=102
44 IFZ=5THENS=160
45 K=INT(8*RND(1))+1
50 IFK=1THENC=9
51 IFK=2THENC=1
52 IFK=3THENC=2
53 IFK=4THENC=3
54 IFK=5THENC=4
55 IFK=6THENC=5
56 IFK=7THENC=6
57 IFK=8THENC=7
80 D=INT(8*RND(1))+1
81 IFD=1THENR=-39
82 IFD=2THENR=-40
83 IFD=3THENR=-41
84 IFD=4THENR=-1
85 IFD=5THENR=1
86 IFD=6THENR=39
87 IFD=7THENR=40
88 IFD=8THENR=41
89 M=INT(40*RND(1))+1
90 FORZ=1TOM:POKEP,S:POKEG,C:P=P+R
95 IFP<=1024THENP=P-R
96 IFP>=2023 THEN P=P-R
97 G=P+54272
99 T=T-1
100 IFT=0THENGOTO10
110 PRINT"TIME";T
120 PRINT"{03 UP}"
1101 NEXTZ
1110 GOTO30
```

Program 2: Sketch-0

```
10 REM SKETCH-0
20 P=1524:S=160:C=1
90 POKE53280,0:POKE53281,0
95 GOTO1000
99 PRINT"{CLEAR}"
100 G=P+54272
200 POKE P,S :POKEG,C
300 GET G$:IFA$<>G$ANDG$<>""THENA$=G$
310 IFA$="I"THENP=P-40
320 IFA$="U"THENP=P-41
330 IFA$="O"THENP=P-39
340 IFA$="J"THENP=P-1
```

Four smart ways to make your Atari 400/800, TRS-80 COLOR, VIC-20 and Commodore 64 much more intelligent.

1

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3

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```
350 IFA$="K"THENP=P+1
360 IFA$="N"THENP=P+39
365 IFA$="M"THENP=P+40
370 IFA$=","THENP=P+41
380 IFA$="1"THENC=0
390 IFA$="2"THENC=1
400 IFA$="3"THENC=2
410 IFA$="4"THENC=3
420 IFA$="5"THENC=4
430 IFA$="6"THENC=5
440 IFA$="7"THENC=6
450 IFA$="8"THENC=7
460 IFA$="Q"THENS=81
470 IFA$="A"THENS=64
480 IFA$="Z"THENS=66
490 IFA$="W"THENS=102
500 IFA$="S"THENS=160
510 FORZ=1024TO1984STEP40:IFP=ZTHENP=P+1
530 IFP<1024THENP=P+40
540 IFP>2023THENP=P-40
550 GOTO 100
1000 PRINT"{CLEAR}":PRINT"{02 DOWN}      DOO
    DLE":PRINT"{DOWN}"
1010 PRINT"HERE ARE THE SYMBOLS YOU CAN PRI
    NT"
1020 PRINT"    PRESS Q FOR Q"
1021 PRINT"    PRESS A FOR C"
1022 PRINT"    PRESS Z FOR B"
1023 PRINT"    PRESS W FOR &"
1024 PRINT"    PRESS S FOR {REV} {OFF}"
1030 PRINT"{GRN}TO CHANGE COLORS PRESS 1 TH
    RU 8"
1040 PRINT"FOR THE COLOR INDICATED ON THE K
    EY":PRINT"{DOWN}"
1070 PRINT"TO MOVE YOUR SYMBOL PRESS"
1080 PRINT"          U   I   O"
1090 PRINT"           M  ↑  N"
1100 PRINT"          J← Q  @K"
1110 PRINT"           N  B  M"
1120 PRINT"          N   M   ,"
1130 PRINT"{PUR}TO STOP SYMBOL PRESS ANY CO
    LOR KEY"
1150 PRINT"FINISHED WITH INSTRUCTIONS? PRES
    S Y"
1160 INPUTR$:IF R$="Y" GOTO 99
```

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Graphics On The Sinclair/Timex

Derek Stubbs

This short guide to the graphics capabilities of Sinclair/Timex computers demonstrates pattern creation, circles, conic sections, and bar graphs. To show how graphics can be used in games, there is "Asterbelt," which will test your abilities as a spaceship pilot.

One great advantage of a computer over most calculators is that a computer can handle letters as well as numbers and can give a graphic output. You possibly bought your ZX/TS hoping to produce some fabulous graphics. If you did, you were soon disappointed by two things: the manual says little about graphics, and computer magazines often contain programs with graphics commands that you cannot use, such as HPLOT, SET, RESET, DRAW, and XDRAW.

Don't be worried. The ZX/TS has lots of graphics capability. My favorite is the unique graphic symbol facility. It can print a million-million different patterns. They each remind you of an Indian blanket, or an urban landscape, or the tiles in an oriental design. Sometimes a striking 3-D pattern emerges.

Program 1 generates a random string of graphic symbols (lines 10-40) and then prints and reprints them until the screen is full (lines 50-110). After a pause of four seconds (line 200), a new pattern is generated. Experiment by reducing the string-length of 11 in lines 10, 20, and 60.

Figures And Graphs

To many people, graphics means geometric figures. A simple program (Program 2A) will draw a circle of radius R and center X,Y. The speed of plotting and the interval between points depend on I. You should experiment with values of R, X, Y, and I before going on to a more fascinating plot (Program 2B). Start with R = X = Y = 15 and I = .2.

Now you will see how Program 2B – which I call "Figures" – will print all kinds of conic sections (circles, ellipses, parabolas, and hyperbolas) and all kinds of lissajous figures (weaves, pretzels, and figures of eight). The interesting thing is that Program 2B is only one line longer than Program 2A – yet it is far more versatile.

A third graphics feature that has many uses is a simple graphic plot of data. Program 3, "Graphs," will plot any mathematical function that you input, as A$. It always fits on the screen because you define the limits, XMIN and XMAX.

If you need to plot a bar graph, Program 4 will be adequate. Typically, such a graph is used to plot "time-data" such as "sales per month" or "bushels of corn per year." Also you might use it for "frequency" data like "how many people weighing 50-100 lbs., 100-150 lbs. and so on." Program 4 allows you to plot and label the axes and bars so that you can understand how to mix the PRINT and PLOT commands to get a good screen. Instead of printing I in line 170, you can print another label such as the time or interval concerned; call it C$ and INPUT it at line 135.

The ultimate graphics program is the moving graphics game. You'll have fun with Asterbelt (Program 5). You're the captain of a spaceship denoted by an asterisk at coordinates X, Y. You can drive it to port or starboard by pressing P or S. A thousand asteroids appear as blobs (subroutine 1000). If you collide with an asteroid, a flash occurs as you destroy it with your hyperspace shields; and you move on through the exploded remnants (subroutine 2000).

You can make it harder by having only two squares between you and the next asteroid to appear. You can adapt subroutine 2000 to keep a count of your collisions. Warning: in the non-play mode, the screen clears very slowly.

Program 1: Random Symbols

```
1 REM ***A MILLION-MILLION PATTERNS
10 DIM G(11)
20 FOR I=1 TO 11
30 LET G(I)=128+INT(RND*12)
40 NEXT I
50 LET C=0
60 FOR I=1 TO 11
70 PRINT CHR$ G(I)
80 NEXT I
90 LET C=C+1
```

```
100 IF C>60 THEN GOTO 200
110 GOTO 60
200 PAUSE 240
210 CLS
220 GOTO 20
```

Program 2A: Circle

```
1 REM***CIRCLE***
10 INPUT R
20 INPUT X
30 INPUT Y
40 INPUT I
50 LET T=0
60 PLOT X+R*COST,Y+R*SINT
70 LET T=T+1
80 IF T>2*PI THEN STOP
90 GOTO 60
```

Program 2B: Figures

```
1 REM *** FIGURES***
10 DIM A(4)
20 FOR I=1 TO 4
30 LET A(I)=25*RND
40 NEXT I
50 FOR N=0 TO 100
60 PLOT A(1)-A(1)*COS(N/A(2)),A(3)-A(3)
   *SIN(N/A(4))
70 NEXT N
80 PAUSE 240
90 CLS
100 GOTO 10
```

Program 3: Graphs

```
1 REM***GRAPHS***
10 INPUT XMIN
20 INPUT XMAX
30 INPUT A$
40 LET X=XMIN
50 LET YMIN=VAL A$
60 LET X=XMAX
70 LET YMAX=VAL A$
80 IF YMAX<YMIN THEN GOSUB 5000
90 LET XL=XMAX - XMIN
100 LET YL=YMAX - YMIN
110 GOSUB 1000
120 GOSUB 2000
130 STOP
1000 FOR I=0 TO 63
1010 PLOT I,0
1020 NEXT I
1030 FOR I=0 TO 43
1040 PLOT 0,I
1050 NEXT I
1060 RETURN
2000 FOR X=XMIN TO XMAX STEP XL/63
2010 LET Y=VAL A$
2020 PLOT (X-XMIN)*63/XL,(Y-YMIN)*43/YL
2030 NEXT X
2040 RETURN
5000 LET U=YMIN
5010 LET V=YMAX
5020 LET YMAX=U
5030 LET YMIN=V
5040 RETURN
```

Program 4: Bar Graphs

```
1 REM***BAR GRAPHS***
10 PRINT "NUMBER OF BARS (<=20)?"
20 INPUT B
30 PRINT "HEIGHT OF TALLEST BAR?"
40 INPUT HMAX
50 PRINT "LABEL ON X-AXIS?"
60 INPUT A$
70 PRINT "LABEL ON Y-AXIS?"
80 INPUT B$
100 CLS
110 GOSUB 1000
120 FOR I=1 TO B
130 INPUT H
140 FOR J=2 TO 43*H/HMAX
150 PLOT (I*63/J),J
160 NEXT J
170 PRINT AT 21,31*I/B;I
180 NEXT I
190 STOP
1000 FOR I=0 TO 63
1010 PLOT I,2
1020 NEXT I
1030 PRINT AT 21,(31-LEN A$);A$
1040 FOR I=2 TO 43
1050 PLOT 0,I
1060 NEXT I
```

Program 5: Asterbelt

```
1 REM***ASTER-BELT***
10 DIM A(1000)
20 LET X=9
30 LET Y=6
40 GOSUB 1000
50 LET A(1)=J
60 GOSUB 1000
70 LET A(2)=J
80 FOR N=4 TO 1000
90 PRINT AT X<Y;"*"
100 IF Y=A(N-3) THEN GOSUB 2000
110 GOSUB 1000
120 LET A(N)=J
130 IF INKEY$="P" THEN LET Y=Y-1
140 IF INKEY$="S" THEN LET Y=Y+1
150 NEXT N
1000 LET J=INT(30*RND)
1010 PRINT AT 12,J;" "
1020 SCROLL
1030 RETURN
2000 FAST
2010 FOR M=1 TO 15
2020 LET R=3*RND
2030 LET T=2*PI*RND
2040 PRINT AT X+R*COST,Y+R*SINT;"."
2050 NEXT M
2060 SLOW
2070 RETURN
```

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Part I

NUMERIC OUTPUT

Outputting strings from machine language is no problem. The programmer takes the characters from memory and sends them out. Numbers need more work: the binary values must be changed to ASCII characters which must be sent out one at a time.

An added complexity is format: numbers often need to be carefully formed into a specific number of characters, so that they will print neatly in columns. Zero suppression is often desirable, so that a number such as 00204 will print as 204. Some of these jobs are fairly straightforward mechanical tasks; the hardest part is often the math routine which is needed to break up a binary number into several digits.

Single Digits

Binary values of zero to nine are easy. All we need to do is to change them to ASCII before sending them out.

We've mentioned before that ASCII represents the character zero, for example, as hexadecimal 30, decimal 48. PRINT CHR$(0) will not print a zero character – indeed, it won't print anything – so that we must do the job with PRINT CHR$(48). So, to print a binary zero, we must change it to hex 30, binary one must be changed to hex 31, and so forth, up to binary 9 changing to hex 39. Binary 10 is a different matter: we must make two digits out of it, one and zero. The easiest way to convert a single digit is with an ORA command: ORA #$30 will insert the desired high bits.

When we move on to more complex numbers, we'll need to remember that each digit, as we generate it, must be converted to ASCII before output.

Let's write a simple program to print several single numeric digits. We'll use $FFD2 for PRINT; this will work on all PET/CBM machines, VIC, and Commodore 64. Our coding goes:

```
      LDX  #$00    (start at zero)
LOOP  TXA          (move number to A)
      ORA  #$30    (convert to ASCII)
      JSR  $FFD2   (print it)
      INX          (go to next number)
      CPX  #$0A    (less than ten?)
      BCC  LOOP    (yes, print it)
      RTS
```

The output looks like a large number – the digits are printed side by side – but, in fact, it's ten independent digits.

As an exercise, let's convert the above program to BASIC POKEs and run it. Our BASIC equivalent goes:

```
100 DATA 162, 0,   138,   9,48
110 DATA 32,210,255,   232,   224,10
120 DATA 144,245,   96
200 FOR J=848 TO 861:READ X
210 POKE J,X:NEXT J
300 FOR J=1 TO 10:SYS 848:NEXT J
```

The first three lines give the machine language program in decimal. The individual instructions have been separated by spaces to make them more visible. Lines 200 and 210 POKE the program into the cassette area. Finally, line 300 invokes the machine language program ten times; you'll get a hundred digits printed.

Hexadecimal Output

Hex output, like input, is fairly easy. Hexadecimal might be viewed as a compact way of representing binary, and since the computer has binary, the conversion must be easy. It is. All we need to do is grab four bits at a time. Each group of four bits is a hex digit value, which can be converted to ASCII and then output. For example, a decimal value of 225 (hex E1) can be converted this way: take the high four bits, binary 1110, and convert and print as a hex character. That works out to a letter E. Now take the low four bits, binary 0001, and do the same, giving us the digit 1. We've printed E1, the hex value.

Let's get technical. How do we get the four high bits? By giving four shift-right instructions. The bits obligingly move over to the low order side, and zeros are left in the vacated space. Later, how do we get the four low bits? By taking the original value and performing an AND #$0F, which wipes out the high bits.

When the four-bit group is extracted, how do

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we change to ASCII? If the four-bit value is zero to nine, we can use the simple ORA #$30 as mentioned before. For the six high values, ten to fifteen (A to F), we would need to use arithmetic, usually the ADC command. Of course, we could bypass the whole question by setting up a table of digits and looking up each digit. Most programmers go for the arithmetic.

Multiple bytes are no problem for hex. We just convert them starting at the high order end: each byte generates two hex digits. Let's write a program to convert some memory bytes into hex and display them. First, a subroutine to convert and output a four-bit value in the A register as two hex digits:

```
HEXDIG CMP  #$0A     (alphabetic digit?)
       BCC  SKIP     (no, skip next part)
       ADC  #$06     (add seven)
  SKIP ADC  #$30     (convert to ASCII)
       JMP  $FFD2    (print it)
```

There are a couple of curious coding quirks above. We need to add seven to the alphabetics: why does the coding say ADC #$06? Because the carry bit is set, that's why. Adding six plus a carry makes a total increase of seven. Another oddity: the subroutine doesn't return with RTS. Instead, it goes to another subroutine; when the other subroutine (FFD2) returns, it will return directly to the caller.

Now an outer subroutine. This one breaks a byte in the A register into two four-bit numbers and prints the two digits. It uses HEXDIG, above:

```
HEXOUT PHA          (save the byte)
       LSR  A
       LSR  A       (extract four..)
       LSR  A       (.. high bits)
       LSR  A
       JSR  HEXDIG  (print hex char)
       PLA          (bring back byte)
       AND  #$0F    (extract low four)
       JMP  HEXDIG  (restore ASCII)
```

Again, we save an RTS by doing a JMP direct to a subroutine.

Now we can do the main job: displaying a number of memory locations:

```
   JOB LDX  #$00     (counter)
 JLOOP LDA  $FFC0,X  (get a byte)
       JSR  HEXOUT   (print it)
       LDA  #$20     (space char)
       JSR  $FFD2    (print it)
       INX
       CPX  #$0A     (ten bytes yet?)
       BCC  JLOOP    (no, do another)
       LDA  #$0D     (RETURN char)
       JMP  $FFD2    (print it)
```

We've written the program to display a specific range of addresses. You may change it to display what you wish.

The four LSR instructions may be considered the equivalent of dividing by 16. That's what the word "hexadecimal" means, of course: hex for six and decimal for ten, giving a total of 16.

Sneaky Hex

You may have decided that hexadecimal output is quite easy. It is, compared to decimal, and that gives us an interesting possibility.

Could we write hex numbers that looked like decimal numbers? In other words, could we print decimal 22 by somehow converting it to look like hex 22, and then printing it? It sounds complex: decimal 22 would be written as hex 16, and hex 22 has a decimal value of 34. Not much in common there. But there's a gimmick.

The 6502 processor has an arithmetic feature called "decimal mode." When we invoke it (with the SED, Set Decimal, command), decimal arithmetic takes place using numbers that look like hex. In other words, the decimal value of 22 is stored as hex 22. The proper name for this kind of number is not hexadecimal, of course. This numbering system is called "binary coded decimal."

We can't go into the inner mysteries of BCD at this time, but a few facts can be noted. Decimal mode affects only the ADC (add with carry) and SBC (subtract) instructions; all other instructions still deal with binary numbers. If you're going to play with decimal mode, kill the interrupt for the moment; your interrupt routines may not be able to cope with "new math." And remember to put everything back (clear decimal mode, restore the interrupt) when you've finished doing the task at hand.

Decimal mode arithmetic is great for things like keeping score in video games. The scores can be easily translated and delivered to the screen. But decimal mode is not too good for serious mathematics: multiplication, division, square roots and such become much harder to handle. For most applications, stick with binary.

We'll be talking about how to convert binary numbers to decimal in the next session. ©

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PET/CBM POP

Michael W. Schaffer

You can avoid stacking up too many subroutines by using POP to cancel a GOSUB (command that sends control to a subroutine at a given line number and then RETURNs to the statement after GOSUB). A programming tool for all PET/CBM computers.

Atari BASIC and the Microsoft BASIC used on the Apple II provide a rather useful command called POP. The POP command removes the last GOSUB from the stack, so that a RETURN will return the program to the second-to-last GOSUB. For example, in this program:

```
10 GOSUB100
20 PRINT "CONTROL RETURNS HERE."
30 STOP
100 GOSUB200
110 PRINT"NOT HERE."
120 STOP
200 POP
210 PRINT "GOING"
220 RETURN
```

the RETURN on line 220 returns the program to line 20 (not 110). This utility can be very useful, but it is not available in Commodore BASIC. Well, it wasn't.

Here is a machine language utility that executes a POP on all PET/CBM models. The code is position independent – in other words, it can be moved to any convenient spot in memory without any changes. I prefer to locate the code at the top of memory. A POKE 53,127:POKE 52,0:CLR (for 32K systems) will prevent BASIC from using this space.

Program 1 provides the machine language routine in the form of a BASIC loader. The program will load and protect the POP routine, and then indicate the proper SYS location to call the routine. Programs 2 and 3 provide changes for older ROMs.

A GOSUB in BASIC pushes five bytes onto the system stack. These bytes tell BASIC where to start running when the RETURN statement is executed. These five bytes are the low and high bytes of the CHRGET pointer (locations 119 and 120 for newer ROMs, 221 and 222 for Original ROMs) and the current line number (locations 54 and 55 for newer ROMs, 136 and 137 for Original ROMs), and the token for GOSUB (141). To perform a POP, all we do is remove these five bytes from the stack. The routine uses the same subroutine that BASIC uses (JSR $B322 for BASIC 4.0, JSR $C2AA for Upgrade BASIC, JSR $C2AC for Original BASIC) to search the stack for the GOSUB token. The subroutine loads the accumulator with the token found at the top of the stack. We compare it to 141 to see if we have located a GOSUB. If a GOSUB is not found, then an error is returned. The error message sent is "?without gosub error in xxxx". Notice that the standard BASIC error routine is used, so program and variable integrity are assured. The five PLAs simulate the action of a RETURN without really doing anything.

This utility is especially useful in highly "modular" programs. An error handling subroutine can easily remove "pending" GOSUBs from the stack to prevent them from building up (and resulting in an "?out of memory error").

To use this POP in the preceding program, change the POP in line 200 to a SYS 32512, or whatever SYS location the loader indicates should be used. The program does not change in any other way.

Program 1: BASIC 4.0 Version

```
10 POKE53,PEEK(53)-1:POKE 52,0:CLR
20 SADR=PEEK(52)+PEEK(53)*256
30 FOR ADDR=SADR TO SADR+22
40 READ DTTA:POKE ADDR,DTTA:NEXT ADDR
50 PRINT"USE SYS ";SADR
60 END
70 DATA 169,255,133,71,32,34,179,201
80 DATA 141,240,5,162,29,76,207,179
90 DATA 154,104,104,104,104,104,96
```

Program 2: Make These Changes For Upgrade BASIC

```
70 DATA 169,255,133,71,32,170,194,201
80 DATA 141,240,5,162,29,76,87,195
```

Program 3: Make These Changes For Original BASIC

```
70 DATA 169,255,133,71,32,172,194,201
80 DATA 141,240,5,162,29,76,89,195
```

Bootmaker For VIC, PET, And 64

M. G. Ryschkewitsch

Here's a good, short boot routine that's going to simplify your programming efforts. This general technique can be applied to many different boots (programs that load other programs). A timesaver for any Commodore computer.

How many times have you turned on your computer and wished that you didn't have to go through the tedium of loading utility programs or remembering where to PEEK, POKE, or SYS to link them in?

I'd like to describe a booting system which uses the "dynamic keyboard" technique and a modified version of the "Universal Wedge."

This particular boot can be used to simplify setting up your computer for the graphing utility which follows, but the general technique is simple and useful for a wide variety of boots. A similar technique can be used, for example, to ask a user questions in order to initialize a printer prior to loading a word processing program. If your PET has BASIC 4.0 and you put your boot on a diskette as the first program, the process is particularly simple. Press SHIFT/RUN, and the hard part is done by the computer.

The Dynamic Keyboard Technique

The dynamic keyboard technique involves fooling the computer into thinking the user is entering data from the keyboard. This is particularly easy with the PET. It involves printing messages on the screen and POKEing two locations in PET memory, the keyboard buffer at decimal addresses 623-632 and location 158, which normally contains the current number of characters in the buffer.

Your BASIC program must print all the entries you'd normally make on the screen in the proper locations (to leave room for the normal PET messages such as LOADING, etc.) and then return the cursor to the home position. If you then POKE the number of carriage returns (character 13) that you'd normally enter beginning with location 623 and that number also into location 158, here's what happens.

After the PET finishes executing your boot, it will wake up with the cursor in the home position and believe you've pushed the RETURN key a number of times. The first RETURN will cause it to execute the line that the cursor is on, and, after printing any appropriate messages, it will execute as many subsequent lines as there are RETURNS in the buffer. The only catch is that each line that you want it to execute *must* be in the right place or you will get no response or a SYNTAX ERROR. Study the example in Program 1 to see exactly what is necessary.

Note that Program 1 is merely an example of setting up a boot program using the dynamic keyboard technique. If the files INVISIBLE WEDGE, PRINTER, and WORD PROC existed on a disk, the program would first enable the use of the Invisible Wedge utility as described below. It would then load and execute a printer setup routine called PRINTER. Finally, it would load and run a word processing program with the file name WORD PROC.

Sleight Of Hand

There is a hitch to this procedure if you want to use the Universal Wedge. That program clears the screen and prints a message when it's executed, wiping out your carefully laid out screen. The part of the Wedge that prints the message is fortunately in BASIC, but it requires a bit of sleight of hand to modify since the BASIC line editor will change the machine code that does the work unless you protect it.

If you load the Universal Wedge without running it and use the Monitor (SYS 54386 for 4.0), you will find what looks like a BASIC program from locations hexadecimal $0400 to $0496, terminated by the usual set of triple double zeros. Starting at $0500 and $0700, there are two blocks

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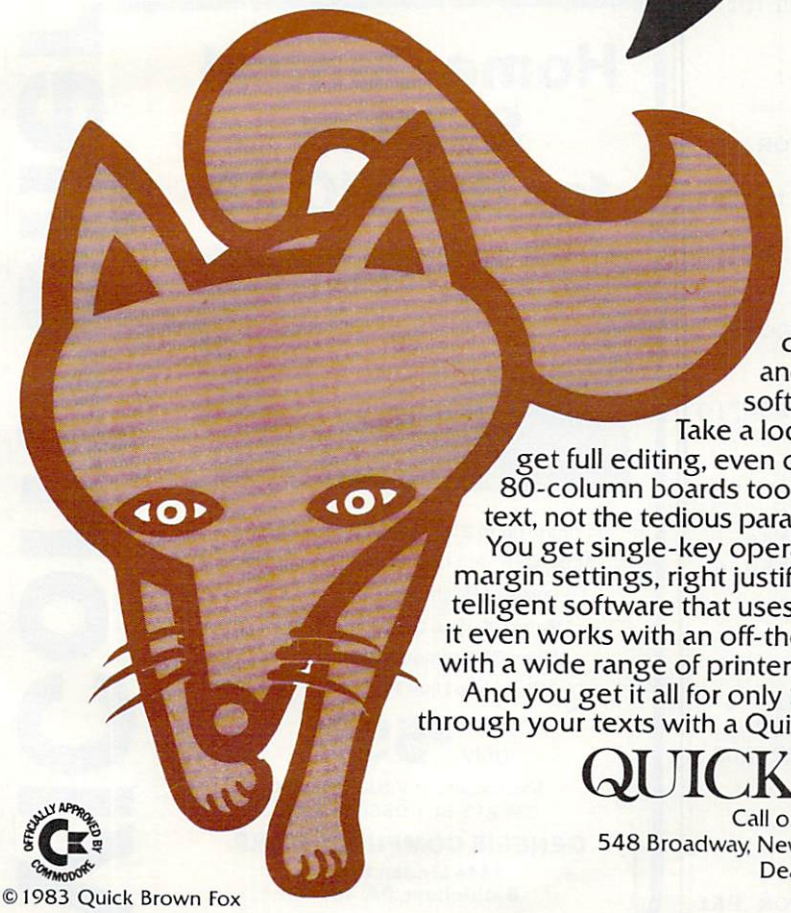

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of machine code that do the actual work. If you also PEEK at the contents of decimal 42 and 43 (which store the location of the end of the BASIC text and the start of variable storage), you will find that they point to a location at the end of the second block of machine code ($B8 and $08).

Now POKE42,131 and POKE43,4 and type CLR. This tells the editor that BASIC really doesn't include the two blocks of machine code. You can then change the BASIC program as long as you don't increase it by more than 106 characters. Try to use less than this just to be safe. In Program 2, two UP CURSORs replace the CLEAR/HOME and all the CURSOR DOWNs in the original.

You can now use the Monitor to save everything up to the address hexadecimal $08B8. And from now on you can load this version of the Wedge just as you would load the original.

This same technique is equally applicable to the VIC-20 and Commodore 64 (see Program 3). For both these machines, the keyboard buffer is located in memory locations 631-640 decimal, and the number of characters in the buffer is contained in location 198 decimal. The VIC's narrow screen width must be taken into account when formatting the program. Some of the messages may run over onto a second line.

A small investment in bootmaking now can pay big dividends later by causing fewer errors, saving time and making the computer easier for others to use.

Program 1: Sample Boot Program

```
100 QO$=CHR$(34): REM DEFINE QUOTE FOR PRI
    NTING
110 REM PRINT ENTRIES TO THE SCREEN IN PRO
    PER SPOTS
120 PRINT"{CLEAR}{03 DOWN}LOAD";QO$;"INVIS
    IBLE WEDGE";QO$;",8"
130 PRINT"{04 DOWN}RUN"
140 PRINT"{DOWN}LOAD";QO$;"PRINTER";QO$;",
    8"
150 PRINT"{04 DOWN}RUN"
160 PRINT"{02 DOWN}LOAD";QO$;"WORD PROC";Q
    O$;",8"
170 PRINT"{04 DOWN}RUN{HOME}"
180 REM POKE SIX RETURNS INTO KEYBOARD BUF
    FER
190 REM POKE # OF RETURNS INTO LOC. 158
200 FORI=1TO6:POKE622+I,13:NEXT:POKE158,6
```

Program 2: Invisible Wedge

```
5 A=12*16^3:REM $C000
10 IFPEEK(A)<>76THEN SYS1639:REM BASIC 2
15 IFPEEK(A)=76 THEN SYS2151:REM BASIC 4
20 PRINT"{02 UP}UNIVERSAL DOS SUPPORT LOA
    DED"
25 NEW



100 QO$=CHR$(34): REM DEFINE QUOTE FOR PRI
    NTING
110 REM PRINT ENTRIES TO THE SCREEN IN PRO
    PER SPOTS
120 PRINT"{CLEAR}{03 DOWN}LOAD";QO$;"PRINT
    ER";QO$;",8"
130 PRINT"{04 DOWN}RUN"
140 PRINT"{02 DOWN}LOAD";QO$;"WORD PROC";Q
    O$;",8"
150 PRINT"{05 DOWN}RUN{HOME}"
160 REM POKE FOUR RETURNS TO KEYBOARD BUFF
    ER
170 REM POKE # OF RETURNS TO LOC. 198
180 FORI=1TO4:POKE630+I,13:NEXT:POKE198,4
```

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Basic Atari BASIC Sorts

E. P. McMahon

Choosing a sort routine that eliminates unnecessary searches can save you time. Four sorting methods are examined in terms of their speed, and there are some hints on making sorts work faster.

Sorts – many programmers ignore them, many don't understand them, and most misuse them.

Let's look at the *insertion* sort, the *selection* sort, and the *bubble* sort. (The widely used bubble sort is about the most inefficient sort routine around.)

Why is it so widely used? Maybe because it's so simple: go through the list to be sorted and examine items, an adjacent pair at a time. If any pair is not in the correct order, swap the pair. Continue to the end of the list. If a swap was performed, repeat the above steps; if not, the sort is finished. This sounds more simple and direct than it may be.

Some Terms Defined

A *file* contains *records* (or *items*) which are to be sorted according to the *keys* which are a part, or all of, each record. (The last name in a file of names and addresses is a key for alphabetizing the list.) We will assume *sorted* means "placed in the order of ascending or descending value of the keys." Another way to sort is to build an auxiliary file of pointers which identify the records in the desired order – a good approach for large disk files.

One more definition: a *stable* sort does not disturb the results of a previous sort when the sort keys are equal. For example, you sort a file of records consisting of names and addresses alphabetically by first name (key = first name). You then sort the file by last name. If the sort is stable, when you have finished the second sort John Doe will follow Jane Doe and precede Joseph Doe; if not, the order of the Does will be arbitrary.

Multiple passes through a stable sort (in reverse order of importance of the keys) will accomplish the same thing as a *sort on multiple keys*. Simply said, a sort on multiple keys checks the second key any time the first keys of two records being compared are equal. This is how to convert any of the following single key sorts into a multiple key sort.

Let's discuss the program listings now so you can refer to them as you read the rest of this article.

Bubble Sort

The first program is a bubble sort written in Atari BASIC. I'll review this listing since some of the REMark lines will apply to the other programs, and sections of the code will be identical in the other programs.

The file to be sorted is in string S$ and consists of N records each of length LREC. We will sort this file *in place* according to the key which is part of the record. The key starts at KB and ends at KF characters offset from the beginning of each record.

Lines in the 100's initialize; line 200 sets the clock to zero. Lines in the 1000's and 1100's are the sorts. Line 1500 reads and prints the clock; and the subroutine in the 2000's generates a random file to be sorted (each record consists of two random letters and a blank).

Let's look at the bubble sort. Why is it so weak? Primarily because many redundant comparisons are made, but also because records being moved are put down and picked up at each step. There really are better ways to sort which are just as easy.

The bubble sort (Program 1) uses one trick to make the "standard" bubble sort a little faster. Each pass through the file moves the largest remaining out-of-place record to its correct position. Also, we might be lucky and find some records already sorted. Remember that we use a flag to signal if another pass through the file is necessary. The trick is to use that flag to identify the location of the last swap made (line 1040). We never need examine past that point again; so, as shown in the program, FLAG and TOP limit the search. The bubble still isn't good enough.

Insertion Sort

I'll use a card player sorting a hand of 13 cards to help you visualize what's going on in each sort.

Our right-handed card player does the insertion sort by holding the first dealt card in the left hand and the other 12 cards in the right. Notice that the first card is already "inserted" in the sorted file in the left hand. He or she examines the next card to be sorted, initially card number

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two, and compares it to the cards in the left hand, initially just the first card. If card two is bigger, it remains card two as it is placed in the left hand; if smaller, card one is shifted to become card two, and card two from the right hand becomes card one in the left.

Each step, then, compares the next card to be inserted (from the right hand) with the last card in the left hand. If the new card is larger, it becomes the last card; if not, the old card in the left hand is moved one space lower, and the new card is compared with the next old card in line. This last step is repeated until the new card is inserted.

Now what is the worst case for this sort? A file that must be inverted. Each card must be compared with every card in the left hand, and every card in the left hand must be moved in each step. Best case? When the file is in order except for a new entry at the end (new last card).

Some people defend using the bubble sort when it's used to add a record to an already sorted file, but the insertion sort is faster at this, too. Just put the new record at the end of the file (new record number N) and change the loop indices (line 1000) to "FOR J = N TO N" and less than one pass through the sort will correctly place the new record.

Program 2 is an insertion sort written in Atari BASIC. Lines 1000-1100 are the sort itself; the rest of the lines follow the same convention described for the bubble sort.

Selection Sort

The selection sort is just as easy. This time, the card player holds all the cards in the right hand and scans from left to right for the smallest. The smallest card is extracted, placed in the left hand as card one, and the cards in the right hand are shifted to the right to fill the gap caused by the extracted card. The cards in the right hand are now numbered two to thirteen. The process repeats: scan the cards in the right hand, extract the smallest, and add it at the end of the cards in the left hand. Shift cards in the right hand to the right to remove the gap. When only one card remains in the right hand, it is the largest, and the sort is finished.

The worst case for this sort is also a file that must be inverted. Each card that is selected is the last one in the set of unsorted cards.

Let's look at the differences in these algorithms. In the insertion sort, we examined a *sorted* sub-list and insert a new record; in the selection sort, we examine an *unsorted* sub-list and select a new record. Suppose you are interested in the first ten items in a 100-item file. Which routine would you use? The selection sort of course, stopping after the tenth item is found.

If you implement the selection algorithm exactly as stated above to sort string variables, you'll find that shifting the "cards" in the right hand to remove the gap is inconvenient. (Try shifting a string of, say, ten characters five spaces to the right. If you don't know what will happen, try A$(6,16) = A$(1,10) and see what the result is.)

A Couple Of Tricks

Atari BASIC loves to shift strings to the left, so we'll modify the sort algorithm to take advantage of this. All we do is hold the unsorted cards in the left hand and put the extracted cards in the right hand. The gap is removed by shifting cards in the left hand to the left. Take a look at Program 3, a modified selection sort. There are a couple of tricks there. The variable TAIL defined in line 1000 locates the last record in the file S$. This location is the spot in our right hand where the selected card (record) will be placed.

The second trick is using the variable LAST to remember information from the last examination pass through the left hand. It is set to the next-to-the-smallest item in the list, so it has a head start on our next examination search. It is easy to save this information during the search.

Note that we save time on every other search (unless there are ties – then we save more) because we have to reset the flag in case we do not hit a swap. Line 1090 extracts the selected record, line 1100 moves the entire right side of the file one record to the left in one fell swoop, and the selected record is put at the tail. Lines 1140 to 1160 put the last record in its place at the end.

What would the bubble sort look like to our card player? He would examine cards one and two, and swap them if necessary. He would then compare cards two and three, swapping if needed. The process continues with cards three and four, four and five, and so on, to 12 and 13. Finished? Not yet. If any pair of cards were swapped, the process is repeated from the start. Have you ever sorted cards this way? Would you?

Modified Insertion Sort

The string-moving trick in the selection sort suggested that the same trick could be applied to the insertion sort. This results in the modified insertion sort (Program 4), where the sorted file is on the right of the string and the unsorted part of the file is on the left. The first record is always the record to be inserted, and when the insertion spot is found, the string up to the insertion spot is shifted to the right, over the first record.

This is a fast program; unfortunately, it is no longer as stable as the first three programs. It can be made stable by adding an artificial record to the file which is guaranteed to be the last record for any search key (no ties), since the instability

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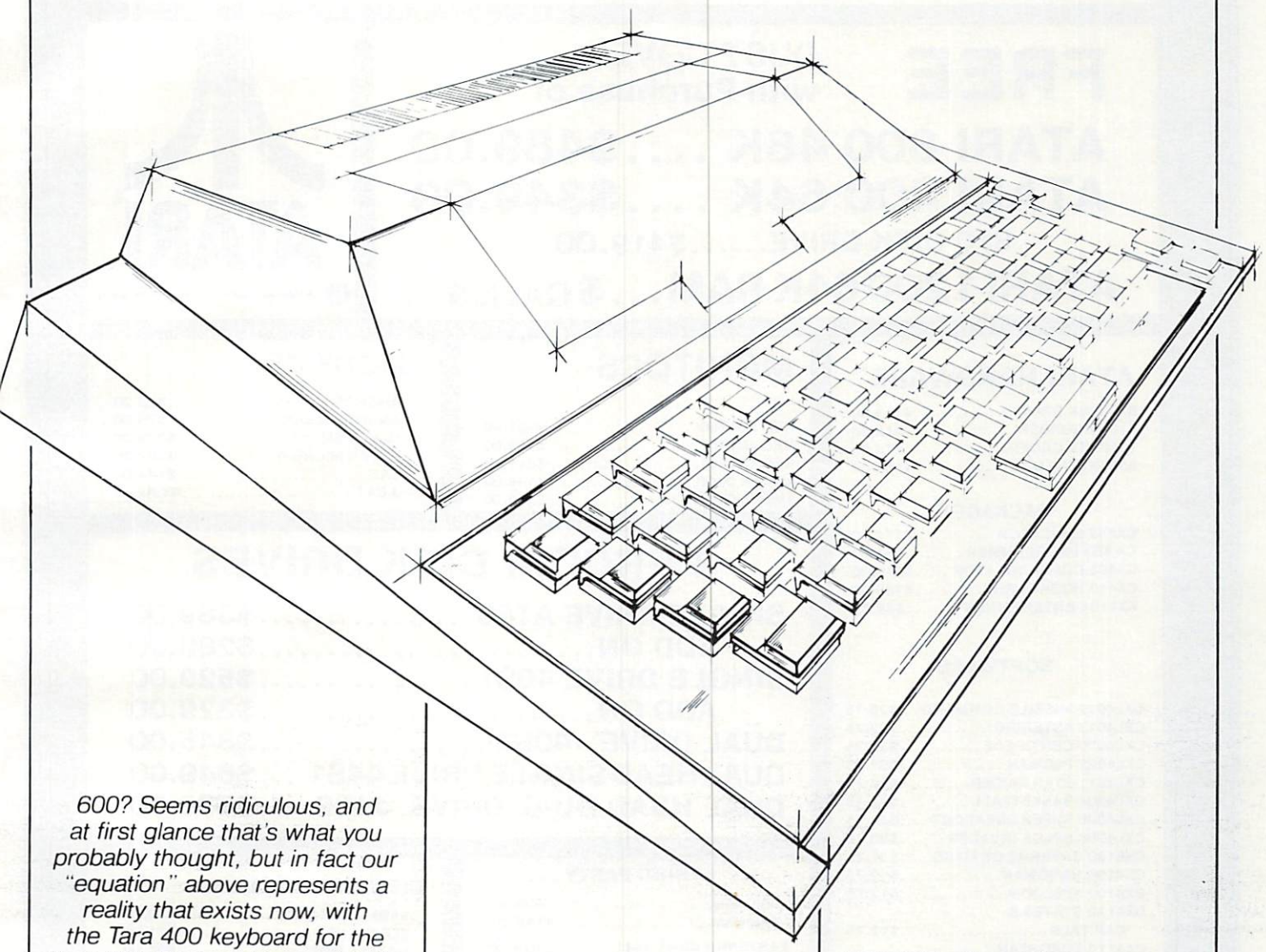

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occurs only with the last record in the file. To examine the stability of these sorts, sort first with both keys (KB and KF) equal to two, and then sort with both equal to one.

There is another way to make the modified insertion sort stable, and that is to pick the record to be inserted from the end of the unsorted part of the list (record J instead of record 1) and remove the equal sign from the sort test in line 1020. This results in a slower program than the modified insertion sort shown.

Powering Up

A short set of runs of the four programs (with no PRINT statements and with N=50) gave average times of 80.8 seconds for the bubble, 48 for the insertion, 34 for modified selection, and 23.3 for modified insertion. The programs can be powered, made faster. One easy way is to precompute the constant part of the test in each sort statement. In the insertion sort, for instance, add line 1015 HOLD$=S$((J-1)*LREC+KB, (J-1)*LREC+KF) and substitute HOLD$ for the right side of the test in line 1020.

If the above descriptions of the sort algorithms aren't clear to you, try sorting a hand of cards according to the rules. Then execute the programs as listed. If it will help, print out the loop indices at each step to see what's going on and how the tricks work to save a few searches here and there. If you're going to use these routines in another program, take out the REMs and print statements for more speed. Better yet, code the sort you need in machine language.

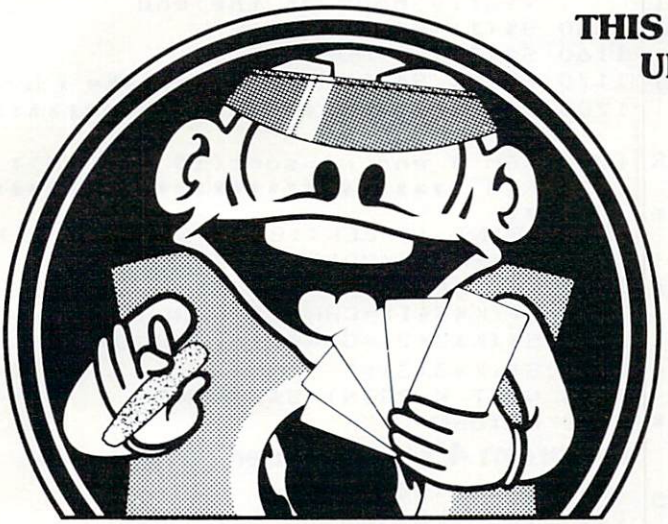
There are more efficient (and more complex) sorts: Shell's sort, Quicksort, and Heapsort, for examples. A quite complete study and reference on sorting (and searching) is the third volume of Donald E. Knuth's *The Art of Computer Programming* (Addison-Wesley, Reading, Mass., 1973).

