

What To Get Your Computer For Christmas

COMPUTE!

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1982
Issue 30
Vol. 4, No. 11
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The Leading Magazine Of Home, Educational, And Recreational Computing

A Buyer's Guide To Modems

**Laser Gunner:
An Action Game
For Atari And PET**

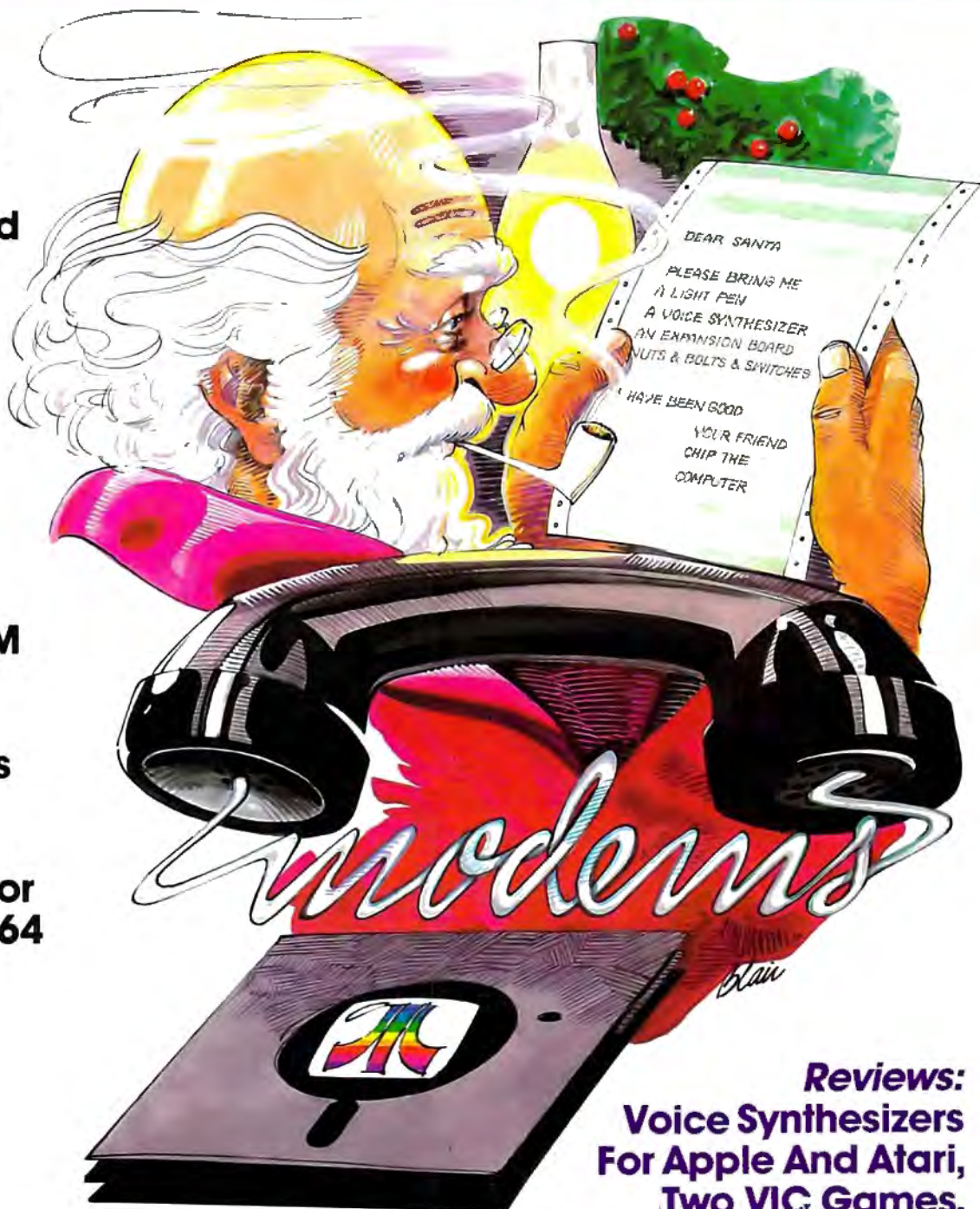
**UXB: A Fast-paced
Game For VIC
And Atari**