Program 1: Bubble Sort

```
100 DIM S$(200):REM the file
110 DIM HOLD$(3):REM temporary space
    to move a record
120 LREC=3:KB=1:KF=2:REM record leng
    th, begining and end of KEYfield
130 N=13:REM number of records
140 GOSUB 2000:REM generate random f
    ile
200 POKE 20,0:POKE 18,0:POKE 19,0:PO
    KE 20,0:REM start clock at zero
990 REM ******************************
    **
991 REM *{28 SPACES}*
992 REM * bubble sort{16 SPACES}*
993 REM *{28 SPACES}*
994 REM ******************************
    **
1000 TOP=N-1
1010 FLAG=0:REM points to last recor
     d swapped or zero
1020 FOR J=1 TO TOP:REM only look up
      to last record swapped (start
     at N)
1030 IF S$((J-1)*LREC+KB,(J-1)*LREC+
     KF)<=S$(J*LREC+KB,J*LREC+KF) TH
     EN 1080:REM check if NO swap ne
     eded
1040 FLAG=J:REM flag that we're swap
     ping record J
1050 HOLD$=S$((J-1)*LREC+1)
1060 S$((J-1)*LREC+1,J*LREC)=S$(J*LR
     EC+1,(J+1)*LREC)
1070 S$(J*LREC+1,(J+1)*LREC)=HOLD$:R
     EM 1050 to here swaps J and J+1
      (not J-1)
1080 NEXT J
1085 PRINT S$:REM remove this for sp
     eed.  This shows file after eac
     h pass.
1090 IF FLAG<>0 THEN TOP=FLAG-1:GOTO
      1010:REM if a swap was made, r
     eset TOP and start over.
1100 REM ******************************
     **
1101 REM * end of sort{15 SPACES}*
1102 REM ******************************
     **
1490 REM read and print the clock
1500 PRINT ((PEEK(18)*256+PEEK(19))*
     256+PEEK(20))/60:STOP
1990 REM generates a random file
2000 FOR K=0 TO N-1
2010 S$(K*3+1)=CHR$(INT(RND(0)*26+65
     ))
2020 S$(K*3+2)=CHR$(INT(RND(0)*26+65
     ))
2030 S$(K*3+3)=" "
2035 NEXT K:PRINT S$:PRINT
2040 RETURN
```

Program 2: Insertion Sort

```
100 DIM S$(200)
110 DIM HOLD$(3)
120 LREC=3:KB=1:KF=2
130 N=13
140 GOSUB 2000
200 POKE 20,0:POKE 18,0:POKE 19,0:PO
    KE 20,0
990 REM ******************************
    **
991 REM *{28 SPACES}*
992 REM * insertion sort{13 SPACES}*
993 REM *{28 SPACES}*
994 REM ******************************
    **
1000 FOR J=2 TO N:REM pick record to
      be inserted
1010 I=J-1:REM I is the end of the s
     orted part of the file (left ha
     nd)
1020 IF S$((I-1)*LREC+KB,(I-1)*LREC+
     KF)<=S$((J-1)*LREC+KB,(J-1)*LRE
     C+KF) THEN 1050:REM should rec
     J be inserted?
1030 I=I-1:REM no, look at next sort
     ed record
1040 IF I>0 THEN 1020:REM unless thi
     s is the first record
1045 REM insertion starts here
1050 IF I=J-1 THEN 1105:REM don't in
     sert J on itself
1060 HOLD$=S$((J-1)*LREC+1,J*LREC):R
     EM pick up rec J
```



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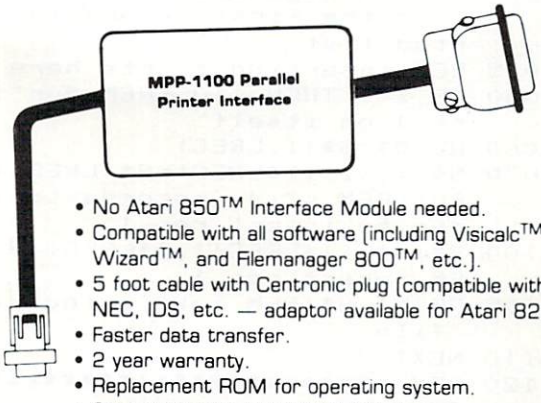

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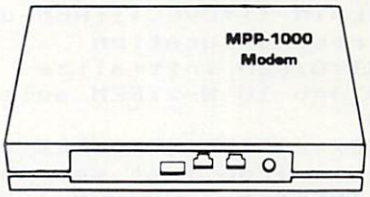

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```
1070 FOR K=J-1 TO I+1 STEP -1:REM sl
     ide sorted records to make room
      for J
1080 S$(K*LREC+1,(K+1)*LREC)=S$((K-1
     )*LREC+1,K*LREC)
1090 NEXT K
1100 S$(I*LREC+1,(I+1)*LREC)=HOLD$:R
     EM insert rec J
1105 PRINT S$:REM take a look at the
      file
1110 NEXT J
1120 REM ******************************
     **
1130 REM * end of sort{15 SPACES}*
1140 REM ******************************
     **
1500 PRINT ((PEEK(18)*256+PEEK(19))*
     256+PEEK(20))/60:STOP
2000 FOR K=0 TO N-1
2010 S$(K*3+1)=CHR$(INT(RND(0)*26+65
     ))
2020 S$(K*3+2)=CHR$(INT(RND(0)*26+65
     ))
2030 S$(K*3+3)=" "
2035 NEXT K:PRINT S$:PRINT
2040 RETURN
```

Program 3: Modified Selection Sort

```
100 DIM S$(200)
110 DIM HOLD$(3)
120 LREC=3:KB=1:KF=2
130 N=13
140 GOSUB 2000
200 POKE 20,0:POKE 18,0:POKE 19,0:PO
    KE 20,0
990 REM ******************************
    **
991 REM *{28 SPACES}*
992 REM * modified selection sort
    {4 SPACES}*
993 REM *{28 SPACES}*
994 REM ******************************
    **
1000 TAIL=(N-1)*LREC+1:REM define la
     st record location
1010 LAST=0:REM initialize
1020 FOR J=0 TO N-2:REM select a rec
     ord
1030 INDEX=LAST:LAST=0:REM adjust po
     inters from last search
1040 IF INDEX>N-J-2 THEN 1090:REM ne
     xt selection is now last unsort
     ed rec
1050 FOR I=INDEX+1 TO N-J-1:REM sear
     ch unsorted part of file
1060 IF S$(I*LREC+KB,I*LREC+KF)<S$(I
     NDEX*LREC+KB,INDEX*LREC+KF) THE
     N LAST=INDEX:INDEX=I:REM best &
      2nd best
1070 NEXT I
1080 IF INDEX=N-1 THEN 1120:REM reco
     rd is in place
1090 HOLD$=S$(INDEX*LREC+1):REM pick
      up selected record
1100 S$(INDEX*LREC+1)=S$((INDEX+1)*L
     REC+1):REM slide many records t
     o close up space
1110 S$(TAIL)=HOLD$:REM put selected
      rec at end
1120 PRINT S$:REM take a look
1130 NEXT J:REM next selection
1140 HOLD$=S$:REM last selection tri
     vially goes at the end
1150 S$(1)=S$(LREC+1)
1160 S$(TAIL)=HOLD$
1170 PRINT S$:REM all done,take a look.
1200 REM ******************************
     **
1210 REM * end of sort{15 SPACES}*
1220 REM ******************************
     **
1500 PRINT ((PEEK(18)*256+PEEK(19))*
     256+PEEK(20))/60:STOP
2000 FOR K=0 TO N-1
2010 S$(K*3+1)=CHR$(INT(RND(0)*26+65))
2020 S$(K*3+2)=CHR$(INT(RND(0)*26+65))
2030 S$(K*3+3)=" "
2035 NEXT K:PRINT S$:PRINT
2040 RETURN
```

Program 4: Modified Insertion Sort

```
100 DIM S$(200)
110 DIM HOLD$(3)
120 LREC=3:KB=1:KF=2
130 N=13
140 GOSUB 2000
200 POKE 20,0:POKE 18,0:POKE 19,0:PO
    KE 20,0
990 REM ******************************
    **
991 REM *{28 SPACES}*
992 REM * modified insertion sort
    {4 SPACES}*
993 REM *{28 SPACES}*
994 REM ******************************
    **
1000 FOR J=N-1 TO 1 STEP -1:REM J wi
     ll be the beginning of the sort
     ed list
1010 I=N:REM I is the end of the sor
     ted part of the file(right hand)
1020 IF S$((I-1)*LREC+KB,(I-1)*LREC+
     KF)<=S$(KB,KF) THEN 1050:REM sh
     ould rec 1 be inserted here?
1030 I=I-1:REM no, look at next sort
     ed record
1040 IF I>J THEN 1020:REM unless thi
     s is the first record in the so
     rted list
1045 REM insertion starts here
1050 IF I=1 THEN 1105:REM don't inse
     rt J on itself
1060 HOLD$=S$(1,LREC)
1070 S$(1,(I-1)*LREC)=S$(LREC+1,I*LR
     EC):REM slide records to make r
     oom to insert rec 1
1100 S$((I-1)*LREC+1,I*LREC)=HOLD$:R
     EM insert rec 1
1105 PRINT S$:REM take a look at the
      file
1110 NEXT J
1120 REM ******************************
     **
1130 REM * end of sort{15 SPACES}*
1140 REM ******************************
     **
1500 PRINT ((PEEK(18)*256+PEEK(19))*
     256+PEEK(20))/60:STOP
2000 FOR K=0 TO N-1
2010 S$(K*3+1)=CHR$(INT(RND(0)*26+65))
2020 S$(K*3+2)=CHR$(INT(RND(0)*26+65))
2030 S$(K*3+3)=" "
2035 NEXT K:PRINT S$:PRINT
2040 RETURN
```

Beginners: see the special program typing instructions on page 128.

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One of the first items many people buy for their computers is a word processing program. A word processor (or its cousin, the text editor) allows text data to be entered, changed, added, or deleted at will. Because a word processor is screen-oriented, the user can manipulate the displayed text and quickly perform editing functions.

Word processing is not the only application which requires the input of extensive text data. Other applications, such as mailing list management or data base management, also involve the entry of much text data. In many of these programs, however, input is laborious and inflexible, limited to line-by-line entries.

With a text editor, text entry is easy. Input for other applications can be just as easy. Although most word processor and text editor programs are written in assembly language, a simple, fast BASIC routine provides some of the advantages of the dedicated text processors, without resorting to machine language. This routine can be incorporated into any program.

This article introduces a use of the GET command that gives the programmer full control of the keyboard and the screen. I have used it to write a text editor, a mailing list program, and an assembler-editor. The routine described below is screen-oriented, displays a blinking cursor, lets each key act normally unless altered by the programmer, and is as fast as the fastest typist. Although I have written this routine for the PET, the idea can be used with many computers. It is necessary to know only a few operating system locations.

What GET Does

The GET command in most BASICs polls the keyboard and returns a value if a key has been struck since the last inquiry. The TRS-80 equivalent is INKEY$. If a key has been struck, GET returns the ASCII value of the key struck; otherwise, it returns the null string (string of length zero). Hitting RETURN is not necessary, and the key hit does not appear on the screen, unless the program provides for that. GET is often used in games for a waiting loop:

```
10 PRINT "HIT ANY KEY TO CONTINUE."
20 GET Z$: IF Z$= "" THEN 20  :REM  NULL ~
    STRING
30 < PROGRAM CONTINUES >
```

In another common use of GET, the answer from the user will appear on the screen as soon as a valid key is hit:

```
10 PRINT "DO YOU WANT [QUESTION]? ANSWER
     'Y' OR 'N' ";
20 GET Z$: IF Z$ <>"Y" AND Z$ <> "N" THEN
     20
30 IF Z$ = "Y" THEN PRINT "YES": . . . YE
    S RESPONSE
40 PRINT "NO": . . . NO RESPONSE
```

The previous example demonstrates two things. First, the keyboard can be *selectively enabled*. (This is sometimes called *softkey*, since the keys are defined by software, not hardware.) Each key can have its usual meaning, a special meaning, or no meaning. (If the key has no meaning, it is said to be disabled.) Second, the program determines what screen output, if any, there is for each key. (By "key" we mean a value that can be input from the keyboard. Most keys have a shifted and an unshifted value.)

Combining GET With Softkeys

These two features can be combined to allow full-screen editing and input under program control. This is far superior to the line-by-line function of the INPUT statement. The routine below has the following advantages:

- full-screen editing.

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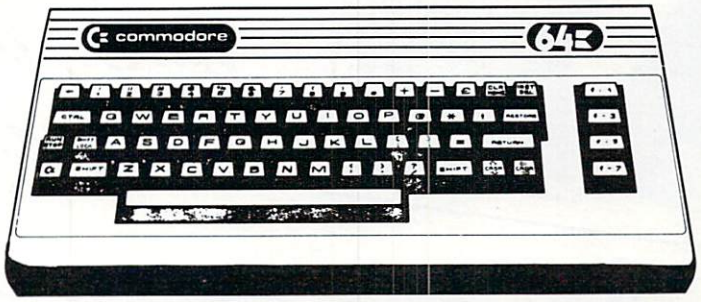

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- TAB function can be simulated without a TAB key.
- blinking cursor (without footprints).
- normal or special use of every key.

Program 1: Kernel Of Screen Editor

```
90 PRINT HOME$; : REM *HOME$= CHR$(19)
100 P=PEEK(196)*256+PEEK(197)+POS(0):IF PO
    S(0)=MB THEN PRINT BELL$; :REM *B
    ELL$=CHR$(7)
110 CH= PEEK(P): K= 128
120 POKE P, CH+K:  T= TIME+ 30
130 IF TIME> T THEN K= 128-K:  GOTO 120
140 GET Z$:  IF Z$= "" OR Z$= QT$ THEN 130
     : REM *QT$= CHR$(34)
200 POKE P, CH: PRINT Z$; ESC$; : GOTO 100
```

The Kernel Routine

Program 1 is the kernel of a screen editor. I use this in any program that involves extensive input. So far, that includes a text editor, a mailing list program, an assembler-editor, and a sales account program.

Lines

90 Puts cursor in top left corner. Not mandatory.

100 p is the location in screen RAM of the cursor. If the cursor has advanced to the margin minus 4 (mb), then the bell rings.

110 ch is the screen character at location p.

120 - 130 The automatic cursor, once a second, alternates the character at the position it is over with the character in reverse video. This can be done manually. Adding 128 to the screen code results in the reverse video character. The variable k changes its value every 30 jiffies (1/2 second) from 0 to 128, providing a simulation of the cursor. (It is assumed that there are originally no reverse video characters on the screen. If there are, change line 110 to: ch = peek(p): kc = 128: if ch> kc then kc = -kc: k = 0, and change line 130 to: if time> t then K = kc-k: goto 120.)

140 The wait loop illustrated above, with one difference: the double quote mark is disabled so that later the program can take data off the screen using the INPUT statement.

150 - 190 This is where all sorts of special work can be done.

200 Puts the character into its original video mode and prints the new character. The program prints the invisible character, esc$, to avoid insert mode, and (CBM 8000 only) to prevent the user from breaking the window through successive HOME's. for Upgrade ROM PETs, use POKE 205, 0. For Original PETs, use POKE 234, 0.

Some Applications

Here are four examples of how to use this control of keyboard and screen. The line numbers given replace or add to the lines in Program 1.

1. To set a bottom margin and prevent scrolling. When accepting lines by the screenful, it is inconvenient to have lines scroll off the top of the screen. It takes special programming not to lose that data. To avoid that, I allow the user to work on only what can fit on the screen, and I do not permit any lines to scroll up. Lines 200-210 work because a p value greater than 34687 means that the cursor is on the last line.

```
200 POKE P,CH: IF P>34687 THEN IF Z$=CR$ O
    R Z$=CD$ THEN 100 : REM 34687=327
    68+80*24-1
210 PRINT Z$; ESC$; :  GOTO 100
```

(cr$ = chr$(13) = car. return,
cd$ = chr$(17) = cursor down)

This kind of bottom margin that prevents scrolling is different from the CBM 8000 Set Bottom command, which allows scrolling.

2. To set a top margin (must be used with bottom margin to prevent scrolling). The PET stores the row number (0-24) of the cursor at memory location 216. "tmargin" is the number of the top row of the margin.

```
105 IF PEEK(216) < TMARGIN THEN PRINT : GO
    TO 100
```

3. To set a left margin.

```
106 IF POS(0) < LMARGIN THEN TAB(LMARGIN -
     1); : GOTO 100
```

4. To set a right margin.

```
115 IF POS(0) < RMARGIN THEN PRINT CHR$(15
    7); : Z$= CR$ : GOTO 200
```

(chr$(157) is cursor left.)

To develop special key functions, use IF statements. For example, the backslash (\ ) key is seldom used. It could be defined to print an often-used phrase, such as the name of your company.

```
150 : IF Z$= "\" THEN Z$= "ACME SOFTWARE, ~
    INC.": GOTO 200
```

In this way the TAB key for PETs can be simulated. Here we will use the RVS key for a TAB key. Tabs are at 5, 10, 20, and 30.

Given: dim tb(4): tb(0) = 4: tb(1) = 9: tb(2) = 19: tb(3) = 29: tb(4) = 40

```
150 IF Z$<> CHR$(18) THEN 200
160 X= -1
170 X= X+1: IF POS(0)> TB(X) THEN 170
180 POKE P, CH: PRINT TAB(TB(X));: GOTO 100
```

Adding Control And Function Keys

The most powerful use of this feature is the implementation of two-key sequences, with the first key acting like a control or SHIFT key. If desired,

every key can be given an additional meaning. The CBM 8000 offers many special editing features that do not correspond to a single key.

I designated one key, the backslash, as a control key. (This special key can be any one of your choosing. The keys are all *soft* now. If you are using Charles Brannon's Keyprint utility, change the definition of B$ below.) Certain keys after a backslash were given new functions. If the keys are not preceded by a backslash, they operate normally. The four special edit functions I implemented are: delete line (\DEL), insert line (\ INST), erase end (\CRSR right), and erase begin (\ CRSR left). Given: B$="\"

```
150 IF Z$ <> B$ THEN 200
155 POKE P, CH+ 128: REM REVERSE CHAR SO U
    SER KNOWS PROGRAM WAITING FOR NEX
    T KEY
160 GET Z$:  IF Z$= "" THEN 160
170 IF Z$= CHR$(148) THEN Z$= CHR$(149): G
    OTO 200
175 IF Z$= CHR$(20) THEN Z$= CHR$(21): GOT
    O 200
180 IF Z$= CHR$(29) THEN Z$= CHR$(22): GOT
    O 200
185 IF Z$= CHR$(157) THEN Z$= CHR$(150): G
    OTO 200
190 Z$= "" : REM INVALID KEY HIT; IGNORE B
    ACKSLASH
```

Another use of this feature allows you to define the keys to have certain string values. In a mailing list program, I allowed the user to define up to four keys. The user (in my area) might define them:

\m="Mr. and Mrs. "
\d="Dr. and Mrs. "
\p="Philadelphia PA 191"
\n="New York NY 100"

Both the keys used and the strings assigned are changeable.

Accepting Data From The Screen

The PET has a feature that makes accepting a screenful of data possible: an addressable keyboard buffer. Here is how the screen can be accepted:

Given: dim a$(24)
Given: in$=chr$(148)+qt$+esc$+chr$(157)+chr$(148)+chr$(148)

chr$(148) is the insert key; chr$(157) is the cursor left. (Due to the use of esc$, PET <4.0 may have to use a POKE statement to get out of quote mode.)

Important restriction: The maximum length of the line is three less than the screen width; for example, 80 -3=77. This can be enforced by using either a left or right margin (explained above).

Here's the program to accept the screen:

```
400 PRINT HOME$; HOME$ : FOR I=1 TO 10: GE
    T Z$: NEXT I : REM  EMPTY BUFFER
410 FOR I= 0 TO 24
420 :  POKE 623, 13:  POKE 158, 1
430 :  PRINT IN$; :  INPUT A$(I)
440 :  NEXT I
```

The whole screen is now in a$ array. One other restriction: it is important that no key be struck during the few seconds required to accept the screen.

The screen is altered after in$ is printed. This is not important if the next action, for example, is to print the menu. If it is important, all traces can be erased by printing deletes. But then only 24 lines at a time can be taken in: the top 24 for other than CBM 8000, or the bottom 24 with CBM 8000 and the use of the scroll down command. This is because a carriage return will be executed after the last INPUT command. If the bottom screen line is INPUT, then when the carriage return is executed, the line will scroll up. I take only 24 lines at a time anyway, in order to use the top line for instructions and messages.

Speed: The routine in Program 2 is very fast. It will accept typing at the rate of 110 words a minute. Three things are done to attain this speed. All constants are replaced by variables. The variables used most often are the first defined. And the routine is written into the first lines of the program.

Program 2 is an example configuration for a CBM 8000. Lines 100-220 are the GET routine. Lines 300-420 are for the programmer to define his special functions. After a double backslash (\\), the data on the screen is accepted into a$ array in lines 500-660. The top line is used for messages. A ** \\ appears in the top right corner when \\ is hit so that the user knows another keystroke is needed. The text data is displayed in screen pages of 24 lines each. The routine corrects for the insertions and deletions of lines. The screen will not scroll. Lines 1000-1100 define the variables and constants (order is important). Lines 2000-2200 are the beginning of a main program.

Since the strings in the a$ array may contain commas and colons, the strings must be enclosed in quotes to save on tape. Also the a$ array may contain null strings. The PET cannot read a null string from tape. Therefore, use the following for reading and writing:

```
100 FOR I= 0 TO LAST
110 PRINT#1, QT$; CHR$(32); A$(I); QT$; C
    R$; : NEXT I :REM ';CR$;' IS FOR ~
    < 4.0 ONLY
200 FOR I= 0 TO LAST
210 INPUT#1, Z$: A$(I)= MID$(Z$,2) : NEXT ~
    I
```

(chr$(32) may be almost any character, since it is discarded upon reading.)

Program 2: Example Screen Input Routine

```
10 REM*****  EXAMPLE SCREEN INPUT ROUTINE
```

```
20 GOTO 1000
30 :
100 REM**  GET ROUTINE
110 PRINT ESC$, HOME$; :  DL= 0:  IN= 0
120 P= PEEK(PH)*S8+ PEEK(PL)+ POS(0): IF P
    OS(0)= MB THEN PRINT BELL$;
130 CH= PEEK(P): KC= KD: K= KC: IF CH>= KC
     THEN KC= -KC: K= 0
140 POKE P, CH+K:  T= TIME+ THIRTY
150 IF TIME> T THEN K= KC-K:  GOTO 140
160 GET Z$:  IF Z$= "" OR Z$= QT$ THEN 150

170 IF Z$= BS$ THEN 300
180 :     :     :
190 :     :     :
200 POKE P, CH: IF P> LROW THEN IF Z$= CR$
     OR Z$= CD$ THEN 120
210 PRINT Z$; ESC$; :  GOTO 120
220 :
300 REM**  SPECIAL FUNCTIONS
310 POKE V, 42:  POKE V+1, 42:  POKE V+3, ~
    28   :REM  DISPLAY ** \
320 POKE P, CH+KC:  Z$= ""   :REM  INVERSE
     CHARACTER
330 GET X$:  IF X$= "" THEN 330
340 IF X$= "M" THEN Z$= "MR. AND MRS. ":  ~
    GOTO 400
350 IF X$= "P" THEN Z$= "PHILADELPHIA PA 1
    91":  GOTO 400
360 IF X$= CHR$(20) THEN Z$= CHR$(21): DL=
     DL+1: GOTO 400  :REM DELETE LINE

370 IF X$<> CHR$(148) THEN 400   :REM INSE
    RT LINE
380 Z$= CHR$(149):  IF DL= 0 THEN IN= IN+ ~
    1:  GOTO 400
390 DL= DL- 1   :REM  EXCESS DL'S SO ROOM ~
    FOR INSERT
395 :
400 FOR I= V TO V+3:  POKE I, 32:  NEXT I ~
      :REM  CLEAR ** \
410 IF X$<> BS$ THEN 200
420 :
500 REM**  ACCEPT SCREEN
510 POKE P, CH:  PRINT HOME$; HOME$   :REM
      BREAK WINDOW
520 REM*  INSERT LINES IF NECESSARY
530 IF IN= 0 THEN 550
540 FOR I= 24*10-IN TO PG+24-IN STEP -1: A
    $(I+IN)= A$(I):  NEXT I
550 FOR I= 0 TO 23   :REM  ACCEPT SCREEN H
    ERE
560 :  POKE 623, 13:  POKE 158, 1
570 :  PRINT IN$; :  INPUT A$(PG+I)
580 :  PRINT DEL$
590 :  NEXT I
595 PRINT HOME$; CHR$(153);   :REM  SCROLL
     DOWN
600 REM*  SQUEEZE TOGETHER IF NECESSARY
610 IF DL= 0 THEN 640
620 FOR I= PG+24 TO 10*24: A$(I-DL)= A$(I)
    : NEXT :REM  SHIFT LEFT
630 FOR I= 10*24-DL TO 10*24: A$(I)= "": N
    EXT  :REM CLEAR DUP'D LINES
640 RETURN
650 REM**  END ROUTINE
660 :
1000 REM***  IMPORTANT CONSTANTS AND VARIAB
    LES, IN ORDER
1010 Z$="": P=0: CH=0: K=0: T=0: THIRTY= 30
    : KC=0: KD= 128
1020 PH= 197: PL= 196: S8= 256: MB= 74
1030 QT$= CHR$(34): BS$= CHR$(92): ESC$= CH
    R$(27)
1040 LROW= 32768+ 24*80 -1
1050 CR$= CHR$(13): CD$= CHR$(17): X$=""
1060 IN$= CHR$(148)+ QT$+ ESC$+ CHR$(157)+ ~
    CHR$(148)+ CHR$(148)
1070 DEL$= CHR$(145)+ "   "+ CHR$(20)+ CHR$
    (20)+ CHR$(20)
1080 V= 32768+ 75:  DIM A$(10*24)   :REM  1
    0 PAGES OF 24 LINES EACH
1090 HOME$= CHR$(19):  CLS$= CHR$(147):  CU
    $= CHR$(145):  LC$= CHR$(157)
1100 :
2000 REM****  MAIN PROGRAM
2010 PRINT HOME$; HOME$; CLS$:  POKE 59468,
     14  :REM  SET TEXT MODE
2020 PRINT,, "SCREEN  INPUT  PROGRAM"
2030 PRINT,, "    BY CRAIG DISSTON": PRINT: ~
    PRINT
2040 PRINT "ENTER THE PAGE NUMBER OF TEXT T
    O ENTER OR EDIT";
2050 PRINT "   0"; LC$; LC$; LC$; : INPUT P
    AGE
2060 IF PAGE< 1 OR PAGE> 10 THEN 2040
2070 PRINT CLS$
2080 PG= (PAGE-1)*24 +1
2090 FOR I= PG TO PG+ 22
2100 :  PRINT A$(I)
2110 :  NEXT I
2130 PRINT HOME$; "ENTER TEXT FOR PAGE"; PA
    GE; LC$; ":"
2140 PRINT CHR$(15)   :REM  SET TOP MARGIN
2150 :
2160 GOSUB 100
2170 :
2180 GOTO 2000
2190 REM*****  "END PROGRAM."
```

VICSTATION: A "Paperless Office"

Joel Peter Anderson

Don't neglect your VIC when you have paperwork to do. With this program, you can create, review, and edit text files – bringing you one step closer to a paperless office. Along with VICSTATION are two application programs that can use the files created by VIC's Line/Pro. Also, there are some ideas on using the VIC as a smart terminal for telecommunications.

Why did you buy your VIC? Maybe you saw it as a "smart" game machine, or perhaps as an educational tool – or you could have seen it as an inexpensive way to get into word processing. Whatever the reason, you've no doubt learned that the VIC can do quite a lot, probably more than you ever expected!

I have a friend who owns a computer with more memory than mine. He had bought a word processing program to use on his system and was describing how it worked.

"But you haven't got a printer," I pointed out, "what good is a program like that?"

He explained that it was very good indeed. Even if he had to type his final copy by hand, the word processor could be used very effectively to produce the rough draft.

That was something I had never thought of before. I wasn't planning on expanding my system for a long time, but I had a good electric typewriter – couldn't I come up with some way to have my VIC work up the rough drafts? Besides that, maybe some things could just as well be written and saved as tape files.

I came up with the program presented here – a line editor that can create, review, and edit text files – a start on a "paperless" office. Along with the editor, I've included two application programs which can use the files created by VIC's Line/Pro.

Program 1 is all you need to get started. RUNning the program will give you a display LINE/PRO and a list of reserved words. *These are very important* (more about these in a minute).

To begin using the editor, hit any key. The screen will clear, and a green cursor will flash in the upper left corner. Type a line, hit RETURN, and the line will appear as blue text in the lower portion of the screen about four lines down from the top. As you continue to type, each line (up to 88 characters) will appear below the text already entered. As you will see when you have more than a screen of information, the entire text entered scrolls past after each line. If you want to quickly review what you've written, press the CTRL key to slow it down.

Two cautions: Input is through a special INPUT# statement, so if you want to include commas or colons, you have to enclose the entire line in double quotes. And obviously you can't use double quotes in your text. I usually use two apostrophes.

The reserved words are invoked by entering each word in lowercase alone, as input. If you want to have that word as part of the text all by itself, enter it as "read" (enclosed in double quotes, with an extra space following). The program will see it as five characters long and ignore it. Any line beginning with a reserve word, such as "reading is a pleasure," will *not* be picked up. The same trick is used to indent text – " text" indents the word "text" three spaces. The following reserve words pass control temporarily to special subroutines:

SAVE

This is used to put your current text onto tape. A corresponding routine, BYBY, is always used following one or more SAVEs. Although it is optional, when SAVEing, a file name is requested

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and prompts are printed for the datasette. In a series of SAVEs, the file name is only requested the first time – when opening the file. When the text is saved, control returns to the main program, but now, there is no text in memory. If you don't want to add any more to the text file, type "byby". This closes the file and ends the program.

If, on the other hand, you want to create a longer file, and there is no limit to the length of a tape file other than the length of the tape itself, then go back to entering text, editing it, and typing "save" again, as many times as you like. You very likely will wind up with a file longer than this program can handle – but more about that later.

Important note: the closing subroutine "byby" prints the character "£" as an end-of-file marker, so you can't use that in your text. If you can't live without that character, change lines 310 and 670 to use some other odd character. You'll also have to change the application programs because they expect the character "£" to end text files.

EDIT

The edit routine allows you to move line-by-line through your text – a handy way to review what you have written. You can page through a text as much as you want, and you can also change, insert, and delete anything on any line. This also uses an INPUT# statement, so the same caution as above applies. When you hit a line that needs changes, press F7 and change the line however you like as long as it doesn't become longer than 88 characters. To get quickly to something at the end of a text, page backwards past the beginning and you will be at the end of the text (sorry, this doesn't work going forward – getting to the end exits the "edit" routine).

READ

This slowly displays the entire text in memory. To pause after any line, just hit the space bar; to resume, press it again. At the end of the text, the program will wait for you to hit the space bar to return to the main program.

TAPE

"What do I do with these tape files?" you may wonder. Well, by typing in "tape" you can reenter them into the program – for review, editing, to graft them onto another file – anything you want to do as long as you don't exceed the 50-line limit. Also, you cannot use it once SAVE has been invoked.

By the way, if you ever do get kicked out of the program, type "GOTO140" to return to the main program.

BYTE

This last reserved word gives you a quick report of what line you're on and how many characters remain in memory.

FILE READER

Program 2 is what you do when your files get too long for memory. The file reader will display a tape file on the screen, and pause for any keystrokes, except for F1, which ends the program.

When the end of a file is reached, the program goes into an infinite loop which ends either:

- when you press F1 to terminate the session or
- when you press F3 to search for the next file on the tape.

DUMBTERM

Program 3 is a modification of a program that appeared in the August 1982 issue of **COMPUTE!**, "VIC Communications: The RS-232 Interface." What I have done is add several features to smarten up this "dumb terminal."

I noticed that several programs I used for terminals had features where special messages (passwords, i.d.'s, etc.) were often just printed directly to the RS-232 Interface without any translation. As an experiment, I tried doing that with an INPUT# statement. What I got was a simple way to have a screen editor built into your terminal. To use this, hit F3 – a red ? will appear, and the cursor will turn red. As long as you don't care about upper- or lowercase, this will give you the ability to move the cursor back within the text on your screen, modify it, and then send it back over the terminal.

I have found this very handy for editing programs. The host computers I use support a line-based text editor. Often I use the editor to first delete the line I'm changing (it prints it out for verification) and then modify it and send it back using the screen editor. Be careful to enclose anything using commas or colons within double quotes.

The escape key (F1) is simply a way to exit a line being entered. The control "c" (F7) is included because the host computers I use have that as an exit character in various programs. You can change it to whatever character your local mainframes require. Simply change the CHR$(3) in line 2000 to CHR$(1) for "a" and so on.

Finally, the "tape file" command (F2) will take any tape file and send it over the terminal. Like the screen editor, this command doesn't translate; it just sends the characters over, so forget upper- and lowercase. I know from experience that this only works well when you are using some sort of text mode during which all text received is appended to a current file. Also it is necessary to instruct the host computer to go to half mode – the program prints the text file on the screen during transmission.

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DEALER INQUIRIES WELCOME

Half Mode

There is another reason for that last instruction. It's the reason this trick can work at all.

To quote Butterfield and Law, in the article mentioned above, "You can't use the... cassette tape while the RS-232 is in gear." You shouldn't be able to send text via the modem from the cassette. I tried it and you can't – unless you tell the host computer to stop echoing your message. If you do that, your text will go over intact with perhaps a few glitches (it pays to check it).

This feature has been very handy. When I am paying for my computer time, or doing schoolwork within a limited amount of computer time, I find it helps to begin writing a program on my home computer and then send it to the mainframe for editing and implementation. Also, the mainframes I use support a type of word processing. This means that a text created and edited with Line/Pro can be formatted and printed (on a printing terminal) in a nice final copy.

The effectiveness of this may vary on systems other than the CDC Cyber I am familiar with. I think, though, that you will find this a simple but effective way to use your VIC to do some powerful things.

Note: The character which appears as a backslash (\) in Programs 1-3 should be typed as the British pound symbol (£) on the VIC keyboard.

Program 1: Line Editor

```
10 PRINT" {CLEAR}        {REV}LINE/PRO"
20 PRINT"{02 DOWN}{02 RIGHT}THIS LINE-PRO
   CESSOR"
30 PRINT"WILL EDIT AND SAVE A  SERIES OF ~
   LINES (NO    LIMIT, HOWEVER ONLY ~
    50 ";
40 PRINT"LINES ARE TAKEN AT A TIME)."
50 PRINT"{DOWN}{02 RIGHT}SAVE{04 RIGHT}RE
   AD"
60 PRINT"{DOWN}{02 RIGHT}EDIT{04 RIGHT}TA
   PE"
70 PRINT"{DOWN}{02 RIGHT}BYBY"
80 PRINT"{DOWN}{02 RIGHT}BYTE"
90 GETA$:IFA$=""THEN90
100 DIMW$(50)
110 PRINT"{CLEAR}";CHR$(14)
120 FORX=1TO104:B$=B$+" ":NEXTX
130 OPEN1,0,0
140 PRINT"{HOME}";CHR$(30);B$;"{HOME}";
150 INPUT#1,A$
160 PRINT"{BLU}";:IFLEN(A$)=0THEN140
170 IFLEN(A$)=4THENGOSUB230
180 IFLEN(A$)=0THEN140
190 W$(L)=A$:PRINT"{02 DOWN}"
200 PRINT"{CLEAR}";B$:FORX=0TOL:PRINTW$(X)
   :NEXTX
210 L=L+1:GOTO140
220 REM CONTROL ROUTINE
230 IFA$="EDIT"THENA$="":GOSUB490
240 IFA$="SAVE"THENA$="":GOSUB420
250 IFA$="BYTE"THENA$="":GOSUB720
260 IFA$="BYBY"THENA$="":GOSUB300
270 IFA$="READ"THENA$="":GOSUB330
280 IFA$="TAPE"THENA$="":GOSUB640
290 PRINT"{CLEAR}";:RETURN
300 REMEND OF FILE
310 PRINT#2,"{F1}\\\\"
320 CLOSE2:END
330 REM FILE REVIEW
340 PRINT"{CLEAR}{GRN}";:POKE36879,110:FOR
   G=0TOL-1:FORX=1TOLEN(W$(G)):PRINT
   MID$(W$(G),X,1);:NEXTX
350 FOR D=1TO300:NEXT:GETR$:IFR$=" "THENGO
   SUB390
360 PRINT:NEXTG
370 GETR$:IFR$="" THEN 370
380 POKE36879,27:PRINT"{CLEAR}":RETURN
390 FORXX=1TO10:GETR$:NEXTXX
400 GETR$:IF R$=""THEN400
410 RETURN
420 IFFL$="OPEN"THEN450
430 FL$="OPEN":INPUT"TITLE";T$
440 OPEN2,1,1,T$
450 FORG=0TOL-1
460 PRINT#2,W$(G):W$(G)=""
470 NEXTG:L=0
480 RETURN
490 REM EDIT ROUTINE
500 INPUT"CLEAR IT ALL";R$
510 IF LEFT$(R$,1)="Y"THENFORG=0TOL+1:W$(G
   )="":NEXT:L=0:RETURN
520 PRINT"{CLEAR}{04 DOWN}{REV}F5{OFF} PAG
   E FORWARD{DOWN}":PRINT"{REV}F3{OF
   OFF} PAGE BACKWARD{DOWN}":PRINT"{
   REV}F7{OFF} INPUT NEW LINE{DOWN}"

530 FORG=1TO1000:NEXTG:PRINT"{CLEAR}"
540 FORG=0TOL-1
550 PRINT"{HOME}";CHR$(30);B$;"{HOME}";
560 PRINTW$(G);"{HOME}";
570 GETR$:IFR$<>"{F7}"ANDR$<>"{F5}"ANDR$<>
   "{F3}"THEN570
580 IFR$="{F3}"ANDG=0THENG=L-1:GOTO550
590 IFR$="{F3}"ANDG<>0THENG=G-1:GOTO550
600 IFR$="{F5}"THEN620
610 INPUT#1,W$(G)
620 NEXTG
630 RETURN
640 REM TAPE INPUT
650 INPUT"{CLEAR}FILENAME";F$:OPEN2,1,0,F$
   :PRINT"FILE OPEN, BOSS"
660 FORX=LTO50
670 GET#2,L$:IFL$="\"THEN L=X:PRINT"{
   CLEAR}":CLOSE2:RETURN
680 IF L$=CHR$(13)THENNEXTX
690 IFX>50THENCLOSE2:L=X:RETURN
700 W$(X)=W$(X)+L$
710 GOTO670
720 REM BYTES FREE
730 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}{DOWN}
   BYTES FREE"
740 PRINT"{04 RIGHT}{DOWN}";FRE(X):PRINT"{
   DOWN}{REV}LINE";L
750 FORG=1TO1500:NEXTG:PRINT"{CLEAR}";
760 RETURN
770 END
```

Program 2: File Reader

```
20 REM VIC STATION - FILE READER
30 PRINT"{CLEAR}";CHR$(14)
40 PRINT"{CLEAR}{02 DOWN}{REV}{GRN}     FI
   LE@READER        {BLU}{OFF}"
50 PRINT"{03 DOWN}THIS FILE READER WILL O
   PEN A FILE ON   TAPE"
```

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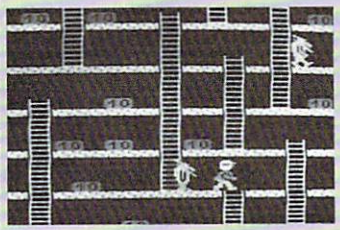

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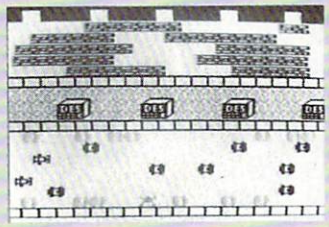

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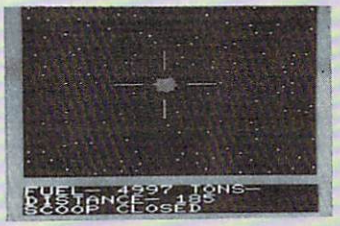

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```
60 PRINT"AND DISPLAY ITS CON-  TENTS. PAU
   SING FOR    KEYSTROKES,"
70 PRINT"{DOWN}{REV}F1{OFF} ENDS CURRENT ~
   FILE":PRINT"{DOWN}{REV}F3{OFF} BE
   GINS NEXT FILE"
80 OPEN1,1,0
90 PRINT"{CLEAR}FILE OPEN"
100 GET#1,W$:IFW$="\"THEN170
110 PRINTW$;
120 GETA$:IFA$=""THEN160
130 GETA$:IFA$<>""THEN130
140 GETA$:IFA$=""THEN140
150 IFA$="{F1}"THEN 170
160 GOTO100
170 PRINT"{REV}END OF FILE"
180 CLOSE1
190 GETA$:IFA$="{F1}"THEN END
200 IFA$="{F3}"THEN 80
210 GOTO190
```

Program 3: Dumbterm Modification

```
0 REM MODIFICATION OF  COMPUTE! PROGRAM(
   8/82)DUMBTERM
1 PRINT"{CLEAR}"
2 PRINT"{02 DOWN}{REV}      DUMBTERM      ~
      ":PRINT"{DOWN}{RIGHT}{REV}F1{
   OFF} ESCAPE LINE":PRINT"{DOWN}{
   RIGHT}{REV}F2{OFF} OPEN TAPE FILE

3 PRINT"{DOWN}{RIGHT}{REV}F3{OFF} SCREEN
    EDITOR":PRINT"{DOWN}{RIGHT}{REV}
   F7{OFF} CTRL 'C'"
4 PRINT"{04 DOWN}{REV}{YEL}    PRESS SPA
   CE BAR          TO BEGIN       {
   BLU}"
5 GETA$:IF A$="" THEN 5
6 PRINT"{CLEAR}";
10 OPEN1,2,3,CHR$(38)+CHR$(160)
20 GETA$: IF A$=""THEN60
21 IF A$="{F3}"THEN GOSUB1000
22 IF A$="{F1}"THEN PRINT#1,CHR$(27)
23 IF A$="{F7}"THEN GOSUB2000
24 IF A$="{F2}"THEN GOSUB3000
30 IFA$=CHR$(147)THEN90:REM CLEAR HOME QU
   ITS
40 A=ASC(A$) AND 127: IF A=20 THEN PRINT#
   1,CHR$(8);:GOTO60
50 IF A>31 OR A=13 THEN PRINT#1, CHR$(A);

60 GET#1,A$:IFA$=""THEN 20
70 A=ASC(A$)AND127 : IF A=8 THEN PRINTCHR
   $(20);:GOTO20
80 IF A>31 OR A=13 THEN PRINT CHR$(A);
85 GOTO20
90 CLOSE1:END
1000 INPUT"{RED}";Q$:PRINT#1,Q$:PRINT"{BLU}
   ";:RETURN
2000 PRINT#1,CHR$(3);:RETURN
3000 INPUT"{RED}FILE NAME?";FM$
3010 OPEN2,1,0,FM$
3020 OP$=""
3025 FOR X=1TO100:NEXT
3030 GET#2,E$:IF E$="\" THEN 3100
3040 IF E$=CHR$(13)THEN PRINT#1,OP$:PRINTOP
   $:GOTO3020
3050 OP$=OP$+E$:GOTO3025
3100 CLOSE2:PRINT"{BLU}";:RETURN
```

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Screen Printer For The Atari Wedge

Michael E. Hepner

Because of its flexible design, the Atari Wedge (published in the November 1982 issue of **COMPUTE!***) can be expanded to include countless new commands. In this Wedge update, SPRINT is added which sends an entire screen to the printer.*

Every Atari owner with a disk drive knows how long it takes to go to DOS and return. I do not wish to find fault with the design of DOS 2.0S. I have several programs that need every spare byte of RAM. So by having only the minimum essential logic in memory and having the extra options in a separate, nonresident module, there is more RAM free for my own use.

But most of my programs are small, leaving plenty of memory unused. It is annoying to wait for memory to be swapped as you go to DOS when you know that 20K of RAM is sitting idle in your computer. But now, with the Wedge, this is no longer a problem. I can use my large programs as always, but for my short programs, I can have Wedge automatically loaded and use all of the disk commands that I normally use without the time delay.

As much as the disk commands have helped me, the nicest feature of the Wedge is its table-driven design. Any new function can be added by simply adding the command name and the address of its routine to the table of commands. In this article, I will show you how to add a utility to copy a text screen to the printer.

SPRINT

Although I wrote a program that worked, making it *easy to use* wasn't so easy. The Wedge has taken care of that problem for me. I chose the command name SPRINT because of the similarity to the LPRINT command. Instead of sending a line to the Line *PRINT*er as LPRINT does, SPRINT sends an entire Screen to the line *PRINT*er.

The screen printer routine prints everything on the screen, up to (but not including) the line with the SPRINT command. The routine reads the screen by changing the operation mode in the Editor's Input/Output Control Block to the special editor input mode which is mentioned on page 27 of the *BASIC Reference Manual*. The routine also changes the vector to the Editor Get routine to bypass the Wedge until the print operation is complete, so that nothing on the screen is accidentally interpreted as a Wedge command.

Program 1 is a BASIC loader for the revised Wedge. It is very similar to the loader in the original Wedge except for the DATA statements. I apologize that most of the DATA statements have changed. I had hoped that only a few bytes other than the end of the program would have to be changed.

Program 2 is the assembly language listing of the screen printer routine alone. If you have an Assembler Editor cartridge and wish to add this routine to the original Wedge, you must take the steps listed below to break the Wedge into two parts, renumber the second part, merge the two parts together again, and then type in the new code for the screen printer routine. The comma-M in the last step is required to merge TEMP with the program in memory.

```
ENTER #D:WEDGE
DEL 100,3140
REN 9000,10
LIST #D:TEMP
ENTER #D:WEDGE
DEL 3150,3390
ENTER #D: TEMP,M
```

ML To BASIC

Program 3 is for anyone who is writing programs in machine language and wants to convert them into a BASIC loader program. Along with converting the machine language to BASIC DATA statements, Program 3 also counts the number of bytes in the machine language program, computes the checksum of those bytes, and writes this information to the lowest numbered DATA statement. I used Program 3 to generate the DATA statements in Program 1. To use Program 3, you

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must first assemble your program and save the machine language output as D:AUTORUN.SYS. Then put in the BASIC cartridge and run Program 3. The DATA statements will be written in LIST format to the file D:DATA. LOAD the main part of your loader program and type ENTER "D:DATA". The DATA statements will be added to your loader program.

Program 1: Wedge BASIC Loader

```
100 REM WEDGE BASIC LOADER
110 GRAPHICS 0:? "Insert a DOS 2.0S
    diskette"
120 ? "with DOS.SYS in drive 1."
130 ? "Press RETURN when you have do
    ne this."
140 IF PEEK(764)<>12 THEN 140
150 POKE 764,255
160 ? :? "Now writing the Wedge AUTO
    RUN.SYS file"
170 TRAP 190:CLOSE #1
180 OPEN #1,8,0,"D:AUTORUN.SYS":TRAP
     4000:GOTO 200
190 CLOSE #1:? :? "Can't open AUTORU
    N.SYS for write.":END
200 REM Disk header values are
210 REM in the data statements.
220 READ NUMBYTES,CHECKSUM
230 FOR I=1 TO NUMBYTES
240 READ A:TRAP 310:PUT #1,A:TRAP 40
    000
250 CKSUM=CKSUM+A
260 NEXT I
270 CLOSE #1
280 IF CKSUM<>CHECKSUM THEN ? "
    {BELL}Bad number in DATA stateme
    nts.":END
290 ? :? "DATA ok, write successful.
    "
300 END
310 ? :? "Error-";PEEK(195);" when a
    ttempting disk write.":CLOSE #1:
    END
320 REM
330 REM Following is the decimal
340 REM equivalent of Wedge 1.1
350 REM Must be type in perfectly
360 REM in order to function.
370 REM
1000 DATA 794,78719
7930 DATA 255,255,0,31,164,31
7936 DATA 104,165,12,141,37,31
7942 DATA 165,13,141,38,31,169
7948 DATA 36,133,12,169,31,133
7954 DATA 13,32,43,31,32,92
7960 DATA 31,169,162,141,231,2
7966 DATA 169,34,141,232,2,96
7972 DATA 32,42,31,32,11,31
7978 DATA 96,169,80,141,68,3
7984 DATA 169,31,141,69,3,169
7990 DATA 0,141,73,3,169,12
7996 DATA 141,72,3,169,11,141
8002 DATA 66,3,162,0,32,86
8008 DATA 228,152,48,1,96,76
8014 DATA 142,34,65,116,97,114
8020 DATA 105,32,87,101,100,103
8026 DATA 101,155,160,0,185,26
8032 DATA 3,201,69,240,7,200
8038 DATA 200,192,34,208,243,96
8044 DATA 200,169,165,153,26,3
8050 DATA 200,169,31,153,26,3
8056 DATA 162,0,189,0,228,157
8062 DATA 165,31,232,224,16,208
8068 DATA 245,169,184,141,169,31
8074 DATA 169,31,141,170,31,24
8080 DATA 173,4,228,105,1,141
8086 DATA 186,31,173,5,228,105
8092 DATA 0,141,187,31,169,0
8098 DATA 133,203,96,185,31,108
8104 DATA 32,32,62,246,8,201
8110 DATA 155,240,4,230,203,40
8116 DATA 96,140,181,31,142,182
8122 DATA 31,165,203,240,86,169
8128 DATA 51,133,205,169,32,133
8134 DATA 206,160,0,177,205,217
8140 DATA 128,5,208,12,200,177
8146 DATA 205,240,40,196,203,208
8152 DATA 240,76,37,32,201,255
8158 DATA 240,53,160,0,177,205
8164 DATA 240,9,230,205,144,2
8170 DATA 230,206,76,242,31,24
8176 DATA 165,205,105,3,133,205
8182 DATA 144,2,230,206,76,215
8188 DATA 31,200,132,204,177,205
8194 DATA 141,183,31,200,177,205
8200 DATA 141,184,31,108,183,31
8206 DATA 160,0,169,46,153,128
8212 DATA 5,169,0,133,203,169
8218 DATA 155,172,181,31,174,182
8224 DATA 31,40,96,68,73,82
8230 DATA 0,134,32,83,67,82
8236 DATA 65,84,67,72,0,31
8242 DATA 33,76,79,67,75,0
8248 DATA 36,33,85,78,76,79
8254 DATA 67,75,0,41,33,82
8260 DATA 69,78,65,77,69,0
8266 DATA 46,33,75,73,76,76
8272 DATA 0,51,33,83,80,82
8278 DATA 73,78,84,0,64,33
8284 DATA 255,129,32,21,34,68
8290 DATA 58,42,46,42,162,80
8296 DATA 169,12,157,66,3,32
8302 DATA 86,228,162,80,169,3
8308 DATA 157,66,3,169,6,157
8314 DATA 74,3,169,129,157,68
8320 DATA 3,169,32,157,69,3
8326 DATA 32,86,228,152,16,3
8332 DATA 76,142,34,162,80,169
8338 DATA 5,157,66,3,169,109
8344 DATA 157,68,3,141,68,3
8350 DATA 169,32,157,69,3,141
8356 DATA 69,3,169,20,157,72
8362 DATA 3,141,72,3,32,86
8368 DATA 228,152,48,13,169,9
8374 DATA 141,66,3,162,0,32
8380 DATA 86,228,76,175,32,162
8386 DATA 80,169,12,157,66,3
8392 DATA 32,86,228,76,30,32
8398 DATA 162,80,157,66,3,169
8404 DATA 0,157,73,3,164,203
8410 DATA 153,128,5,56,152,229
8416 DATA 204,157,72,3,24,169
8422 DATA 128,101,204,157,68,3
8428 DATA 169,5,105,0,157,69
8434 DATA 3,32,86,228,152,16
8440 DATA 3,76,142,34,76,30
8446 DATA 32,169,33,76,238,32
8452 DATA 169,35,76,238,32,169
8458 DATA 36,76,238,32,169,32
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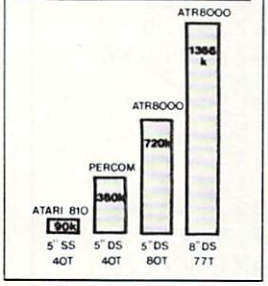

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8470 DATA 133,12,173,38,31,133
8476 DATA 13,76,116,228,56,165
8482 DATA 84,233,2,16,3,76
8488 DATA 30,32,141,20,34,173
8494 DATA 74,3,141,21,34,162
8500 DATA 80,169,12,157,66,3
8506 DATA 32,86,228,162,80,169
8512 DATA 3,157,66,3,169,17
8518 DATA 157,68,3,169,34,157
8524 DATA 69,3,169,8,157,74
8530 DATA 3,32,86,228,152,16
8536 DATA 3,76,142,34,169,0
8542 DATA 133,84,165,82,133,85
8548 DATA 169,9,141,74,3,173
8554 DATA 4,228,141,169,31,173
8560 DATA 5,228,141,170,31,162
8566 DATA 0,169,22,157,68,3
8572 DATA 169,34,157,69,3,169
8578 DATA 5,157,66,3,169,120
8584 DATA 157,72,3,169,0,157
8590 DATA 73,3,32,86,228,152
8596 DATA 48,71,162,80,169,22
8602 DATA 157,68,3,169,34,157
8608 DATA 69,3,169,9,157,66
8614 DATA 3,169,120,157,72,3
8620 DATA 169,0,157,73,3,32
8626 DATA 86,228,152,48,38,165
8632 DATA 84,205,20,34,48,183
8638 DATA 240,181,173,21,34,141
8644 DATA 74,3,162,80,169,12
8650 DATA 157,66,3,32,86,228
8656 DATA 169,184,141,169,31,169
8662 DATA 31,141,170,31,76,30
8668 DATA 32,72,173,21,34,141
8674 DATA 74,3,169,184,141,169
8680 DATA 31,169,31,141,170,31
8686 DATA 76,143,34,80,58,0
8692 DATA 0,0,142,34,161,34
8698 DATA 72,162,80,169,12,157
8704 DATA 66,3,32,86,228,104
8710 DATA 162,255,154,133,185,76
8716 DATA 64,185,226,2,227,2
8722 DATA 1,31
```

Program 2: Screen Printer Routine

```
2122  .BYTE "SPRINT",0
2124  .WORD SPRINT
3150 ;
3160 ; Start of screen to printer ou
     tput routine
3170 ;
3180 ;
3190 LMARGN=$52
3200 ROWCRS=$54
3210 COLCRS=$55
3220 ;
3230 SPRINT
3240 ;
3250 ; Compute last line to print
3260 ;
3270  SEC
3280  LDA ROWCRS      ;Current cursor
      row is the line below SPRINT
3290  SBC #2          ; minus two to
     skip the SPRINT line
3300  BPL SAVELINE
3310  JMP EXIT        ;Cursor out of
     range - nothing to copy
3320 SAVELINE
3330  STA SVPOS       ;Save last line
3340 ;
3350 ; Save the original open mode o
     f the Editor.
3360 ;
3370  LDA ICAUX1      ;Save ICAUX1
3380  STA SVAUX
3390 ;
3400 ; Open the printer
3410 ;
3420  LDX #$50        ;IOCB #5
3430  LDA #CCLOSE     ;Close it first
3440  STA ICCOM,X
3450  JSR CIO
3460  LDX #$50        ;IOCB #5
3470  LDA #COPN       ;Then open it
3480  STA ICCOM,X
3490  LDA #PNAME&255
3500  STA ICBADR,X
3510  LDA #PNAME/256
3520  STA ICBADR+1,X
3530  LDA #8          ;8 = Output
3540  STA ICAUX1,X
3550  JSR CIO
3560  TYA
3570  BPL HOME
3580  JMP ERROR       ;Error on open
3590 ;
3600 ; Home the cursor.
3610 ;
3620 HOME
3630  LDA #0          ;Place cursor a
     t
3640  STA ROWCRS      ; top of screen
3650  LDA LMARGN      ; and at left
3660  STA COLCRS      ; margin
3670 ;
3680 ; Change EDITOR to special inpu
     t mode.
3690 ;
3700  LDA #9          ;9 = read scree
     n
3710  STA ICAUX1      ; automatically
3720  LDA $E404       ;Restore old E
3730  STA WEDGETAB+4
3740  LDA $E405
3750  STA WEDGETAB+5
3760 ;
3770 ;  Loop to read the screen.
3780 ;
3790 PLOOP
3800  LDX #$00        ;IOCB #0
3810  LDA #EBUF&255
3820  STA ICBADR,X
3830  LDA #EBUF/256
3840  STA ICBADR+1,X
3850  LDA #CGTXTR     ;Get record
3860  STA ICCOM,X
3870  LDA #120        ;120 characters
3880  STA ICBLEN,X
3890  LDA #0
3900  STA ICBLEN+1,X
3910  JSR CIO
3920  TYA
3930  BMI SPERROR     ;Error on read
3940 ;
3950 ; Print the line
3960 ;
3970  LDX #$50        ;IOCB #5
3980  LDA #EBUF&255
3990  STA ICBADR,X
```

```
4000  LDA #EBUF/256
4010  STA ICBADR+1,X
4020  LDA #CPTXTR     ;Put record
4030  STA ICCOM,X
4040  LDA #120        ;120 characters
4050  STA ICBLEN,X
4060  LDA #0
4070  STA ICBLEN+1,X
4080  JSR CIO
4090  TYA
4100  BMI SPERROR     ;Error on write
4110 ;
4120 ; Check if done
4130 ;
4140 CHECK
4150  LDA ROWCRS
4160  CMP SVPOS       ;Compare to end
    ing row
4170  BMI PLOOP       ;Loop if more
4180  BEQ PLOOP       ; lines to read
4190 ;
4200 ; Close IOCB #5 and restore Wed
    ge and Editor mode.
4210 ;
4220 SPDONE
4230  LDA SVAUX       ;Restore saved
4240  STA ICAUX1      ; ICAUX1
4250  LDX #$50        ;Close IOCB #5
4260  LDA #CCLOSE
4270  STA ICCOM,X
4280  JSR CIO
4290  LDA #MYINPUT-1&255  ;Point to
4300  STA WEDGETAB+4      ; Wedge
4310  LDA #MYINPUT-1/256
4320  STA WEDGETAB+5
4330  JMP EXIT        ;Jump to common
     exit
4340 SPERROR
4350  PHA             ;Save error cod
    e
4360  LDA SVAUX       ;Restore saved
4370  STA ICAUX1      ; ICAUX1
4380  LDA #MYINPUT-1&255  ;point to
4390  STA WEDGETAB+4      ;Wedge
4400  LDA #MYINPUT-1/256
4410  STA WEDGETAB+5
4420  JMP ERROR+1     ;Jump past the
    PHA instruction
4430 :
4440 PNAME .BYTE "P:",0
4450 SVPOS .BYTE 0
4460 SVAUX .BYTE 0
4470 EBUF *=*+120
```

Program 3:

Conversion Of ML To BASIC Loader

```
10 DIM L$(40),B$(3)
20 OPEN #4,4,0,"D:AUTORUN.SYS"
30 OPEN #5,8,0,"D:DATA"
40 LNUM=7930:CKSUM=0
50 L$="7930 DATA "
60 DNUM=0
70 TRAP 800:GET #4,BYTE:TRAP 40000
80 IF DNUM<6 THEN 140
90 PRINT #5;L$:PRINT L$
100 LNUM=LNUM+6
110 L$=STR$(LNUM)
120 L$(LEN(L$)+1)=" DATA "
130 DNUM=0
140 B$=STR$(BYTE)
150 IF DNUM>0 THEN L$(LEN(L$)+1)=","
160 L$(LEN(L$)+1)=B$
170 COUNT=COUNT+1:DNUM=DNUM+1
180 CKSUM=CKSUM+BYTE
190 GOTO 70
800 IF PEEK(195)<>136 THEN 900
810 PRINT #5;L$:PRINT L$
820 L$="1000 DATA "
830 L$(11)=STR$(COUNT)
840 L$(LEN(L$)+1)=","
850 L$(LEN(L$)+1)=STR$(CKSUM)
860 PRINT #5;L$:PRINT L$
870 PRINT COUNT;" BYTES OF DATA"
880 PRINT "CHECKSUM=";CKSUM
890 CLOSE #4:CLOSE #5:END
900 CLOSE #4:CLOSE #5
910 PRINT "ERROR ";PEEK(195)
920 END
```

©

INSIGHT: Atari

Bill Wilkinson

The series on writing your own interpreter continues. In part 2, the expression evaluator and the "PRINT" statement are added to BAIT. There's also a look at Atari's new 200XL computer.

We hope to introduce several new products at the West Coast Computer Faire this year, including some designed specifically for the new model 1200 Atari (of which machine I will speak more below). I can't tell you exactly what the new products will be, but I can say that I think that those who have written software which follows the "rules" will benefit.

Which "rules"? Oh, nothing much. Just those regarding LOMEM, HIMEM, device drivers, reset vectors, break vectors, etc. If you are an author (or company) who is developing or has developed software for the Atari computers, you might want to ask Atari for a copy of the note from Howard Chan, Manager of Software Acquisition, which details what Atari considers the "untouchable" locations as well as what "vectors" are immutable. We hope to be able to reproduce that note in this column next month.

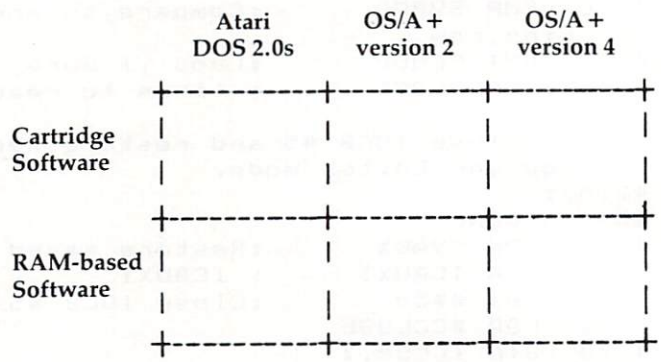
Anyway, what are we looking into in this month's column? Obviously, we will have part two of the series on writing your own interpreter. (And if you missed part one, you must go out right now and buy the March issue! We cannot and will not recap the materials previously covered.) Also, as mentioned, I would like to briefly discuss the new Atari 1200XL machine. But first I am going to hang my head a little.

Pardon Me, My Pratfall Is Showing

After giving everyone else (particularly Atari) a hard time about not doing things "right," I am embarrassed to admit that I, too, did a thing definitely "un-right."

I must start by giving credit to F. T. Meiere, President of the Indy Atari Club from Indianapolis, for not only finding my goof, but also giving me what seems to be a workable and proper fix.

The mistake occurred, not surprisingly, in my fix to the Atari RS-232 drivers, as published in this column in the December 1982 issue of **COMPUTE!**. It came about because of the variety of configurations that I work in. The possible combinations I use can be shown as a small array:



Now, obviously, the vast majority of the Atari user population finds itself in the upper left box (Atari BASIC with Atari DOS). And, yet, because I really don't like working with "MEM.SAV" and "DUP.SYS" (and the consequential swapping in and out and sometimes losing my memory and ...), I generally leave that left-hand column for last. And, unfortunately, in this case I apparently didn't even get to it. For shame.

Anyway, taking F.T. Meiere's advice to heart, I have indeed tested the change he has proposed in several of the possible configurations. Additionally, I have looked at my original code and found out why it failed (and why this new code works). So here, without further ado, is the fix to my RS-232 fix in the form of a change to line 1990 of the assembly language code:

```
was: 1990 JMP (DOSINI)  WRONG!
now: 1990 JMP PATCH3    RIGHT!
```

To Excel Or Not To Excel

The new Atari machine is named the "1200XL." I suppose the "XL" is supposed to designate speed and sexiness, à la sports cars. And certainly the machine *looks* sleek and sexy enough; it is by far the best looking of the current crop of home computers. Were it not for the serial I/O cable, you could easily envision holding the machine in your lap while leaning back in your easy chair, admiring and caressing it as you would a glass of good wine.

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capability, nearly complete compatibility with the 400/800 systems, four function keys and a "help" key, two status LEDs.

- *Minuses*: One cartridge slot (on the side, and you *can* remove the cartridge with power on even though you shouldn't), two (not four) joystick ports (both on the same side of the case; consider getting a joystick cord extender for two-person games), no memory board slots, no external expansion capabilities.
- *Implications*: Goodbye, 80-column boards. Goodbye, RAMDISKs and the like. Goodbye, CORVUS hard disk drive (which, I believe, interfaces via joysticks three and four).
- *Unfounded rumors*: There is *not* an RS-232 interface built in. There is certainly *no* parallel printer port. In fact, there is no hardware other than what I have described.

Some "features" of the machine are less obvious: none of the current Atari software will take advantage of the expanded RAM. When you bank select the RAM, all of the OS software, including the interrupt handlers, goes away, so you must provide at least a minimal OS substitute. Because the I/O space is from $D000 to $D800 (as on the 400/800), there is no way around having a "hole" in your otherwise contiguous RAM. There is no way to get at the RAM which is "under" the cartridge (this flaw is left over from the 400/800; it is a real deficiency). It uses the same old slow floating point routines.

So how do I rate the 1200XL in overall features and performance? Quite honestly, it depends entirely on what the price of the machine is. At anything under $450, it's a terrific bargain. I feel that, given the obvious cost-cutting Atari was able to achieve, it should be able to sell for half the cost of the 800. However, the indications are that the price of the 800 will be dropped and that the 1200 will cost more than the 800. If so, buy an 800 quick!

The exception to this suggestion is if you will write in machine language or be using non-Atari languages that can take advantage of the extra 14K of RAM (now *where* would you get a language like that?). If you *need* the extra RAM, then you may have to seriously consider the 1200. Of course, by the time you read this, the price of the 1200 and the new price of the 800 should be public knowledge, so you will be able to see how accurate my forecasting is.

BAIT, Part 2

In March, we started the process of writing a pseudo-BASIC interpreter, which I called "BAIT." If you don't have that article, this month's work will make virtually zero sense, so don't even attempt to follow the rest of this column.

This month, as promised, we add the expression evaluator and the "PRINT" statement to BAIT. Note that the listing published here is *not* complete. It is meant to be added to the March listing. In a few cases, this month's lines will overwrite (be the same number as) those from March. For example, we have replaced lines 4010 through 4040 and deleted line 4050.

Before we get into the explanation of the actual listing, we need to extend our discussion of just how an interpreter – and, in particular, BAIT – works.

There are two major parts to most language interpreters: the program editor and the program executor. The March column presented BAIT's editor. It is not fundamentally different from most BASIC editors. True, only a few BASICs that I know of use a line number table, as we did for BAIT (some that do include Cromemco 32K Structured BASIC, which we wrote, and Data General's Business BASIC, both designed for relatively large machines). But, to be fair, BAIT cheats by using a very small fixed number of possible line numbers.

The editor used by Atari BASIC and BASIC A+ (and Cromemco and DG BASICs) does, however, differ markedly from BAIT's editor in one important apsect. In these more sophisticated BASICs, the user's program line is scanned for correct syntax as it is entered and automatically converted to more usable internal "tokens." Of course, BAIT should not be chided for any deficiency here: most microcomputer BASICs (including, for example, Microsoft BASICs) do *not* do any syntax checking at entry (nor do they tokenize anything except, perhaps, recognized keywords). In any case, BAIT's editor seems quite adequate to me.

This month, we begin the second major part of an interpreter: the program executor. Not surprisingly, the program executor is much larger and more complex than the editor. In fact, we need to break the executor down into manageable hunks. I think an outline would be useful here.

I. Program Editor
II. Program Executor
  A. Initialization
  B. Execution by Line
    1. Execution by Statement
    2. Execution of Statements
      a. Display statement
      b. Print statement
      ... (various statements)
  C. Execution of a direct statement or line
  D. Error handler

This month, we will add parts C, D, and B to BAIT. (Note that we did part A in March and faked C.) Actually, part C and part B are so inti-

mately entwined in BAIT that it is hard to see where one begins and the other leaves off, but that doesn't make our outline any less valid.

Executing Expressions In BAIT

Not shown in the above outline are the major routines which are common to the execution of most statements. To illustrate, first consider these two BAIT statements:

```
L A=7*13      (Let A=7*13)
P A+5         (Print A+5)
```

What do these two statements have in common? An expression. From BAIT's viewpoint, the two expressions here are "7*13" and "A+5". A major portion of BAIT (and, indeed, a major portion of *any* language) is the subroutine known as "EXecute EXPression," which resides in lines 5000 through 5999 in the accompanying listing. Actually, EXEXP in BAIT is fairly simple when compared to that of Atari BASIC. Remember the rules from last month? No functions, no precedence of operators, no arrays, no strings.

Not surprisingly, almost all BAIT statements call the EXEXP subroutine. In turn, EXEXP calls a couple of routines, including GETNC (GET Next Character – lines 8100 to 8160). GETNC is perhaps the lowest level routine of the program execution phase of BAIT. It simply scans the program memory for the next non-space character, tests to see if it is an alphabetic character, and protests when the line runs out of characters.

EXEXP uses GETNC (line 5100) to find any ALPHAbetic characters in an expression; such characters are assumed to be variables (lines 5300, 5310). If instead, GETNC found a numeric character (line 5110), EXEXP backs up and scans for the entire number (lines 5400 to 5450). Only digits and a decimal point are allowed (line 5430); but there is a flaw (read that as *bug*) here that allows, but ignores, more than one decimal point and the digits which might follow. Finally, if the character is neither alphabetic nor numeric, BAIT assumes that it is an operator and figures out which one (lines 5120 to 5230). If it is not an operator, and if the expression was valid, EXEXP returns to its caller (line 5160).

Note that in the case of either a variable or a numeric literal, EXEXP assumes that it has received the second argument of an expression of the form "arg1 op arg2" (lines 5500 through 5530). Of course, in the case of the very first argument in any expression, there has been no preceding argument. But EXEXP takes care of that by providing a dummy argument ("0") and a dummy operator ("+") in its initialization code (line 5010). Incidentally, if EXEXP detects two operators or two arguments in a row, it rules the expression invalid (lines 5210, 5220, and 5510). Similarly, null expressions and expressions ending in an operator are illegal (lines 5230, 5530, and 5160).

Finally, the actual operators of BAIT are "simulated" via Atari BASIC in lines 5610 through 5680. Note that BAIT allows BASIC's operators "+", "-", "*", "/", ">", "<", and "=". BAIT simplifies the inequality sign to "#", instead of BASIC's "<>". (But did you know that many, many of the early BASICs used or allowed "#" as an alternative to "<>"?)

Normally, I wouldn't be so bold as to suggest changing an entire section of code, but I think the clumsiness of EXEXP deserves at least one alternative idea. If you are using BASIC A+ (or any BASIC with a "FIND" or "SUBSTRing" function), you could replace lines 5120 to 5128 with a single line of code:

```
5120 OP=FIND("+-*/><=#",C$,0):IF OP
     THEN 5200
```

Of course, one could have achieved similar results with a string and a FOR/NEXT loop under Atari BASIC, but that would have slowed down EXEXP even more than it already is.

BAIT's Print Statement

Lines 10200 through 10330 comprise the execution of "Print" under BAIT. Notice that DOPRINT also uses GETNC (line 10210). Here, we are looking to see whether a quoted string (line 10220), an expression (line 10240), or nothing at all (line 10210) follows the "P" keyword. (Or should we call it a key-letter?)

Literal strings are fairly simple to handle. Starting at the character after the quote mark, we simply loop through the buffered line printing characters as we go and looking for an ending quote (lines 10300 and 10310). If no matching quote is found, it is *not* an error, just as with Atari BASIC (end of line 10310). If the quote is found, we adjust the character pointer and look for a trailing semicolon or comma (lines 10320, 10330, then 10250 to 10280).

And, strangely enough, arithmetic expressions are the easiest of all things to print. We simply call EXEXP and display the calculated result (line 10240), falling through to the trailing semicolon and comma check. (Of course, if we were writing in assembly language, we would have to write the "display a numeric result in ASCII" routine, but even here the Atari OS ROMs would help us.)

What Else Was Added

Finally, we must comment on the other code that was added this month. Most of it, of course, was needed to support the EXEXP and DOPRINT routines. However, some of it certainly is obscure enough to bear explanation. As we did in March, we will comment on the code by line number(s).

1100. C$ is used to capture the next character by GETNC. The array VARIABLES is designed to hold 26 variables (A-Z). One could easily amend this to any multiple of 26 and allow variable names of the form A1, A2, etc.

1110. This is kind of silly. In the final code, all variables will be initialized to zero. However, since we do not yet have a "Let" statement, I wanted to give each variable a unique value so we could use it in "Print". Hence, A=1, B=2, C=3, etc.

1120. Simply a place to stuff an error message.

1520 to 1550. The line numbers of some of our more important routines.

1710. I hate using "TRAP 40000". I like "TRAP UNTRAP" much better.

2360. The only line I actually corrected from the March listing. Do you see what the bug was?

3320. Just changed the comment to make more sense.

4010 to 4040. The beginnings of our "Line execution" control routine. We get the starting and ending positions of the current line. If the line doesn't exist, we try for the next line. If this is a direct line, we flag it for later detection (line 4040).

4210. As things sit now, if we get here we are ready to execute the direct statement. It had better be the "P" (Print) key-letter.

4220. Why call line 4900? Why not do it in-line right here? Wait until next month.

4610. If we didn't just execute a direct line, we go do another line. (Won't happen this month.)

4620 to 4640. This code was at lines 4010 to 4040 last month. It just cleans up the program buffer for use by the editor.

4910. Read line 4920.

5010 to 8160. Described in the text above.

8200 to 8290. Why do this several places when a single routine will do? Note line 8240: Atari BASIC does a similar thing with the 6502's CPU stack when it encounters an error. Why try to recover through who knows how many subroutine calls when one can simply reset the stack to the top and ignore them?

10200 to 10330. Described in the text above.

Using What We Have

Again, BAIT seems to work as designed up to this point. You can type in program lines (with preceding line numbers) or you can type in a direct statement. Unfortunately, all direct statements are assumed to be "Print," but just wait until next month.

And just what can you "Print"? Virtually any numeric expression that uses the BAIT operators and literal numbers. Of course, you can also use the variable letters "A" through "Z," but this month you will get the artificial values they contain. To get you started, here are some statements to try when you get BAIT's "ready" prompt:

```
P "HI THERE"
P "HI THERE",
P "HI THERE";
P 1+2+3+4
P 1 + 2 + 3 + 4
P A+B+C+D
P 4>5
P 4<5
P 1/3
P 1/2=0.5
P 1/2 # 0.5
P 1/3;
```

And one last P.S., a kind of taste of what's to come. Once you have the listing working and saved, try adding one line:

```
4905 IF C$="D" THEN GOTO DODISPLAY
```

If you don't see what it allows, then wait for next month.

Next Month

Naturally, we will have Part 3 of BAIT. We will actually begin running BAIT programs, and we will add about half of the remaining BAIT statements to our vocabulary.

Unless something else hits me in the next week or two, I think I will respond to my own challenge and begin talking about how to write self-relocatable assembly language.

```
1100 DIM C$(1),VARIABLES(26)
1110 FOR ALPHA=0 TO 26:VARIABLES(ALPHA)=AL
     PHA:NEXT ALPHA
1120 DIM ERR$(40)
1520 LET GETNC=8100
1530 SYNTAX=8300:ERROR=8200:EXEXP=5000
1550 DODISPLAY=10100:DOPRINT=10200
1700 REM MISCELLANY
1710 UNTRAP=40000
2360 IF LINE$(1,1)="?" THEN LINE$=LINE$(2)
     :GOTO 2350
3320 REM NOTE THAT CURLINE=0 AS WE FALL TO
      LINE 4000
4010 LENGTH=LINES(CURLINE):IF LENGTH=0 THE
     N 4600
4020 CURLOC=INT(LENGTH/1000):LENGTH=LENGTH
     -1000*CURLOC
4030 CUREND=CURLOC+LENGTH-1
4040 IF CURLINE=0 THEN CURLINE=-1
<<< DELETE LINE 4050>>>
4100 REM READY TO EXECUTE A LINE
4200 REM EXECUTE THE STATEMENT
4210 GOSUB GETNC:IF NOT ALPHA THEN GOTO SY
     NTAX
4220 GOSUB 4900
4600 REM COME HERE FOR NEXT LINE
4610 CURLINE=CURLINE+1:IF CURLINE>0 THEN 4
     000
4620 BUFFER$(INT(LINES(0)/1000))="*"
4630 LINES(0)=0
4640 GOTO PROMPT
4900 REM THE STATEMENT CALLER
```

```
4910 GOTO DOPRINT
4920 REM LINE 4910 IS TEMPORARY !!!!
5010 EVAL=0:LASTOP=-1
5020 VALID=0
5100 GOSUB GETNC:IF ALPHA THEN 5300
5110 IF C$>="0" AND C$<="9" THEN 5400
5120 REM WHICH OPERATOR?
5121 IF C$="+" THEN OP=1:GOTO 5200
5122 IF C$="-" THEN OP=2:GOTO 5200
5123 IF C$="*" THEN OP=3:GOTO 5200
5124 IF C$="/" THEN OP=4:GOTO 5200
5125 IF C$=">" THEN OP=5:GOTO 5200
5126 IF C$="<" THEN OP=6:GOTO 5200
5127 IF C$="=" THEN OP=7:GOTO 5200
5128 IF C$="#" THEN OP=8:GOTO 5200
5160 IF VALID THEN RETURN
5170 GOTO 5900
5200 REM GOT AN OPERATOR
5210 IF LASTOP>0 THEN 5170
5220 IF LASTOP<0 AND OP>2 THEN 5170
5230 LASTOP=OP:VALID=0:GOTO 5100
5300 REM GOT A VARIABLE
5310 VAL2=VARIABLES(ALPHA):GOTO  5500
5400 REM GOT A NUMERIC
5410 CURLOC=CURLOC-1:REM BACKUP TO FIRST N
     UMERIC
5420 FOR LL=CURLOC TO CUREND:C$=BUFFER$(LL
     )
5430 IF (C$>="0" AND C$<="9") OR C$="." TH
     EN NEXT LL
5440 VAL2=VAL(BUFFER$(CURLOC,LL-1))
5450 CURLOC=LL
5500 REM VAR OR NUMERIC
5510 IF LASTOP=0 OR ABS(LASTOP)>8 THEN 590
     0
5520 GOSUB 5600+10*ABS(LASTOP)
5530 LASTOP=0:VALID=1:GOTO 5100
5600 REM EXECUTE OPERATORS
5610 EVAL=EVAL+VAL2:RETURN
5620 EVAL=EVAL-VAL2:RETURN
5630 EVAL=EVAL*VAL2:RETURN
5640 EVAL=EVAL/VAL2:RETURN
5650 EVAL=(EVAL>VAL2):RETURN
5660 EVAL=(EVAL<VAL2):RETURN
5670 EVAL=(EVAL=VAL2):RETURN
5680 EVAL=(EVAL<>VAL2):RETURN
5900 ERR$="INVALID EXPRESSION":GOTO ERROR
8100 REM GETNC
8110 IF CURLOC>CUREND THEN C=-1:C$=CHR$(15
     5):GOTO 8140
8120 C=ASC(BUFFER$(CURLOC)):C$=CHR$(C)
8130 CURLOC=CURLOC+1
8140 IF C=32 THEN GOTO GETNC
8150 ALPHA=(C$>="A" AND C$<="Z")*(C-64)
8160 RETURN
8200 REM ERROR ROUTINE
8210 PRINT :PRINT "***";ERR$;"***";
8220 IF CURLINE>0 THEN PRINT " AT LINE ";C
     URLINE
8230 PRINT :TRAP 8250
8240 POP :POP :POP :POP :POP :POP :POP :PO
     P
8250 TRAP UNTRAP
8290 GOTO PROMPT
8300 REM SYNTAX ERROR
8310 ERR$="SYNTAX ERROR":GOTO 8200
10200 REM ==EXECUTE PRINT==
10210 GOSUB GETNC:IF C<0 THEN PRINT :RETURN
10220 IF C=34 THEN 10300
10230 CURLOC=CURLOC-1
10240 GOSUB EXEXP:PRINT EVAL;
10250 IF C$=";" THEN RETURN
10260 IF C$="," THEN PRINT ,:RETURN
10270 IF C<0 THEN PRINT : RETURN
10280 GOTO SYNTAX
10300 FOR LL=CURLOC TO CUREND:C$=BUFFER$(LL
      )
10310 IF ASC(C$)<>34 THEN PRINT C$;:NEXT LL
      :PRINT :RETURN
10320 CURLOC=LL+1:GOSUB GETNC
10330 GOTO 10250
```

Part IV

Commodore 64 Video — A Guided Tour

Jim Butterfield, Associate Editor

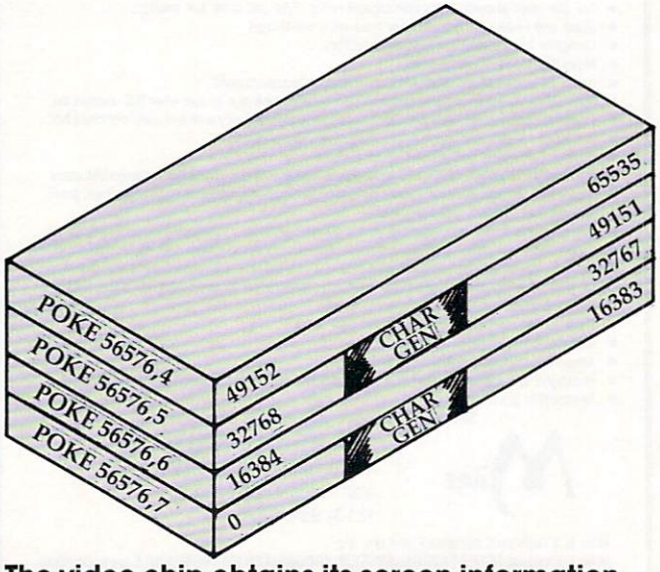
In Part 4 of this guided tour of the impressive video capabilities of the Commodore 64, we take a look at the video structure itself and explore program design considerations.

The story so far: we're touring the 6566 chip, which gives the Commodore 64 its video. We have noted that the chip goes to memory for its video information, but can only reach 16K; the computer controls which 16K bank via control lines in 56576 (hex DD00). Then we looked through the functions of the video control words – sprite and non-sprite – at 53248 to 53286 (hex D000 to D026).

We've examined all the bits in the video chip control registers. Now let's ease back and look at the 64's video structure. We'll talk a bit about program design considerations.

A Single 16K Slice

In Part 1 of this series (February 1983), we discussed how the video chip gets its screen information directly from memory. We indicated that the chip must dig out all of its information from a single 16K slice. We might draw this as a diagram (see the figure).



The video chip obtains its screen information from one of four 16K memory "slices." Two of the slices contain the ROM character generator.

We can control which slice we want by manipulating the two low bits in address 56576 (hex DD00). Normally, the processor picks the slice from 0 to 16383.

Once we've picked a 16K block, we must get all screen data from this block: the "screen memory," the character set, and the sprites. We cannot get the screen data from one block, the character base from another, and sprites from still another. Because we are restricted, we must do a little planning, and design our video information into our program.

After we have picked the 16K slice, we must set the video matrix (screen memory) to some point within it. We may pick any multiple of 1024 as a starting address. The normal 64 configuration is set to a value of one, meaning we take the screen information from memory starting at address 1024. The video matrix, you may remember, is stored in the high nybble (that means multiply it by 16) of 53272 (hex D018).

We must pick our character base next. If we're in normal resolution, we may pick any even multiple of 1024 as a starting address: i.e., 0, 2048, 4096, etc. If we're in high resolution mode, we must pick only values of zero and eight, meaning that the hi-res starting address will be either 0 or 8192. The normal 64 configuration is set to four or six for either graphics or text mode, meaning we take our character set from 4096 or 6144. You probably remember that the character base is stored in the low nybble of 53272.

So we'd expect a normal 64 to place into address 53272: a video matrix of one, times 16, plus a character base of four or six, yielding a total of 20 or 22. You may in fact see 21 or 23 if you PEEK the location, but the extra bit doesn't matter – it's not used. And if we switch to high resolution without changing anything else, our character base of four or six will be trimmed back to zero – explaining why we saw zero page when we tried POKE 53265,48 in Part 1 of this series.

Let's try a few specific design jobs.

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Task 1: Simple Graphics

We're quite satisfied with the screen and character set, but we'd like to add a few sprites to liven things up. Fine, the normal 64 configuration leaves room for about four sprite drawings (numbers 11, 13, 14, and 15), provided we don't need to use cassette tape during the program run. This may be enough for a lot of animation; all eight sprites could use a single drawing, if that suited the task.

If we needed more than four drawings, we might be tempted to move the start-of-BASIC pointer to a higher location, making room for the extras. That can work quite well, but it will probably call for two programs: a configuring program and a final program. It's hard for a program to reconfigure itself and survive.

Task 2: New Character Sets

If we wish to use the regular character set as well as new characters that we might devise, we'll want to stay in the memory blocks from 0 to 16383 or 32768 to 49151. These two blocks contain the ROM character generator at offset 4096 to 8191. If we don't need regular characters at all (if we intend to use our own) it may be more convenient to switch to either of the other two blocks: 16384 to 32767 or 49152 to 65535. Since there's nothing but RAM in these two, we may find more room.

Note that some of these RAM addresses are "hidden" beneath ROMs – BASIC from 40960 to 49151, and the Kernal from 57344 to 65535. The video chip sees only the RAM; but in a normally configured 64 system, programs will see only the ROM. You can POKE or store to the RAM beneath, but when you PEEK or load from these addresses, you'll get the ROM. That's OK; the video chip sees the RAM locations you have POKEd. Result: something for nothing! You can build a character base into RAM, and not lose any memory from your system.

Task 3: Emulating A PET

This is a clear-cut task. We want to move the screen to the same place that the PET uses the screen. That's very straightforward from a video chip standpoint. (Note: If you type the following POKEs in one at a time, you may have to type blind for some of them.) The PET screen belongs at 32768, so we must select that slice with:

```
POKE 56576,5
```

so that we'll pick up RAM starting at 32768. The ROM character generator is still in place.

Since we want the screen (video matrix) to be positioned right at the start of the block, we must set it to a value of zero. The character base can stay at its value of four (for graphics mode), so we must set up address 53272 with zero times 16 plus four:

```
POKE 53272,4
```

That completes the video, but we have a few other things to do to make BASIC work in a sound manner. We must tell BASIC where the new screen is located:

```
POKE 648,128
```

And finally, we should set the start and end of BASIC to correspond with a 32K PET:

```
POKE 1024,0:POKE 44,4:POKE 56,128:NEW
```

Clear the screen, and the job's done. Zero page usage is still different, so not all PEEKs and POKEs will automatically work on this reconfigured system; but BASIC and screen now match the PET.

Task 4: High Resolution Plotting

There are only eight places in memory that we can place a high resolution screen: 0, 8192, 16384, 24576, 32768, 40960, 49152, and 57344. We tend to choose the two 16K blocks that don't have the character generator, 16384 to 32767 and 49152 to 65535. That way, we'll have more clear RAM to use; there will be more space left for our video matrix and any sprites we need.

If we want to write characters on the hi-res screen, we'll have to generate them ourselves or steal them from the character generator. Here's an odd thing – the video chip sees the character ROM at two different addresses, but the processor chip (and that includes your program) sees the same 4K ROM only at a third location, 53248 to 57343. Most of the time, the processor can't see the ROM anyway, since the addresses are overlaid with the I/O chips.