**Easy File Input
For Commodore
Computers**

**Screen Save
Utilities For
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**Apple Menu:
Making Programs
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**A Shape Generator
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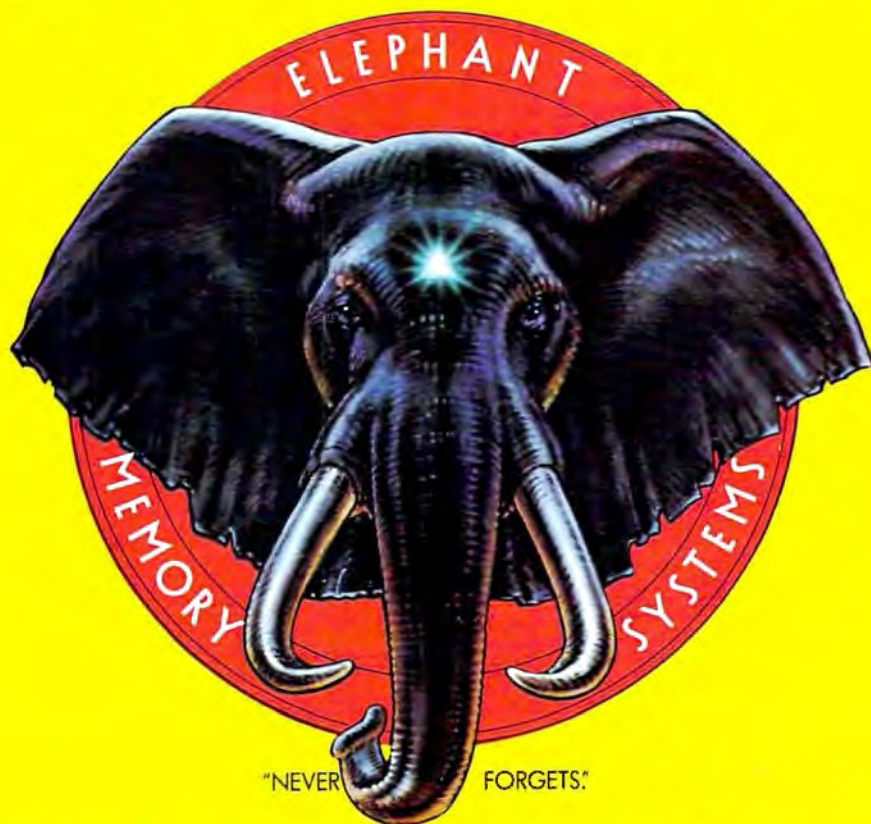


**Reviews:
Voice Synthesizers
For Apple And Atari,
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PET Compiler And More**



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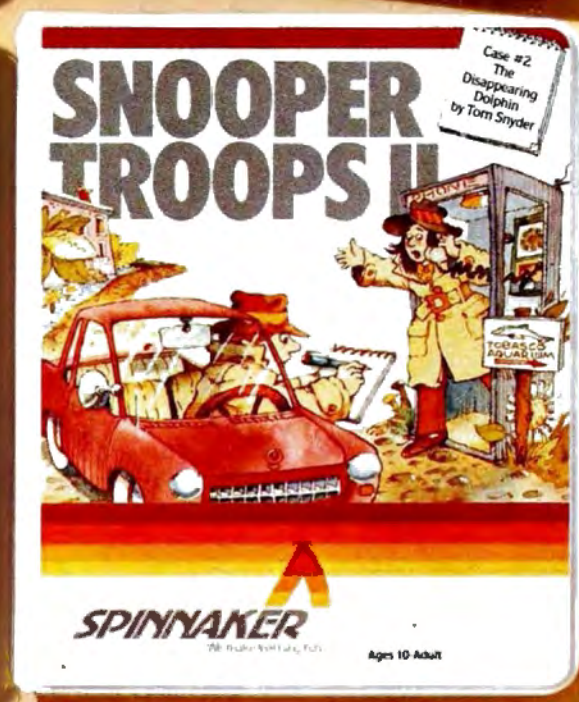
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At Spinnaker Software, we make educational games that are actually fun.