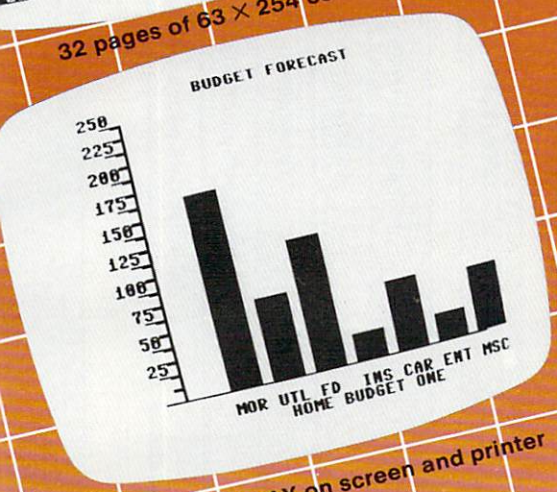
So if our program wants to see the character set, it must flip away the I/O chip with POKE 1,51 – stop, don't do it yet! There are two problems. First, once the I/O chips are moved out – sound, video, interface, everything – you won't be able to type on the keyboard; so you'll never be able to type the POKE to put everything back. Second, the interrupt program uses these I/O chips for quite a few things, and it will go berserk the moment you take them out of action. So we must use a program or a multiple direct command to do the job, and we must temporarily lock out the interrupt activity. Type the following statements as a single line:

```
POKE 56333,127:     (lock out the interrupt)
  POKE 1,51:        (flip out I/O)
    X=PEEK(53256):  (read part of character)
  POKE 1,55:        (restore I/O)
POKE 56333,129      (restore interrupt)
```

X will contain the top row of pixels for the letter "A." If you like, you can draw a character's shape with the following program:

```
100 INPUT"CHARACTER NUMBER";A
110 IF A<0 OR A>255 THEN STOP
120 B=53248+8*A
130 C=56333
```

32 pages of 63 × 254 cells



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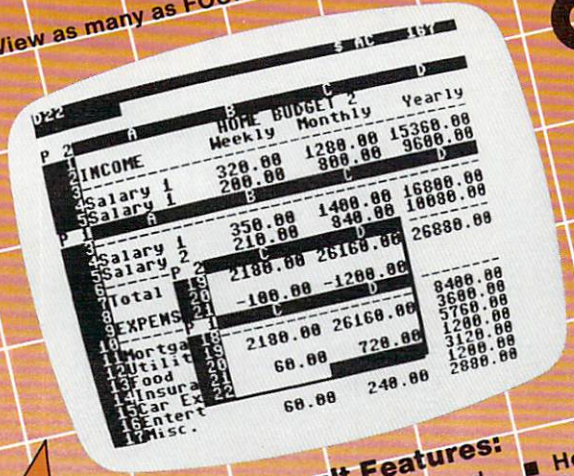

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Table 1:

6566 Video Chip
C64 Control and Miscellaneous Registers

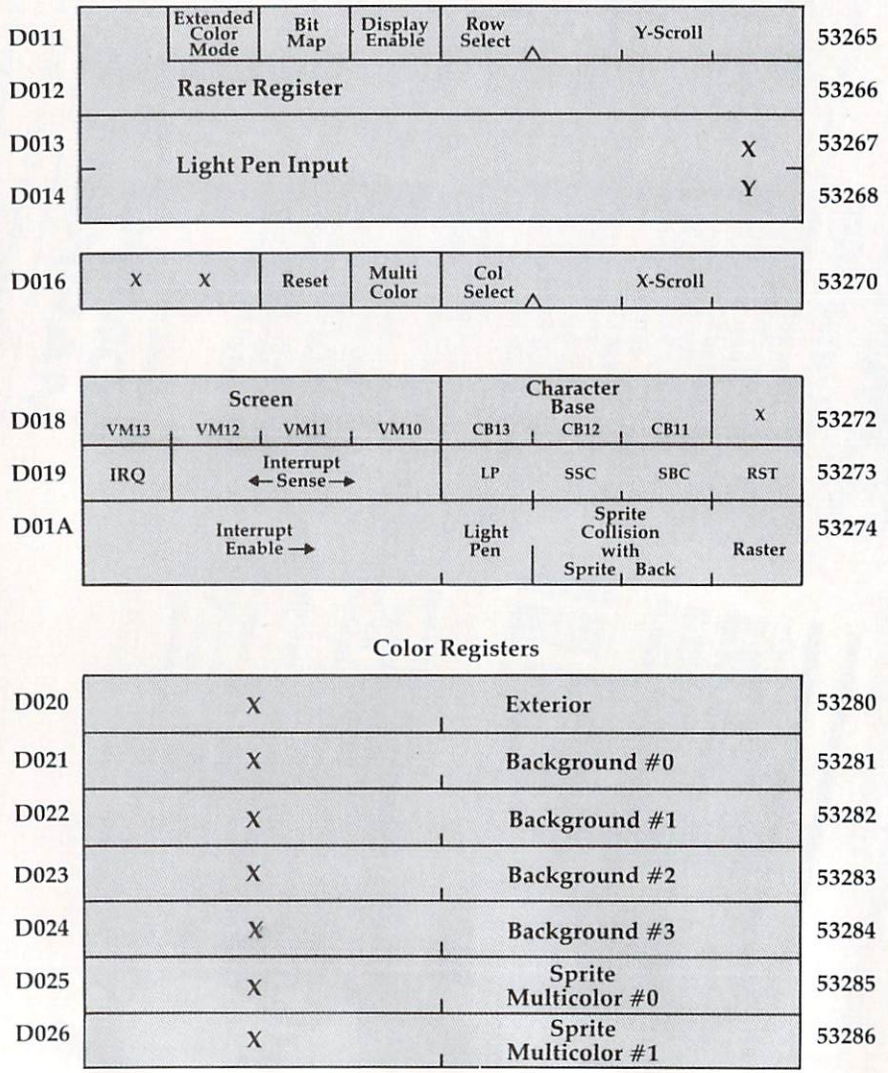
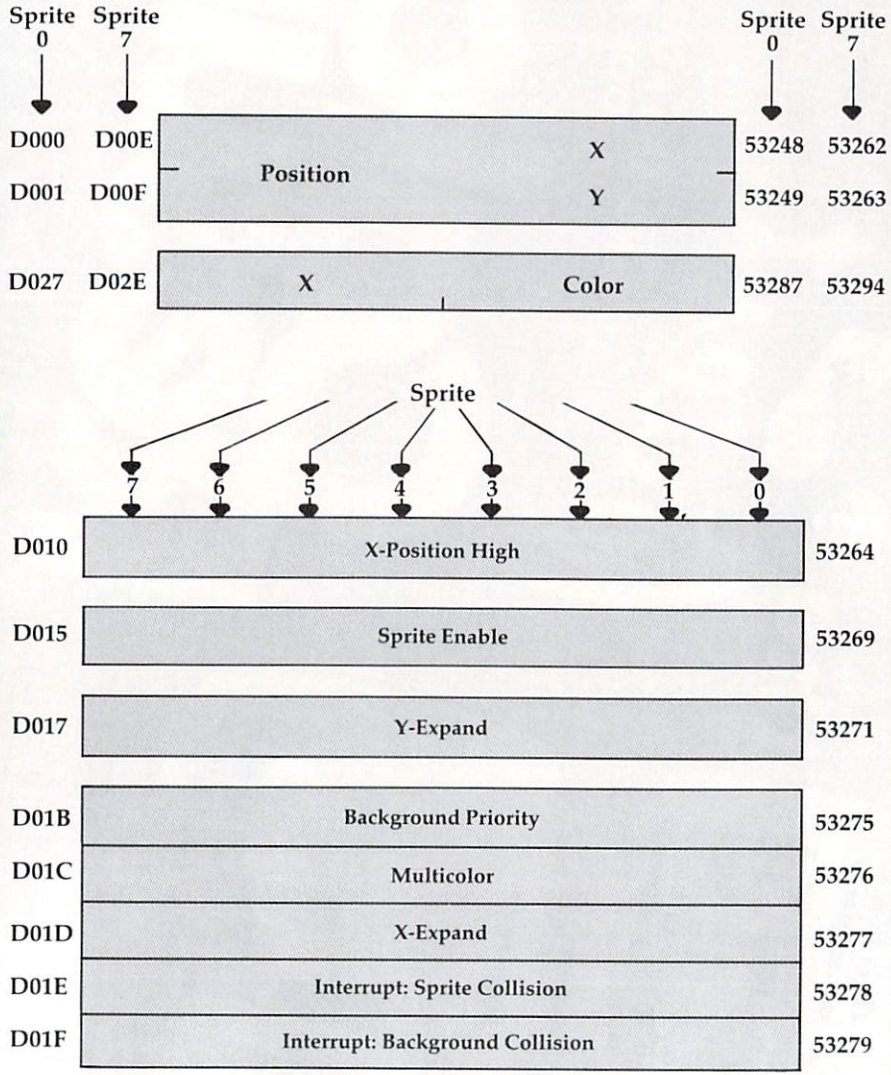


Table 2:

6566 Video Chip
C64 Sprite Registers



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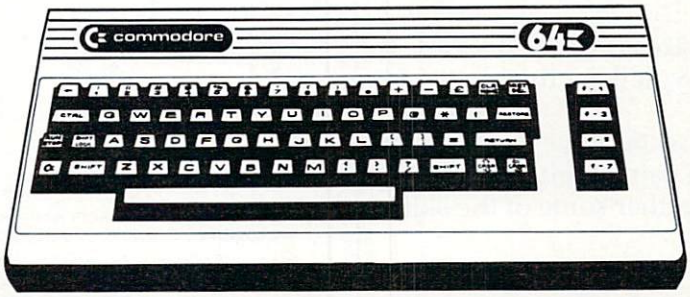

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```
140 FOR J=Ø TO 7
150 POKE C,127:POKE 1,51:X=PEEK(B+J)/
    128
160 POKE 1,55:POKE C,129
170 FOR K=1 TO 8
180 X%=X:X=(X-X%)*2
190 PRINT CHR$(32+X%*3);
200 NEXT K:PRINT
210 NEXT J
220 GOTO 100
```

To terminate this program, enter a number over 255. You'll note that most of the characters are drawn with "double width" lines. A video technician would tell you that this reduces the video frequencies and is likely to cause less picture smear.

Arranging the video areas is almost an art. It takes a little practice, but you'll get the knack of it fairly quickly.

In the next and final section, we'll give a simple example of a program using sprites. In this way, we'll try to draw together some of the skills discussed in this series.

VIC File Case

John Stilwell

Nothing difficult. Just a straightforward, easy-to-use (how-did-I-manage-without it?) program for your VIC to keep track of files. For VIC's of any memory size.

I have a lot of fun playing games on my VIC-20, but I use it for work, too. I recently found that I needed a program to keep track of files – something versatile, so the format had to be simple. Since I couldn't find anything already written, I wrote my own.

The "File Case" is a set of 31 pages with ten entries per page. Because of the limited screen space, each entry can be no more than two lines long to prevent any scrolling.

Because of the "crunching" techniques I used when writing this program, some lines are longer than the maximum 80 columns. When typing in the longer lines, use abbreviations for the commands. For example, PRINT is entered as ?.

Type N to start a new file. You will be asked to confirm and then to give the new file name. *Note:* This will erase any data already in the computer.

Type P and the page number you want; then push RETURN. The page shows ten entry numbers with a "-" after them. To make an entry, type E and type in the number (one of the ten displayed) on the page where you want it to go. After pressing RETURN again, type in your entry. The entry cannot include commas or colons. When you hit RETURN, it will appear on the page. When entering or inserting a line, if you want the line to appear in the catalog, it has to be reversed. To do this, type ", then CONTROL RVS ON, and then type in your entry (all of this on the same line). When you hit RETURN, the entry will appear in inverse video on the page (white on black).

Type I to insert a line between two existing entries. An existing line may be deleted by typing K. This kills the specified line and moves up all succeeding lines. Type S to save your data on tape, and L to load the data back into the computer. Type ? to get the definitions of the controls.

To cancel a control (except for Load, Save, or New), simply type any control letter instead of an entry number.

Pressing RETURN will move you to the next page. Type C to get the catalog. If any of your entries are reversed, they will appear next to the page number that they are on. The catalog can show only ten listings at a time. If you have more than ten reversed entries, push RETURN to get the next ten reversed entries.

If you are not using a memory cartridge, I suggest that the variable N in line 1 be changed from 309 to 109. This gives you only 11 pages to work with. If you want more or fewer pages to work with, then change this number by multiples of 10 only. The program will work with any memory configuration.

```
10 N=309:X=(N+1)/10:DIMS$(N):P=1:POKE3687
   9,187
20 FORI=0TON:S$(I)="-":NEXT
30 PRINT"{CLEAR}"
40 GOSUB590:IFA=0THENPRINT"{03 UP}":GOTO4
   0
50 ONAGOTO60,140,220,260,330,390,450,510,
   550
60 K=0
70 Q=0:PRINT"{CLEAR}{BLK}{REV}CATALOG :";
   T$:PRINT"PAGE{PUR}"
80 FORJ=KTON:IFASC(S$(J))=18THEN:PRINTINT
   (J/10+1);S$(J):Q=Q+1:IFQ>9THENGOT
   O100
90 NEXTJ
100 IFJ>=NTHENGOTO40
110 PRINT"{DOWN}{REV}HIT RETURN TO CONTINU
   E{OFF}"
120 GETA$:IFA$=""THEN 120
130 K=J+1:GOTO70
140 INPUT"{BLK}WHAT PAGE{PUR}";P$:P=VAL(P$
   ):A$=P$:GOSUB610:IFA=0THEN160
150 GOTO40
160 IFP<1ORP>XTHENPRINT"{02 UP}":GOTO140
170 PRINT"{CLEAR}{REV}{BLK}PAGE"P;T$:PRINT
   "{PUR}":FORI=0TO9:L=(P-1)*10+I:PR
   INT"{LEFT}"L;S$(L):NEXT
180 GOSUB 590:IF A=0 THEN 200
190 GOTO 50
200 P=P+1:IF P>XTHENP=1
210 GOTO 170
220 INPUT"{BLK}ENTER#{PUR}";R$:R=VAL(R$):A
   $=R$:GOSUB610:IFA=0THEN240
230 GOTO40
240 IFR<0ORR>NTHEN PRINT"{02 UP}":GOTO220
250 INPUTS$(R):GOTO170
260 INPUT"{BLK}INSERT#{PUR}";R$:R=VAL(R$):
   A$=R$:GOSUB610:IFA=0THEN280
270 GOTO40
280 IFR<0ORR>NTHEN PRINT"{02 UP}":GOTO260
290 PRINT"{BLK}ENTRY{PUR}":INPUTD$:PRINT"{
   BLK}INSERTING{PUR}":IFR=NTHEN170
```

```
300 FORI=RTON-1STEP2:SA$=S$(I+1):S$(I+1)=S
    $(I):S$(I)=D$:D$=SA$:IFASC(D$)=45
    THENGOTO320
310 NEXT
320 GOTO170
330 INPUT"{BLK}KILL WHICH LINE#{PUR}";R$:R
    =VAL(R$):A$=R$:GOSUB610:IFA=0THEN
    350
340 GOTO40
350 IFR<0ORR>NTHENPRINT"{02 UP}":GOTO330
360 IFR=NTHEN380
370 FORI=RTON-1:S$(I)=S$(I+1):NEXT
380 S$(N)="-":GOTO170
390 PRINT"{CLEAR}{BLK}{REV}SAVE TO TAPE":P
    RINT"{DOWN}ARE YOU SURE (Y/N)
400 GETA$:IFA$=""THEN400
410 IFA$="N"THEN170
420 OPEN1,1,1,T$:PRINT#1,T$:FORI=0TON:PRIN
    T#1,S$(I):PRINT"{HOME}"TAB(15);I:
    NEXT:CLOSE1
430 PRINT"{10 DOWN}"T$" SAVED{DOWN}{PUR}"
440 GOTO40
450 PRINT"{CLEAR}{BLK}{REV}LOAD FROM TAPE"
    :PRINT"{DOWN}ARE YOUR SURE (Y/N)
460 GETA$:IFA$=""THEN460
470 IFA$="N"THEN170
480 OPEN1,1,0:INPUT#1,T$:FORI=0TON:INPUT#1
    ,S$(I):PRINT"{HOME}"TAB(15);I:NEX
    T:CLOSE1
490 PRINT"{06 DOWN}{PUR}"
500 GOTO40
510 PRINT"{DOWN}{BLK}{REV}ARE YOU SURE (Y/
    N){PUR}"
520 GETA$:IFA$=""THEN520
530 IFA$<>"Y"THEN170
540 PRINT"THE NEW FILE NAME":INPUTT$:GOTO2
    0
550 PRINT"{CLEAR}{REV}{BLK} CONTROL DEFINI
    TIONS  ":PRINT"{REV}C{OFF}ATALOG{
    DOWN}":PRINT"{REV}P{OFF}AGE NUMBE
    R{DOWN}"
560 PRINT"{REV}E{OFF}NTER LINE{DOWN}":PRIN
    T"{REV}I{OFF}NSERT LINE{DOWN}":PR
    INT"{REV}K{OFF}ILL LINE{DOWN}"

570 PRINT"{REV}S{OFF}AVE TO TAPE{DOWN}":PR
    INT"{REV}L{OFF}OAD FROM TAPE{DOWN}"
    :PRINT"{REV}N{OFF}EW FILE{DOWN}"
    :PRINT"{REV}?{OFF} DEFINITIONS"

580 GOTO40
590 PRINT"{DOWN}{BLK}{REV}C,P,E,I,K,S,L,N,
    ?{PUR}"
600 GETA$:IFA$=""THEN600
610 IFA$="C"THENA=1:RETURN
620 IFA$="P"THENA=2:RETURN
630 IFA$="E"THENA=3:RETURN
640 IFA$="I"THENA=4:RETURN
650 IFA$="K"THENA=5:RETURN
660 IFA$="S"THENA=6:RETURN
670 IFA$="L"THENA=7:RETURN
680 IFA$="N"THENA=8:RETURN
690 IFA$="?"THENA=9:RETURN
700 A=0:RETURN                                    ©
```

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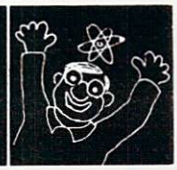

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COMPUTE! published an eye-opening article in the February 1982 issue entitled "Transposition." The author, Janet Whitehead, explained the simple mathematical relationship between each of the pitch values for the various musical notes available in Atari BASIC. After she explained how this could be put to use in musical transposition, she challenged the reader to find further applications. Here is my crack at it.

Four-Note Chords

The most commonly used chords are the four-note major and minor chords. The four notes of any chord can be defined by the first note of the chord and the interval pattern for that particular type of chord. The first (lowest pitch) note of the C-major chord, for example, is a C. The second note of any major chord is always located four half-steps, or two whole steps, above the first. This gap between the notes is known as an interval.

A half-step interval can be found on the piano by locating any two adjacent keys, such as C and C sharp. It can also be found in the pitch table of the *Atari BASIC Manual* by locating any two consecutive entries.

Since we know that the first interval of a major chord is four half-steps, we determine the second note in a C-major chord by counting up four half-steps from C, arriving at E. The interval between the first and third notes of a major chord is always seven half-steps. If we again count upward from C, we find that the third note of a C-major chord is a G. The fourth note is always a 12 half-step interval, or *octave*, above the first, which gives us a C for our final note. Thus, the four notes of a C-major chord are C-E-G-C. In a similar manner, the four notes of an F-major chord are found to be F-A-C-F.

Computing Pitch Values

At this point, let's summarize the previous article. Basically, the author pointed out that the pitch values for any two adjacent notes in the pitch table are related in the same way that the frequencies for those two notes are. Namely, they differ by a constant factor of M = 2^(1/12) for each half-step interval. Two half-steps would involve a factor of M squared, three half-steps a factor of M cubed, and so forth.

Therefore, to compute the pitch value of the second note of a major chord, multiply the first value by M raised to the fourth power. To compute the third pitch, multiply the first by M to the seventh power, and to compute the fourth, multiply the first pitch by M to the twelfth power, which is just two. This procedure will result in pitch values for any major chord, *regardless of the starting value*. The only limitation is that we are restricted to eight bits in which to specify a pitch, which gives us a range from zero to 255 to work with.

If we continue with our example of the C-major chord, we start with a pitch value of 121 for middle C and proceed to compute the rest of the chord as follows:

```
C = 121
E = 121/(2^(4/12)) = 96
G = 121/(2^(7/12)) = 81
C = 121/2 = 60
```

Program 1 is a demonstration which puts all of this information together. This program allows you to select a starting pitch and play either a major or minor chord built upon the selected low note. The desired chord will then be played for a few seconds.

Scales, Chords, And Duets

If you prefer, you can generate scales using a similar technique. Program 2 allows you to play a major, minor, or chromatic scale of one octave, given a starting pitch. All major scales consist of eight notes and have the following interval pattern: whole-step, whole-step, half-step, whole-step, whole-step, whole-step, and half-step. Minor scales also have eight notes, but they differ from major scales in that the third and sixth notes are each dropped down a half-step. A chromatic scale includes every half-step in an octave, which results in 13 notes.

When a song is transposed it simply means that you are playing the same tune, but starting it on a different note. To do this, multiply (or divide) the variable used to hold the pitch values of the song by a constant of your choice.

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play random chords instead. Once you have selected your random low note, use the previously mentioned techniques to generate the other notes.

Have you tried to play piano along with your Atari? If so, you may have found that they were not quite in tune with each other. It could be expensive to tune your piano, so tune your computer instead. Find a pitch value that sounds in tune with middle C on your piano (or other instrument). Then divide by M repeatedly to generate pitch values for higher notes, and multiply by M to compute the lower notes. Remember, your pitch values must stay in the range from zero to 255. Now use the table you have generated to replace the one given in the *Atari BASIC Manual*. You can start playing duets with your Atari.

Program 1: Major And Minor Chords

```
10 DIM D(3)
20 D(1)=1.25992103
30 D(2)=1.1892071
40 D(3)=1.49830706
50 PRINT " ENTER PITCH OF LOW NOTE O
   F CHORD";:INPUT X1
60 IF X1>255 THEN 50
70 PRINT " ENTER 1 FOR MAJOR OR 2 FO
   R MINOR";:INPUT Y
80 X2=X1/D(Y)
90 X3=X1/D(3)
100 X4=X1/2
110 SOUND 0,X1,10,10:SOUND 1,X2,10,1
    0:SOUND 2,X3,10,10:SOUND 3,X4,10
    ,10
120 FOR X=1 TO 1000:NEXT X
130 FOR X=0 TO 3:SOUND X,0,0,0:NEXT
    X
140 STOP
```

Program 2: Scale Generation

```
10 DIM D(2)
20 D(1)=1.12246203
30 D(2)=1.05946308
40 PRINT " ENTER PITCH OF LOW NOTE O
   F SCALE";:INPUT X
50 IF X>255 THEN 40
60 PRINT " ENTER 1 FOR MAJOR, 2 FOR
   MINOR,":PRINT " OR 3 FOR CHROMATI
   C";:INPUT Y
70 IF Y=3 THEN 200
80 GOSUB 500
90 X=X/D(1):GOSUB 500
100 X=X/D(Y):GOSUB 500
110 IF Y=2 THEN X=X/D(2)
120 X=X/D(2):GOSUB 500
130 X=X/D(1):GOSUB 500
140 X=X/D(Y):GOSUB 500
150 IF Y=2 THEN X=X/D(2)
160 X=X/D(1):GOSUB 500
170 X=X/D(2):GOSUB 500
180 STOP
200 GOSUB 500
210 FOR I=1 TO 12
220 X=X/D(2):GOSUB 500
230 NEXT I
240 STOP
500 SOUND 0,X,10,10
510 FOR Z=1 TO 200:NEXT Z
520 SOUND 0,0,0,0
530 RETURN
```

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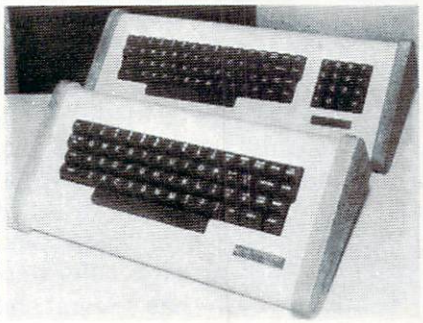

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PROGRAMMING THE TI

C. Regena

GRAPHICS

"Graphics" or drawing pictures on the TI can be a lot of fun, and using graphics in your programs can really enhance them. The TI has 16 colors, and all 16 colors may be used at the same time on the screen, even with high-resolution graphics. Later in this column, I will discuss user-defined graphics characters.

Video-Graphs

First, let's briefly review the TI Video-Graphs command module, since using the command module is an easy way to see graphics on the TI without actually programming. You may see different random color patterns, or you may draw pictures on the screen using the arrow keys and a few function keys. You may save or load a picture on cassette tape.

Because Video-Graphs was one of the first command modules produced by TI, the manual you get with your module may be written for the TI-99/4 console. There are some changes that are necessary for the module to work with the TI-99/4A console. (By the way, if you have the TI-99/4 console, be sure to use the overlay that comes with the module or ask Texas Instruments to send you an overlay. The overlay has all the colors and commands so you don't need to keep referring to the manual.)

Make these changes for the TI-99/4A console. Instead of pressing ENTER, press the period key to return to the activity selection list. You will also need to press the period instead of zero to return to the main index lists. The comma key represents the color GRAY. To save a picture or to get to the TAPE options, press the semicolon key. To change colors, use the virgule/slash key.

The "Patterns" option presents three different random graphics demonstrations. STOP a picture by pressing N. You can't change colors while a picture is stopped. To restart the picture, press 6. While a pattern is going, you may change colors. Let's say you are looking at pulsing lights and want to change all the white squares to magenta. Press / then M then 0.

The "Pictures" option presents four different ways you can draw on the computer. Mosaic and Sketchpad are like using a pen directed by the arrow keys. Color Life is designed to be like the venerable computer game "Life," which replicates cells according to strict rules. Building Blocks has several shapes at the bottom of the screen. You may move the cursor to the shape you want for your picture, then press Y for the pen and move the shape up to your picture. Again, you may change colors by pressing / followed by the present color and then the color desired.

Programming Your Own Graphics

Think of the screen on your monitor or television set as a rectangle divided up into 24 rows and 32 columns. To graphically place a character on the screen, you specify the row number, the column number, and the character number – the ASCII code number of the character you desire. You may also specify a number of repetitions. CALL HCHAR(8,5,65,7) will start in row 8 and column 5 and draw character number 65, which is the letter A, seven times horizontally. CALL VCHAR(12, 14,66,9) will draw the letter B nine times vertically, starting in row 12 and column 14.

If you don't want to draw a picture using A's and B's or the other letters and symbols available, you can define your own high-resolution characters. Each square in the 24 x 32 rectangle can be divided up into an 8 x 8 square, and each dot in that 8 x 8 square can be turned on or off – colored in or not. By specifying with code numbers which dots you want on and which you want off, you can define your own graphics character and then place it on the screen.

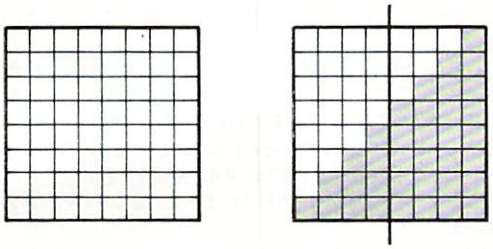
Here is an example. I want to draw a small triangle. The dots in the 8 x 8 square are colored in. The next step is to divide the square in half so that there are columns of four squares on each side. Now, working left to right and downward, figure out the hex code for each pattern of four squares. In the first row, 0000 is 0 and 0001 is 1. In the second row 0000 is 0 and 0011 is 3. Continue

down the rows. The code is 0103070F1F3F7FFF. In your program, you can define the character with a CALL CHAR statement, then place the character on the screen:

```
200 CALL CHAR(128,"0103070F1F3F7FFF")
210 CALL HCHAR(12,15,128)
```

Line 200 defines character number 128 to be the colored-in triangle, and line 210 places that character on the screen. You may either redefine one of the existing characters (numbers 32 through 127) or use numbers from 128 to 159. If I had redefined the letter A (character 65), every time I print A on the screen you would see a triangle instead of an A.

```
200 CALL CHAR(65,"0103070F1F3F7FFF")
210 PRINT "A CAT"
220 GOTO 220
```



Program 1, "Defining Characters," allows you to design a graphics character. You will see a large square which has been divided up into an 8 x 8 square. Use the arrow keys to move the cursor. Press F if you want the space filled in; press the SPACE BAR if you don't. Press ENTER when you are finished with your character. The computer will go through to compare the patterns of on and off dots and will print the code values, then an actual-size character will be placed on the screen so you can see what your character looks like. The definition is then repeated in a string form so you may copy it and use it in your own programs.

After the character is defined, you have the option of modifying it, defining a new character, or ending the program. If you choose to modify it, the character will reappear, and you may alter it in any way you wish.

Character 97, "a", is defined as an open square □, and Character 98, "b", is defined as a filled square ■ (lines 200-210). When the 8 x 8 square is drawn on the screen, it is done by printing "aaaaaaaa" eight times (lines 420-440).

The hex codes are read in as data (lines 120-170). H$(I,1) is the pattern of blank or filled squares, and there are 16 patterns. H$(I,2) is the corresponding hex code number or letter. The flashing cursor is red so you can tell where you are on the pattern you are designing (lines 180-190). CALL GCHAR(X,Y,C) determines what character number C is at row X and column Y.

Program 2, "Bull," is a graphics demonstration program that illustrates user-defined, high-resolution graphics. Lines 130 to 340 define graphics characters. Lines 350-460 draw the bull's head on the screen by printing redefined characters. Lines 470-530 place more graphics characters on the screen. (George H. Sunada of Logan, Utah, was the artist of the original Utah State University "Aggie bull.")

A later column will discuss how to use the CALL COLOR statement and how to plan color sets.

Program 1: Defining Characters

```
100 REM  DEFINING CHARACTERS
120 DIM H$(15,2)
130 FOR I=0 TO 15
140 READ H$(I,1),H$(I,2)
150 NEXT I
160 DATA aaaa,0,aaab,1,aaba,2,aabb,3
    ,abaa,4,abab,5,abba,6,abbb,7,baa
    a,8,baab,9
170 DATA baba,A,babb,B,bbaa,C,bbab,D
    ,bbba,E,bbbb,F
180 CALL COLOR(13,9,1)
190 CALL CHAR(128,"FFFFFFFFFFFFFFFF"
    )
200 CALL CHAR(97,"FF818181818181FF")
210 CALL CHAR(98,"FFFFFFFFFFFFFFFF")
220 CALL CLEAR
230 PRINT "DEFINE A GRAPHICS CHARACT
    ER"
240 PRINT :"PRESS F TO FILL THE SQUA
    RE"
250 PRINT "PRESS SPACE TO CLEAR SQUA
    RE"
260 PRINT "PRESS ARROW KEYS TO MOVE"
270 PRINT :"PRESS ENTER WHEN FINISHE
    D":::
280 IF (K=50)+(K=0)THEN 420
290 FOR I=1 TO 15 STEP 2
300 FOR L=0 TO 15
310 IF SEG$(D$,I,1)=H$(L,2)THEN 330
320 NEXT L
330 C$=H$(L,1)
340 PRINT "{3 SPACES}";C$;
350 FOR L=0 TO 15
360 IF SEG$(D$,I+1,1)=H$(L,2)THEN 38
    0
370 NEXT L
380 C$=H$(L,1)
390 PRINT C$
400 NEXT I
410 GOTO 450
420 FOR I=1 TO 8
430 PRINT "{3 SPACES}aaaaaaaa"
440 NEXT I
450 X=16
460 Y=6
470 CALL SOUND(150,1397,2)
480 CALL GCHAR(X,Y,C)
490 CALL KEY(0,K,S)
500 CALL HCHAR(X,Y,128)
510 CALL HCHAR(X,Y,C)
520 IF S<0 THEN 490
```

```
530 IF K=13 THEN 760
540 IF K=70 THEN 740
550 IF K=32 THEN 720
560 IF K<>68 THEN 600
570 IF Y=13 THEN 470
580 Y=Y+1
590 GOTO 480
600 IF K<>88 THEN 640
610 IF X=23 THEN 470
620 X=X+1
630 GOTO 480
640 IF K<>83 THEN 680
650 IF Y=6 THEN 470
660 Y=Y-1
670 GOTO 480
680 IF K<>69 THEN 490
690 IF X=16 THEN 470
700 X=X-1
710 GOTO 480
720 CALL HCHAR(X,Y,97)
730 GOTO 470
740 CALL HCHAR(X,Y,98)
750 GOTO 470
760 CALL SOUND(150,440,2)
770 D$=""
780 FOR I=1 TO 8
790 C$=""
800 FOR J=6 TO 9
810 CALL GCHAR(I+15,J,C)
820 C$=C$&CHR$(C)
830 NEXT J
840 GOSUB 1050
850 CALL HCHAR(I+15,16,ASC(D1$))
860 D$=D$&D1$
870 C$=""
880 FOR J=10 TO 13
890 CALL GCHAR(I+15,J,C)
900 C$=C$&CHR$(C)
910 NEXT J
920 GOSUB 1050
930 CALL HCHAR(I+15,17,ASC(D1$))
940 D$=D$&D1$
950 NEXT I
960 CALL CHAR(136,D$)
970 CALL HCHAR(20,20,136)
980 PRINT :"DEFINITION = ";D$
990 PRINT ::"PRESS 1 TO MODIFY"
1000 PRINT "{6 SPACES}2 TO START OVE
     R"
1010 PRINT "{6 SPACES}3 TO END PROGR
     AM";
1020 CALL KEY(0,K,S)
1030 IF (K=49)+(K=50)THEN 220
1040 IF K=51 THEN 1110 ELSE 1020
1050 FOR L=0 TO 15
1060 IF C$=H$(L,1)THEN 1090
1070 NEXT L
1080 L=L-1
1090 D1$=H$(L,2)
1100 RETURN
1110 PRINT ::
1120 END
```

Program 2: Graphics Demonstration

```
120 CALL CLEAR
130 FOR C=33 TO 140
140 READ C$
150 CALL CHAR(C,C$)
160 NEXT C
170 DATA FFFFFFFFFFFFFFFF,,0001070F1
    F3F7F7F,40C0800000000808,0000000000
    003C4582,0000003040810200,7FC
180 DATA C0303F0804020,0000876810100
    8,0000806C12473804,0004060703030303
    07,0000000008 0C0E0F,E0FFFFFFFFFFF
    FFF
190 DATA 0102FFFEFFFFFAFC,0548902 0C0
    8,0000030301110E,0080800000CF3,07
    0F3F2F271D06 02,F0FCFFFFFFF1F0D
200 DATA 0000FFFFFFFFFFFF,0F1FFFFFF
    FFFFFF,FCFCFCFCFCFCFCFC,7F7F7F3
    F1F1F2F2,FFFFFFFFFCF0C,FCF9FA0D
210 DATA 7080384488102021,0300010204
    040402,438C304040818282,0E166EBF
    7E,FFFFFFFF0F0301,F8F0F0E0C08
220 DATA 0000000106040E0F,2020418307
    1F7FFF,0080008 08CFFFFFF,0000806A
    7FFFFFFF,2224455EFFFEFFFE
230 DATA 01FD037985030 10D,84B4242424
    1C0101,0C0830408090 20C,00807 07C3
    E3E1F1F,0000101C3E3FFFFF
240 DATA 38300E81406,0000000 80C020100
    C,1F1F3F3F7F7F797,FFFFFFFFFFFCFA
    FD,FEFFFCFCF858810B,749C2008A8F8
    FCFC
250 DATA 8040404020204010 08,1F0F0F0F
    070707E7,070301,FFFFFF7F,F4E9CB8
    30F070707,17FFFFF9FDFCFEFE
260 DATA 0F000818FCFCFCFC,F8C8070060
    906,38D890187C94E407,FFFFFFFEF09
    0909,FFFFFF7F3F1F272,FFFFFFFFFFF
    CF8
270 DATA 0303030301010101,7F7F7DF8E0
    FFFFFF,0707030101010303,FFFFFFCF
    CFCEFCF1,9090A0A06040C09,202020
    202020202
280 DATA FEFCF8F0E0C0C081,1010202040
    439418,2040408 08,7F7F3F3F3F1F1F0
    F,FCF8F0E0E0E6FFFF,00001F205F84C
    7E
290 DATA 0404848480C0F3FF,0000000 0C0
    20101,1202020204040808,0F0F07070
    70737C7,FFFFFFB38080F0FF,E0E0C08
    000003FFF
300 DATA 7F7F7F3E1C0080F,8080000181C1
    E3F7E,1010202040808038,FFFF3F3F3
    F3F1F1F,FEFEFEFCF0F2F1F,0F0F,FF7
    F,FFF8
310 DATA F0E,0780402018050381,00E040
    808,4222120A06020101,86463A01,80
    0000000030505 05,000003FC,408
320 DATA 0808081010102 02,0808040404 0
    40404,0000000804020101,0000070 80A
    0A04,0333428008102 04,0E7080010 20
    C106
330 DATA 8000402010101 02,8001020080 8
    080C,A0100F,000 10638C,8080407807
    ,4040808080808 08,8080808 08E513E2
340 DATA 0000071820204 04,00C020100 00
    00001
350 PRINT TAB(6);"#$ %&'()*  +,"
360 PRINT TAB(6);"!-./  0123456"
370 PRINT TAB(6);"789:  ;< =>!?"
380 PRINT TAB(5);"@ABCDE  FGHIJK"
390 PRINT TAB(5);"L!!MNOP{3 SPACES}Q
    !!5,"
400 PRINT TAB(6);"RSTU!VWX#YZ[S"
410 PRINT TAB(8);"\!]6 ^_`a"
420 PRINT TAB(9);"!!6 \bcd"
430 PRINT TAB(9);"e!fghij"
440 PRINT TAB(9);"k!lmnop"
```

```
450 PRINT TAB(10);"q!!!r"
460 PRINT TAB(10);"s tuv":::::
470 FOR I=1 TO 25
480 READ X,Y,C
490 CALL HCHAR(X,Y,C)
500 NEXT I
510 DATA 18,17,119,18,18,120,19,17,1
    21,20,18,122,19,18,123,20,19,124
    ,20,20,125,1
9,20,126
520 DATA 18,20,127,17,20,128,17,19,1
    29,18,11,130,18,10,131,19,11,132
    ,20,11,125,2
0,10,134
530 DATA 19,10,133,20,9,135,20,8,136
    ,19,8,137,18,8,138,17,8,139,17,9
    ,39,17,10,14
0,1,1,32
540 GOTO 540
550 END
```

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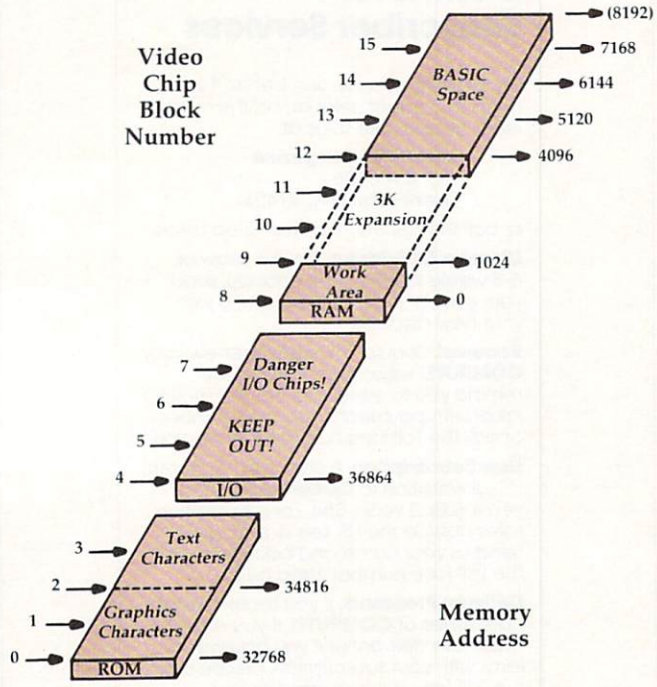
Part I

Visiting The VIC-20 Video

Jim Butterfield, Associate Editor

In which the traveler discovers a new way of viewing the computer's memory: through a video chip. This is the first of a multi-part series about the structure and uses of the VIC's video chip.

If we want to put the VIC-20 video chip to work, we must learn to see things from its standpoint. It sees the computer memory in a way that differs significantly from the way the processor chip sees it. Let's look at what the video chip sees:



How the video chip sees memory.

The video chip sees only the memory shown above. Even if you have expanded your computer to include lots of extra RAM above address 8191, the chip can't see it. The chip sees only the character ROM, in blocks 0, 1, 2, and 3; and the lowest 8K of RAM (in blocks 8 to 15). Blocks 4, 5, 6, and 7 would look at the Input/Output area, but take my advice: don't do it – no good will come from these addresses.

What The Chip Wants

The video chip wants to dig out two things from memory and deliver them to the screen. It wants to look at "screen memory" – usually the characters you have typed. On a minimum 5K VIC, that's block 15.5, which corresponds to decimal address 7680 or hexadecimal 1E00. Did I mention that for screen memory, we can look at "half blocks"? It makes sense, since only five hundred odd characters are needed to fill the screen.

By the way, the official name for screen memory is the "video matrix." Whatever you call it, if you POKE 7680,1 on an unexpanded VIC, you'll see the letter A appear at the start of the screen. Unless, of course, you're printing white on white, in which case you need very good vision to see it.

The second thing that the chip wants from memory is the "character set" – instructions on how to draw each character on the screen. On a typical VIC, this will be either block 0 for the graphics character set or block 2 for the text mode (upper- and lowercase). You can change it, but you'll usually want to stay with even numbers: a full character set including the reversed characters takes up 2048 bytes of memory.

The official name for the character set is "Character Cells," although the term "Character Base" is coming into use. Whatever you call it, you can't POKE 32768,55 and expect anything to happen – the standard characters are in ROM and cannot be changed. They're carved in stone, or silicon, to be more exact. If you want to switch to

custom characters, you'll need to stage them in RAM and tell the chip which block to take them from.

There's a third thing that the chip uses, but it doesn't come from regular memory in the usual way. That's the screen colors (the "Color Matrix"). This color information for each character comes through the back door, so to speak, and we won't worry about the details too much here. When we need to, we'll set the color and assume everything will work.

Architecture

Looking at the diagram, we can begin to see why the VIC does its odd screen switch when you add memory. In the 5K VIC, the screen sits at the top of memory – and that's the highest address that the video chip can see (block 15.5). If we add 3K RAM expansion, the screen can stay where it is above the BASIC RAM area. But if we add 8K or more, the video chip can't see that high, and the screen memory must flip down to the bottom where it won't get in the way of your BASIC program. Which bottom, you may ask? It turns out to be block 12, which is memory address 4096 or hexadecimal 1000, even if the 3K expansion is in place.

You can move this around yourself, of course, and we'll be doing that in just a few moments.

The trick is mostly location 36869, which contains instructions on which blocks to use for screen and characters. We do it this way: select which blocks you want for each. Now, multiply the screen block (not including the .5 if you're using it) by 16 and add the character block. POKE the result into 36869, and the job's done. We'll need to do a couple of other things for sanity's sake, but that's the main job.

The "half page" for the screen memory goes into location 36866; you invoke it by adding 128 to the "column count" if you want to go the extra distance. That means that under normal circumstances (22 columns), you want to POKE 36866,22 for an exact block number, and POKE 36866,150 to nudge to the extra half page.

An Adventure

Let's do something useless, but fun. We'll move the screen memory down to address zero (that's block 8). We can't play with this area – too many important things are happening there – but we can watch interesting things in progress, like the timer and the cursor doing their peculiar things.

First, the calculation. We want the character set to stay the way it is (block 0 for graphics), and we want to move the screen memory to block 8. Eight times 16 plus zero gives 128. No half block, so 36866 should be 22.

A preliminary step: let's make sure that we don't print white-on-white by clearing the screen and typing:

```
FOR J=37888 TO 38911:POKE J,0:NEXT J
```

Ready? Here goes: enter POKE 36869,128:POKE 36866,22. Press RETURN. No, we haven't crashed, but we'll have to type blind from now on.

First, examine the fascinating busy things that are under way. The timer is working away in three bytes. At first glance, only one byte seems to be changing. The cursor flash is being logged and timed somewhat below. And if you start typing, you'll see a whole new series of working values coming into play. Indeed, if you can type blind, you might try PRINT 1234+5678 and watch the flurry of activity.

If you type a lot, the screen will start to scroll, and the display will start to vanish as the colors are rolled off the top.

Restore everything to normal by holding down RUN/STOP and tapping the RESTORE key.

This has been a first exploration, but you may feel that you understand better what the video chip is up to. Indeed, you may feel that you have gained some measure of control.

There's much more to be learned. This is a start.

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Part II:

COLOR COMPUTER GENERAL-PURPOSE DATA BASE

Jeffrey S Yohay

This concludes a two-part tutorial and model program for creating data bases on the TI/99-4A and TRS-80 Color Computer. The model program is called "Video Movie Data Base Program" (VMDP), because it was designed to catalog and manage a collection of movies on videotape. Here the author discusses screen displays and program structure, and presents the data base program itself. The Color Computer program requires 16K RAM memory and Extended BASIC.

Before utilizing this data base manager, there are a few more details to explore. We'll pick up where we left off in March with a discussion of how to add new records.

Adding A Record

When you add a new record, the "add record" routine of the VMDP will prompt you for all of the information necessary to fill the 17 fields. Since the field lengths are all fixed (see Table 1), the "add record" routine will also display a left arrow at the point where the length of the input will match the length of the field.

If you write over this arrow while answering an input prompt, your answer will be too big to fit into the field being filled. You should then backspace and start over, using abbreviations where possible. If you don't, your input will be larger than the field size and will be truncated. If your input is smaller than the field size, the field will be filled with blanks to keep the field (and the record) size constant.

Note that your answer to a field input question will be displayed (in its final length) after you press ENTER; so if your answer was truncated, you'll see it on the screen immediately. You'll have to delete and reenter the record if the truncated data isn't correct.

As I mentioned before, several of the fields contain a code that can be expanded by the VMDP into usable information. The "type of movie" field is a two-byte code that describes the movie; the code can be any of the following:

CO – Comedy (or any light drama)
DR – Drama (a good death scene qualifies)
HI – History (war movies, costume dramas, etc.)
HO – Horror (Bela and Boris, or "Halloween XXIII")
MU – Musical (that's entertainment!)
MY – Mystery (from my favorite director, I presume)

The "commercials" field is a one-byte code that describes how you dealt with commercials when you recorded the movie:

N – None (a pre-recorded tape, or a movie broadcast on non-commercial television)
E – Edited (you removed them)
F – Few (you tried for an "E" but fell asleep!)
M – Many (you deleted a few, then decided it wasn't worth the effort)
A – All (you weren't home, or you just got lazy)

And finally, the "recording speed" field will vary depending on the video format of your VCR. VHS owners will put an S, L or E in this field, for SP, LP or EP recording speed. Beta owners will use 1, 2 or 3 in this field, for Beta I, Beta II, or Beta III recording speed. Beta owners might also want to

change line 490 of the "add record" routine from "SPEED (S,L,E)" to "SPEED (1,2,3)" and line 250 of the "display full-data" routine from "P VIEW TIME: " to "B VIEW TIME: ".

The rest of the fields are self-explanatory. You may have to do some thinking to fit a particularly long name into the "title," "director," or "actor/actress" fields, but that shouldn't happen often (unless you have a lot of movies like *Abbott and Costello Meet Dr. Jekyll and Mr. Hyde*).

And filling the "approximate viewing time" and "approximate time remaining" fields will require some extra effort on your part. You'll need to make a chart of your VCR's counter number vs. recording time, or buy one of the commercially available ones (if there is one for your machine). Note that if the movie is the last one on a particular videotape, you can answer "EOT" (end-of-tape) to the "time remaining" question instead of calculating the few minutes remaining.

It's designed to display as much information in as little space as possible.

Text Screen Displays

The text screen of the Color Computer consists of 512 bytes of RAM at memory locations 1024-1535. This allows for 16 lines of 32 characters, or 512 characters total.

It takes a lot of planning to use this text screen properly, since the small number of characters doesn't allow you to display very much information at once. So I designed the text screens of the VMDP to display as much information in as little space as I could. I also made ample use of the reverse video feature of the text screen (green letters on a black background instead of the usual black letters on a green background) to highlight various portions of the screen. Since lowercase letters are displayed in reverse video, you'll see a lot of PRINT output in lowercase in the program listing.

You might also notice a lot of POKEs into the text screen memory area. Since there is no way to PRINT spaces or special characters (colon, comma, period, etc.) in reverse video, I wondered how I could do the highlighting I had in mind. Luckily, I discovered from the *TRS-80 Color Computer Technical Reference Manual* that POKEing the ASCII value of these characters directly into the video memory locations in RAM will cause them to appear on the screen in reverse video. Just add 1024 to the desired "PRINT @" screen location to get the correct memory address for the POKE.

I have included some "screen prints" of the VMDP's main text screen displays: Figure 1 is the main menu, Figure 2 is a sample full-data output for a particular movie, and Figure 3 is a sample titles-only movie display. These figures will give you a good idea of how the VMDP displays will look on your screen.

Memory Requirements

The program itself is 5211 bytes long, leaving ample room for movie data: up to 60 movie records in a 16K computer, and up to 180 in a 32K computer. But this storage is available only if you don't reserve any RAM for graphics (which the VMDP doesn't need anyway). This means not reserving even one graphics page (1536 bytes). Since the Color Computer does not have a "PCLEAR 0" command to clear all the graphics memory for programs and data, you'll have to do it yourself.

Before loading the program, type in the line:

```
POKE 25,6: NEW <ENTER>
```

This does the same thing as the missing "PCLEAR 0" command. Then load and run the VMDP. If you forget to clear the graphics memory, the VMDP will remind you by generating an OM (Out of Memory) error in line 40 when it tries to CLEAR the string space for the movie record array.

Note that I use a POKE to test for a 32K machine (line 40), then CLEAR the appropriate amount of string space for the available RAM. I can do this because memory location 16384 (16K + 1) will be 255 in a 16K computer (since it doesn't really exist), but will contain whatever you POKE into it in a 32K machine.

Program Structure

Table 2 shows the structure of the VMDP, and Table 3 is a list of the program variables.

Line 40 reserves RAM for movie record storage as described before. Lines 50-80 display the main menu of program options and get the desired option from a two-character command. To check for a correct response and then run the desired subroutine, I used a technique to truncate every answer to one size and then compare it to a string of all the correct answers (CC$) that I previously defined.

Lines 120-200 are *global* subroutines, i.e., subroutines called from various places in the program. Lines 240-360 are the display routines, including "full-data" and "titles-only" displays of movie data as well as the "search and display" of a particular movie.

Lines 400-430 repeat the "full-data" and "titles-only" displays for a printer. Here is where you might want to use your own imagination to customize the program. Though I have a very capable printer (the NEC 8023), I hesitated to use any of its special features in these routines in order to keep the VMDP as general as possible. So feel free to add the control codes for your printer to enhance the printed output in any way you want.

Lines 470-560 perform the "add record" and "delete record" functions. The "add record" function will prompt you for all the data necessary to build a movie record. The "delete record" function will just find and delete an existing movie record. Note that there is no way to edit an existing record to change only one or more fields. I felt this would require too much memory to implement, and I wanted to keep the VMDP as small as possible to leave ample room for movie data in a 16K machine.

Lines 600-690 are the sort routines. Using a Shell-Metzger sorting algorithm, I provided three sort routines (with many of the required program lines shared by all three) to sort the movie records:

1. Alphabetically by title.
2. Alphabetically by type and, within types, by title.
3. Numerically by videotape number and, within videotapes, numerically by VCR counter number.

You can sort the movie records whenever you want before displaying or printing the movie data.

And finally, lines 730-770 perform all cassette I/O operations to load and save movie data files.

Table 1: VMDP Record Format

Position In Record	Length In Bytes	Information
1-28	28	Title of movie
29-32	4	Year of release
33-48	16	Director
49-64	16	Actor/Actress
65-80	16	Actor/Actress
81-96	16	Actor/Actress
97-98	2	Type of movie (code)
99-100	2	Videotape number
101-104	4	Start of movie (VCR counter number)
105-108	4	End of movie (VCR counter number)
109	1	Reserved for future use (now "/")
110	1	Recording speed (code)
111-113	3	Approximate viewing time of movie
114-116	3	Approximate time remaining on tape
117	1	Reserved for future use (now "/")
118-123	6	Date recorded
124-125	2	Channel
126	1	Color?
127	1	Commercials (code)

Program 1: Color Computer Version

```
40 POKE16384,0:IFPEEK(16384)<>0THENCL
   EAR8132:DIMR$(60)ELSECLEAR24396:DI
   MR$(180)
50 CC$="DA DT DS PA PT AD DE SM ST SN
    LO SA ":CLS:PRINT@9,"VIDEOTAPE MO
```

Table 2: VMDP Structure

Line No.	Function
40	Tests for memory size and CLEAR space for data
50-80	Display main menu and get command
120-130	Expand type of movie code (subroutine)
140-180	Assign data fields to variables (subroutine)
190-200	Search for a movie record (subroutine)
240-280	Display full data for all movies
290-330	Display titles only for all movies
340	Searches and displays full data for any movie
350-360	Display subroutines
400-420	Print full data for all movies
430	Prints titles only for all movies
470-550	Add record for new movie
560	Deletes record of an existing movie
600-690	Sort movies by title, type, or videotape
730-740	Load data file
750	Saves data file
760-770	Load/Save subroutine

Table 3: VMDP Variables

A$	Answer to question
A1$,A2$,A3$	Actor/Actress #1, #2, #3
C,C$,CC$	Main Menu command variables
CH$	Channel
CL$	Color?
CM$	Commercials code
CN$	VCR counter numbers
DI$	Director
DT$	Date recorded
F$	Data file name
I,I1,I2	Loop counters
I1,I2,I3,I4	Shell-Metzger sort counters
IL,IO,IP	Line and page counters for display and print
IR	Number of records counter
K$	Input from keyboard
L	Add Record field length
MP	Maximum number of pages in titles-only display
N	Shell-Metzger sort variable
Q, Q$	Add Record field input question variables
R$,R$()	Individual movie record and movie record array
RP	Add Record input field location in movie record
S	Add Record field input question screen location
S$	Print output spacing variable
SP$	Recording speed code
T$	Title to search for to display or delete
TN$	Videotape number
TY$	Type of movie code
VR$,VT$	Remaining time on tape and viewing time of movie
X$,X1$,X2$	Subroutine call variables
W	Loop Variable to pause program

```
VIE":POKE1042,32:PRINT@41,"DATABAS
E SYSTEM":POKE1073,32:PRINT@73,"CO
MMAND":PRINT"DISPLAY  <DA> ALL
{3 SPACES}<DT> TITLES":POKE1127,32
:PRINT@137,"<DS> SEARCH AND DISPLA
Y"
60 PRINT"PRINTER  <PA> ALL{3 SPACES}<
PT> TITLES":POKE1223,32:PRINT:PRIN
T"CHG DATA <AD> ADD{3 SPACES}<DE>
DELETE":POKE1283,32:PRINT@297,"<SM
> SORT BY MOVIE":PRINT@329,"<ST> S
ORT BY TYPE":PRINT@361,"<SN> SORT
BY TAPE #"
70 PRINT:PRINT"DATAFILE <LO> LOAD  <S
A> SAVE":PRINT@489,"<QU> QUIT PROG
RAM";:PRINT@80,"";:INPUTC$
80 C$=C$+"   ":C$=LEFT$(C$,3):IFC$="QU
 "THENCLS:ENDELSEC=INSTR(CC$,C$)-1
:IFC/3<>INT(C/3)THEN50ELSEONC/3+1G
OSUB240,290,340,400,430,470,560,60
0,600,600,730,750:GOTO50
90 '
100 ' GLOBAL SUBROUTINES
110 '
120 R$=R$(IO):TY$=MID$(R$,97,2):IFTY$
=="CO"THENTY$="COMEDY"ELSEIFTY$="D
R"THENTY$="DRAMA"ELSEIFTY$="HI"TH
ENTY$="HISTORY"ELSEIFTY$="HO"THEN
TY$="HORROR"ELSEIFTY$="MU"THENTY$
="MUSICAL"ELSEIFTY$="MY"THENTY$="
MYSTERY"
130 RETURN
140 A1$=MID$(R$,49,16):A2$=MID$(R$,65
,16):A3$=MID$(R$,81,16):DI$=MID$(
R$,33,16):TN$=MID$(R$,99,2):CN$=M
ID$(R$,101,4)+"-"+MID$(R$,105,4)
150 SP$=MID$(R$,110,1):VT$=MID$(R$,11
1,1)+":"+MID$(R$,112,2):VR$=MID$(
```

Figure 1: VMDP Main Menu

```
          VIDEOTAPE MOVIE
          DATABASE SYSTEM
          COMMAND?
DISPLAY   <DA> ALL    <DT> TITLES
          <DS> SEARCH AND DISPLAY

PRINTER   <PA> ALL    <PT> TITLES

CHG DATA  <AD> ADD    <DE> DELETE
          <SM> SORT BY MOVIE
          <ST> SORT BY TYPE
          <SN> SORT BY TAPE #

DATAFILE  <LO> LOAD   <SA> SAVE

          <QU> QUIT PROGRAM
```

Figure 2: Sample Full-Data Display

```
TI: The Man Who Knew Too Much
YEAR: 1934          TYPE: MYSTERY

STARRING: Peter Lorre
          Leslie Banks
          Edna Best

DIRECTOR: Alfred Hitchcock

TAPE: 25 <0575-1125>  SPEED: EP
VIEW TIME: 1:25  TIME REM: 2:45

RECORDED: 04-16-82  CHANNEL: 14
COLOR: NO   COMMERCIALS: EDITTED

 <N>EXT PAGE <L>AST PAGE <M>ENU
```

Figure 3: Sample Titles-Only Display

```
TI: Bringing Up Baby
YEAR: 1938          TYPE: COMEDY

TI: Frankenstein
YEAR: 1931          TYPE: HORROR

TI: It's a Wonderful Life
YEAR: 1947          TYPE: DRAMA

TI: The Man Who Knew Too Much
YEAR: 1934          TYPE: MYSTERY

TI: Top Hat
YEAR: 1935          TYPE: MUSICAL

 <N>EXT PAGE <L>AST PAGE <M>ENU
```

```
R$,114,1):IFVR$="E"THENVR$="EDT"E
LSEVR$=VR$+":"+MID$(R$,115,2)
160 DT$=MID$(R$,118,2)+"-"+MID$(R$,12
0,2)+"-"+MID$(R$,122,2):CH$=MID$(
R$,124,2):CL$=MID$(R$,126,1):IFCL
$="N"THENCL$="NO "ELSECL$="YES"
170 CM$=MID$(R$,127,1):IFCM$="N"THENC
M$="NONE"ELSEIFCM$="E"THENCM$="ED
ITTED"ELSEIFCM$="F"THENCM$="FEW"E
LSEIFCM$="M"THENCM$="MANY"ELSEIFC
M$="A"THENCM$="ALL"
180 RETURN
190 CLS:PRINT@41,X1$;" RECORDS":POKE1
071,32:PRINT@96,"TITLE TO ";X2$:P
RINT@158,CHR$(127)
200 PRINT@128,"";:INPUTT$:T$=LEFT$((T
$+STRING$(28,32)),28):PRINT@130,T
$:FORIO=1TOIR:IFT$=LEFT$(R$(IO),2
8)THENRETURNELSENEXT:PRINT@192,"N
O SUCH RECORD":POKE1218,32:POKE12
23,32:FORW=1TO750:NEXT:RETURN
210 '
220 ' DISPLAY ROUTINES
230 '
240 IO=1
250 GOSUB120:CLS:GOSUB140:GOSUB350:PR
INT"STARRING: ";A1$:PRINTTAB(10)A
2$:PRINTTAB(10)A3$:PRINT:PRINT"DI
RECTOR: ";DI$:PRINT:PRINT"TAPE: "
;TN$;" <";CN$;">  SPEED: ";SP$;"P
 VIEW TIME: ";VT$;"  TIME REM: ";
VR$
260 PRINT:PRINT"RECORDED: ";DT$;"  CH
ANNEL: ";CH$:PRINT"COLOR: ";CL$;"
  COMMERCIALS: ";CM$:GOSUB360
270 K$=INKEY$:IFK$=""THEN270ELSEIFK$=
"M"THENRETURNELSEK=ASC(K$):IFK<>7
6ANDK<>78OR(K=78ANDIO=IR)OR(K=76A
NDIO=1)THEN270ELSEIFK=78THENIO=IO
+1ELSEIFK=76THENIO=IO-1
280 GOTO250
290 IP=0:MP=INT(IR/5):IFIR/5=INT(IR/5
)THENMP=MP-1
300 CLS:FORIL=1TO5:IO=IP*5+IL:IFIO<=I
R THENGOSUB120:GOSUB350:NEXT
310 GOSUB360
320 K$=INKEY$:IFK$=""THEN320ELSEIFK$=
"M"THENRETURNELSEK=ASC(K$):IFK<>7
6ANDK<>78OR(K=78ANDIP=MP)OR(K=76A
NDIP=0)THEN320ELSEIFK=78THENIP=IP
+1ELSEIFK=76THENIP=IP-1
330 GOTO300
340 X1$="SEARCH":X2$="SEARCH FOR":GOS
UB190:IFIO>IR THENRETURNELSE250
350 PRINT"TI: ";LEFT$(R$,28);:PRINT"Y
EAR: ";MID$(R$,29,4)TAB(18)"TYPE:
```

```
    ";TY$:PRINT:RETURN
360 PRINT@481,"<N>EXT PAGE <L>AST PAG
    E <M>ENU";:RETURN
370 '
380 ' PRINTER ROUTINES
390 '
400 S$=STRING$(4,32):FORIO=1TOIR:GOSU
    B120:GOSUB140:PRINT#-2,STRING$(3,
    13);"TITLE: ";LEFT$(R$,28);S$;"YE
    AR: ";MID$(R$,29,4);S$;"TYPE: ";T
    Y$:PRINT#-2,CHR$(13);"STARRING: "
    ;A1$;S$;A2$;S$;A3$:PRINT#-2,"DIRE
    CTOR: ";DI$
410 PRINT#-2,CHR$(13);"TAPE: ";TN$;S$
    ;"COUNTER: ";CN$:PRINT#-2,"SPEED:
     ";SP$;"P";S$;"VIEW TIME: ";VT$;S
    $;"TIME REM: ";VR$:PRINT#-2,"RECO
    RDED: ";DT$;S$;"CHANNEL: ";CH$;S$
    ;"COLOR: ";CL$;S$;"COMMERCIALS: "
    ;CM$:IFIO/5=INT(IO/5)THENPRINT#-2
    ,STRING$(10,13)
420 NEXT:RETURN
430 PRINT#-2,STRING$(2,13);TAB(10)"TI
    TLE";TAB(34)"YEAR";TAB(45)"TYPE";
    CHR$(13):FORIO=1TOIR:GOSUB120:PRI
    NT#-2,LEFT$(R$,28);TAB(34)MID$(R$
    ,29,4);TAB(44)TY$:NEXT:RETURN
440 '
450 ' ADD/DELETE ROUTINES
460 '
470 X$=" AND LOWER CASE)":GOSUB530:R$
    =STRING$(127,32):RP=1:Q$="TITLE"+
    STRING$(27,32):L=28:GOSUB540:S=S+
    32:Q$="YEAR":L=4:GOSUB540:Q$="DIR
    ECTOR":L=16:GOSUB540:FORI=1TO3:Q$
    ="ACTOR #"+RIGHT$(STR$(I),1):GOSU
    B540:NEXT:FORW=1TO250:NEXT
480 X$="CASE ONLY)":GOSUB530:Q$="TYPE
     (CO,DR,HI,HO,MU,MY)":L=2:GOSUB54
    0:Q$="TAPE #":L=2:GOSUB540:Q$="CO
    UNTER START":L=4:GOSUB540:Q$="COU
    NTER END  ":GOSUB540:MID$(R$,RP,1
    )="/":RP=110
490 Q$="SPEED (S,L,E)":L=1:GOSUB540:Q
    $="VIEW TIME (H:MM)":L=4:GOSUB540
    :Q$="TIME REM  (H:MM)":L=4:GOSUB5
    40:MID$(R$,111,7)=MID$(R$,111,1)+
    MID$(R$,113,3)+MID$(R$,117,2)+"/"
    :RP=118
500 Q$="DATE RECORDED (MM-DD-YY)
    (8 SPACES)":L=8:GOSUB540:S=S+32:M
    ID$(R$,120,4)=MID$(R$,121,2)+MID$
    (R$,124,2):RP=124:Q$="CHANNEL":L=
    2:GOSUB540:Q$="COLOR (Y OR N)":L=
    1:GOSUB540:Q$="COMMERCIALS (N OR
    E,F,M,A)":L=1:GOSUB540
510 IFIR=0THENI1=1:GOTO520ELSEFORI1=1
    TOIR:IFLEFT$(R$(I1),28)<LEFT$(R$,
    28)THENNEXTELSEFORI2=IR TOI1 STEP
    -1:R$(I2+1)=R$(I2):NEXT
520 R$(I1)=R$:IR=IR+1:RETURN
530 CLS:PRINT@11,"ADD RECORD":POKE107
    0,32:PRINT:PRINT"(ANSWER IN UPPER
    ";X$:S=64:RETURN
540 S=S+32:Q=LEN(Q$):PRINT@S,Q$;"?":P
    RINT@S+Q+L+3,CHR$(127):PRINT@S+Q+
    2,"";:LINEINPUTA$:MID$(R$,RP,L)=A
    $:RP=RP+L
550 PRINT@S+Q+L+2,STRING$(32,32):RETU
    RN
560 X1$="DELETE":X2$="DELETE":GOSUB19
    0:IFIO>IR THENRETURNELSEPRINT@192
    ,"DELETING RECORD...":FORI=IO TOI
    R-1:R$(I)=R$(I+1):NEXT:IR=IR-1:RE
    TURN
570 '
580 ' SORT ROUTINES
590 '
600 IFC$="SM "THENC=1ELSEIFC$="ST "TH
    ENC=2ELSEIFC$="SN "THENC=3
610 CLS:PRINT@70,"...SORTING RECORDS.
    ..":N=IR
620 N=INT(N/2):IFN=0THENRETURNELSEI3=
    IR-N:I2=1
630 I1=I2:ONC GOTO640,660,680
640 I4=I1+N:IFLEFT$(R$(I1),28)>LEFT$(
    R$(I4),28)THENT$=R$(I1):R$(I1)=R$
    (I4):R$(I4)=T$:I1=I1-N:IFI1>=1THE
    N640
650 I2=I2+1:IFI2>I3 THEN620ELSE630
660 I4=I1+N:IFMID$(R$(I1),97,2)+LEFT$
    (R$(I1),28)>MID$(R$(I4),97,2)+LEF
    T$(R$(I4),28)THENT$=R$(I1):R$(I1)
    =R$(I4):R$(I4)=T$:I1=I1-N:IFI1>=1
    THEN660
670 GOTO650
680 I4=I1+N:IFMID$(R$(I1),99,6)>MID$(
    R$(I4),99,6)THENT$=R$(I1):R$(I1)=
    R$(I4):R$(I4)=T$:I1=I1-N:IFI1>=1T
    HEN680
690 GOTO650
700 '
710 ' LOAD/SAVE ROUTINES
720 '
730 X1$="LOAD":X2$="ON THE CASSETTE R
    ECORDER.":GOSUB760:PRINT:PRINT"LO
    ADING ";F$;"...":IR=1:OPEN"I",-1,
    F$
740 IFEOF(-1)THENIR=IR-1:CLOSE#-1:RET
    URNELSEINPUT#-1,R$(IR):IR=IR+1:GO
    TO740
750 X1$="SAVE":X2$="AND RECORD ON THE
    CASSETTE RECORDER.":GOSUB760:PRIN
    T:PRINT"SAVING ";F$;"...":OPEN"O"
    ,-1,F$:FORI=1TOIR:PRINT#-1,R$(I):
    NEXT:CLOSE#-1:RETURN
760 CLS:PRINT@41,X1$;" DATA FILE":POK
    E1069,32:POKE1074,32:PRINT:INPUT"
    DATA FILE NAME";F$:PRINT:PRINT"PO
    SITION TAPE AND PRESS PLAY ";X2$:
    PRINT@256,"PRESS <ENTER> WHEN REA
    DY."
770 IFINKEY$<>CHR$(13)THEN770ELSERETU
    RN
```

Program 2: TI Version

```
10 REM VMDP TI VERSION
40 DIM R1$(60),Y$(5)
41 YY$="CODRHIHOMUMY"
42 FOR I=0 TO 5
43 READ Y$(I)
44 NEXT I
45 DATA COMEDY,DRAMA,HISTORY,HORROR,M
   USICAL,MYSTERY
50 CC$="DA DT DS PA PT AD DE SM ST SN
    LO SA "
52 CALL CLEAR
54 PRINT TAB(6);"VIDEOTAPE MOVIE":TAB
   (6);"DATABASE SYSTEM": : :"DISPLAY
     <DA> ALL":TAB(10);"<DT> TITLES"
56 PRINT TAB(10);"<DS> SEARCH,DISPLAY
   ": :"PRINTER  <PA> ALL":TAB(10);"<
   PT> TITLES"
60 PRINT :"CHG DATA <AD> ADD
   (3 SPACES)":TAB(10);"<DE> DELETE":
   TAB(10);"<SM> SORT BY MOVIE"
62 PRINT TAB(10);"<ST> SORT BY TYPE":
   TAB(10);"<SN> SORT BY TAPE #": :"D
```

Notes On TI-99/4A Version

C. Regena

An effort was made to keep the translation as close to the author's version as possible. The VMDP record format is the same and the variables used in the program are the same as in the TRS-80 CC version. The line numbers with the explanation are the same in most cases; sometimes lines were added in the TI version because TI BASIC does not allow multi-statement lines.

The TI printed screen is 28 columns wide and 24 lines long. The TI does not have PRINT AT capabilities, so while you are adding a record the screen will scroll, rather than using separate screens.

The cassette file processing procedure is similar to the TRS-80. Line 734 OPENs file device #1, "CS1" or cassette 1. INPUT is used to read in previously saved data. INTERNAL format is used rather than DISPLAY format for more efficiency in this application. Each record is a FIXED length of 127. The TI cassette tape device will use record lengths of 64, 128, or 192 positions in FIXED record type, so we need to specify FIXED 128.

Line 752 OPENs file device #2 to save data in the same format required to read in data.

This program does not check your INPUT as you are adding a record to make sure your answers are logical. Follow the instructions listed in the TRS-80 version for each item entered.

Cassette file processing does not have an EOF function to signal the last data record (disk file processing does). To signal the last record, this program will read the record, then check to see if the first three characters are "ZZZ". Therefore, just before you choose the option to save your data, enter a title of ZZZ (or ZZZZ, etc.). You may press ENTER on each of the remaining INPUT prompts.

Since you may have nearly any type of printer connected to your TI, you will be asked to enter your printer configuration when you choose the printing options. Be sure to use the quotation marks. For example, if you have a TI 825 printer, your printer configuration will be:

"RS232.BA=600"

For a teletype, the configuration may be:

"RS232.TW.BA=110"

This program illustrates the power of string manipulation. The data is saved as one long string of characters (127 long), then certain segments are examined for the sort routines or the displays. SEG$ is a function that will return a specific SEGment of a string variable. For example, R$ is the data record. SEG$(R$,1,28) is the segment of R$ starting with the first character and taking 28 characters – the title. SEG$(R$,97,2) is the segment of R$ starting with the 97th character and taking two characters (the TYpe of movie). String variables need to be combined with &, not +.

```
   ATAFILE <LO> LOAD":TAB(10);"<SA> S
   AVE"
64 PRINT :TAB(10);"<QU> QUIT PROGRAM"
   : :
70 INPUT C$
80 C$=SEG$(C$,1,2)
82 IF C$="QU" THEN 800
84 P=POS(CC$,C$,1)
85 IF P=0 THEN 52
86 P=INT(P/3)+1
88 ON P GOSUB 240,290,340,400,430,450
   ,560,600,600,600,730,750
89 GOTO 52
120 R$=R1$(I0)
122 TY$=SEG$(R$,97,2)
124 P=POS(YY$,TY$,1)
125 P=INT(P/2)
126 TY$=Y$(P)
130 RETURN
140 A1$=SEG$(R$,49,16)
141 A2$=SEG$(R$,65,16)
142 A3$=SEG$(R$,81,16)
143 DI$=SEG$(R$,33,16)
144 TN$=SEG$(R$,99,2)
145 CN$=SEG$(R$,101,4)&"-"&SEG$(R$,10
    5,4)
150 SP$=SEG$(R$,110,1)
151 VT$=SEG$(R$,111,1)&":"&SEG$(R$,11
    2,2)
152 VR$=SEG$(R$,114,1)
154 IF VR$="E" THEN 158
155 VR$=VR$&":"&SEG$(R$,115,2)
156 GOTO 160
158 VR$="EOT"
160 DT$=SEG$(R$,118,2)&"-"&SEG$(R$,12
    0,2)&"-"&SEG$(R$,122,2)
162 CH$=SEG$(R$,124,2)
164 CL$=SEG$(R$,126,1)
165 IF CL$="N" THEN 168
166 CL$="YES"
167 GOTO 170
168 CL$="NO"
170 CM$=SEG$(R$,127,1)
171 IF CM$<>"N" THEN 174
172 CM$="NONE"
173 GOTO 185
174 IF CM$<>"E" THEN 177
175 CM$="EDITTED"
176 GOTO 185
177 IF CM$<>"F" THEN 180
```

```
178 CM$="FEW"
179 GOTO 185
180 IF CM$<>"M" THEN 183
181 CM$="MANY"
182 GOTO 185
183 CM$="ALL"
185 RETURN
190 CALL CLEAR
192 PRINT X1$;" RECORDS": :"TITLE TO
    ";X2$: :
200 INPUT T$
201 T$=SEG$(T$&"{28 SPACES}",1,28)
203 FOR IO=1 TO IR
204 IF T$=SEG$(R1$(IO),1,28)THEN 212
205 NEXT IO
207 PRINT : :"** NO SUCH RECORD **"
208 PRINT :"PRESS <ENTER>";
209 CALL KEY(0,K,S)
210 IF K<>13 THEN 209
212 RETURN
240 IO=1
250 GOSUB 120
252 CALL CLEAR
254 GOSUB 140
255 GOSUB 350
256 PRINT "STARRING: ";A1$:TAB(11);A2
    $:TAB(11);A3$: :"DIRECTOR: ";DI$
258 PRINT :"TAPE: ";TN$;" <";CN$;">":
    "SPEED: ";SP$;"P":"VIEW TIME: ";V
    T$:"TIME REM:  ";VR$
260 PRINT :"RECORDED: ";DT$:"CHANNEL:
     ";CH$:"COLOR: ";CL$:"COMMERCIALS
    : ";CM$
265 GOSUB 360
270 CALL KEY(0,K1,S1)
271 IF K1=77 THEN 365
272 K=K1
273 IF (K<>76)*(K<>78)+(K=78)*(IO=IR)
    +(K=76)*(IO=1)THEN 270
274 IF K<>78 THEN 277
275 IO=IO+1
276 GOTO 250
277 IF K<>76 THEN 250
278 IO=IO-1
280 GOTO 250
290 IP=0
291 MP=INT(IR/5)
292 IF IR/5<>INT(IR/5)THEN 300
294 MP=MP-1
300 CALL CLEAR
301 FOR IL=1 TO 5
302 IO=IP*5+IL
303 IF IO>IR THEN 310
304 GOSUB 120
305 GOSUB 350
306 NEXT IL
310 GOSUB 360
320 CALL KEY(0,K1,S1)
321 IF K1=77 THEN 365
322 K=K1
323 IF (K<>76)*(K<>78)+(K=78)*(IP=MP)
    +(K=76)*(IP=0)THEN 320
325 IF K<>78 THEN 328
326 IP=IP+1
327 GOTO 300
328 IF K<>76 THEN 300
329 IP=IP-1
330 GOTO 300
340 X1$="SEARCH"
341 X2$="SEARCH FOR"
342 GOSUB 190
344 IF IO>IR THEN 365 ELSE 250
350 PRINT "TI: ";SEG$(R$,1,28):"YEAR:
     ";SEG$(R$,29,4);TAB(14);"TYPE: "
    ;TY$: :
355 RETURN
360 PRINT :"<N>EXT PAGE":"<L>AST PAGE
    ":"<M>ENU";
365 RETURN
390 CALL CLEAR
392 PRINT "  ** PRINTER ROUTINE **  "
    : : :
394 PRINT "ENTER YOUR PRINTER":"CONFI
    GURATION:": :
395 INPUT P1$
397 OPEN #3:P1$
399 RETURN
400 GOSUB 390
402 S$="{4 SPACES}"
403 FOR IO=1 TO IR
404 GOSUB 120
405 GOSUB 140
406 PRINT #3: : : :"TITLE: ";SEG$(R$,
    1,28);S$;"YEAR: ";SEG$(R$,29,4);S
    $;"TYPE: " ;TY$
407 PRINT #3: :"STARRING: ";A1$;S$;A2
    $;S$;A3$:"DIRECTOR: ";DI$
410 PRINT #3: :"TAPE: ";TN$;S$;"COUNT
    ER: ";CN$:"SPEED: ";SP$;"P";S$;"V
    IEW TIME:";VT$;S$;"TIME REM: ";VR$
412 PRINT #3:"RECORDED: ";DT$;S$;"CHA
    NNEL: ";CH$;S$;"COLOR: ";CL$;S$;"
    COMMERCIALS: ";CM$
414 IF IO/5<>INT(IO/5)THEN 420
416 PRINT #3: : : : : : : : : :
420 NEXT IO
421 CLOSE #3
422 RETURN
430 GOSUB 390
431 PRINT #3: : :TAB(10);"TITLE";TAB(
    34);"YEAR";TAB(45);"TYPE": :
432 FOR IO=1 TO IR
433 GOSUB 120
434 PRINT #3:SEG$(R$,1,28);TAB(34);SE
    G$(R$,29,4);TAB(44);TY$
435 NEXT IO
436 CLOSE #3
437 RETURN
450 X$=""
451 GOSUB 530
452 RP=1
453 Q$="TITLE"&"{23 SPACES}"
454 L=28
455 GOSUB 540
456 Q$="YEAR"
457 L=4
458 GOSUB 540
459 Q$="DIRECTOR"
460 L=16
461 GOSUB 540
462 FOR I=1 TO 3
463 Q$="ACTOR #"&STR$(I)
464 GOSUB 540
465 NEXT I
466 PRINT
467 Q$="TYPE(CO,DR,HI,HO,MU,MY)"
468 L=2
469 GOSUB 540
470 Q$="TAPE #"
471 L=2
472 GOSUB 540
473 Q$="COUNTER START"
474 L=4
475 GOSUB 540
476 Q$="COUNTER END  "
477 GOSUB 540
478 R$=R$&"/"
479 RP=110
```

```
480 Q$="SPEED (S,L,E)"
481 L=1
482 GOSUB 540
483 Q$="VIEW TIME (H:MM)"
484 L=4
485 GOSUB 540
486 Q$="TIME REM (H:MM)"
487 L=4
488 GOSUB 540
490 R$=SEG$(R$,1,110)&SEG$(R$,111,1)&
    SEG$(R$,113,3)&SEG$(R$,117,2)&"/"
492 RP=118
494 Q$="DATE RECORDED (MM-DD-YY)
    {4 SPACES}{8 SPACES(,}"
496 L=8
498 GOSUB 540
500 R$=SEG$(R$,1,119)&SEG$(R$,121,2)&
    SEG$(R$,124,2)
502 RP=124
503 Q$="CHANNEL"
504 L=2
505 GOSUB 540
506 Q$="COLOR (Y OR N)"
507 L=1
508 GOSUB 540
509 Q$="COMMERCIALS (N OR E,F,M,A)"
510 L=1
511 GOSUB 540
512 IF IR<>0 THEN 515
513 I1=1
514 GOTO 525
515 FOR I1=1 TO IR
516 IF SEG$(R1$(I1),1,28)>=SEG$(R$,1,
    28)THEN 520
517 NEXT I1
518 GOTO 525
520 FOR I2=IR TO I1 STEP -1
521 R1$(I2+1)=R1$(I2)
522 NEXT I2
525 R1$(I1)=R$
526 IR=IR+1
529 RETURN
530 CALL CLEAR
532 PRINT "{4 SPACES}** ADD RECORD **
    ": : :
533 R$=""
534 RETURN
540 PRINT Q$;
541 INPUT A$
542 IF LEN(A$)<=L THEN 546
543 A$=SEG$(A$,1,L)
544 GOTO 550
546 FOR II=LEN(A$)+1 TO L
548 A$=A$&" "
549 NEXT II
550 R$=R$&A$
551 RP=RP+L
552 PRINT
554 RETURN
560 X1$="DELETE"
561 X2$="DELETE"
562 GOSUB 190
563 IF IO>IR THEN 572
565 PRINT :"DELETING RECORD ..."
567 FOR I=IO TO IR-1
568 R1$(I)=R1$(I+1)
569 NEXT I
570 IR=IR-1
572 RETURN
600 IF C$<>"SM" THEN 603
601 C=1
602 GOTO 610
603 IF C$<>"ST" THEN 606
604 C=2
605 GOTO 610
606 IF C$<>"SN" THEN 610
607 C=3
610 CALL CLEAR
611 PRINT "... SORTING RECORDS ...":
    : :
613 N=IR
620 N=INT(N/2)
622 IF N=0 THEN 699
624 I3=IR-N
626 I2=1
630 I1=I2
632 ON C GOTO 640,658,680
640 I4=I1+N
641 IF SEG$(R1$(I1),1,28)<=SEG$(R1$(I
    4),1,28)THEN 650
642 T$=R1$(I1)
643 R1$(I1)=R1$(I4)
644 R1$(I4)=T$
645 I1=I1-N
646 IF I1>=1 THEN 640
650 I2=I2+1
655 IF I2>I3 THEN 620 ELSE 630
658 I4=I1+N
659 S1$=SEG$(R1$(I1),97,2)&SEG$(R1$(I
    1),1,28)
660 S2$=SEG$(R1$(I4),97,2)&SEG$(R1$(I
    4),1,28)
661 IF S1$<=S2$ THEN 650
663 T$=R1$(I1)
664 R1$(I1)=R1$(I4)
665 R1$(I4)=T$
666 I1=I1-N
667 IF I1>=1 THEN 658 ELSE 650
680 I4=I1+N
681 IF SEG$(R1$(I1),99,6)<=SEG$(R1$(I
    4),99,6)THEN 650
682 T$=R1$(I1)
683 R1$(I1)=R1$(I4)
684 R1$(I4)=T$
685 I1=I1-N
687 IF I1>=1 THEN 680 ELSE 650
699 RETURN
730 X1$="LOAD"
732 GOSUB 760
734 OPEN #1:"CS1",INPUT ,INTERNAL,FIX
    ED 128
736 IR=0
738 IR=IR+1
740 INPUT #1:R1$(IR)
742 IF SEG$(R1$(IR),1,3)<>"ZZZ" THEN
    738
746 IR=IR-1
747 CLOSE #1
748 RETURN
750 X1$="SAVE"
751 GOSUB 760
752 OPEN #2:"CS1",OUTPUT,INTERNAL,FIX
    ED 128
754 FOR I=1 TO IR
755 PRINT #2:R1$(I)
756 NEXT I
757 CLOSE #2
758 RETURN
760 CALL CLEAR
762 PRINT "{4 SPACES}** ";X1$;" DATA
    FILE **": : : :
764 RETURN
790 B$=""
792 FOR B=1 TO B1
794 B$=B$&" "
796 NEXT B
798 RETURN
800 CALL CLEAR
810 END
```

TCON:
The Apple Writer Processes Programs

Michael Ginsberg

Would you like to have the power to: change all or some variables in an Apple program; look at two different parts of a program at the same time; find all occurrences of a word or phrase; move one or more lines of a program around at will; have named GOSUB targets; and have other powerful programming tools at your fingertips? You've already got it. Here's how to get more out of the Apple Writer than you may have thought possible.

The Apple Writer, the word processor which comes with every Apple II, can be used in two ways to aid your programming. First, you can use the features of Apple Writer to modify existing programs. Second, you can write your new programs directly using the Apple Writer. If you write programs using the Apple Writer, the only difference is that you use the control-K to keep the characters in uppercase.

A knowledge of text files and BASIC files is necessary to understand how this process works. A short program is included here for files that are currently BASIC programs. This short program uses the EXEC feature of the Apple to create a routine that converts the BASIC program to text so that the Apple Writer can read it.

The TCON program appends three lines to the beginning of your program. The line numbers are 0, 1, and 2. If you already have lines in your program that use those numbers, you must increase these line numbers to 3 or above. First, type in and run EXEC TCON; it will create the TCON program which will convert BASIC to text. Load in the BASIC program and type in EXEC TCON; the disk will start spinning, and your program will be converted. When the program has been converted, you can boot your Apple Writer and use all of the features to help you debug your program. After it is booted, you should hit control-K so it will be in alpha lock.

Some of the features of TCON are: search, replace, scrolling, deleting and retrieving, split screen, and word and phrase counter. Some experimenting with Apple Writer is necessary to learn how it works. After you have finished debugging your program, all you need to do is save the file.

The next step involves converting your file to a BASIC program. This sounds hard but is actually quite simple. After DOS is booted, you need to type NEW; then type EXEC followed by the file name. That's it. Two minutes later, after you've seen many]'s, your file will be magically converted to a working BASIC program. Now you should save the BASIC program and, if you are through making changes, you can delete the text file. Apple Writer can be extraordinarily versatile as a programming aid.

```
10 Q$ =  CHR$ (34):D$ =  CHR$ (4)
20  PRINT D$;"OPEN TCON"
30  PRINT D$;"WRITE TCON"
100  PRINT "0  D$ = CHR$(4) : PRINT D$;"Q$;"
     OPEN FILE";Q$; CHR$ (13)
110  PRINT "1  PRINT D$;"Q$;"WRITE FILE";Q$;
     ": LIST 3-"; CHR$ (13)
120  PRINT "2  PRINT D$;"Q$;"CLOSE FILE";Q$;
     ": END"; CHR$ (13)
130  PRINT "RUN"
140  PRINT "0"; CHR$ (13): PRINT "1"; CHR$ (
     13): PRINT "2"; CHR$ (13)
```

Apple Fast Sort

John Sarver

It can take a long time to put a list into alphabetical order. In a recent experiment, using a basic bubble sort routine, it took the author's Apple eight hours and 57 minutes to sort 1000 randomly created strings of random length between one and 20 characters. This subroutine puts both one- and two-dimensional Apple arrays in order at a tolerable speed: that same list of 1000 strings now takes one minute and 45 seconds.

Strings values, when assigned, are stored at the very top of Apple's free RAM, and as more strings are assigned, they are stored below the strings already in memory. A table, created when you use the DIM statement, keeps track of where each string is in RAM.

Some important information is stored at the beginning of this table. The first byte represents the first character in the variable name. The second byte represents the second character in the variable name plus $80 (adding $80 designates it as a string array rather than an integer or decimal point number array). The next pair of bytes gives the length of this pointer table.

The fifth byte is the number of dimensions that you have used with the DIM statement. If you used a two-dimensional array, the next two bytes tell how many variables are in the second part of the dimension (if three-dimensional, the next four bytes, and so on).

The final two bytes of information are the number of strings in the first dimension. The table begins here. Each variable is located by a three-byte pointer. The first byte is the length of the record, and the next two point to where the first character of the variable is stored. These pointers are always in order from the zero dimension to the nth dimension.

At the end of this grouping of pointers are the pointers for the first group of the second dimensioned part of the array. Following this is the second group of pointers for the second dimensioned part of the array, and so on. If you used a one-dimensional array, there is only one group of pointers.

As you can see, there is no need to sort the strings themselves. Just sort the pointers. Therefore, there is no time wasted in garbage collection and, in most cases, the length of the strings does not affect the time of execution.

Simple To Use

Using this sort is quite simple. Apple stores the last variable used in $81 and $82, so you may need to insert a statement in your BASIC program such as A$(0) = A$(0) (see line 90 of Program 2), or you may POKE these values in if you are putting this utility on another machine. The sort can be easily changed to use the zero dimension of an array if you wish. To do this, simply change the following lines in the BASIC loader (Program 1).