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Our games are educational, because you can't kid parents.

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Kids like Spinnaker games for the same reasons they like roller coasters, going to the beach and ice cream sundaes.

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I plan to add a hard disk system to my Atari: yes no.

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AN ATARI 800™ HOME COMPUTER AND A FATHER'S LOVE COMBINED TO HELP CHILDREN EVERYWHERE.

Fernando Herrera became the first grand prize winner of the ATARI Software Acquisition Program (ASAP) competition because he believed in computers, his son and himself.

The story of Herrera's success began with his son's sight problems. Young Steve Herrera had been born with severe cataracts in both eyes and, naturally, his father was concerned. Herrera reasoned that the boy's learning abilities could be seriously affected by growing up in a world he could not see.

Having just purchased an ATARI 800 Home Computer, it occurred to Herrera that this could be the perfect tool for testing Steve's vision. So he wrote a program simply displaying the letter "E" in various sizes.

Success! It turned out that 2-year-old Steve could see even the smaller "E's" without special lenses. Herrera was first relieved, and then intrigued when he discovered that not only could his son see the "E's," but he would happily play with the computer-generated letters for hours. So Herrera added a picture of an elephant to go with the "E," and then more letters and pictures. Thus, "My First Alphabet" was born, a unique teaching program for children two-years and older consisting of 36 high resolution pictures of letters and numbers.

Herrera submitted the program to the ATARI Program Exchange, where it became an instant best-seller. ATARI was so impressed with the outstanding design, suitability and graphic appeal of "My First Alphabet," that the program is being incorporated into the ATARI line of software.



In addition to his grand prize winnings of \$25,000 in cash and an ATARI STAR trophy, Herrera also automatically receives royalties from sales of his program through the ATARI Program Exchange.

But Fernando Herrera wasn't the only software "star" that ATARI discovered. Three other ATARI STARS were awarded at the ASAP awards ceremony for software submitted to the ATARI Program Exchange and

judged by ATARI to be particularly unique and outstanding.

Ron and Lynn Marcuse of Freehold, New Jersey, teamed up to write three winning entries in the Business and Professional category for home computers: "Data Management System," "The Diskette Librarian" and "The Weekly Planner."

Sheldon Leeman of Oak Park, Michigan, captured an ATARI STAR for his exceptionally well-engineered "INSTEDIT" character set editor.

Greg Christensen of Anaheim, California, became our youngest ATARI STAR winner at the age of 17.

Christensen designed the clever "Caverns of Mars" game program, which also will be incorporated into the ATARI product line. Greg designed the program in 1½ months after owning his ATARI Home Computer for less than a year.

Every three months, ATARI awards ATARI STARS to the writers of software programs submitted to the ATARI Software Acquisition Program and judged first, second and third place in the following categories: Consumer (including entertainment, personal interest and development); Education; Business and Professional programs for the home (personal finance and record keeping); and System Software.

Quarterly prizes consist of selected ATARI products worth up to \$3,000, as well as an ATARI STAR, plus royalties from program sales through the ATARI Program Exchange. The annual grand prize is the coveted ATARI STAR trophy and \$25,000 in cash.

To be eligible, your software idea must be accepted by the ATARI Software Acquisition Program. Your program can have a broad application or serve a very specific purpose.



After submittal, consultation from ATARI is available if you need personal assistance with sound, graphics, or other technical aspects of your program.

To make your job easier, ATARI provides some 20 software development tools through the ATARI Program Exchange. A list and description of the various system software is published quarterly in the ATARI Program Exchange Catalog. These tools enable you to utilize all the ATARI resources and software, including the six ATARI programming languages.

Fernando Herrera had a great idea that made him a star. ATARI would like to give you the same opportunity.