```
120  IF CK <  > 56854 THEN PRINT "CHECK DAT
     A STATEMENTS FOR ERROR": STOP
200  DATA  169,0,133,253,133,239,169,1
400  DATA  165,6,105,2,133,6,169,0
```

If you are using a two-dimensional array, you will need to store the records that are to be put in order by using the zero subscript of the second dimension (that is, A$(1,0), A$(2,0), etc.). The accompanying arrays (A$(1,1), A$(2,1), A$(1,2), A$(2,2), etc.) will be kept with their respective zero-subscripted record.

The sort will automatically ascertain if you are using a one- or two-dimensional array and will adjust itself accordingly. You may use any number of subscripts desired in one-dimensional arrays and in the first part of the two-dimensional arrays. But don't try to use anything larger than a two-dimensional array, or attempt to use more than 255 variables in the second part of your two-dimensional array. Some of the corresponding subarrays would not be properly aligned.

Program 1 loads the machine language sorting routine into RAM. You should save this on disk by typing:

```
BSAVE SORT, A$944A,L$1B6
```

Program 2 provides an example of the steps necessary to use the routine.

Program 1: ML Fast Sort Loader

```
100  REM  THIS PROGRAM INSTALLS BUT DOES
      NOT RUN THE ML FAST SORT
110  FOR I = 37962 TO 38399: READ A:CK =
      CK + A: POKE I,A: NEXT
120  IF CK <  > 56857 THEN  PRINT "CHECK
      DATA STATEMENTS FOR ERROR": STOP
130  TEXT : HOME : PRINT "TYPE 'BSAVE SORT,
      A $944A,L$1B6'"
140  PRINT "TO SAVE SORT ROUTINE ON DISK"
```

```
150  NEW
200  DATA  169,0,133,253,169,1,133,239
210  DATA  133,31,166,107,134,6,166,108
220  DATA  134,7,165,129,160,0,209,6
230  DATA  208,3,32,126,148,200,208,246
240  DATA  232,134,7,228,112,208,239,209
250  DATA  6,208,3,32,126,148,200,196
260  DATA  111,208,244,96,165,130,200,208
270  DATA  2,230,7,209,6,240,10,192
280  DATA  0,208,2,198,7,136,165,129
290  DATA  96,192,0,208,2,198,7,136
300  DATA  24,152,101,7,133,7,169,0
310  DATA  101,7,133,7,104,104,56,160
320  DATA  4,177,6,233,1,240,8,200
330  DATA  200,177,6,133,31,169,2,24
340  DATA  101,6,105,5,133,6,169,0
350  DATA  101,7,133,7,160,0,177,6
360  DATA  133,249,133,251,133,26,200,177
370  DATA  6,133,250,133,25,162,2,24
380  DATA  165,250,101,25,133,25,165,251
390  DATA  101,26,133,26,202,208,240,24
400  DATA  165,6,105,5,133,6,169,0
410  DATA  101,7,133,7,56,165,250,229
420  DATA  239,133,250,133,252,176,10,165
430  DATA  239,240,6,198,249,165,249,133
440  DATA  251,165,6,133,237,165,7,133
450  DATA  238,169,0,198,250,197,250,208
460  DATA  42,197,249,240,5,198,249,24
470  DATA  144,33,197,253,240,18,133,253
480  DATA  198,252,165,251,133,249,165,252
490  DATA  133,250,208,213,165,251,208,1
500  DATA  96,56,233,1,133,249,133,251
510  DATA  24,144,198,24,165,237,133,235
520  DATA  105,3,133,237,165,238,133,236
530  DATA  105,0,133,238,160,0,132,254
540  DATA  177,235,208,6,177,237,240,177
550  DATA  208,54,209,237,240,8,144,6
560  DATA  177,237,240,165,133,254,133,255
570  DATA  162,0,200,177,235,149,0,177
580  DATA  237,149,2,232,192,2,208,242
590  DATA  160,0,177,0,209,2,240,4
600  DATA  144,135,176,12,200,196,255,208
610  DATA  241,165,254,208,3,76,19,149
620  DATA  169,1,133,253,160,0,177,235
630  DATA  72,177,237,145,235,104,145,237
640  DATA  200,192,3,208,241,166,31,202
650  DATA  240,45,24,165,235,101,25,133
660  DATA  27,165,236,101,26,133,28,165
670  DATA  237,101,25,133,29,165,238,101
680  DATA  26,133,30,160,0,177,27,72
690  DATA  177,29,145,27,104,145,29,200
700  DATA  192,3,208,241,202,208,3,76
710  DATA  19,149,24,165,27,101,25,133
720  DATA  27,165,28,101,26,133,28,165
730  DATA  29,101,25,133,29,165,30,101
740  DATA  26,133,30,24,144,205,141,183
```

Program 2: Steps Necessary To Use Fast Sort

```
10  HIMEM: 37962
20 D$ =  CHR$ (4)
30  PRINT D$"BLOAD SORT"
40  INPUT "HOW MANY RECORDS";N
45  DIM A$(N)
50  FOR A = 1 TO N
60  PRINT "WHAT IS RECORD #"A;
70  INPUT " ";A$(A)
80  NEXT
90 A$(0) = A$(0)
100  CALL 37962
110  FOR A = 1 TO N
120  PRINT A$(A)
130  NEXT
140  END
```

©

64 Odds And Ends

David Martin

Here are a few interesting tidbits about the 64.

• Warm Start By SYS 64738

This handy little number will help save your power switch. However, if the system crashes or locks up, you will have to power down.

• List Terminator

This feature will keep others from viewing your program after it's run. To disable the list, add to your program POKE 775,200. To restore the list feature, use POKE 755,167.

• STOP Key

POKE 808,239 turns the STOP key off.
POKE 808,237 turns the STOP key on.

•RUN/STOP And RESTORE Key Terminator

POKE 808,225 disables these keys; however, it changes the appearance of the program listing (this does not affect the program run). POKE 808,237 restores both keys to normal.

• Keyboard Killer

POKE 649,0 turns the keyboard off.
POKE 649,10 turns the keyboard on.

• Save And List Destroyer

The saving and listing of your program can be prevented by killing the STOP and RESTORE keys. To do this, add POKE 808,225:POKE 818,32 to your program. To go back to normal, type POKE 808,237:POKE 818,237. Note: POKE 808,225 has a side effect – it messes up the system clock.

• Magic Merge

"Magic Merge" will work on the 64, if you use the VIC-20 method.

"Magic Merge" is a technique described by Jim Butterfield (**COMPUTE!**, June 1982) that lets you combine lines from one program with another. Here is a condensed set of instructions:

To prepare the lines you want to merge:

1. Insert a blank tape, rewind, and then type:

```
OPEN 1,1,1,"PROGNAME":CMD1:LIST
```

("PROGNAME" is a name for your program)

2. When the tape stops and 'READY' comes back, enter: PRINT#1:CLOSE 1
3. After the tape stops, you can remove it.

To merge with a program in memory:

1. Put the "merge tape" in the tape unit.
2. Enter: POKE 19,1:OPEN 1
3. After 'READY' comes back, clear the screen (SHIFT-HOME).
4. Press exactly three cursor-downs.
5. Enter:

```
PRINTCHR$(19) :POKE198,1:POKE631,13:POKE153,1
```

6. The tape will finally stop with an error message. Ignore the error, and enter CLOSE 1.
7. The lines are now merged, magically. ©

Atari Times

B. B. Garrett

Knowing how much time the Atari needs to perform specific operations can help you speed up running times for BASIC programs. Here are the durations of various operations, along with suggestions for fixing the most time-consuming ones.

Most people who purchase a home computer do so for a long list of practical reasons beyond the fact that computers are great fun. My own list included the preparation of color slides, a modest amount of word processing, and some fairly heavy number crunching in connection with my research in theoretical solid state chemistry.

Because of its excellent color graphics, very good keyboard feel, and relatively fast 1.8 MHz clock rate, the Atari 800 was my choice.

After using the computer for all those other things for a few months, it came time to make the machine earn its keep by doing a big repetitive calculation. I won't drag you through the details of that computation, but the size of the problem is illustrated by the fact that four deep nested loops with indices ranging up to 40 were required. This meant about a million passes through the inner loop where several calculations and a couple of comparisons were necessary.

My original BASIC program *would still be running* today, if it had been turned loose on the full problem. I needed to optimize the program or develop a machine language subroutine to get the calculation done in a reasonable time. In any case, a knowledge of the execution times for specific operations was required to make intelligent programming decisions. Let's examine some of the facts and myths about speeding up program running times in Atari BASIC.

Taking A Hard Look

In the problem I have been discussing, an overall time reduction of 66 percent was accomplished without resorting to machine language. These savings were achieved by utilizing every speedup hint I had ever encountered. Many of these changes were tedious and ineffective, but others obviously worked. Examining the actual time savings proved that a systematic approach to faster BASIC programs was called for.

The most important idea is to spend your time where the program is spending its time. There is little value in clipping a few milliseconds off a section of the program which is traversed only once or twice. It also helps if programs are laid out from the start with fast execution in mind. The best way to write faster, more efficient programs is to know your tools. To understand the way BASIC works, one needs to know:

- How it proceeds from statement to statement and line to line,
- How it branches and sets up loops,
- How it stores and looks up variables, matrices, and strings, and, most important for speed,
- How long it takes to perform various operations.

Lane Winner and Bill Wilkinson have described many aspects of Atari BASIC recently in very informative articles. These articles give a clear description of the first three items above. Briefly, BASIC lines are stored sequentially in memory beginning with line numbers and the number of bytes offset to the next line. The offset to the next statement precedes each tokenized BASIC statement. Tokens are one-byte identifiers of commands, variables, etc., which serve as offset addresses in appropriate tables. Command and syntax tables guide the interpretation of the statement. A matrix or string would be tracked from the variable name table through the variable value table to the string array table. Branch destination lines are found by sequentially comparing line numbers from the beginning of the program each time the branch is made. Return line numbers and statement offsets are saved on a last-in, first-out runtime stack.

The main focus of this article is on the time required to perform a specific operation in Atari BASIC. This information should allow a programmer to make better choices to increase speed.

Before looking at BASIC operation times, let's review the kinds of advice about speeding up programs which have been published in various places. Such advice falls into three categories:

A. Choose the most efficient program logic for the task at hand.

B. Don't distract the machine while it is trying to get your calculation done.

C. Avoid unnecessary or time-consuming operations, particularly in loops.

Type A advice includes selecting the most efficient algorithm, rewriting heavily revised programs to eliminate the tangles, and substituting machine language for BASIC loops, via USR subroutines. Advice in categories B and C is usually more specific, recommending particular machine operations or program sequences.

Turning The Screen Off

Fixes of type B might involve shutting down the screen or using a lower resolution graphics display while calculations are in progress. Screen support in Graphics mode 0 occupies 31 percent of the Atari's time, which may be saved with POKE 559,0 before entering the calculational loop and later POKEing 559,34 to get the display back. An additional three percent saving accrues when the display processor is turned off by inserting a one in register 66 in place of the usual zero. The display processor should be disabled after the screen, but not before the next vertical blank period; wait 17 milliseconds (*ms*) to be sure. Before the machine gets down to serious computation, all INPUT, READ, and disk access operations should be completed. Removal of such extraneous activities from its workload leaves the 6502 free to crunch your numbers as fast as BASIC will allow.

Most timesaving programming hints are of type C. BASIC branches to a line number or returns to a FOR statement by searching line numbers from the start of the program; thus, frequently used destination lines and loops should have low line numbers. Similarly, variables, matrix elements, and strings must be looked up in the variable name table and should be near the beginning of the table if they are used often.

GOSUBs and loops remember where to return by saving that line number on a stack. Removing GOSUBs from loops and placing the most repeated loop deepest in nested loops should minimize such stack operations. Calculations may be needlessly repeated by placing them within a loop. For example, multiplication every time through a loop can often be replaced by multiplying the sum once after the loop is completed. Most of these hints are based on a valid premise, but some offer negligible time savings.

Some contradictory admonitions are also in circulation. Preferences for both variables and constants in BASIC statements have appeared. The relative merits of IF __ THEN __ and ON __ GOTO__,__,__ conditional branches are debated in letters to the editor. Some confusion may develop when the characteristics of one computer are assumed to be the same as those of another. For the Atari, constants are actually marginally faster than the equivalent variable. Constants are ten to forty times slower to read in a BASIC line for both PET and Apple, which is the reason why BASIC games written for these machines all seem to start with the sequence, N1=1:N0=N1-N1: N2=N1+N1:.... The construction IF A THEN __ which fails (A=0) is the single fastest BASIC operation for all three machines, but ON __ GOTO __ may be preferred for the PET under most conditions.

Timing Functions

The time for an operation in BASIC is easily determined: set up a loop to perform the operation some number of times and then read the internal clock (RTCLOK at 18, 19, 20; notice that the order of bit significance is the reverse of that given in Appendix I of the *Atari BASIC Reference Manual)* before and after the loop. The following program does this timing for any desired operation substituted for FUNCTION(A) in line 50. Loop overhead time is obtained by removing the function from the loop.

```
10 REM ** BASIC FUNCTION TIMER **
20 N=1000:OVERHEAD=1.58333333:A=-1.2
   3456789:B=9.87654321
30 FOR K=1 TO 3
40 POKE 559,0:X=PEEK(20)+PEEK(19)*
   256
50 FOR I=1 TO N:C=FUNCTION(A):NEXT I
60 Y=PEEK(20)+PEEK(19)*256:POKE 559,
   34
70 ?(1000/N)*(Y-X)/60-OVERHEAD;" ms,
   C = ",C
80 FOR J=1 TO 1000:NEXT J:NEXT K
```

Line 20 establishes parameters for the loop. The variables used in the loop should have nine significant figures because some functions are faster with fewer digits. The POKE 559,0 command in line 40 turns off the TV screen so that we can obtain times independent of screen support. The clock is read in lines 40 and 60 with the difference printed in 70. The K loop (lines 30-80) repeats the measurement so that we may see any clock rollover and roundoff effects, and the J loop in line 80 allows us to observe the results between runs.

The time data in the table demonstrate that Atari BASIC operates in the millisecond time domain which corresponds to a few thousand machine cycles. Addition and subtraction require two milliseconds. Multiplication and division are several times longer. Logarithms, exponentiation, trigonometric functions, and square roots take about a tenth of a second. It is clear that we should avoid using the latter functions in loops whenever possible.

Integer powers up to 12 or more are actually faster by direct multiplication. As an example,

BASIC Operation Times (milliseconds) [a]

Arithmetic Functions

A+B	2.0	A*B	3-12[b]
A-B	2.1	A/B	8[c]
SQR	99	A^B	150
COS	51[f]	CLOG(B)	84
SIN	51[f]	LOG(B)	89
ATN	79[f]	EXP(B)	76

Assignments

A=#[d]	1.15
A=B[e]	1.18
C$=B$	1.5
A=B+1	2.0
A=A(3,3)	4.4
A(3,3)=A	4.0

Special Functions

PEEK( )	3.1
POKE_,_	2.5
FRE(0)	2.5
RND(0)	9.5
ABS( )	1.7
INT( )	1.8
SGN(+)	1.8
SGN(-)	2.1
ADR	2.5

Strings [g]

ASC	2.6
CHR$	2.5
LEN	2.6
STR$	2.5
VAL	3.7
C$=B$	1.5
C$=B$(I,I)	3.9
A$(I,I)=B$	3.6
C$(I,J)=B$(K,L)	6.1

Graphics

GRAPHICS	15-81
COLOR	1.1
SETCOLOR	3.1
SOUND	2.9
PLOT	2.9
LOCATE	4.7
POSITION	1.1
STICK/STRIG	2.8

Branches and Loops

line look up	0.041 ms per line	
FOR/STEP/NEXT	1.7 (all in one line) STEP adds no time	
GOSUB/RETURN	1.7 (to line 2, return to line 4)	
GOTO	(2.0 to line 2)	
ON N GOTO_,_,	(1.2+N)	
IF_THEN_	false	true
A=0	1.4	2.5
A=# or var.	1.7	2.9
A	0.52	1.7
TRAP (set)	2.0	
LPRINT with no printer	930	
A(3,4)=A with DIM A(3,3)	3.5	
GOTO 1 with no line 1	1.7	
X=USR(addr,A,B)	3.5, 4.6, 6.1	
(# variables passed:	0 , 1 , 2)	

[a] Measured with the screen off and the display processor on; multiply by 1.45 to get normal graphics mode 0 time.

[b] Multiplication time varies from 3.1 to 12.3 ms depending on the sum, S, of digits in the multiplier only. T(ms)=2.99+.1154*S (see text).

[c] Division takes 8+/-2 ms with rare extremes of 5.3 and 12.3 ms.

[d] # means 1.23456789 was entered in the BASIC statement.

[e] All Atari BASIC functions require 0.035 ms longer to get a variable than read the same number in the BASIC line.

[f] Trig functions take the same time in degree and radian modes.

[g] String operations involve 10 characters except as noted.

R2=X*X+Y*Y+Z*Z takes only 23 ms, while the more typical R2=X^2+Y^2+Z^2 requires 460 ms. The SQR function does offer a one-third savings compared to R^(0.5), but 0.1 second is still a long time.

The time required for trig functions suggests that it might be quicker to cast problems in a geometric format and use triangle ratios directly. A better solution is to calculate the trig functions separately and pass the values to the loop as variables. The binary operations addition, subtraction, and division show little effect of operand order, digit size, or the number of digits.

Multiplication is more complicated in Atari BASIC. It depends almost exclusively on the multiplier, the left member of the product A*B. Both the number and magnitude of the digits in the multiplier are important, but in a simple way. The sum, S, of all the digits in the multiplier determines multiplication time according to the relation, T(ms)=2.99+0.1154*S. So, small numbers should be multipliers and larger ones multiplicands.

An example of this occurs in the Timer program above, where a two-byte number is read from memory with the statement: PEEK(20)+PEEK(19)*256. This statement has the preferred form because the most probable sum of digits in an unknown byte is 10 compared to 2+5+6=13 for the multiplicand. This kind of information should allow time savings every time a program is written.

Looking Up Variables

Something that doesn't appear in the table is the observability of differences in lookup time for variables. Comparison of reading times for variables separated by 35 positions in the variable name table failed to show any time differences. The idea that a low position in the variable name table would yield shorter access times for loop variables is not borne out in practice. Another great idea ambushed by the facts. It is also possible to compare read times for constants and variables since BASIC treats floating point numbers from any source the same way. Variables require 0.035 ms longer than constants in all operations.

A closer look at the table indicates that the one millisecond time scale probably represents the overhead time associated with BASIC itself. Even the functions ABS and SGN, which interact with only the single sign bit of a number, require about two ms for execution. I had expected that the more direct byte manipulations of memory such as PEEK, POKE, and strings would be very fast compared to floating point number juggling. Such is

not the case, as can be seen by comparing the times for C$=B$, 1.5 ms, and A=B, 1.2 ms, where both involve ten characters.

Matrix element assignments are significantly slower than variable or string assignments. Calculation of indexed element locations in the string array table probably accounts for the extra time in both matrix and substring operations. Atari's special graphics functions all proceed with reasonable alacrity.

Even the GRAPHICS command (which takes 80 ms in mode 8) is not slow, considering that it completely rewrites screen memory. The principal use for speedy graphics functions is in writing games, and one caveat in this area is that the often used random number generator is quite slow at 9.6 ms. BASIC game designers who need random numbers would do well to prepare a table outside the main game loop.

Probably the most interesting time-saving features are in the branches and loops section of the table. The time required to compare each line number with the destination line number is only 0.04 ms, which can add up in a hurry, or perhaps I should say slowly. In the megapass interior loop of the program mentioned earlier, finding the FOR statement in line 5 took a little over three minutes, but it would have required over two hours in the original form of the program. Each of the branch times in the table should have appropriate line hookup times added. I really don't suggest that you do such calculations, but rather that you realize the implications and organize your programs accordingly.

A one-line FOR/NEXT loop takes 1.65 ms per cycle; placing the NEXT statement in the following line increases the repeat time to 1.71 ms. This means that BASIC uses 0.06 ms to fetch the next line. The savings of in-line FOR/NEXT loops are small compared to other time-savers. The megapass loop above took only one minute per line for fetching the next line or about one percent of the total loop time. Inclusion of a STEP in the FOR/NEXT counter adds no time because the *step is always there*, with a default value of one.

Fast GOSUBs

As the table shows, a GOSUB-RETURN sequence takes less time than a GOTO. This is unexpected. Particularly in view of the fact that branches with returns (GOSUBs) must first leave their intended return address on a "stack" in the computer, for later reference. I suspected some sort of error in at least one of these measurements, but several more measurements in different program environments gave consistent results. Why? Anyone know?

The conditional branch commands ON __ GOTO __,__,__ and IF __ THEN __ vary in time requirements depending on the way they are used. "The road not taken" with A=0:IF A THEN __ is the quickest thing BASIC can do (or not do), taking 0.52 ms on the Atari. This quick test could be very useful in determining when to leave a many-pass loop because it is so much faster than anything else. The IF construction is faster than ON __ GOTO __ for simple decisions, but the latter is superior to a sequence of IF statements for multiple branches.

It is also worth noting that the more frequently chosen destinations should be moved to the front of the GOTO list because each position costs one ms per branch. The TRAP statement is included among conditional branches because that's what it is, and because it is occasionally used to make exit decisions in loops. The time required for trap branching is essentially the time needed to try the operation, establish an error condition, then branch. The fastest trap I've found is to GOTO a nonexistent line 0. TRAP is useful to test whether a disk drive or printer is on-line, but these operations can take many seconds before an error is established.

USR Times

The last entry in the table is the USR function which calls a machine language subroutine and passes variables to the subroutine. BASIC converts the floating point variables into two-byte integers and leaves them in designated memory registers. The three times listed correspond to passing none, one, or two variables. The subroutine tested here performed the housekeeping required by USR (clearing the processor stack) and returned.

Minimum time for machine language interfacing is over three ms; thus, USR calls will not be an effective way to accomplish isolated operations quickly. A better approach would be to construct entire loops or functions which can take advantage of machine language speed, particularly integer arithmetic, without repeated returns to BASIC.

Adding It All Up

When I first needed to know how long the Atari takes to do things, I was surprised that such data had not already been published. After taking the measurements, I find it much easier to understand. The results often vary in different program environments, and complete definition of "program environment" is not easy. Even so, the relative times for alternative operations should be consistent in other situations. You should be able to make better programming choices from the data presented here. A number of general observations about Atari BASIC are worth repeating:

- Nothing much happens in less than 1.2 ms.
- Constants are faster than variables, but not enough to get excited about.

- Multiplication is a complicated affair in which we want to put the least first.
- Logs, roots, trigs, and powers take a while.
- Despite their simplicity, strings are slower than floating point numbers.
- Access times for matrix elements and substrings are much longer than variables and whole strings.
- Lookup times within the variable name table and variable value table were too short to measure.
- Runtime stack operations don't appear to be very time-consuming.
- Calling the next line costs only 0.06 ms which, by itself, isn't enough to justify line packing.
- Special number modes such as degrees, radians, and scientific notation have no measurable effect on operation times.
- The single most effective time-saver is to turn off the screen.

Programs should be organized to isolate the most time-consuming parts so that special attention is needed only in these sections. The entry routine placed at the back of the program should take care of program setup, including all input, disk access, and other slow interactive processes.

The main routine may have large parts which are not repeated and use little time. The time-consuming parts should be moved to the front of the program as a subroutine and carefully optimized using the timing information in this article, line packing, or anything else that leads to maximum efficiency. The latter part of the main routine cleans up after the fast subroutines and delivers the results to an output routine which displays and prints them.

If the program is interactive and includes frequent reruns, then reentry points which take advantage of the original setup should be provided. The sequence in the program listing will be (1) branch to entry, (2) optimized subroutines, (3) main routine, (4) output, and (5) entry. I seldom succeed in preparing a program in this manner from the beginning, but reorganization with these goals in mind is very effective.

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Versatile Data Acquisition With VIC

Doug Horner and Stan Klein

This simple method of adjusting the VIC's internal jiffy clock can slow it down to match your timing needs making possible "variable speed" machine language subroutines. You can save a good amount of money by transforming a VIC into this special-purpose tool. You can even use this to speed up games.

Home computers are finding their "homes" in labs, more and more frequently. Their flexibility and low cost make them excellent substitutes for more expensive special equipment. One common use is as a data acquisition device. Data acquisition systems monitor and record information on experiments in progress. For example, a chemist may use a special electrode to measure the concentration of a particular component in a chemical solution. As the concentration changes, the electrode sends a varying voltage to an analog-to-digital converter. The converter changes the voltage signal to binary data which can be recorded and stored for later analysis.

To log the data, the chemist could use a special-purpose data acquisition system perhaps costing thousands of dollars and useful only for a particular type of experiment. On the other hand, a microcomputer could be programmed to perform the same function. Moreover, to perform another type of experiment, the chemist need only modify the program instead of buying new equipment. When the data is stored, the computer might also be useful in analyzing it.

Surprisingly Simple

There is a surprisingly simple method for converting the VIC into a data acquisition system. A good acquisition system is based on a clock which uses interrupts to sample the user port at adjustable, fixed intervals. Data acquisition software is usually complicated because you must worry about interrupts generated from the jiffy clock.

A simpler scheme is to append the data acquisition routine to the front of the interrupt service routine which is already functioning in connection with the jiffy clock. Every 16.667 milliseconds, VIC interrupts whatever it is doing to look at the keyboard and update the jiffy timer. Here's how to attach your own program to the jiffy service routine and how to set the jiffy clock to any rate of data acquisition.

To change the number of interrupts per second, just POKE different numbers into the low timer latch (37158) and the high timer latch (37159). Under normal operating conditions, these bytes are loaded with 137 in the low latch and 66 in the high latch. An interrupt is generated and the latches are reloaded into the counters whenever the counters are decremented to zero. The number of cycles between interrupts is two cycles greater than the number in the latches.

You might expect the counter to be loaded with 16667 less two, since the normal interrupts are every 1/60 of a second; but 66*256 + 137 = 17033 rather than 16665. This means simply that the "1 MHz" counter decrements at $1.022*10^6$ Hz, not at an even rate of $1.00*10^6$ Hz. So, to make the jiffy clock interrupt at a rate different than the normal 1/60 per second, just multiply the desired number of microseconds per interrupt by 1.022 and subtract two from that number. Example: for a millisecond interrupt (1000*1.022)-2 = 1020, so you would POKE 3 into the high byte at location 37159, and 252 into the low byte at location 37158 (3*256 + 252 = 1020) – and now you have an interrupt every millisecond.

There are limits to this method of changing the jiffy clock to produce varied interrupts. At the slow end, the largest number that could be loaded is $FFFF, or 65535. For the longest time interval

Interruptions Can Make Your Games Run Faster

Ottis Cowper, Technical Editor

This is a very powerful programming technique, *the interrupt driven subroutine*, which has a much wider range of applications than merely gathering data from the user port. For example, how would you like your computer to handle two jobs at once? Actually, the 6502 microprocessor is a sequential device and can only do one operation at a time, but the VIC's hardware interrupts occur so frequently (60 times per second) that a machine language interrupt routine can appear to work concurrently with BASIC.

A Demonstration

As a demonstration, make the additions and changes shown in Program 1 to the program in the article. (This demonstration is for the *unexpanded* VIC and requires a joystick. Remove or disable any expansion modules.) Since the DATA statements contain a machine language routine, they *must* be typed in exactly as shown. Be sure to save a copy of the program before you RUN since an error in an interrupt routine almost always causes your system to lock you out. For those interested in the operation of the routine, a disassembly of the code is provided in Program 2.

When you RUN the program, you should see a bar appear in the center of the screen. Try moving your joystick left and right and notice how smoothly the bar moves. Type in a new value for the high and low bytes of the timer. Higher timer values slow down the bar movement; lower values speed it up. Compare this to the slow and jerky movement you're used to in BASIC, and imagine how an interrupt joystick or character movement routine would improve your favorite game.

The main point is that the joystick reading and bar movement are totally independent of BASIC. To prove this to yourself, hit the STOP key. You'll see the message BREAK IN 35. The BASIC program has ended, but the interrupt routine is not affected. The bar movement continues as before. To disable the routine, hit the RUN/STOP and RESTORE keys at the same time.

How To Add It To Your Programs

Here is the procedure for adding an interrupt driven routine to your BASIC program (example lines from the program given in the article are noted in parentheses):

1. Reserve room for the new routine somewhere in memory (line 10).
2. Load the machine language code into the protected area (line 15).
3. Disable interrupts, load the address (known as the "interrupt vector") of the new routine into locations 788 and 789, and re-enable interrupts (line 20).
4. If necessary, modify the speed of the interrupt routine by adjusting the rate of the jiffy clock (line 30).
5. It is *absolutely* essential that the appended interrupt routine end with a JuMP to the normal ROM interrupt handling routine (for the VIC, this would be JMP $EABF).

Program 1: Demonstration Program

```
11 PRINT"{CLEAR}"
12 FORI=38400TO38905:POKEI,0:NEXT
13 POKE 1,8:POKE2,10
14 FORI=0TO2:POKE7909+I,160:NEXT
15 FORZ=0TO69:READQ:POKE(28*256+Z),Q:NEXTZ
22 DATA 166,1,164,2,169,127,141,34,145,173
23 DATA 31,145,41,16,240,26,173,32,145,41
24 DATA 128,208,35,192,21,240,31,169,32,157
25 DATA 220,30,232,200,169,160,153,220,30,24
26 DATA 144,16,224,0,240,12,169,32,153,220
27 DATA 30,202,136,169,160,157,220,30,134,1
28 DATA 132,2,169,255,141,34,145,76,191,234
35 GOTO35
```

Program 2: Disassembly Of Machine Language Routine In Program 1

```
1C00 A6 01     LDX $01
1C02 A4 02     LDY $02
1C04 A9 7F     LDA #$7F
1C06 8D 22 91  STA $9122
1C09 AD 1F 91  LDA $911F
1C0C 29 10     AND #$10
1C0E F0 1A     BEQ $1C2A
1C10 AD 20 91  LDA $9120
1C13 29 80     AND #$80
1C15 D0 23     BNE $1C3A
1C17 C0 15     CPY #$15
1C19 F0 1F     BEQ $1C3A
1C1B A9 20     LDA #$20
1C1D 9D DC 1E  STA $1EDC,X
1C20 E8        INX
1C21 C8        INY
1C22 A9 A0     LDA #$A0
1C24 99 DC 1E  STA $1EDC,Y
1C27 18        CLC
1C28 90 10     BCC $1C3A
1C2A E0 00     CPX #$00
1C2C F0 0C     BEQ $1C3A
1C2E A9 20     LDA #$20
1C30 99 DC 1E  STA $1EDC,Y
1C33 CA        DEX
1C34 88        DEY
1C35 A9 A0     LDA #$A0
1C37 9D DC 1E  STA $1EDC,X
1C3A 86 01     STX $01
1C3C 84 02     STY $02
1C3E A9 FF     LDA #$FF
1C40 8D 22 91  STA $9122
1C43 4C BF EA  JMP $EABF
```

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between interrupts, the number of microseconds would be (65535 + 2)/1.022 = 64126. The fast end limit is set by the percent of time remaining for BASIC. This percent is derived by (L-IR)/(L + 2), where L is the number POKEd in the timer latch described above, and IR is the number of cycles taken up by the unmodified interrupt service routine.

There are approximately 220 cycles in the unmodified interrupt service routine; thus, if the number POKEd into the timer approaches 220, there will be no time available for anything other than attending to the interrupt service routine.

Here's how to add your own machine language routine to the jiffy clock service routine. Normally, when the decrementing counter hits zero, the operation is transferred to the interrupt service routine whose beginning address ($EABF) is stored in 788 and 789 ($0314 and $0315). By changing the address in 788 and 789, you can tell VIC to do additional instructions in machine language and then go to $EABF to run the normal service routine.

To change the address in 788 and 789, you must disable the interrupt enable register for the jiffy clock to allow the number in these locations to be changed. POKEing location 37166 with 128 will disable the interrupt; after the addresses in 788 and 789 have been changed, POKEing location 37166 with 192 will enable the interrupts again. Here's a sample program:

```
10 POKE52,28:POKE56,28:REM SETTING UPPER ~
    BOUNDARY FOR BASIC
15 FOR Z=0 TO 9:READ Q:POKE(28*256+Z),Q:N
    EXT Z:REM MACHINE PROGRAM IN PAGE
     28
20 POKE37166,128:POKE788,0:POKE789,28:POK
    E37166,192
21 REM LINE 20 CAUSES THE INTERRUPT TO NO
    W GO TO PAGE 28
25 DATA 173,16,145,157,0,29,232,76,191,23
    4
30 INPUT"LOW";N1:INPUT"HIGH";N2:POKE37158
    ,N1:POKE37159,N2
31 REM LINE 30 CHANGES THE TIMING OF THE ~
    INTERRUPT
```

The machine language program in line 25 disassembles to:

1C00 LDA $9110;	Get data from user port
1C03 STA $1D00,X;	Store data in page 29 ring buffer
1C06 INX;	Increment pointer for ring buffer
1C07 JMP $EABF;	Jump to normal jiffy service routine

This program can be used as a guide for setting up the jiffy clock for timed data acquisition. One additional consideration in terms of the percent of time left for BASIC: the above program has added an additional fourteen cycles which must be added to the IR variable. Exercise caution if data is to be gathered at faster than half-millisecond intervals. ©

Optimizing PET Speed

Michael W. Schaffer

Careful numbering of program lines in Commodore Upgrade and 4.0 BASIC can improve the execution speed of GOTOs and GOSUBs. This technique is not *applicable to the VIC-20, but the VIC is quite fast without it.*

You can improve the efficiency of certain GOTOs and GOSUBs in your programs. The technique, though simple, is apparent only if you look at a disassembly of the BASIC ROM (it's at hex B830 in 4.0 ROMs).

The major overhead in the execution of GOTOs and GOSUBs is the time taken by BASIC to find the line number you are going to (the target line number). To start the search, BASIC first compares the high-order byte of the target line number to the high-order byte of the current line number. If the target high byte is larger, then BASIC starts to search at the next line of the program. Otherwise, BASIC starts the search at the beginning of the program.

Notice that BASIC only compares the high byte of the line numbers: small jumps forward may still be searched for from the beginning of the program. By carefully numbering the lines of your program, you can avoid this waste of time. The rule for this is simple:

Minimum target line number = 256*(INT(current line #/256) + 1)

In a test program of 100 lines followed by a forward GOSUB, the speed of 100 executions of the GOSUB was improved by a factor of three by numbering the GOSUB as shown above. The amount of time saved is directly dependent on the length of your program and the position of the GOTO or GOSUB in the program, but can be significant, especially in user-interactive routines.

Program 1:
Non-optimized GOSUB And Sample Run

```
100 REM NOTICE THAT THE  HIGH BYTES ARE EQ
    UAL
250 T0=TI:FOR I=1 TO 100:GOSUB 255:NEXT:PR
    INT"NON-OPTIMIZED";(TI-T0):END
255 RETURN

NON-OPTIMIZED 63
```

Program 2:
Optimized GOSUB And Sample Run

```
100 REM NOTICE THAT THE  HIGH BYTES ARE NO
    T EQUAL
250 T0=TI:FOR I=1 TO 100:GOSUB 256:NEXT:PR
    INT"OPTIMIZED";(TI-T0):END
256 RETURN

OPTIMIZED 19
```

TI BASIC One-Liners

Michael A. Covington

The TI BASIC DEF statement can become a powerful tool in your programmer's bag of tricks. Here's how to use it.

If you've been programming in BASIC for any time at all, you've surely come across, and used, some of the built-in functions that the language provides, such as INT, SIN, COS, TAN, ATN, and LOG. But did you know that you can use the DEF statement to create functions of your own? Defining your own functions lets you type a complicated formula only once, and it allows you to build complex functions out of simple ones in a most efficient way.

Suppose, for instance, that your LOG function gives you natural (base *e*) logarithms, and you want base 10 logarithms. (If you're not sure which you've got, type PRINT LOG(10) – if the answer is 1, you're in base 10, and if it's about 2.3026, you're in base *e*.) You can convert base *e* logarithms to base 10 by dividing them by 2.302585093, so one of the options open to you is obviously to write LOG(X)/2.302585093 (or whatever) every time you need a base 10 log. But there's an easier way.

Creating Functions

To create your own function – let's call it LOG10, though some computers may insist that you name it something like FNL – just include, early in your program, a statement like this:

```
10 DEF LOG10(X)=LOG(X)/2.302585093
```

From then on, you'll be able to use the new function LOG10 to get base 10 logarithms. Try it out with a program something like this:

```
10 DEF LOG10(X)=LOG(X)/2.302585093
20 FOR I=1 TO 10 STEP 0.1
30 PRINT I,LOG10(I)
40 NEXT I
```

and compare the results against a table of logarithms.

The DEF statement is different from most BASIC statements in that it can't refer to variables. (The X in it – it could be any variable name – is used only as a placeholder for the number within the parentheses; it is completely separate from any variable named X that you may use elsewhere in the program.) You can refer only to numbers or other functions. Some computers require that the name of the function be three letters and that the first two be FN – FNA, FNB, FNL, and so forth – although the TI-99, and many other microcomputers, allow you to name functions with the same type of names you use for variables.

Sample One Liners

So that's how it's done. Now let's look at some practical examples.

1. *Base 10 logarithms.* That's what we've just discussed. For reference, here is the statement:

```
DEF LOG10(X)=LOG(X)/2.302585093
```

(assuming your machine's LOG function gives you base *e* logs).

2. *Base 2 logarithms.* On a machine on which the LOG function gives base *e* logarithms, you can get base 2 logarithms by using:

```
DEF LOG2(X)=LOG(X)/0.6931471806
```

If your machine's LOG function gives base 10 logarithms, you'll need to use DEF LOG2(X)=LOG(X)/0.3010299957 instead.

3. *Degrees to radians.* If X is the measure of an angle in degrees, then RAD(X) will be the same angle measured in radians, if you define the following function:

```
DEF RAD(X)=X/57.29577951
```

4. *Radians to degrees.* The opposite function, converting X in radians to DEG(X) in degrees, is:

```
DEF DEG(X)=X*57.29577951
```

5. *Arcsine* (in radians). The following definition will give you the arcsine function (which is not usually provided in implementations of BASIC, although the arctangent is).

```
DEF ASN(X)=2*ATN(X/(1+SQR(1-X^2)))
```

If you look through a table of trigonometric identities, you may find an apparently equivalent, but simpler, formula that would lead to the statement DEF ASN(X)=ATN(X/SQR(1-X^2)). But note that this version won't do ASN(1) correctly (it will try to divide by zero). Hence the first version is preferable.

6. *Arccosine* (in radians). If you have the arcsine function, you can get the arccosine, as follows:

```
DEF ACS(X)=1.570796327-ASN(X)
```

Remember that the DEF statement for ASN must precede the DEF statement for ACS (you can't refer to a function until you've defined it).

7. *Rounding to a particular number of decimal places.* Where *n* stands for the number of decimal places you want, use the definition:

```
DEF ROU(X)=INT(((10^N)*X)+0.5)/(10^N)
```

Note that you *must* substitute a number for *n*; in most implementations, *n* cannot be a variable. Hence, for example, if you want rounding to three decimal places, your statement will read DEF ROU(X)=INT(((10^3)*X)+0.5)/(10^3). The number of decimal places can be negative, of course; if you want to round to the nearest 10, ask for -1 decimal place, and if you want to round to the nearest 1000, ask for -3 decimal places.

8. *Rounding to a particular number of significant digits.* Often, you'll find that the most convenient type of rounding involves coming up with a particular number of significant digits rather than a particular number of decimal places. You can accomplish this with the definition

```
DEF RSF1(X)=(N-1)-INT(LOG10(X))
DEF RSF(X)=INT(((10^RSF1(X))*X)+0.5)/(10^RSF1(X))
```

Here the definition is so complex that it is best done in two stages: first we define RSF1, which is a function used internally in RSF, and then we define RSF, which is the function we actually use. *n* stands for the number of significant digits you want; as before, you must substitute a number for it when typing the definition into the computer.

A word of warning: RSF (with its subsidiary calls to RSF1, which in turn calls LOG10) can take quite a bit of time to execute (about half a second of realtime on the TI-99).

9. *Sexagesimal output: minutes.* Our practice of expressing time in hours, minutes, and seconds, and angles in degrees, minutes, and seconds, is a remnant of an ancient Babylonian base-60 (sexagesimal) number system. Often, in a computer program dealing with time or with angles, it is desirable to express the output in terms of units, minutes, and seconds. The units are obtained by taking INT(X); thus the units part of 2.5 hours = INT(2.5) = 2 hours. Here is a function that gives the minutes part:

```
DEF MNT(X)=INT(60*(X-INT(X)))
```

That is, we take the non-integer part of the value, multiply it by 60, and take the INT of that.

10. *Sexagesimal output: seconds.* The seconds part of the value, in turn, is given by:

```
DEF SCD(X)=60*(60*(X-INT(X))-MNT(X))
```

That is, we subtract the integer part *and* the minutes; what's left gets multiplied by 60 twice.

The sexagesimal output functions can be tested by means of a program such as the following:

```
10 DEF MNT(X)=INT(60*(X-INT(X)))
20 DEF SCD(X)=60*(60*(X-INT(X))-MNT(
   X))
30 FOR H=0 TO 2 STEP 0.01
40 PRINT
50 PRINT H,"HOURS"
60 PRINT INT(H),MNT(H),SCD(H)
70 NEXT H
```

From this we learn, for example, that 0.01 of an hour is 36 seconds, and that 0.5 of an hour is 30 minutes. (If your computer uses binary, rather than BCD or Radix-100, internal representations of numbers, you may get odd errors due to rounding or lack of it. The solution would be to round the number of hours to some reasonably small number of decimal places before invoking the conversions, and perhaps to insert some rounding in the definitions of MNT and SCD themselves.)

Incidentally, for sexagesimal *input*, you don't need any special functions, only a bit of multiplication. For instance, the statements

```
10 PRINT "TYPE HOURS, MINUTES, SECON
   DS"
20 INPUT H,M,S
30 H=H+M/60+S/3600
```

will give you (as H) the number of hours expressed as a decimal.

11. *Modulo 12 arithmetic.* In dealing with hours, you'll often want to reduce numbers to modulo 12. For instance, if it's 11 a.m., then you can calculate the time four hours later by adding 11+4 (which gives you 15) and then taking the result modulo 12. The function definition is:

```
DEF MOD12(X)=12*(X/12-INT(X/12))
```

(unless, of course, your computer has a built-in MOD function, which is even simpler to use). This particular function is likely to be bothered by rounding and truncation errors. On the TI-99, I get accurate results for numbers under 1000 or so, but larger numbers give slightly erroneous answers; a binary machine might be plagued by worse problems.

12. *Modulo 60 arithmetic.* The same function, giving modulo 60 answers (for dealing with minutes and seconds), is:

```
DEF MOD60(X)=60*(X/60 - INT(X/60))
```

(as if you couldn't have guessed). The following program starts with a time expressed as H hours M minutes, and adds M1 minutes:

```
10 DEF MOD12(X)=12*(X/12-INT(X/12))
20 DEF MOD60(X)=60*(X/60-INT(X/60))
30 INPUT H,M
40 INPUT M1
50 M=MOD60(M+M1)
60 H=H+INT(M1/60)
70 PRINT H,M
```

Line 50 adds the right number to the minutes part, and line 60 adds to the hours part if necessary. ©

Guest Commentary

Is RAM Memory A Status Symbol?

Barry Miles

Many expensive technological items are bought as status symbols. Are all those Hewlett Packard HP 41c's really used to their fullest extent, for long programs and the use of ROM libraries of fancy programs, or are they merely left on the executive's desk to say "I'm so important that I can justify a purchase of the state-of-the-art programmable calculator"?

The advent of really large RAM sizes means that we should rethink the relationship between RAM and disk storage. We have for a long time lived with the idea that we should use RAM sparingly. This probably stems from the need to conserve RAM usage in a mainframe environment, so that as many users as possible may access the machine at once and so that the queuing problem is reduced to a minimum. Programmers are likely to continue to think in this way, even when the need has evaporated.

Perhaps an example should be taken from the approach used in managerial economics. In budgeting for the future, businessmen seek to identify the Principal Budget Factor – that factor which prevents the business from expanding to infinity. They then seek to make the very best use of that scarce resource, so as to maximize profits. They usually make strenuous efforts to remove the bottleneck which that resource represents, by increasing the amount of it which is available: if you are short of skilled labor, you seek to take on more people, for instance. The successful businessmen are the ones who first remove the constraint which is holding them back, then correctly identify the new constraint and seek to remove it, and so on.

What I am saying is that once RAM ceases to be a scarce resource, we should cease trying to economize in its use, especially as it becomes progressively cheaper, and particularly when it becomes cheaper than similar amounts of secondary storage (such as disks or tapes).

A potential buyer of the Sirius computer has an interesting choice before him; with a limited budget, he will need to decide between various amounts of RAM, and whether to go for double-sided disks to increase secondary storage capacity. He may choose the largest amount of RAM, out of habit, without really considering whether he will make effective use of the extra memory.

More Is Less

Again, economics may come to our aid. The Diminishing Marginal Utility theory says in this context that every extra 1K of RAM is less important to us than the previous one, to the point where more is really of no interest.

Surely we must examine whether what we are doing now will become easier, faster, or more efficient if we have more RAM, and whether there are other things which we could do with more RAM but which are impossible at present, and finally whether we should adopt a whole new approach. There is a danger of misleading ourselves or of being misled by salesmen into thinking that more RAM must be a good idea, without thinking out why. There is even a danger of rationalizing in order to justify what is really only wish-fulfillment.

We might compare this to buying a fast car. Some say that you're much safer in a fast car than in a slower car, regardless of the speed at which you are traveling. The braking system and suspension of such a car have been designed to cope with the effects of traveling quickly, and these systems therefore work very much within their capacity, and very efficiently at slower speeds. A similar argument can be made for extremely powerful hi-fi systems: distortion is less if you do not have to turn up the volume very far to get the loudness you require.

Do these arguments carry over to microcomputer memories? Probably not. The trouble is that you merely get more of the same. If you do not use it, then it just lies idle. Are you really going to write massive BASIC or machine code programs? Are you really going to handle vast amounts of

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data? Most likely not, at least not unless you change your way of doing things to optimize the use of your principal technological factor.

New Freedoms

What I am suggesting is that disks came about because of limited RAM. Now that RAM limitations can be of increasing greater size, we should explore new freedoms. What follows may seem a little far-fetched, but may also be just around the corner.

First, we may take it that a one megabyte RAM is not likely to be filled with a BASIC or machine code program of anything near that length. The debugging alone would take too long! This leaves us with other possibilities.

We could fill a lot of the RAM with a wide range of programs, and call up any of the whole suite, instantaneously, from a special menu program.

We could have as many programming aids in our machine as we could conceivably wish for, and barely scratch the surface of our new-found capacity.

We could have a vast range of help screens available for instantaneous recall when in trouble.

We could call in a whole succession of high resolution pictures, which are usually slow to load from disk, so rapidly that even animation would be possible.

We could have split processing in one machine. After all, it is common for two processors to be in one machine, so why not a schizoid machine with each part operating independently?

We could have a really enormous amount of text in our word processor at any one time, and have many different text areas. Our word processor could perhaps interact with our accounting and data base programs in RAM.

Accounting suites of programs could be truly integrated, so that final accounts are updated after every transaction.

Our data bases could be loaded from disk into RAM first thing in the morning, and all updating could take place in RAM, so as to be almost instantaneous. All the disk activity would have to do is merely dump RAM contents, for safety's sake, at convenient time intervals. Battery backup could protect contents from voltage spikes and power failures.

It might be that disks of all types will become a thing of the past, with programs and data being loaded and dumped over the telephone by a modem, with suitable passwords and protections, into your friendly local overnight datastore. (There are problems in this, in that the use of telephone lines is subject to error, but presumably this will improve and is not an insurmountable obstacle.)

In any case, if the function of the disk unit changes from continual random access to infrequent loading and dumping, disk operating systems could be simplified at the very least. Perhaps the very small diameter disks which the major companies are now developing will become the norm; and disk units will come down in price to become a trivial expense. That, too, is an intriguing prospect.

This would all require greater addressability than even the current 16 bit machines offer, but the megabyte chip is probably just around the corner. ©

Disassemble To Printer Or Disk For Atari

Mark Chasin

If you've been wondering how to take disassemblies of machine language and either store them on a disk or print them out – here's your answer. These programs will make the Atari Assembler/Editor cartridge an even more useful programming tool.

One of the best ways to learn assembly language programming is to look at the ways professional programmers have written complex programs and to study and learn their techniques. Unfortunately, when we buy programs that were originally written in assembly language, they have already been assembled (translated) into machine language. To make sense out of this code, we must be able to disassemble (retranslate) it back into assembly language.

Fortunately, those of us who have the Atari Assembler/Editor cartridge know that Atari has the built-in ability to disassemble machine language back into assembly language, using the L option in the DEBUG mode. This option will convert the information stored in any section of memory into assembly language. This conversion is then displayed on your screen, so that you can look at any part of any machine language program in assembly language.

That's the good news. The bad news is: 1) you can look at only about 20 lines of assembly language code at a time, and 2) you have no way of storing the assembly language version for studying later, except to copy the program from the screen with pencil and paper. This article shows you how to divert the output either to a printer or to your disk and provides programs to implement these options.

Output To A Printer

In your Atari, the Input/Output Control Block (IOCB) #0 is the default IOCB for all output operations, and it is the screen editor. The output from the Assembler/Editor cartridge (and all other cartridges) is routed through this IOCB to direct the output to the screen. In your Atari, all output to any device is handled through the handler table, which is simply a series of pointers to places in the Operating System (OS), where the directions for how the Atari is to deal with each device can be found. Actually, these pointers are directed at address-1 for each set of directions. Therefore, to redirect the output of the Assembler/Editor cartridge to a printer, all we have to do is to change the pointer so that it points at the address-1 of the printer instructions in the OS.

Let's try to disassemble the first part of DOS and get a printout of the assembly language code. I'll assume that you have your system booted up with DOS 2, that the Assembler/Editor cartridge is in place in your computer, and that your printer (and interface module, if you need it) is on. First, go into DEBUG mode by typing BUG, followed by a RETURN. Your screen should say DEBUG. Next, type C346<A6,EE and another RETURN. This changes memory locations $0346 and $0347 to $A6 and $EE, respectively. By the way, the directions for dealing with a printer begin in memory location $EEA7. Remember, we point to address-1.

All output is now directed to your printer. If at this point you type L0700,0756 and hit RETURN, your printer should produce the first part of DOS 2 in assembly language, exactly as it appears in Program 1. The format of this listing is discussed in detail below.

Remember: *All* output is now directed to your printer. To get back to the screen, you'll have to change the pointer back to where it was. You'll need to type C346<A3,F6 and hit RETURN. Now you can see what you're doing, so you can go ahead with normal output.

To A Disk File

Directing the disassembled listing of some portion of memory to your disk drive is a bit more complicated and requires a brief program to handle housekeeping. This assembly language program is shown in Program 2, with the origin at $0600. Before we can direct the output to disk, we need to open a file on the disk. For the purposes of this discussion, we will open a file using IOCB #3, and we'll call the file D1:DISASSEM.

To do this, we first load the X register with #$30 (for IOCB #3), in line 110 of Program 2. We'll use this as an index into IOCB #3 throughout the program. Next, we store the command byte for the OPEN command, $03, into $0342,X in lines 120-130, and the command byte for the OPEN for WRITE command, $08, into $034A,X. Then we point to the name of the file we want to OPEN by storing the low and high bytes of the address of

this string in $0344,X and $0345,X respectively, in lines 160-190. We can then OPEN the file by jumping to the CIO subroutine in line 200. The RTS in the next line returns control to your keyboard, so that you can handle the next steps manually.

The program that actually directs the output to this disk file begins on line 230 of Program 2, at $0620. We set the IOCB to #3 in line 230, and temporarily store the character being sent in the Y register in line 240. By setting the buffer size to zero in lines 250-270, we can pass one character at a time, from the accumulator, directly to the disk file. The command byte for PUT CHARACTER is $0B (lines 280-290). In line 300, we retrieve the character being sent, and we send it to the disk by calling the CIO routine in line 310. Line 320 returns control to the Assembler/Editor cartridge to fetch the next byte of the disassembly. As each character is passed to the disk in turn, the OS takes care of keeping track of how the disk file is to be organized and saves us a lot of work in the process.

It is *important*, once a file is OPENed for writing, that it be closed, or you are likely to lose the last sections of information you wanted to write to the disk. Since your keyboard is not in control during the disassembly, you need to close the file by hitting BREAK when the drive has stopped, indicating that the file has been written.

To use these programs, type them in exactly as shown in Program 2, and LIST them to your disk for safekeeping. Then type ASM and RETURN to assemble these programs. After this is completed, type BUG to enter DEBUG mode, and then G0600 to run the first program. You should hear the disk drive start as the file is OPENed. Next, type C346 < IF, 06 and RETURN. This directs the output to our routine to send one character at a time to the disk (remember: address-1). Then type L0700,0756 and RETURN. This will disassemble the first part of DOS 2 to your disk. When the drive stops, hit the BREAK key to close the file. SYSTEM RESET will now set everything back the way it was before we started our tampering.

Reformatting The Output File

One last problem remains. If we refer to Program 1, we can see that the first set of numbers on each line represents the hexadecimal address of each instruction. The second set of numbers is the machine language nomenclature for the instruction, and the instruction mnemonic itself is the next set. Following the instruction is the operand. In a typical assembly language listing, two more fields would be present. Between the machine language instruction and the mnemonic would be a line number, and frequently following the operand is a comments field. The problem that remains is that the output from the L option of the Assembler/Editor cartridge is not in a form that can be used as input for the Assembler itself. That is, the disk file D1:DISASSEM that we have created cannot be used as source code – yet.

Program 3 is a BASIC program which will reorganize and reformat D1:DISASSEM into another file, D1:OUTPUT, which *can* be used as source code for the cartridge. Line 100 sets the first line number for the OUTPUT file to 1000, and lines 110-160 dimension the input, output, and blank strings, set the blank string equal to all blanks, and erase anything in the other two strings. Lines 170 and 180 open DISASSEM for input, and OUTPUT for output.

We are going to set up a loop, from lines 230-330, which will work its way through all of DISASSEM; so, in line 190, we set a trap to close the files when we get to the end. Lines 200 and 210 discard the first two lines of DISASSEM, a blank line and the word DEBUG on the second line (see Program 1), which are put in by the cartridge. Line 220 blanks out the input string, and line 240 reads the first line of DISASSEM into the input string, INTAKE$.

We would like our output to start with a line number, so line 240 handles this for us. Line 250 leaves the next two spaces blank, because that's how the Assembler/Editor expects to get its source code. Line 260 checks to see if the cartridge understood that particular byte. If it can't interpret a byte, the cartridge puts ??? into the mnemonic field. This program stores the contents of that location in memory as a .BYTE mnemonic. Line 270 fills in the remainder of the line, and line 280 puts in a comments field, with the contents as the memory location of that particular instruction, as an aid in understanding the output. Line 290 puts the output to the disk file, lines 300 and 310 rezero OUT$ and INTAKE$, line 320 increments the line number by two, and line 330 loops back to get the next line for reformatting. Line 340 closes the files and ends the program.

Program 4, the OUTPUT file structure for the first part of DOS 2, requires a few comments. The beginning of DOS is used to store certain variables. For that reason, the first part of the output file (lines 1000 – 1030) looks slightly strange. However, it should be noted that all information is there, and in a form which is understandable to the Assembler. That is, this file *can* be used as source code. Some thought must be given, however, to the interpretation of this code, as with all disassembled machine language programs.

Two final comments: First, if you want to disassemble all of DOS 2, do it in two steps; although the programs described in this article can handle all of DOS, the Assembler/Editor cartridge cannot accept an input file that large. The source code for DOS 2 using these programs is more

than 300 sectors long! Second, all references to addresses in the OUTPUT file are absolute. Therefore, you will not be able to relocate this program with a different origin unless you substitute labels for all of the absolute addresses. However, you will be able to experiment with changes to DOS, or any other machine language program, if you're careful about the specific addresses in your disassembled source code.

If you are specifically interested in modifying or experimenting with DOS 2, I highly recommend the recent book by Bill Wilkinson, *Inside Atari DOS*, published by **COMPUTE! Books**. The documented source code and detailed explanations of the various subroutines within DOS make this an invaluable resource for anyone attempting to change or understand DOS. There are also some very interesting suggestions for modifications to DOS, which should be reasonably simple to implement now that you have a way to obtain the source code.

Program 1: Disassembly Of DOS

```
DEBUG
0700    00          BRK
0701    03          ???
0702    00          BRK
0703    07          ???
0704    40          RTI
0705    15 4C       ORA    $4C,X
0707    14          ???
0708    07          ???
0709    03          ???
070A    03          ???
070B    00          BRK
070C    7C          ???
070D    1A          ???
070E    01 0F       ORA    ($0F,X)
0710    00          BRK
0711    7D CB 07    ADC    $07CB,X
0714    AC 0E 07    LDY    $070E
0717    F0 36       BEQ    $074F
0719    AD 12 07    LDA    $0712
071C    85 43       STA    $43
071E    8D 04 03    STA    $0304
0721    AD 13 07    LDA    $0713
0724    85 44       STA    $44
0726    8D 05 03    STA    $0305
0729    AD 10 07    LDA    $0710
072C    AC 0F 07    LDY    $070F
072F    18          CLC
0730    AE 0E 07    LDX    $070E
0733    20 6C 07    JSR    $076C
0736    30 17       BMI    $074F
0738    AC 11 07    LDY    $0711
073B    B1 43       LDA    ($43),Y
073D    29 03       AND    #$03
073F    48          PHA
0740    C8          INY
0741    11 43       ORA    ($43),Y
0743    F0 0E       BEQ    $0753
0745    B1 43       LDA    ($43),Y
0747    A8          TAY
0748    20 57 07    JSR    $0757
074B    68          PLA
074C    4C 2F 07    JMP    $072F
074F    A9 C0       LDA    #$C0
0751    D0 01       BNE    $0754
0753    68          PLA
0754    0A          ASL    A
0755    A8          TAY
0756    60          RTS
DEBUG
```

Program 2: Disassembly To A Disk File

```
0100   *= $0600
0110 OPEN LDX #$30
0120   LDA #$03
0130   STA $0342,X
0140   LDA #$08
0150   STA $034A,X
0160   LDA #FNAME&255
0170   STA $0344,X
0180   LDA #FNAME/256
0190   STA $0345,X
0200   JSR $E456
0210   RTS
0220   *= $0620
0230 POINT LDX #$30
0240   TAY
0250   LDA #0
0260   STA $0348,X
0270   STA $0349,X
0280   LDA #$0B
0290   STA $0342,X
0300   TYA
0310   JSR $E456
0320   RTS
0330 FNAME .BYTE "D1:DISASSEM",0
```

Program 3: BASIC Reformat Of File

```
100 I=1000
110 DIM INTAKE$(45),BLK$(45),OUT$(45)
120 BLK$(1,1)=" "
130 BLK$(45,45)=" "
140 BLK$(2)=BLK$
150 INTAKE$=BLK$
160 OUT$=BLK$
170 OPEN #1,4,0,"D:DISASSEM"
180 OPEN #2,8,0,"D:OUTPUT"
190 TRAP 340
200 INPUT #1;INTAKE$
210 INPUT #1;INTAKE$
220 INTAKE$=BLK$
230 INPUT #1;INTAKE$
240 OUT$(1,4)=STR$(I)
250 OUT$(5,6)="  "
260 IF INTAKE$(22,23)="??" THEN OUT$(
    7)=".BYTE $":OUT$(14,15)=INTAKE$(
    9,10):GOTO 280
270 OUT$(7)=INTAKE$(22)
280 OL=LEN(OUT$)+1:FOR M=OL TO 21:OUT
    $(M,M)=" ":NEXT M:OUT$(22,23)=";
    ":OUT$(24,27)=INTAKE$(1,4)
290 ? #2;OUT$
300 OUT$=BLK$
310 INTAKE$=BLK$
320 I=I+2
330 GOTO 230
340 CLOSE #1:CLOSE #2:END
```

Program 4: Output File Structure For DOS 2

```
1000   BRK            ; 0700
1002   .BYTE $03      ; 0701
1004   BRK            ; 0702
1006   .BYTE $07      ; 0703
1008   RTI            ; 0704
1010   ORA    $4C,X   ; 0705
1012   .BYTE $14      ; 0707
1014   .BYTE $07      ; 0708
1016   .BYTE $03      ; 0709
1018   .BYTE $03      ; 070A
```

```
1020    BRK                 ; 070B
1022    .BYTE   $7C         ; 070C
1024    .BYTE   $1A         ; 070D
1026    ORA     ($04,X)     ; 070E
1028    BRK                 ; 0710
1030    ADC     $07CB,X     ; 0711
1032    LDY     $070E       ; 0714
1034    BEQ     $074F       ; 0717
1036    LDA     $0712       ; 0719
1038    STA     $43         ; 071C
1040    STA     $0304       ; 071E
1042    LDA     $0713       ; 0721
1044    STA     $44         ; 0724
1046    STA     $0305       ; 0726
1048    LDA     $0710       ; 0729
1050    LDY     $070F       ; 072C
1052    CLC                 ; 072F
1054    LDX     $070E       ; 0730
1056    JSR     $076C       ; 0733
1058    BMI     $074F       ; 0736
1060    LDY     $0711       ; 0738
1062    LDA     ($43),Y     ; 073B
1064    AND     #$03        ; 073D
1066    PHA                 ; 073F
1068    INY                 ; 0740
1070    ORA     ($43),Y     ; 0741
1072    BEQ     $0753       ; 0743
1074    LDA     ($43),Y     ; 0745
1076    TAY                 ; 0747
1078    JSR     $0757       ; 0748
1080    PLA                 ; 074B
1082    JMP     $072F       ; 074C
1084    LDA     #$C0        ; 074F
1086    BNE     $0754       ; 0751
1088    PLA                 ; 0753
1090    ASL     A           ; 0754
1092    TAY                 ; 0755
1094    RTS                 ; 0756
```

COMPUTE!'s Mapping The Atari

Author: Ian Chadwick
(Introduction by Bill Wilkinson)
Price: $14.95
On Sale: Now

The inner workings of today's advanced personal computers unfortunately remain a mystery to many users. From beginners to machine language programmers, people are hungry for vital information about the insides of their machines. For example, there are tens of thousands of memory locations...which are safe to use? How can changing one number in a certain memory cell dramatically speed up output to the disk drive? Which memory address reveals what Operating System is in the computer? How can changing certain numbers in various memory locations improve a program's sound and graphics?

The key to finding one's way around the inside of a computer is a memory map. But often this important information is unavailable from the manufacturer. Or it can be obtained only in piecemeal fashion from scattered sources.

Now, for the first time, there is a comprehensive guidebook available for the Atari 400/800 computers which answers all of these questions, and hundreds more. *Mapping The Atari*, by Ian Chadwick, is a complete reference guide and memory map for one of the most popular of personal computers. From memory location zero to 65,535, *Mapping The Atari* is the most exhaustive memory sourcebook ever offered to Atari users.

Chadwick started by diligently assembling all the information he could find. Then he went a step further by testing this information, to verify its accuracy. And finally, he added months of his own research, delving deep into little-known areas of the Atari's memory to explore every secret. The result, *Mapping The Atari*, is an indispensable reference work for Atari programmers.

TABLE OF CONTENTS

But *Mapping The Atari* is more than just a comprehensive reference book. It is also a tutorial for *all* inquisitive Atari enthusiasts – not just advanced programmers. *Mapping The Atari* explains each memory location in depth for beginning and intermediate programmers. Some descriptions of important locations fill several pages. And the book is packed with ready-to-type example programs and routines which show exactly how to put the information to work.

There's more. A special introduction by Bill Wilkinson, an author of Atari BASIC and the Atari Disk Operating System, explains how to access the Atari's memory in every available programming language. And there are *ten* appendices, covering such topics as "VBLANK Processes," "Atari Timing Values," "Color," "Sound And Music," "Player/Missile Graphics Memory Map," "Display Lists," and others. And to make the book still more useful, there are *two* indices – an Index By Label, and an Index By Subject.

Best of all, *Mapping The Atari* is from **COMPUTE! Books**, associated with **COMPUTE!** Magazine, the leading consumer publication of home, educational, and recreational computing. **COMPUTE!** has led the way for Atari owners since the computers were first introduced in 1979. In the **COMPUTE!** tradition, *Mapping The Atari* is carefully written and edited to be useful to beginners and experts alike. And it is spiral-bound to lie flat while typing programs.

Available at computer dealers and bookstores nationwide. To order directly call TOLL FREE 800-334-0868. In North Carolina call 919-275-9809. Or send check or money order to **COMPUTE! Books**, P.O. Box 5406, Greensboro, NC 27403.

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The Apple Hi-Res Painter

James Totten

"Hi-Res Painter" is a graphics editor for use with a 32K Apple. With it you can: use any one of six colors (or combine colors with your "pen"); select from three different drawing pens; label pictures with upper- and lowercase lettering; color in squares, rectangles; and more.

When using the Apple's hi-res graphics, it seems that a lot of work can yield few results. This is true, of course, only if you are doing your graphics manually (HPLOT 0,0 TO 45,67 etc.). Since I use the graphics considerably (they are one reason I bought the computer), I didn't enjoy taking hours to draw a fairly impressive title page or chart or some other type of picture.

Menu Options

The "Hi-Res Painter" runs from four menus: Main Menu (1), Accessory Menu (2), Diskette Menu (3), and, most important of all, the Picture Menu (4). When you start, you are automatically placed at the first menu (Main). From here you can select to go to any of the other three menus presented by just pressing the first letter of its name. This letter is highlighted on the screen.

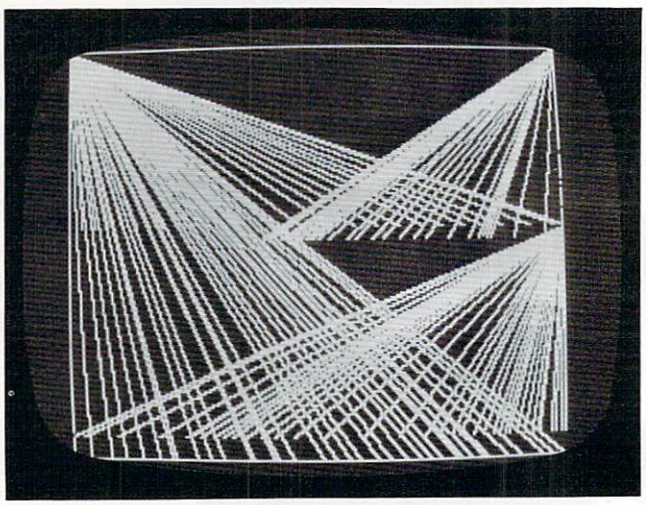
Pressing *A* will take you to the Accessory Menu (2). Here, you can choose from p)rint, f)ill, k)eyboard, and m)ain. The print option will work for those who own either a Trendcom or Silentype printer only. The *fill* option works for everyone. You select two points on the screen: the first is the upper left corner of the square you wish filled, and the other is the lower right corner. Presto! The keyboard option allows the user to change from paddle or joystick control of the pen to keyboard control of the pen. With the change, the I, J, K, M keys move the pen in the direction they are positioned. And, of course, the main option will take you to the main menu again.

The next menu in the list is the Diskette Menu, number three, and you can call that menu by pressing *D*. Here you can n)ame, d)elete, s)ave, l)oad, or r)ename any picture – s)ave will save the picture currently on the screen. Again, m)ain will return you to menu 1.

Finally, menu four is the Picture Menu, and to call it up press *P*. The available options here are: v)iew, l)abel, b)drop, c)olor, d)raw, e)rase, p)ens, and m)ain. The first option allows simply a total view (no text) of the graphics screen which you are working on. *Label* will do just that; you are asked for a date, name, or whatever to be typed in on the keyboard, and it is then transferred to a location of your choice onto the graphics screen.

The *b)drop* option stands for backdrop, and this will simply fill the screen (rather quickly) with a color of your choice. *Color* will allow you to choose a new color. Press the first letter of each as in the menu selections. *Draw* and *erase* are obvious in that they do exactly what they say. A note of warning though: if a picture is erased, it cannot be recalled unless it is on disk. The *pens* option is actually two in one. With it you can change the size of your pen (press 1, 2, or 3 and watch the screen), and turn it on or off. And again, main returns you to menu one. You can draw using paddles or a joystick, or you can switch the controls to use the keyboard.

To produce very good-looking designs, try some experiments. Fantastic pictures (such as stars on a moonlit night) can easily be created by just moving the pen in various sizes and colors.



A design created with a paddle controller using "Hi-Res Painter."

Program 1: Hi-Res Painter

```
20  LOMEM: 24576: ONERR  GOTO 1045
21  DIM PX(2),PY(2),C$(6),P$(1)
25  FOR L = 1 TO 4:MX(L) = 0:MY(L) = 0: NEXT
    L:D$ =  CHR$ (4):C = 3:P = 0:BC = 0
30 KI =  - 16384:RK =  - 16368:BO =  - 16287
    :B1 =  - 16286:TG =  - 16301:FG =  - 16
    302
35 P$(0) = "OFF":P$(1) = "ON":C$(1) = "GREEN
    ":C$(2) = "PINK":C$(3) = "WHITE"
40 C$(4) = "BLACK":C$(5) = "ORANGE":C$(6) =
    "LT.BLUE":I = 1:P$ = "NOT NAMED"
41  IF  PEEK (233) <  > 64 THEN  PRINT D$"BL
    OAD CHARACTERS/SH2": POKE 232,0: POKE 2
    33,64
42  SCALE= 1: ROT= 0:X = 139:Y = 80
43  TEXT : HOME : NORMAL : VTAB 10: PRINT
    TAB(11)"THE HI-RES PAINTER": PRINT  TAB
    ( 7)"-=(                    )=-": PRINT
    TAB(11)"BY JAMES R. TOTTEN"
44  POKE RK,0: VTAB 24: PRINT "<< TO BEGIN P
```

```
 USH ANY KEY EXCEPT RESET >>"
 45  IF  PEEK (KI) < 128 THEN 45
 46  POKE RK,0
 50  HGR : HCOLOR= C: POKE TG,0: POKE 34,20:
     HOME
 55  PRINT "PAINTER MENU NUMBER 1 (MAIN)":
     PRINT
 60  PRINT "A)CCESSORY   D)ISKETTE   P)ICTURE
         >";: GET K$
 65  IF K$ =  CHR$ (27) THEN  POKE RK,0: POKE
     34,0: TEXT : HOME : END
 70  IF K$ = "P" THEN 100
 75  IF K$ = "A" THEN 450
 80  IF K$ = "D" THEN 300
 85  POKE RK,0: HOME : GOTO 55
100  POKE RK,0: HOME
105  PRINT "PAINTER MENU NUMBER 4 (PICTURE)"
     : PRINT
110  PRINT "V)IEW  L)ABEL  B)DROP  C)OLOR
     D)RAW  E)RASE  P)ENS  M)AIN  >";: GET K$
115  IF K$ = "M" THEN 85
120  IF K$ =  CHR$ (27) THEN  POKE RK,0: POKE
     34,0: TEXT : HOME : END
125  IF K$ = "E" THEN  HGR :BC = 0: GOTO 100
130  IF K$ = "V" THEN 145
132  IF K$ = "C" THEN 150
134  IF K$ = "B" THEN 240
136  IF K$ = "D" THEN 185
138  IF K$ = "P" THEN 164
140  IF K$ = "L" THEN 218
142  POKE RK,0: HOME : GOTO 105
145  POKE FG,0
146  IF  PEEK (KI) > 127 THEN  POKE TG,0:
     GOTO 100
147  GOTO 146
150  POKE RK,0: HOME : PRINT "CURRENT COLOR:
     ";: INVERSE : PRINT C$(C): NORMAL :
     PRINT
152  PRINT "G)REEN   O)RANGE   W)HITE
     B)LACK   L)T.BLUE  P)INK    >";: GET K$
154  IF K$ = "G" THEN C = 1: GOTO 100
155  IF K$ = "P" THEN C = 2: GOTO 100
156  IF K$ = "W" THEN C = 3: GOTO 100
158  IF K$ = "B" THEN C = 4: GOTO 100
159  IF K$ = "O" THEN C = 5: GOTO 100
160  IF K$ = "L" THEN C = 6: GOTO 100
162  GOTO 150
164 XC =  INT ( PDL (0)):YC =  INT ( PDL (1) )
165  POKE RK,0: HOME : PRINT "PEN OPERATIONS
     ": PRINT
166  PRINT "S)ET CURSOR SIZE    T)URN ON/OFF
       >";: GET K$
167  IF K$ = "S" THEN 172
168  IF K$ <  > "T" THEN 165
169 P = P + 1: IF P > 1 THEN P = 0
170  HOME : PRINT : PRINT "PEN IS NOW "P$(P)
     : FOR L = 1 TO 300: NEXT L
171  GOTO 100
172  POKE RK,0: HOME : PRINT "TYPE A NUMBER
     FROM 1 TO 3 FOR CURSOR    SIZE (1=SMALL
     EST). CURSOR IS SHOWN ON   SCREEN. WHEN
     DONE, PUSH RETURN.  >";: GET K$
174  IF K$ =  CHR$ (13) THEN 100
176  IF K$ = "1" THEN CS = 0
177  IF K$ = "2" THEN CS = 4
178  IF K$ = "3" THEN CS = 8
179  HCOLOR= BC: FOR L = XC - 1 TO XC + 8:
     HPLOT L,YC - 1 TO L,YC + 8: NEXT L:
     HCOLOR= C
180  FOR L = XC TO XC + CS: HPLOT L,YC TO L,
     YC + CS: NEXT L
182  GOTO 172
185  IF K THEN 1010
186  POKE RK,0: HOME : PRINT : PRINT "TO BEG
     IN OR STOP DRAWING PUSH ANY KEY ";: GET
     K$
187  POKE FG,0: POKE RK,0
190  IF CS = 0 THEN LL = 1:RL = 279:TL = 0:B
     L = 191
191  IF CS = 4 THEN LL = 1:RL = 274:TL = 0:B
     L = 186
192  IF CS = 8 THEN LL = 1:RL = 270:TL = 0:B
     L = 182
194  HCOLOR= C
196 X =  INT ( PDL (0)):Y =  INT ( PDL (1))
198  IF X < LL THEN X = LL
200  IF X > RL THEN X = RL
202  IF Y > BL THEN Y = BL
204  FOR L = X TO X + CS: HPLOT L,Y TO L,Y +
     CS: NEXT L
205  IF  PEEK (KI) > 127 THEN  POKE TG,0: GOTO
     100
206  IF P THEN 210
208  HCOLOR= BC: FOR L = X TO X + CS: HPLOT
     L,Y TO L,Y + CS: NEXT L: HCOLOR= C
209  IF  PEEK (KI) > 127 THEN  POKE TG,0: GOTO
     100
210  IF CS = 0 THEN  IF  PEEK (B1) > 127 THEN
      CALL  - 198:XO = X:YO = Y
212  IF CS = 0 THEN  IF  PEEK (B0) > 127 THEN
      HPLOT X,Y TO XO,YO
215  GOTO 196
218  POKE RK,0: HOME : PRINT : INPUT "ENTER
     LABEL >";L$
219  IF L$ = "" THEN 218
220  HOME : PRINT : PRINT "DO YOU WANT IT ON
      TOP OR BOTTOM (T/B)? ";: GET K$
222  IF K$ = "B" THEN Y = 180: GOTO 226
224  IF K$ = "T" THEN Y = 6: GOTO 226
225  GOTO 220
226 L =  LEN (L$): IF L > 26 THEN 218
228 X = 137 -  INT ((L / 2) * 8)
230  FOR P = 1 TO L: IF  ASC ( MID$ (L$,P,1)
     ) < 62 THEN K =  ASC ( MID$ (L$,P,1)) -
     31: GOTO 232
231 K =  ASC ( MID$ (L$,P,1)) - 3
232  HCOLOR= 0: FOR L = X - 2 TO X + 7: HPLOT
     L,Y - 1 TO L,Y + 8: NEXT L: HCOLOR= 3
233  DRAW K AT X,Y:X = X + 8: NEXT P
234  HCOLOR= C: GOTO 100
240  POKE RK,0: HOME : PRINT "COLORS FOR BAC
     KDROP...": PRINT : PRINT "G)REEN  B)LUE
       P)INK  W)HITE  O)RANGE": PRINT ">";:
       GET K$
242  IF K$ = "G" THEN  HCOLOR= 1:BC = 1: GOTO
     248
243  IF K$ = "B" THEN  HCOLOR= 6:BC = 6: GOTO
     248
244  IF K$ = "P" THEN  HCOLOR= 2:BC = 2: GOTO
     248
245  IF K$ = "W" THEN  HCOLOR= 3:BC = 3: GOTO
     248
246  IF K$ = "O" THEN  HCOLOR= 5:BC = 5: GOTO
     248
247  GOTO 240
248  HPLOT 0,0: CALL 62454
250 BD = 1: GOTO 100
300  POKE RK,0: HOME
302  PRINT "PAINTER MENU NUMBER 3 (DISKETTE)
     ": PRINT
304  PRINT "N)AME  D)ELETE  S)AVE
      L)OAD  R)ENAME  M)AIN   >";: GET K$
306  IF K$ = "M" THEN 85
308  IF K$ =  CHR$ (27) THEN  POKE RK,0: POKE
     34,0: TEXT : HOME : END
310  IF K$ = "N" THEN 320
311  IF K$ = "S" THEN 335
312  IF K$ = "L" THEN 355
313  IF K$ = "R" THEN 385
314  IF K$ = "D" THEN 370
315  GOTO 300
320  POKE RK,0: HOME : PRINT "USE NO COMMAS
     OR COLONS IN NAME.": PRINT : INPUT "> "
     ;P$
```

```
325  IF P$ = "" THEN 320
330  HOME : PRINT "NAME: "P$: NORMAL
332  PRINT : PRINT "IS THIS CORRECT? ";: GET
     K$: IF K$ = "N" THEN 320
333  IF K$ = "Y" THEN 300
334  POKE RK,0: GOTO 330
335  IF P$ = "NOT NAMED" THEN  HOME : CALL  -
     198: POKE RK,0: PRINT : PRINT "PICTURE
     HAS NOT BEEN NAMED": FOR L = 1 TO 550:
     NEXT L: GOTO 300
340  POKE RK,0: HOME : PRINT "PICTURE NAME:
     "P$: PRINT
345  PRINT "SAVE WITH THIS NAME? ";: GET K$:
      PRINT K$: IF K$ = "Y" THEN 350
346  IF K$ = "N" THEN 300
347  GOTO 340
350  PRINT D$"BSAVE "P$",A$2000,L$1FFF": GOTO
     300
355  POKE RK,0: HOME : PRINT : INPUT "NAME?
     ";P$
356  IF P$ = "" THEN 355
358  HOME : PRINT "PICTURE NAME: "P$: PRINT
360  PRINT "IS THIS NAME CORRECT? ";: GET K$
     : PRINT K$
362  IF K$ = "N" THEN 300
363  IF K$ = "Y" THEN 365
364  GOTO 358
365  PRINT D$"BLOAD "P$
366  GOTO 300
370  POKE RK,0: HOME : PRINT : INPUT "NAME?
     ";P$
371  IF P$ = "" THEN 370
372  HOME : PRINT "PICTURE NAME: "P$: PRINT
375  PRINT "DELETE THIS PICTURE? ";: GET K$:
      PRINT K$
376  IF K$ = "Y" THEN 380
377  IF K$ = "N" THEN 300
378  GOTO 372
380  PRINT D$"DELETE "P$: GOTO 300
385  POKE RK,0: HOME : PRINT "USE NO COMMAS
     OR COLONS IN NEW NAME": PRINT
388  INPUT "CURRENT NAME? ";P1$: IF P1$ = ""
      THEN 385
390  INPUT "NEW NAME? ";P2$: IF P2$ = "" THEN
     385
393  HOME : PRINT "OLD NAME: "P1$: PRINT "NE
     W NAME: "P2$: PRINT
395  PRINT "ARE THESE BOTH CORRECT? ";: GET
     K$: PRINT K$: IF K$ = "N" THEN 385
396  IF K$ = "Y" THEN 400
398  GOTO 393
400  PRINT D$"RENAME "P1$","P2$: GOTO 300
450  POKE RK,0: HOME
452  PRINT "PAINTER MENU NUMBER 2 (ACCESSORY
     )": PRINT
454  PRINT "P)RINT  F)ILL  K)EYBOARD  M)AIN
        >";: GET K$
456  IF K$ = "M" THEN  POKE RK,0: HOME : GOTO
     55
458  IF K$ =  CHR$ (27) THEN  TEXT : POKE RK
     ,0: HOME : END
459  IF K$ = "P" THEN 475
460  IF K$ = "F" THEN 500
461  IF K$ = "K" THEN 465
462  GOTO 450
465  POKE RK,0: HOME : IF K THEN K = 0: GOTO
     468
466  IF  NOT K THEN K = 1
468  IF K = 0 THEN  PRINT : PRINT "KEYBOARD
     IS OFF"
469  IF K = 1 THEN  PRINT : PRINT "KEYBOARD
     IS ON"
470  FOR L = 1 TO 300: NEXT L: GOTO 450
475  POKE RK,0: HOME : PRINT "PICTURE PRINTI
     NG OPTIONS -": PRINT
476  PRINT "I)NVERSED  N)ORMAL
        R)OTATED   C)ONTINUE     >";: GET K$
478  IF K$ = "N" THEN ST = 0: GOTO 475
480  IF K$ = "I" THEN ST = 1: GOTO 475
482  IF K$ = "R" THEN RR = 1: GOTO 475
484  IF K$ = "C" THEN 488
486  GOTO 475
488  POKE RK,0: HOME : PRINT : PRINT "TURN P
     RINTER ON AND PRESS ANY KEY ";: GET K$
490  IF RR AND ST THEN  POKE 1145,88: CALL  -
     16038: GOTO 450
492  IF RR THEN  POKE 1145,120: CALL  - 1603
     8: GOTO 450
494  IF ST THEN  POKE 1400,0: CALL  - 16036:
      GOTO 450
496  CALL  - 16044: GOTO 450
500  POKE RK,0: HOME : INPUT "UPPER LEFT POI
     NT (X,Y)  >";UX$,UY$: IF UX$ = "" OR UY
     $ = "" THEN 500
505  IF ( VAL (UX$) < 0) OR ( VAL (UX$) > 27
     9) THEN 500
506  IF ( VAL (LY$) < 0) OR ( VAL (LY$) > 19
     1) THEN  VTAB  PEEK (37): GOTO 507
507  INPUT "LOWER RIGHT POINT (X,Y)  >";LX$,
     LY$: IF LX$ = "" OR LY$ = "" THEN  VTAB
      PEEK (37): GOTO 507
508  IF ( VAL (LX$) < 0) OR ( VAL (LX$) > 27
     9) THEN  VTAB  PEEK (37): GOTO 507
510  HOME : PRINT : PRINT "PRESS A KEY TO BE
     GIN FILL ";: GET K$: PRINT K$
511  HCOLOR= C
515  FOR L =  VAL (UX$) TO  VAL (LX$): HPLOT
     L, VAL (UY$) TO L, VAL (LY$): NEXT L
520  GOTO 450
1010  POKE RK,0: HOME : PRINT : PRINT "TO BE
     GIN OR STOP DRAWING PUSH RETURN ";: GET
     K$
1012  POKE FG,0: POKE RK,0
1015  IF CS = 0 THEN LL = 1:RL = 279:TL = 0:
     BL = 191
1016  IF CS = 4 THEN LL = 1:RL = 274:TL = 0:
     BL = 186
1017  IF CS = 8 THEN LL = 1:RL = 270:TL = 0:
     BL = 182
1018  HCOLOR= C
1019  FOR L = X TO X + CS: HPLOT L,Y TO L,Y +
     CS: NEXT L
1020  IF  NOT P THEN  HCOLOR= BC: FOR L = X TO
     X + CS: HPLOT L,Y TO L,Y + CS: NEXT L:
     HCOLOR= C
1021  IF  PEEK (KI) < 128 THEN 1019
1023 L =  PEEK (KI)
1024  IF L = 201 THEN Y = Y - 1: GOTO 1036
1025  IF L = 205 THEN Y = Y + 1: GOTO 1036
1026  IF L = 202 THEN X = X - 1: GOTO 1036
1027  IF L = 203 THEN X = X + 1: GOTO 1036
1028  IF L = 213 THEN X = X - 1:Y = Y - 1:
     GOTO 1036
1029  IF L = 206 THEN X = X - 1:Y = Y + 1:
     GOTO 1036
1030  IF L = 207 THEN X = X + 1:Y = Y - 1:
     GOTO 1036
1031  IF L = 172 THEN X = X + 1:Y = Y + 1:
     GOTO 1036
1032  IF (CS = 0) AND (L = 211) THEN XO = X:
     YO = Y: CALL  - 198: GOTO 1036
1033  IF (CS = 0) AND (L = 196) THEN  HPLOT
     X,Y TO XO,YO: GOTO 1036
1034  IF L = 141 THEN  POKE TG,0: GOTO 100
1035  POKE RK,0: GOTO 1021
1036  IF X < LL THEN X = LL
1037  IF X > RL THEN X = RL
1038  IF Y > BL THEN Y = BL
1039  IF Y < TL THEN Y = TL
1040  POKE RK,0: GOTO 1019
1045  HOME : PRINT : PRINT "DISK ERROR CODE
     " PEEK (222): PRINT "CHECK SYNTAX AND T
     RY AGAIN >";: GET K$
1050  POKE RK,0: HOME : GOTO 55
```

Program 2: Shape Table For Picture Labels