Enter the ATARI ASAP competition and you could win \$25,000 in cash, royalties, some great prizes and an ATARI STAR.

SUBMIT TO: ATARI® Software Acquisition Program
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Sunnyvale, CA 94086

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I'm reaching for the stars. Please send me an entry form today.

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The Editor's notes...

Robert Lock, Publisher/Editor In Chief

IBM Comes Home

A recent *Wall Street Journal* column reported that IBM is rumored to be studying an entry into the low-end, home/personal computing market. Several sources indicated their expectation that the company will expand their successful product line (15,000 personal computers a month) into the \$500 or so market by sometime in 1983. We look forward to their further expansion and support of the marketplace. We'll also point out that the way prices have been going lately, the \$500 systems will be substantially less by the end of 1983.

The Commodore 64 Charges Out Of The Gate

Our sources indicate that Commodore shipped 12,000 64's in the first two weeks of full release of the product. Now, their primary problem, much like Atari with the 800, is building them fast enough to meet demand. And *that's* at a time when the VIC-20 is now base priced at \$199 and reportedly shipping around 80,000 units a month. No wonder outside analysts around the country are starting to recognize that there really is a strong and thriving home computer market. No news to you, right? The marketplace is growing *so* fast we're even beginning to see evidence that some of the other magazines in our industry may start trying to provide some editorial coverage of VIC, II,

the 400, and others.

Your First Computer

If you've recently joined the ranks of first time computer users, welcome to **COMPUTE!** In every issue, you'll find a broad range of useful information designed and selected to support you in growing with your system. If you're still selecting your first computer, whether for home, educational, recreational or whatever use, you'll find us informative and helpful. Next month, our feature article will be "Selecting Your First Computer."

The Atari 600 And The Atari 1000

Additional rumors... Next summer's Consumer Electronics Show may mark the debut of the two newest entries into the Atari product line. You may reasonably infer that the 600 will fall between the 400 and 800 in pricing and features, and the 1000 is rumored to be Atari's planned entry into the small business market.

Our First Apple Columnist

Keith Falkner has contributed Apple articles of exceptional quality to these pages in the past. Beginning with the December issue, you'll find Keith's monthly Apple column, "Extrapolations." Keith lives in Toronto and has a broad background in all levels of computing. We welcome him to **COMPUTE!**



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by Brad Templeton

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POWER produces a dramatic improvement in the ease of editing BASIC on Commodore's computers. POWER is a programmer's utility package (in a 4K ROM) that contains a series of new commands and utilities which are added to the Screen Editor and the BASIC Interpreter. Designed for the CBM BASIC user, POWER contains special editing, programming, and software debugging tools not found in any other microcomputer BASIC. POWER is easy to use and is sold complete with a full operator's manual written by Jim Butterfield.

POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes

new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

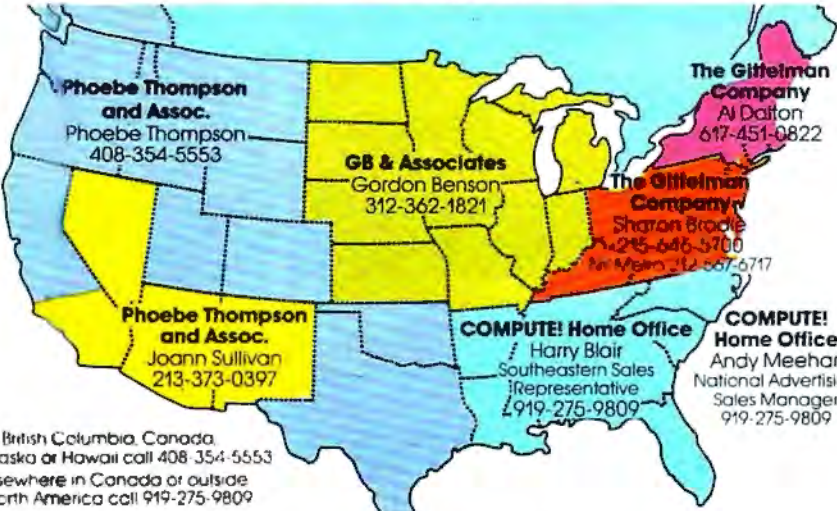
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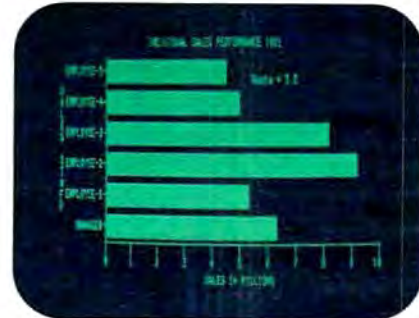
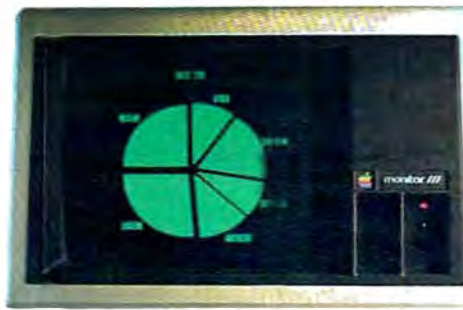
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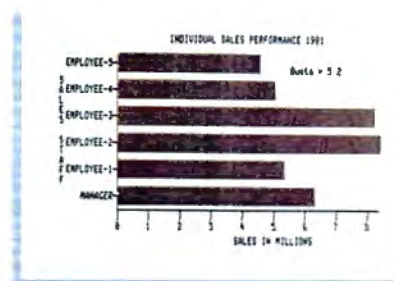
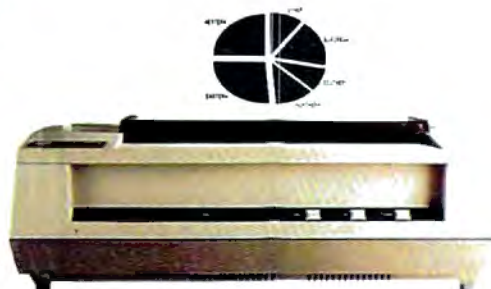
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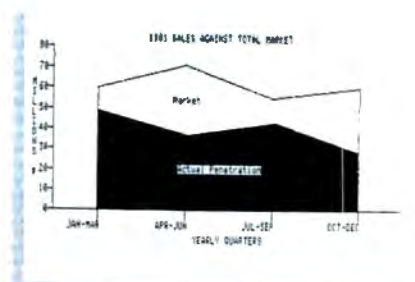
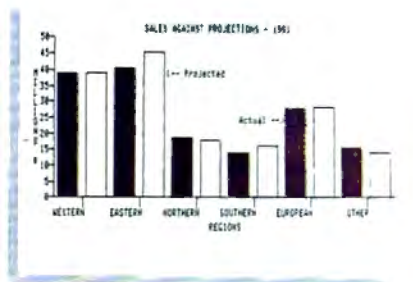
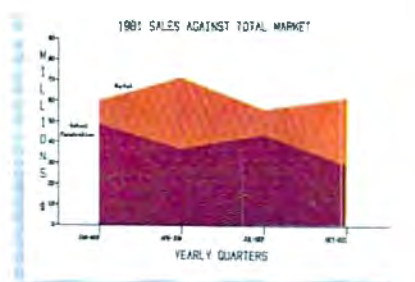
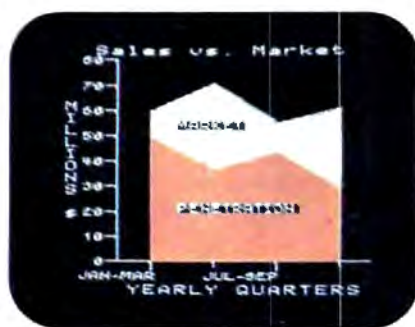
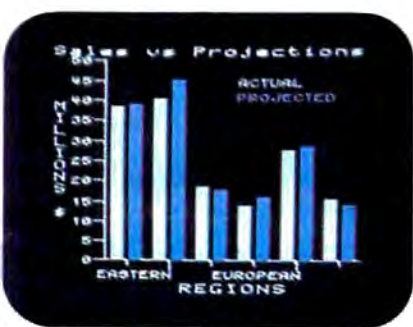
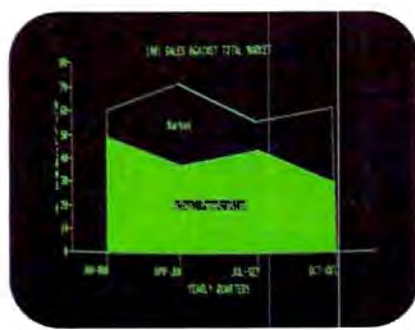
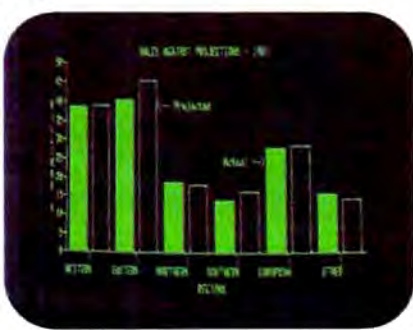
	Apple	VisiTrend/ VisiPlot	pfsGraph
Graph Types			
Line	Yes	Yes	Yes
Vertical Bar	Yes	Yes	Yes
Horizontal Bar	Yes	No	No
Side-by-side Bar	Up to 4	2	4
Pie	Yes	Yes	Yes
Partial Pie	Yes	No	No
Scattergram	Yes	Yes	No
Curve Fitting	5 Kinds	1	None
Data Points (Max.)	3500+	645	36
Plotter	Virtually Any	None	H-P7470A Only
Compatible	Pascal	BASIC	pfs
File Types	BASIC	VisiCalc	VisiCalc
Math Functions	Yes	Yes	No
Available Colors	6	4	4

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Ask The Readers

The Editors And Readers of COMPUTE!

Interfacing An Apple To EEG

I currently own an Apple III Computer and wish to interface a 16 channel EEG machine with this. I also have an Apple II computer and may wish to interface the Apple II with the Apple III as well. Can anyone supply the necessary information?

Frederick T. Strobl

How Many Languages?

Exactly what languages am I capable of using on the Atari 400? I understand that assembly language can be written with an "Assembler" ROM Cartridge, but can't machine language subroutines be written in BASIC? What book teaches about this process? Also, I've heard that PILOT and FORTH can be used, but I know nothing about them.

Stephen Roszell

Simply put, a computer could theoretically use any language. If there's enough RAM memory space, you could have APL, FORTH, FORTRAN, COBOL, or any other language you wanted. A language is just a program. If you buy a language on disk, it can be LOADED and RUN just like any other program. Languages come as cartridges (Atari BASIC), on disks (Microsoft BASIC on Atari, FORTH for PET, etc.) or as part of the computer's hardware in ROM chips inside. The size of micro languages can vary greatly: from less than 4000 bytes (for a stripped down version of BASIC) up to and beyond 65,000 bytes (a version of APL for the SuperPET).

For proof that a language is a program, type in the program on page 114, October 1982 – you'll then have Pilot on your Atari. (In the September issue we published a Pilot for Apple and next month we conclude with Pilot for PET/CBM).

Machine Language is a special case. It's in all computers already, but it's not easy to program. Each Central Processing Unit (CPU – the "computing" part of a computer) follows instructions coded as numbers. In the 6502 CPU, for example, the number 169 puts something in the "A" register. If you type POKE 2000,169:POKE 2001,66:POKE 2002,96 you have "written" a little machine language program which will put the symbol for the letter "B" into the accumulator. You won't see it happen, but it's there. In this way, a BASIC program can contain a series of machine language instructions as

numbers in DATA statements and just POKE them somewhere into memory. That's called a "BASIC Loader."