```
4000- 58 00 B2 00 C5 00 D8 00
4008- EC 00 02 01 15 01 29 01
4010- 3C 01 4F 01 62 01 75 01
4018- 8A 01 9D 01 B0 01 C3 01
4020- D6 01 E9 01 FE 01 12 02
4028- 26 02 3B 02 50 02 65 02
4030- 79 02 8D 02 A2 02 B6 02
4038- C9 02 DD 02 F1 02 06 03
4040- 19 03 2C 03 41 03 55 03
4048- 69 03 7D 03 91 03 A5 03
4050- B8 03 CC 03 DF 03 F2 03
4058- 06 04 19 04 2C 04 40 04
4060- 54 04 68 04 7C 04 8F 04
4068- A3 04 B6 04 C9 04 DD 04
4070- F1 04 05 05 1A 05 2E 05
4078- 41 05 54 05 67 05 7C 05
4080- 90 05 A3 05 B7 05 CC 05
4088- E0 05 F4 05 08 06 1C 06
4090- 30 06 43 06 57 06 6B 06
4098- 7F 06 94 06 A8 06 BC 06
40A0- D0 06 E4 06 F8 06 0D 07
40A8- 21 07 36 07 4B 07 5F 07
40B0- 74 07 49 09 1A 1B 1B 4A
40B8- 49 1A 1B 1B 4A 49 1A 1B
40C0- 1B 4A 49 02 00 09 4D 1A
40C8- 1B 1F 4A 4D 1A 1B 1F 4A
40D0- 4D 1A 1B 1B 4A 4D 02 00
40D8- 69 0D 1A 3B 3B 0A 0D 0D
40E0- 1A 1B 1B 4A 49 1A 1B 1B
40E8- 4A 49 02 00 69 0D 1A 3B
40F0- 3B 2A 2D 2D 1A 3B 3B 2A
40F8- 2D 2D 1A 3B 3B 0A 0D 0D
4100- 02 00 09 4D 1A 3F 3F 6A
4108- 4D 1A 3B 3F 4A 0D 15 1B
4110- 3F 77 69 11 00 6D 09 1A
4118- 1F 3B 4E 69 1A 1B 1F 0A
4120- 4D 11 3B 1F 73 09 2D 02
4128- 00 69 09 1A 1B 1F 6E 4D
4130- 1A 1B 3B 6A 0D 15 1B 1F
4138- 73 6D 15 00 49 0D 1A 1B
4140- 1F 0A 4D 11 1B 1B 53 49
4148- 11 1B 1B 53 49 11 00 09
4150- 4D 1A 1B 3B 6A 49 1A 1B
4158- 1B 6E 49 1A 1B 3B 4A 4D
4160- 02 00 09 4D 1A 3B 1B 4A
4168- 09 15 3B 1B 53 49 15 1B
4170- 1F 53 69 11 00 09 4D 1A
4178- 1F 1F 0E 2D 0D 1A 3F 3F
4180- 0E 2D 0D 1A 1F 1F 4E 4D
4188- 02 00 49 09 1A 1B 1F 4A
4190- 4D 1A 3F 3F 4E 4D 1A 1B
4198- 1F 4A 49 02 00 49 09 1A
41A0- 1B 1B 4A 49 1A 1B 1B 4A
41A8- 6D 1A 3B 1F 0A 6D 11 00
41B0- 49 09 1A 1B 1B 4A 49 1A
41B8- 3F 3F 4E 49 1A 1B 1B 4A
41C0- 49 02 00 49 09 1A 1B 1B
41C8- 4A 49 1A 1B 1B 4A 49 1A
41D0- 1B 3F 0A 6D 11 00 49 09
41D8- 1A 1F 1B 4A 69 1A 1B 1F
41E0- 0A 4D 11 1B 1B 73 49 11
41E8- 00 29 6D 1A 1F 1B 6E 29
41F0- 15 3B 3B 33 6D 29 1A 1F
41F8- 1B 0E 2D 0D 02 00 09 4D
4200- 1A 1B 3F 4A 4D 1A 1B 1F
4208- 4A 4D 1A 1B 1F 0A 2D 0D
4210- 02 00 29 6D 1A 1F 1B 4E
4218- 09 15 1B 3F 53 4D 11 1B
4220- 1B 33 2D 2D 15 00 2D 2D
4228- 15 3B 1B 53 09 0D 1A 3B
4230- 1F 4A 09 15 3B 1B 73 2D
4238- 0D 02 00 49 0D 1A 3B 1F
4240- 0A 0D 0D 1A 3B 1B 2E 2D
4248- 2D 1A 3B 1B 4A 69 02 00
4250- 2D 2D 15 1B 1B 33 2D 6D
4258- 1A 1F 1B 4A 09 15 3B 1B
4260- 73 2D 0D 02 00 29 6D 1A
4268- 1F 1B 6E 49 1A 3B 3F 6E
4270- 09 15 3B 1B 73 2D 0D 02
4278- 00 2D 2D 15 3B 1B 53 09
4280- 0D 1A 1B 1F 0A 4D 11 1B
4288- 1B 57 4D 11 00 29 6D 1A
4290- 1F 1B 6E 09 15 1B 3F 17
4298- 4D 29 1A 1F 1B 0E 2D 0D
42A0- 02 00 29 6D 1A 1F 1B 6E
42A8- 09 15 3B 3F 57 49 15 3B
42B0- 1B 73 2D 0D 02 00 49 09
42B8- 1A 1B 3F 0A 6D 11 1B 1B
42C0- 53 6D 11 1B 3B 57 49 11
42C8- 00 49 09 1A 1B 3F 0A 6D
42D0- 11 1B 1B 53 6D 11 1B 3B
42D8- 17 6D 09 02 00 49 2D 1A
42E0- 3B 1F 0A 6D 11 1B 1B 77
42E8- 6D 11 1B 3F 53 09 2D 02
42F0- 00 49 09 1A 1B 1B 0A 2D
42F8- 0D 1A 1B 1B 0A 2D 0D 1A
4300- 1B 1B 4A 49 02 00 6D 09
4308- 1A 1B 3F 4A 6D 1A 3F 1B
4310- 4A 6D 1A 1B 3F 2A 4D 11
4318- 00 29 6D 1A 1F 1B 4E 09
4320- 15 1B 3F 53 4D 11 1B 1B
4328- 53 4D 11 00 29 6D 1A 1F
4330- 1B 6E 0D 15 3B 3F 33 0D
4338- 0D 15 1B 1B 73 2D 2D 02
4340- 00 49 09 1A 3B 3F 4A 09
4348- 15 3B 3F 17 4D 29 1A 3F
4350- 3F 4A 49 02 00 4D 09 1A
4358- 3B 1F 2E 4D 15 3B 1B 33
4360- 6D 29 1A 3B 1F 4E 49 02
4368- 00 49 09 1A 3B 3F 6A 09
4370- 15 1B 1B 33 4D 29 1A 3B
4378- 3F 4A 49 02 00 49 29 1A
4380- 1F 3F 6A 29 15 3B 1B 33
4388- 4D 2D 1A 1F 3F 4A 49 02
4390- 00 49 09 1A 3B 3F 6A 09
4398- 15 3B 3F 37 4D 09 1A 3B
43A0- 3F 4A 49 02 00 09 6D 1A
43A8- 1F 3B 0A 4D 11 1B 3B 77
43B0- 4D 11 1B 1B 57 49 11 00
43B8- 49 09 1A 1F 3F 6A 29 15
43C0- 3B 1F 73 6D 15 3B 1B 53
43C8- 2D 0D 02 00 4D 09 1A 1B
43D0- 1B 6E 6D 1A 1F 3B 6E 09
43D8- 15 3B 1B 73 49 11 00 09
43E0- 4D 1A 1B 1B 0A 6D 11 1B
43E8- 3B 53 69 11 1B 3F 57 49
43F0- 11 00 49 29 1A 1B 1B 4A
43F8- 29 15 3B 1B 53 49 15 3B
4400- 1B 73 2D 0D 02 00 4D 09
4408- 1A 3B 1B 6E 4D 1A 1B 3B
4410- 6E 4D 1A 3B 1B 4E 49 02
4418- 00 29 4D 1A 1B 1F 4A 4D
4420- 1A 1B 1F 4A 4D 1A 3B 3F
4428- 4A 49 02 00 49 09 1A 3B
4430- 3B 6A 0D 15 3B 3B 33 0D
4438- 0D 15 3B 3B 73 49 11 00
4440- 49 09 1A 3B 1F 2E 4D 15
4448- 3B 1B 33 4D 29 1A 1F 1B
4450- 4E 49 02 00 49 09 1A 3B
4458- 3F 6A 09 15 3B 1B 33 4D
4460- 29 1A 3B 3F 4A 49 02 00
4468- 49 09 1A 3B 1F 2E 4D 15
4470- 3B 1B 37 0D 6D 1A 1B 1B
4478- 6E 49 02 00 49 09 1A 1F
4480- 3F 6A 29 15 3B 1F 73 6D
4488- 15 3B 1B 53 49 15 00 49
4490- 09 1A 3B 1F 2E 4D 15 1B
4498- 1B 33 4D 09 1A 1B 1B 4E
44A0- 49 02 00 49 09 1A 3F 3F
44A8- 6A 49 1A 3B 3F 4A 09 15
44B0- 1B 3F 77 49 11 00 69 09
44B8- 1A 1B 3F 0E 4D 11 1B 1B
44C0- 57 4D 15 1B 3F 53 49 11
44C8- 00 49 09 1A 1F 1B 6E 09
44D0- 15 3B 1B 33 4D 2D 1A 1F
44D8- 3F 4A 49 02 00 49 09 1A
44E0- 1F 1B 6E 09 15 1B 1F 57
44E8- 0D 0D 1A 1B 1F 4A 49 02
44F0- 00 49 09 1A 1F 1F 6E 0D
44F8- 15 3B 3B 33 0D 0D 15 1B
4500- 1F 57 49 11 00 49 09 1A
4508- 1F 1B 0E 0D 0D 1A 1B 1F
4510- 0A 0D 0D 1A 1F 1B 4E 49
4518- 02 00 49 09 1A 1F 1B 6E
4520- 09 15 3B 1F 73 6D 15 3B
4528- 1B 53 2D 0D 02 00 49 09
4530- 1A 3F 3F 4E 69 1A 1B 1F
4538- 0A 4D 11 3B 3F 77 49 11
4540- 00 29 4D 1A 3B 1B 4A 69
4548- 1A 1F 1B 4A 69 1A 3B 1B
4550- 0A 6D 11 00 09 4D 1A 3B
4558- 3B 6A 09 15 1B 1B 53 49
4560- 11 1B 1B 53 49 11 00 09
4568- 4D 1A 3B 3B 6A 09 15 3B
4570- 1B 33 2D 2D 15 3B 1B 33
4578- 4D 29 02 00 2D 6D 1A 1F
4580- 3B 0A 4D 15 1B 3F 57 4D
4588- 15 3B 1B 17 2D 6D 02 00
4590- 09 6D 1A 1F 3B 6A 49 1A
4598- 1B 1B 6E 49 1A 1F 3B 4A
45A0- 6D 02 00 2D 6D 1A 1F 3B
45A8- 0A 4D 15 3B 1B 57 4D 15
45B0- 3B 1B 17 2D 6D 02 00 2D
45B8- 2D 15 3B 1B 33 4D 09 1A
45C0- 1B 3F 6E 49 1A 1F 1B 2E
45C8- 2D 2D 02 00 2D 2D 15 3B
45D0- 1B 33 4D 09 1A 1B 3F 6E
45D8- 49 1A 1B 1B 6E 49 02 00
45E0- 29 6D 1A 1F 1B 6E 49 1A
45E8- 3F 1F 6E 09 15 3B 1B 73
45F0- 2D 0D 02 00 4D 29 1A 1F
45F8- 1B 6E 09 15 3B 3F 37 4D
4600- 29 1A 1F 1B 6E 09 15 00
4608- 29 6D 1A 1B 1F 4A 4D 1A
4610- 1B 1F 4A 4D 1A 1B 1F 0A
4618- 2D 0D 02 00 09 2D 15 1B
4620- 1F 53 09 0D 1A 3B 1B 4A
4628- 69 1A 3B 1B 0E 6D 11 00
4630- 4D 29 1A 3B 1B 6E 4D 1A
4638- 1B 3B 6E 4D 1A 3B 1B 6E
4640- 09 15 00 6D 09 1A 1B 3B
4648- 0A 4D 11 1B 1B 57 4D 11
4650- 3B 1B 17 2D 2D 15 00 4D
4658- 29 1A 3F 3B 6E 0D 15 3B
4660- 1B 33 4D 29 1A 1F 1B 6E
4668- 09 15 00 4D 29 1A 1F 1B
4670- 2E 4D 15 3B 3B 33 4D 2D
4678- 1A 1F 1B 6E 09 15 00 29
4680- 6D 1A 1F 1B 6E 09 15 3B
4688- 1B 33 4D 29 1A 1F 1B 0E
4690- 2D 0D 02 00 2D 6D 1A 1F
4698- 3B 0A 4D 15 1B 3F 57 4D
46A0- 11 1B 1B 17 6D 09 02 00
46A8- 29 6D 1A 1F 1B 6E 09 15
46B0- 3B 1B 33 0D 0D 15 1B 1F
46B8- 73 6D 15 00 2D 6D 1A 1F
46C0- 3B 0A 4D 15 1B 3F 57 0D
46C8- 0D 1A 1F 3B 2A 4D 15 00
46D0- 29 6D 1A 1F 1B 6E 49 1A
46D8- 3B 3F 4A 09 15 3B 1B 73
46E0- 2D 0D 02 00 2D 2D 15 3B
46E8- 3B 73 69 11 1B 3B 53 69
46F0- 11 1B 3B 53 2D 0D 02 00
46F8- 4D 29 1A 1F 1B 6E 09 15
4700- 3B 1B 33 4D 29 1A 1F 1B
4708- 0E 2D 0D 02 00 4D 29 1A
4710- 1F 1B 6E 09 15 3B 1B 33
4718- 4D 29 1A 3B 3B 4A 4D 02
4720- 00 4D 29 1A 1F 1B 6E 09
4728- 15 3B 1B 33 0D 0D 15 3B
4730- 1F 37 4D 29 02 00 4D 29
4738- 1A 1F 1B 0E 0D 0D 1A 1B
4740- 1F 0A 0D 0D 1A 1F 1B 6E
4748- 09 15 00 4D 29 1A 1F 1B
4750- 0E 0D 0D 1A 1B 1F 4A 4D
4758- 1A 1B 1F 4A 4D 02 00 2D
4760- 2D 15 3B 1B 73 09 0D 1A
4768- 1B 1F 0A 4D 11 3B 1B 33
4770- 2D 2D 15 00 2D 2D 15 3B
4778- 3F 37 2D 2D 15 3B 3F 37
4780- 2D 2D 15 3B 3F 37 2D 2D
4788- 15 00 00
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NEWS & PRODUCTS

Games For TRS-80 Computers

The Cornsoft Group has introduced four recreational software items for TRS-80 computers – *Crazy Painter*, *Bounceoids*, *Avenger*, and *MicroChord*. *Crazy Painter*, *Bounceoids*, and *Avenger* are joystick-compatible arcade games. *MicroChord* is a music generation program.

Crazy Painter requires the player to paint the screen completely before moving on to the next skill level. This is complicated by a mischievous puppy, snakes, and "paint eaters" – all remove parts of the paint at different times. The player must catch the puppy while avoiding the poisonous turpentine bucket and the dreadful snake. *Crazy Painter* is available for the TRS-80 Models I and III.

Bounceoids come crashing in from space, attracting alien natives with poison darts, off-world snakes, and shaking bugs. Players must blast the bounceoids and eliminate all the other hazards to advance. During the challenge mode, the flying space flock adds suspense and excitement in a test of strategy, coordination, and targeting skills. *Bounceoids* is available for the TRS-80 Models I and III.

In *Avenger*, your Pesticraft zeros in on the invasion of space pests. Take too long to clear the pests, and the mighty Avenger appears and attempts to destroy you. Droid-filled birds and waves of space pests combine for hours of tense aerial challenges. *Avenger* is available only for the TRS-80 Color Computer.

MicroChord facilitates the creation of original music or favorite tunes. This single program, in machine language,

produces excellent two-note harmonics, with the aid of the easy-to-use music editor. *Micro-Chord* is available for the TRS-80 Models I and III.

The Cornsoft Group
6008 N. Keystone Avenue
Indianapolis, IN 46220
(219)257-3227

Memory Module For The VIC

Apropos Technology has released Ramax, a memory module with 27K bytes of static RAM and two expansion connectors for the VIC-20.

Features include:

– compatibility with any plug-in device for the VIC-20

– completely switchable memory in 3K and 8K sections

– a system reset switch

– fuse protection for the memory and extension connectors

– very low power usage (less than 150 ma. max.)

– fully self-contained

– six-month factory warranty.

The cost is $169, shipping included.

Apropos Technology
340 N. Lantana, Suite 821-C
Camarillo, CA 93010
(805)482-3604

Voice Box II For Atari

The Alien Group announces the *Voice Box II*, a programmable speech synthesizer for Atari 400/800 computers. The *Voice Box II* requires a 32K disk system, and has the following features:

- The ability to speak with inflection.
- The ability to speak in foreign languages with correct foreign spelling as input.
- The ability to sing with voice and three-part music.
- A library of 30 famous songs.
- A music system that allows the user to enter new songs.
- Software that can convert the bottom two rows of the Atari keyboard into a piano with a range of 3½ octaves using the shift and control keys.
- Programmable musical sound effects such as tremolo, vibrato, and glissando.
- A singing *human* face with lip-sync animation designed by Jerry White.
- A talking or singing *Alien* face with software that allows the user to change the face as he sees fit.
- A talk and spell program by Ron Kramer. Users can program any vocabulary for this spelling game. The program can speak in a foreign language, and the user must spell the correct word in English, or vice versa.

Products for Commodore, Atari, Apple, and others!

NEW

THE MONKEY WRENCH II
A PROGRAMMERS AID FOR ATARI 800
NEW AND IMPROVED — 18 COMMANDS
PLUGS INTO RIGHT CARTRIDGE SLOT

If you are a person who likes to monkey around with the ATARI 800, then THE MONKEY WRENCH II is for you!! Make your programming tasks easier, less time-consuming and more fun. Why spend extra hours working on a BASIC program when the MONKEY WRENCH can do it for you in seconds. It can also make backup copies of boot type cassette programs. Plugs into the right slot and works with ATARI BASIC cartridge.

$59.95

The MONKEY WRENCH provides 18 direct mode commands. They are: AUTO LINE NUMBERING — Provides new line numbers when entering BASIC program lines. RENUMBER — Renumbers BASIC's line numbers including internal references. DELETE LINE NUMBERS — Removes a range BASIC line numbers. VARIABLES — Display all BASIC variables and their current value. Scrolling — Use the START & SELECT keys to display BASIC lines automatically. Scroll up or down BASIC program. FIND STRING — Find every occurrence of a string, XCHANGE STRING — Find every occurrence of a string and replace it with another string. MOVE LINES — Move lines from one part of program to another part of program. COPY LINES — Copy lines from one part of program to another part of program. FORMATTED LIST — Print BASIC program in special line format and automatic page numbering. DISK DIRECTORY — Display Disk Directory. CHANGE MARGINS — Provides the capability to easily change the screen margins. MEMORY TEST — Provides the capability to test RAM memory. CURSOR EXCHANGE — Allows usage of the cursor keys without holding down the CTRL key. UPPER CASE LOCK — Keeps the computer in the upper case character set. HEX CONVERSION — Converts a hexadecimal number to a decimal number. DECIMAL CONVERSION — Converts a decimal number to a hexadecimal number. MONITOR — Enter the machine language monitor.

In addition to the BASIC commands, the Monkey Wrench also contains a machine language monitor with 16 commands used to interact with the powerful features of the 6502 microprocessor.

NEW

VIC RABBIT CARTRIDGE
AND CBM 64 RABBIT CARTRIDGE

"High-Speed Cassette Load and Save!"

$39.95
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Expansion Connector on the VIC Cartridge

"Don't waste your Life away waiting to LOAD and SAVE programs on Cassete Deck."

Load or Save 8K in approximately 30 seconds! Try it — your Un-Rabbitized VIC takes almost 3 minutes. It's not only Fast but VERY RELIABLE.

Almost as fast as VIC Disk Drive! Don't be foolish — Why buy the disk when you can get the VIC Rabbit for much, much less!

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Expansion Connector on rear.
Works with or without Expansion Memory.
Works with VIC Cassette Deck.
12 Commands provide other neat features.

Also Available for 2001, 4001, and 8032

Now for the "64"

STCP — 300/1200 Baud
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PFO IOD OOA CP<D1>D2 BELL = 12:30:00 10:14:36

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- Can be controlled from keyboard or user supplied basic or machine language program

Specify 3.0 or 4.0 ROMS or 8032 Commodore Computer 4040 or 8050 or PEDISK II Disk or CBM64 on 1541.

Price: $129.95

PET BASIC SCROLL PROGRAM
Scroll thru Basic Programs using cursor up/down keys. Specify computer. $6.00 on cassette, $9.00 on diskette.

65C02 MAE
Same as our MAE but enhanced for the new 65C02 Opcodes. Turns your computer into a development system for the new ROCKWELL 65C02 Microprocessor. $200.00 — Specify Computer.

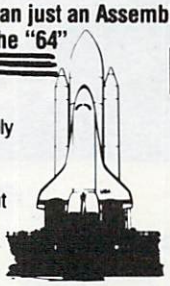
6800 CROSS ASSEMBLER
A Cross Assembler based on the MAE that runs on the PET, Apple, or Atari but assembles opcodes for the Motorola 6800 microprocessor. Turns your computer into a development system for the Motorola 6800 Microprocessor. $200.00 — Specify Computer.

ATARI and VIC Cartridges
EHS can supply large quantities of ATARI and VIC Cartridges for software developers. If you need cartridges, call for pricing.

More than just an Assembler/Editor!
Now for the "64"

MAE
for PET APPLE ATARI
~~$169.95~~
New Price $99.95

It's a Professionally Designed Software Development System



Blast off with the software used on the space shuttle project!

- Designed to improve Programmer Productivity.
- Similar syntax and commands — No need to relearn peculiar syntaxes and commands when you go from PET to APPLE to ATARI.
- Coresident Assembler/Editor — No need to load the Editor then the Assembler then the Editor, etc.
- Also includes Word Processor, Relocating Loader, and much more.
- Options: EPROM Programmer, unimplemented opcode circuitry.
- STILL NOT CONVINCED: Send for free spec sheet!

ATARI AND PET EPROM PROGRAMMER

Programs 2716 and 2532 EPROMs. Includes hardware and software. PET = $75.00 – ATARI (includes sophisticated machine language monitor) = $119.95

TRAP 65
TRAP 65 is a hardware device that plugs into your 6502's socket. Prevents execution of unimplemented opcodes and provides capability to extend the machines' instruction set.
For PET/APPLE/SYM.
Reduced from $149.95 to $69.95

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Prowriter Printer - Excellent dot matrix print. Parallel = $489.00 Serial = $600.00 IEEE = $589.00

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EPROMS 2716 = $4.50 2532 = $7.50
Over 40 Commodore Programs by Baker (on 4040) = $25.00

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- The screen *never blanks out* while talking or singing.
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- Entries into the $5000 talking or singing game contest can be written using the *Voice Box II* – contest information is enclosed.

The Alien Group
27 West 23rd Street
New York, NY 10010
(212)741-1770

Speech Synthesizer with Singing Human Face

The Alien Group's Voice Box II.

Road Atlas For The Apple

Columbia Software has introduced a computerized road atlas for the Apple II personal computer. Called *Roadsearch*, the program simplifies the process of determining driving routes, mileages, travel times, and fuel usage.

Roadsearch develops different types of routes. One program finds the shortest practical route between cities in its data base. This program can also avoid toll or other roads. Another program develops routes which may be longer but more suitable to a user's specific needs. *Roadsearch* also contains a subroutine that estimates flying time between cities.

The atlas has a data base of 406 cities and road intersections located in the USA and Canada. Also included in the data base are about 69,000 miles of interstate and major through highways. This data base can be modified with updated road mileages.

The printed outputs are an excellent companion on any trip. They include the driving route, distances, travel times, and fuel usage tailored to vehicle average miles per gallon (mpg).

Roadsearch requires an Apple II personal computer with DOS 3.3. The price is $34.95.

Columbia Software
P.O. Box 2235
Columbia, MD 21045
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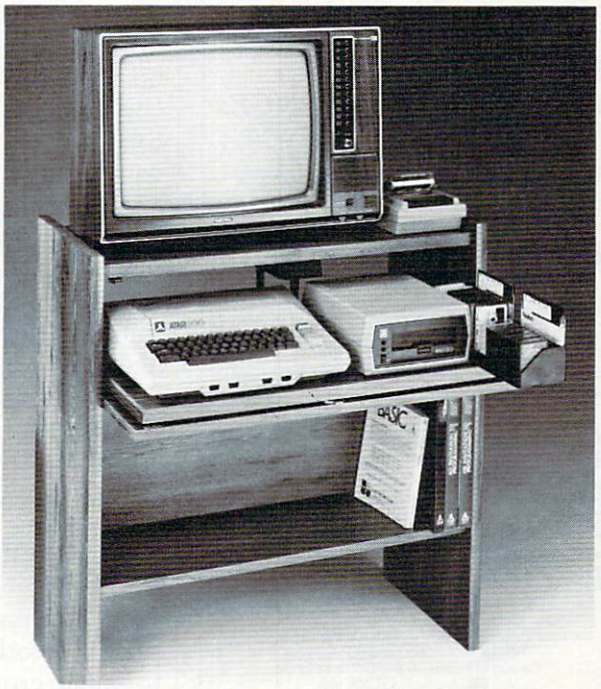

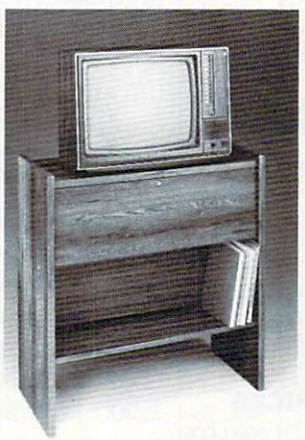

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Software Directory

The PC Clearinghouse Directory contains more than 21,000 software listings. The listings, arranged by application descriptions such as "GENERAL BUSINESS – Accounting" or "HOME USE – Shopping List," provide the user with a full listing of the computer software available for a particular task.

The directory lists hard to find software. Programs for such specialty applications as "feed mill systems" or "resort management" are not normally found on computer store shelves. But these and other specialized vertical market software packages are listed in the directory.

In addition to providing information on the software vendors (company name, address, phone, product line), the directory also cross-references the software with the computer hardware, allowing easy identification of the range of programs designed for use with a specific computer unit. For example, a check of the directory would reveal 785 different general business programs for the Apple personal computer.

The Clearinghouse Directory lists over 200 microcomputers and their manufacturers, and 2,900 software vendors.

PC Stores Telemart Clearinghouse
P.O. Box 1353
Middleburg, VA 22117

Resource Guide For Timex/Sinclair Users

TSG Enterprises has released *The Watchmakers Guidebook to the Timex/Sinclair Computers* (44 pages).

The book contains a directory of about 120 software suppliers, 50 hardware suppliers, and 20 ancillary suppliers. In addition, the guide contains directories of user groups and of Timex/Sinclair specific magazines and books, and an index to general personal computer magazine articles about the Timex/Sinclair computer.

The book is available by mail order ($3.95 plus $1 postage and handling) from:

TSG Enterprises
Guidebook
54 Richwood Place
Denville, NJ 07834

Word Processing For VIC-20

United Microware Industries has introduced Wordcraft 20, a personal word-processor for VIC-20 users – a fully featured cartridge program with 8K of RAM (Random Access Memory). Wordcraft 20 is available from UMI dealers for $269.95.

With Wordcraft 20, docu-

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Characters, words, and large copy blocks can be deleted, inserted, moved, and copied, and up to 40 pages can be stored on a diskette or tape.

A writer can "personalize" business letters using Wordcraft 20's mailing list files, and if electronic mail (computer to computer) is sent, it can be made unreadable to anyone without the keyword.

Wordcraft 20 supports the Commodore 1515 printer as well as a variety of serial printers.

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3503-C Temple Avenue
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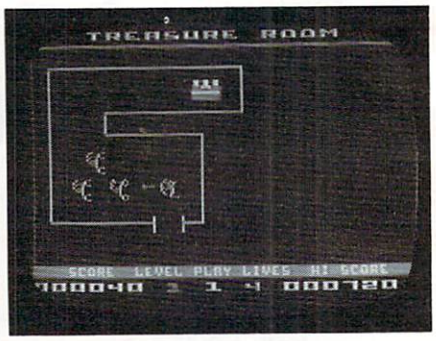
(714)594-1351

Games For The Atari

Romox has released four games for the Atari 400/800 personal computers.

Fortune Hunter is a two-player cartridge game that offers six rooms of treasure and adventure. When you enter a room, it grows to full screen proportions, and then both your treasure and



Fortune Hunter *from Romox.*

your enemies appear on the screen. Your mission: capture the treasure, and evade or destroy your enemies before your time expires. You are also challenged by deadly cobras, scorpions, genies, moving doors and lances, force fields, and relentless guards that disappear at will. *Fortune Hunter* has nine levels of difficulty; your speed and agility with your bow and arrow increase at each level.

Princess and Frog is also a two-player game in cartridge form. Your objective: make a

successful journey to the castle, so that you can kiss the princess and be transformed from a frog into a prince. Your journey must be completed within 60 seconds. You must cross a field of jousting knights to reach the castle moat, and then hop from alligator to snake to the castle gates. The alligators submerge to try to catch you. Once you're at the castle, you must hop into the castle gate that has the lips. Otherwise, you remain just another frog.

Ant Eater is a two-player survival game. You're an ant who journeys to the surface of the earth in search of food for your colony below. On the earth's surface you are exposed to your dreaded enemy, the anteater. Since you know the terrain under the ground, you can lead the anteater under treacherous falling rocks that will destroy him. You can create new paths, but the anteater can travel only in already existing tunnels. You also have five deadly eggs that can be released to dispose of your enemy. If you successfully deliver all the food to the colony, you will be challenged by two anteaters in the next round, and by three in subsequent rounds. The speed also increases with each round.

Typo is an educational game that blends a space maze theme with both spelling and typing drill. The purpose of the game is to introduce the player to the typewriter-style keyboard of a personal computer. *Typo* can be used to test your typing skill; you set the desired words per minute (1 - 120 wpm) that you are chased through the maze. The drill consists of random letters, words, and phrases. You can practice spelling by putting your own word list into the program.

The suggested retail price for each game is $44.95.

Romox, Inc.
501 Vandell Way
Campbell, CA 95008
(408)374-7200

Voice Synthesizer For The Color Computer

Classical Computing has introduced *Speak Up!*, a program for Radio Shack's Color Computer. It is a voice synthesizer, 100% software, and has a small text-to-speech converter. It takes just over 7K of memory, and allows users to access it from BASIC or Extended Color BASIC. With *Speak Up!*, users can type in words and sentences to be spoken, or add speech statements to BASIC programs to make them talk.

The program is available on cassette, with both the 16K and the 32K versions on either side. The documentation includes instructions, a sample calling program in BASIC, and the text to speech rules.

Speak Up! is the first product

offered by Classical Computing. The price is $29.95.

Classical Computing, Inc.
P.O. Box 12247
Lexington, KY 40582

Joystick For Atari, Commodore 64, And VIC-20

Kraft Systems has introduced a joystick for the Atari 400/800, Commodore 64, and VIC-20. The joystick has a spring return that provides fingertip control. Cursor positioning is determined by internal switches, made to withstand heavy use.

The joystick is an easily held, plug-in unit. An eight-foot cord is included. Kraft offers a one-year limited warranty.

Kraft Systems Company
450 W. California Ave.
Vista, CA 92083
(619)724-7146

Kraft Systems' joystick for home computers.

CALENDAR

May 14, Lesley College, Cambridge, MA. The Fifth Annual Computer Conference for Educators, sponsored by Lesley College and the Computer Education Research Coalition (CERC). The conference will be opened by Samuel Gibbon, from Bank Street College, discussing "Micros, Whales, Kids, Boats and TV." The luncheon address, "Computers in Education, The Leaderless Revolution," will be delivered by Dorothy Deringer, from the National Science Foundation. Other activities include two hands-on workshops in FORTH and Pascal, and more than 20 presentations by teachers, researchers, and software producers from the Boston area. For registration forms or additional information, contact Susan Friel or Nancy Roberts, Lesley College, 29 Everett Street, Cambridge, MA 02238; (617)868-9600.

May 19-22, Baltimore Convention Center, Baltimore. Maryland Computer Show & Office Equipment Exposition. Show manager: Dee Harris, Computer Expositions, Inc., P.O. Box 3315, Annapolis, MD 21403; (301)263-8044; toll free (800)368-2066 (outside Maryland). For further information, contact Linda Roth, 1413 K Street, NW, Suite 1200, Washington, DC 20005; (202) 289-4687.

May 21, University of Oklahoma, Norman, OK. The sixth annual Spring microComputer Show & Tell Conference. Several discussions and an on-the-spot

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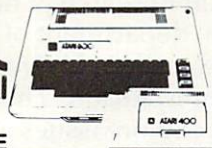

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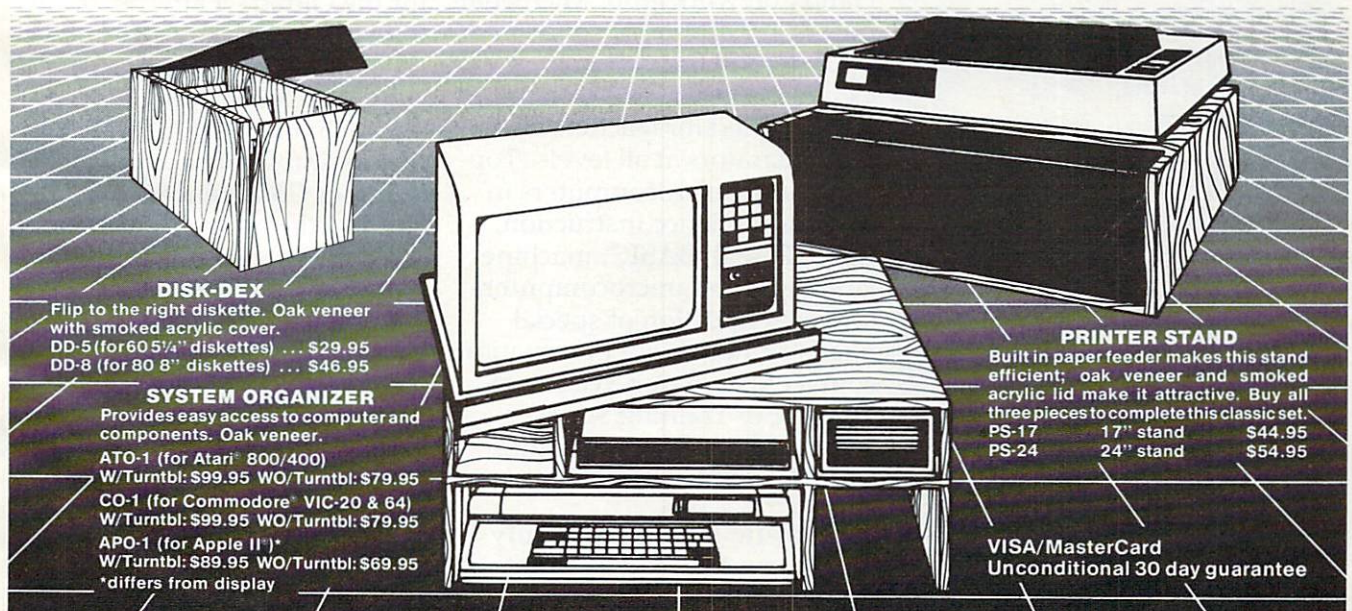

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programming contest with prizes are planned. Computer buffs not attending the conference may participate by submitting original programs for publication consideration in the *Conference Proceedings* and for a prize competition. Such programs should be submitted on the official forms. For further information, send an SASE to Show & Tell, Dr. Richard V. Andree, 601 Elm, Room 423, Norman, OK 73019; (405) 325-3410.

May 24-26, Palo Alto, California. A three-day course, "Microprocessor Background for Management Personnel." Instructor: James Arlin Cooper, Sandia Laboratories. Fee: $565, including text and program materials. Information/sponsor: Continuing Education in Engineering, Dept. 532N, University of California Extension, 2223 Fulton St., Berkeley, CA 94720; (415) 642-4151.

June 9-11, Watertown, CT. Hands-on workshop, Microcomputers in Education, sponsored by Technical Education Research Centers (TERC). The workshops are designed for teachers and administrators at all levels. Topics include microcomputers in math and science instruction, Logo, Pascal, BASIC, machine language, and microcomputers and the education of special needs students. For information, contact Ms. Sharon Woodruff, Director of Training Services, TERC, 8 Eliot St., Cambridge, MA 02138; (617) 547-3890.

June 14-16, Washington; July 12-14, Los Angeles. Technology Opportunity Conference (TOC), covering the convergence of optical storage, videodisk, and computer technology. Sponsored by the publisher and editors of *Optical Memory Newsletter Including Interactive Videodisks*. For further information, contact Ed Rothchild, TOC, P.O. Box 14817, San Francisco, CA 94114; (415) 626-1133.

June 18, University of Wisconsin-Madison. Microcomputers in Education Conference, sponsored by the Wisconsin Center for Education Research, a non-instructional department of the School of Education, University of Wisconsin-Madison. The conference will explore issues and applications of microcomputers in elementary and secondary schools. Contact Suzanne L. Zemke, WCER, Room 785A, 1025 West Johnson Street, Madison, Wisconsin 53706; (608) 263-4200.

July 20-22, and July 25-27, Eugene Hilton and Convention Center, Eugene, Oregon. Two summer conferences, sponsored by the University of Oregon's College of Education. July 20-22: Computers – Extension of the Human Mind II, an expansion of last summer's conference "computers in education" theme, with a look at specific classroom applications and current research in the field. July 25-27: Education for the Gifted – Patterns for the Future, emphasizing future directions, issues, and potential of education for the gifted. Fees: $95 each, or both for $175. For further information, contact: Summer Conference – 1983, College of Education, University of Oregon, Eugene, Oregon 97403; (503) 686-3405.

COMPUTE! *welcomes notices of upcoming events and requests that the sponsors send a short description, their name and phone number, and an address to which interested readers may write for further information. Please send notices at least three months before the date of the event, to: Calendar, P.O. Box 5406, Greensboro, NC 27403.*

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Modifications Or Corrections To Previous Articles

Atari Boggler

In the Atari version of this game (Program 2, p. 84) from the March 1983 issue, in line 870 the "OK" is missing from the third POKE statement.

Direct Atari Disk Access

Two changes are required to Program 3 from this article, which appeared on page 154 of the March 1983 issue. The "{CLEAR" within brackets in lines 30 and 40 should be removed. The {11 M} means type CTRL-M eleven times. The {4 DEL-LINE} means type ESCape-SHIFT-DELETE four times.

Atari Menu Printer

If a file name takes the maximum eight characters plus a three character extension, this program from the March 1983 issue (p. 165) will produce an ERROR 5 at line 780. To correct this, DIMension S$ to 14 instead of 13 in line 130.

Atari Lister

In addition to the changes to this program (January 1983 issue, p. 191) given in last month's CAPUTE!, it is also necessary to change the :FOR X=0 TO T: in line 32710 to :FOR X=1 TO T:

To avoid an ERROR 9 message, change line 32700 to

```
32700 T=0:TRAP 32705:DIM A$(5)
```

and add TRAP 40000: to the beginning of line 32705.

Apple Disk Space Messages

In certain circumstances, it is possible that this program from the January 1983 issue (p. 56) can cause DOS to wipe out the catalog for a disk. Donald Box suggests adding the following two lines to eliminate this danger:

```
35 L = PEEK(72): H = PEEK(73)
120 POKE 72,L: POKE 73,H: NEW
```

VIC Micromon

The following corrections to the Micromon code published in the November 1982 issue (p. 172) will solve the problems with disk access. (The changes are given in hexadecimal.)

LOCATION	OLD DATA	CORRECT DATA
4002	12	15
4013	19	F9
4014	43	FD
4319	20	00
431A	F9	00
431B	FD	00

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October 1981: Automatic DATA Statements for CBM and Atari. VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

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May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

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134	135	136	137	138	139	140	141	142	143	144
145	146	147	148	149	150	151	152	153	154	155
156	157	158	159	160	161	162	163	164	165	166
167	168	169	170	171	172	173	174	175	176	177
178	179	180	181	182	183	184	185	186	187	188
189	190	191	192	193	194	195	196	197	198	199
200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232
233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254
255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276
277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298
299	300	301	302	303	304	305	306	307	308	309
310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331
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134	135	136	137	138	139	140	141	142	143	144
145	146	147	148	149	150	151	152	153	154	155
156	157	158	159	160	161	162	163	164	165	166
167	168	169	170	171	172	173	174	175	176	177
178	179	180	181	182	183	184	185	186	187	188
189	190	191	192	193	194	195	196	197	198	199
200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232
233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254
255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276
277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298
299	300	301	302	303	304	305	306	307	308	309
310	311	312	313	314	315	316	317	318	319	320
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167	168	169	170	171	172	173	174	175	176	177
178	179	180	181	182	183	184	185	186	187	188
189	190	191	192	193	194	195	196	197	198	199
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211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232
233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254
255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276
277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298
299	300	301	302	303	304	305	306	307	308	309
310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331
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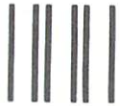

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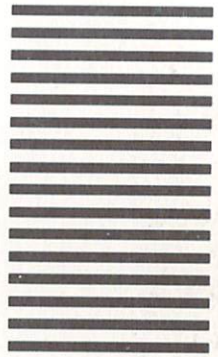

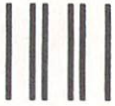

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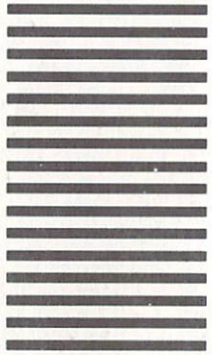

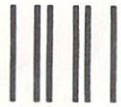

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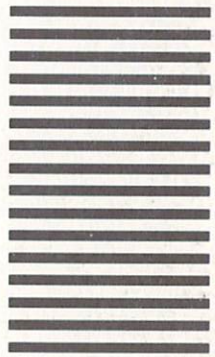

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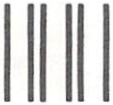

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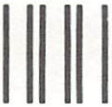

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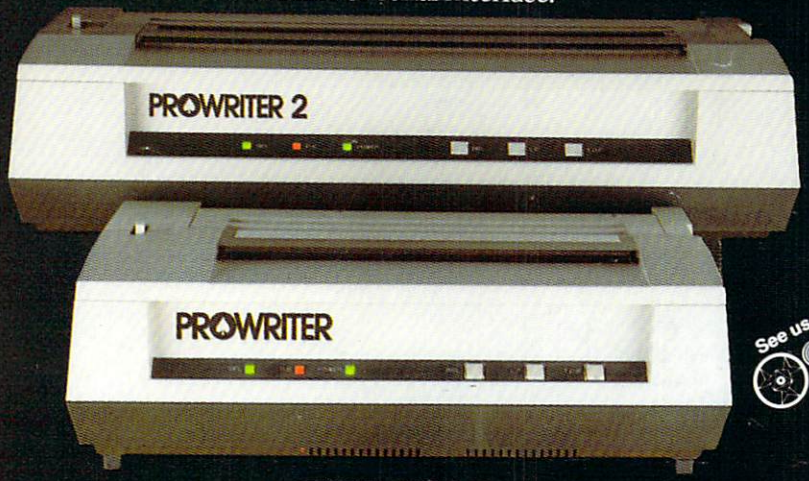

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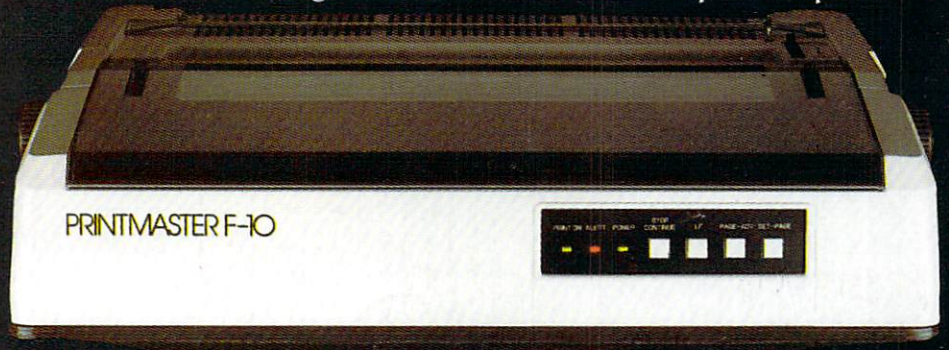

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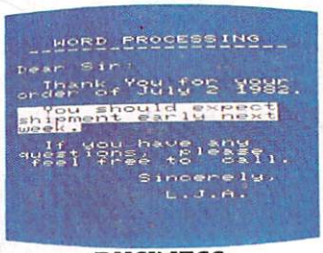

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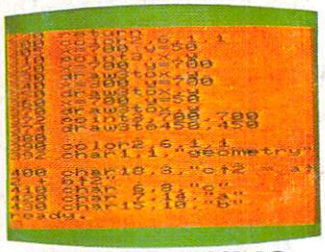
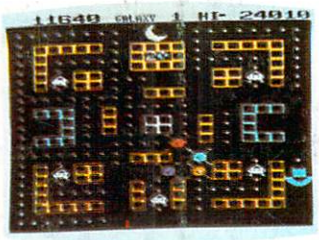


PROGRAMMING



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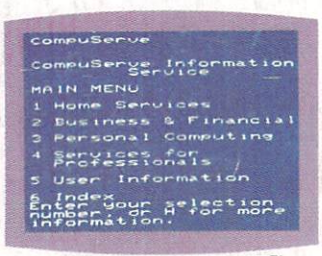

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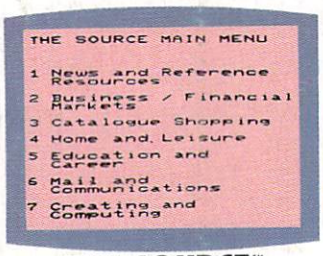

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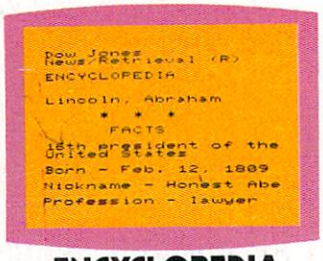

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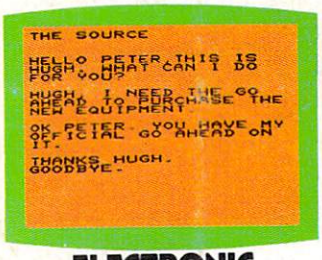
DOW JONES NEWS/RETRIEVAL



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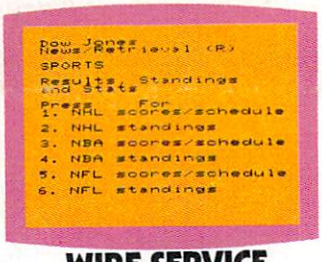
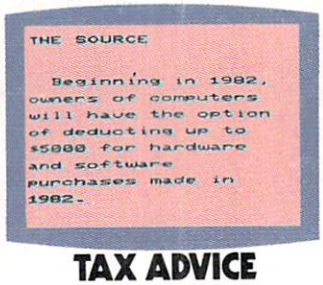


WIRE SERVICE NEWS



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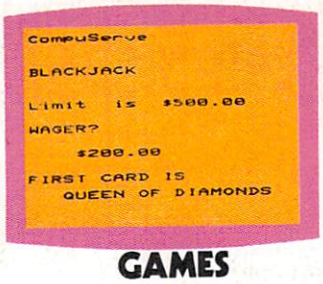

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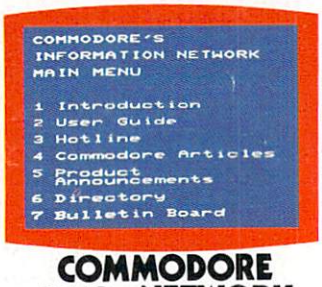

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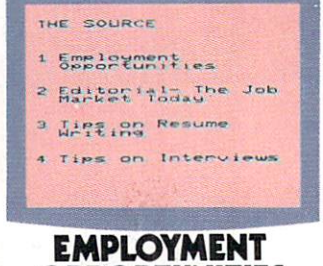

EMPLOYMENT OPPORTUNITIES

The screens at the top of the page show a few examples of how versatile the VIC 20™ or Commodore 64™ can be with the addition of Commodore software.

The screens below them give you a few examples of how much more versatile they can be with the addition of a Commodore VICMODEM.

For around $100, the Commodore VICMODEM will turn your VIC 20 or Commodore 64 computer into a telecomputer.

To make matters even better, Commodore includes a few little extras (such as a free hour's time on the two most popular telecomputing services) that add up to a value of $197.50* A nice return on an investment of about $100.

Most computer companies think it's reasonable to ask as much as $500 for a modem that'll give you telecomputing capabilities such as ours.

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