The easier way to program machine language is by using a language called "Assembly Language" which, too, is a program (it could be a BASIC program). Or you can buy an "assembler" and program with it. There are several books on 6502 machine language available.

COMPUTE! Books will be publishing an introductory book on this subject, Machine Language For Beginners, this fall.

Color For VIC Gold Miner

In **COMPUTE!** July 1982 you published a very good game for Atari and VIC called "Gold Miner" (p. 27). It occupied my brother and me – trying to find out how to get the most gold for our dynamite. We decided that some color would add to the game. I believe that the following lines inserted into Mr. Weber's game will make a great game even better.

```
120 POKE 36879,233
250 POKE Z,90:POKEZ+30720,0
1020 POKE X,102:POKEX+30720,2
1060 POKE I,81:POKEI,30720,7
5101 POKE 36879,INT(RND(1)*247)+8
5102 FORA=1T020:NEXT
5121 POKE 36879,INT(RND(1)*247)+8
5122 FORA=1T021:NEXT
5123 POKE 36879,233
8040 POKEV,102:POKEV+30720,2
8680 POKEZ,42:POKEZ + 30720,1
```

David St. Romain

A VIC Taping Mystery Solved

I only had my VIC-20 for a short time when I started having a problem: programs didn't load, or came up "out of memory", or loaded garbage graphics. I had purchased a new Toshiba black stripe 14" color TV to go with the computer and only experienced the loading problem with the new TV; everything worked perfectly when hooked up to my eight-year-old Electrohome TV.

With excellent assistance from my dealer – Compupro Micro Systems, Welland – I tried to isolate the problem. I changed wiring, computers, recorders, had the TV tested, but the problem persisted. After much frustration I hit upon the solution by accident.

My problem disappeared when I reversed the position of the computer/recorder and TV! Instead of having the TV to the left of the computer/recorder combination, I moved it to the right.

You might think this is crazy, and to this day I am at a loss to explain why this worked. All I know is that I no longer have any loading problems, but if I reverse the components my problem returns!

Foster J. Zanutto

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• **Decimals:** kids are challenged to break balloons by entering the correct decimal corresponding to the position of the balloon on a vertical line. Numbers are entered on a trial-and-error basis. Software automatically adjusts difficulty to the child's performance. For elementary math students.

• **Fractions:** same format as Decimals, but requires the use of fractions to break the balloons. Numbers are entered on a trial-and-error basis. Balloons may burst in any order until none are left. Difficulty adjusts to your child's performance. For elementary math students.

• **Computer Literacy—Introduction:** this lesson is presented in a friendly, non-intimidating manner with touches of humor and simple, supportive graphics. It presents the history and uses of computers in today's society. Designed for junior or senior high and vocational school students.

• **French Vocabulary Builder.**

• **Spanish Vocabulary Builder.**

• **German Vocabulary Builder:** students are presented with a basic vocabulary of 500 words, including useful verbs, number words or common words for traveling or in the home. Groups of related words give learners context and similarity clues, which help increase foreign language skills. Lessons supplement introductory and/or refresher coursework.

• **Physics—Elementary Mechanics:** provides a problem-solving test in the elementary mechanics of physics. Students are shown a physical problem; then must "purchase" the missing information needed to answer it correctly. The emphasis is on *understanding* the problem, rather than just supplying the correct answers. Designed for senior high age level.



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Dump Atari Windows To Printer

In his article, "Copy Atari Graphics To Your Printer" (**COMPUTE!**, June 1982), Mr. Straw offers several subroutines which will copy various graphics modes to the printer. How can the text windows of these modes also be sent to a printer?

K. Gottlieb

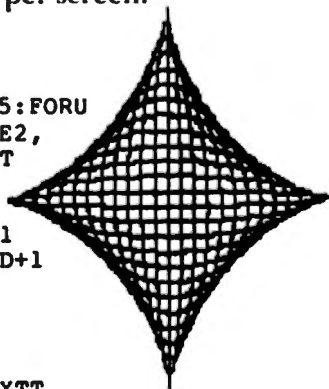
```
10 OPEN #4,9,0,"E:":DIM LL$(40):GRAPHICS 5
31000 OPEN #1,8,0,"P:"
31010 FOR Y=0 TO 39
31020 FOR X=0 TO 79
31030 LOCATE X,Y,Z
31040 IF Z=0 THEN PUT #1,32:GOTO 31080
31050 IF Z=1 THEN PUT #1,42:GOTO 31080
31060 IF Z=2 THEN PUT #1,43:GOTO 31080
31070 PUT #1,111
31080 IF X=79 THEN ? #1
31090 NEXT X
31100 NEXT Y
31110 POKE 656,0:POKE 657,0
31120 FOR Y=0 TO 3:INPUT #4,LL$:? #1;LL$:NEXT Y
31130 CLOSE #1:RETURN
```

This modification to Mr. Straw's screen dump routine copies the text window (as well as the graphics screen) to the printer. Because LPRINT cannot reliably be used to send single characters, file #1 is opened to the printer (line 31000), and PUT is used to send the bytes. In order for the text-window "dump" to work, file #4 must have been previously OPENed before the subroutine is called. The OPEN statement should come before the GRAPHICS statement. LL\$ should also be dimensioned (see line 10).

VIC Superexpander Graphics

This program will let you transfer screens of graphics created with the VIC Superexpander to the 1515 printer. It works best in modes two and three and, while it does give 100% resolution, it takes just over ten minutes per screen.

```
10 GRAPHIC2:COLOR0,0,5,5:FORU
  =0TO500STEP40:CIRCLE2,
  511,511,U,500-U:NEXT
20 DIMA$(19)
30 Y=4096:OPEN1,4
40 FORU=0TO154STEP7:D=-1
50 FORZ=0TO190STEP10:D=D+1
60 W=Y+(Z*16)+E
70 FORF=0TO6
80 A$(F)=PEEK(W+F)
90 NEXTF
95 FORT=0TO9:B$(T)=0:NEXTT
100 S=256:FORL=0TO7:S=S/2:FORI=0TO6
110 IF(A$(I)ANDS)=STHENB$(L)=B$(L)+(2*I)
120 NEXTI:NEXTL
130 FORF=0TO7:IFB$(F)<128THENB$(F)=B$(F)+128
140 A$(D)=A$(D)+CHR$(B$(F)):NEXTF
150 IFD<19THENNEXTZ
```



```
160 FORF=0TO18
170 PRINT#1,CHR$(8)AS(F);
180 AS(F)="":NEXTF
190 PRINT#1,CHR$(8)AS(19)
200 AS(19)="":R=FRE(0)
210 NEXTE
220 PRINT#1,CHR$(15):CLOSE1
```

Richard Holleran

Atari Listing Conventions

I don't know what a few of the symbols used in **COMPUTE!** to specify escape sequences mean (for example, {A}). I own an Atari 800 and if you could print a complete list of these, I'm sure that I and many others would appreciate it.

Ashley Fryer

*To display special graphics characters, or to move the cursor around using a PRINT statement, the Atari uses special control characters. To make it easy to type in programs appearing in **COMPUTE!** which include these characters, we've developed a listing convention with instructions on how to type in these characters when entering a program from the magazine. The conventions are published in every issue for convenience. See page 212, October 1982.*

SuperPET Users Groups

In this column in August 1982, P. V. Skipski asked if there were any users groups forming for owners of the SuperPET. John Collins of the Technical Services Department of Commodore UK replies:


Within the I.P. Sharp Associates network's Mailbox service is a group called SPET. This is, however, mainly of interest to APL users. There is also a group called TEACH, for users of APL in education. Sharp's New York office is at Suite 210, 230 Park Avenue, NY, NY 10169. Telephone (212) 557-1200.

Running 40-Column Programs On The 8032 PET/CBM

I recently typed in Mike Peterson's "Maze Race" (July 1982) and discovered it won't run on my CBM 8032. Is there any way to adapt a 40-column program to the 80-column screen?

Charles Lewis

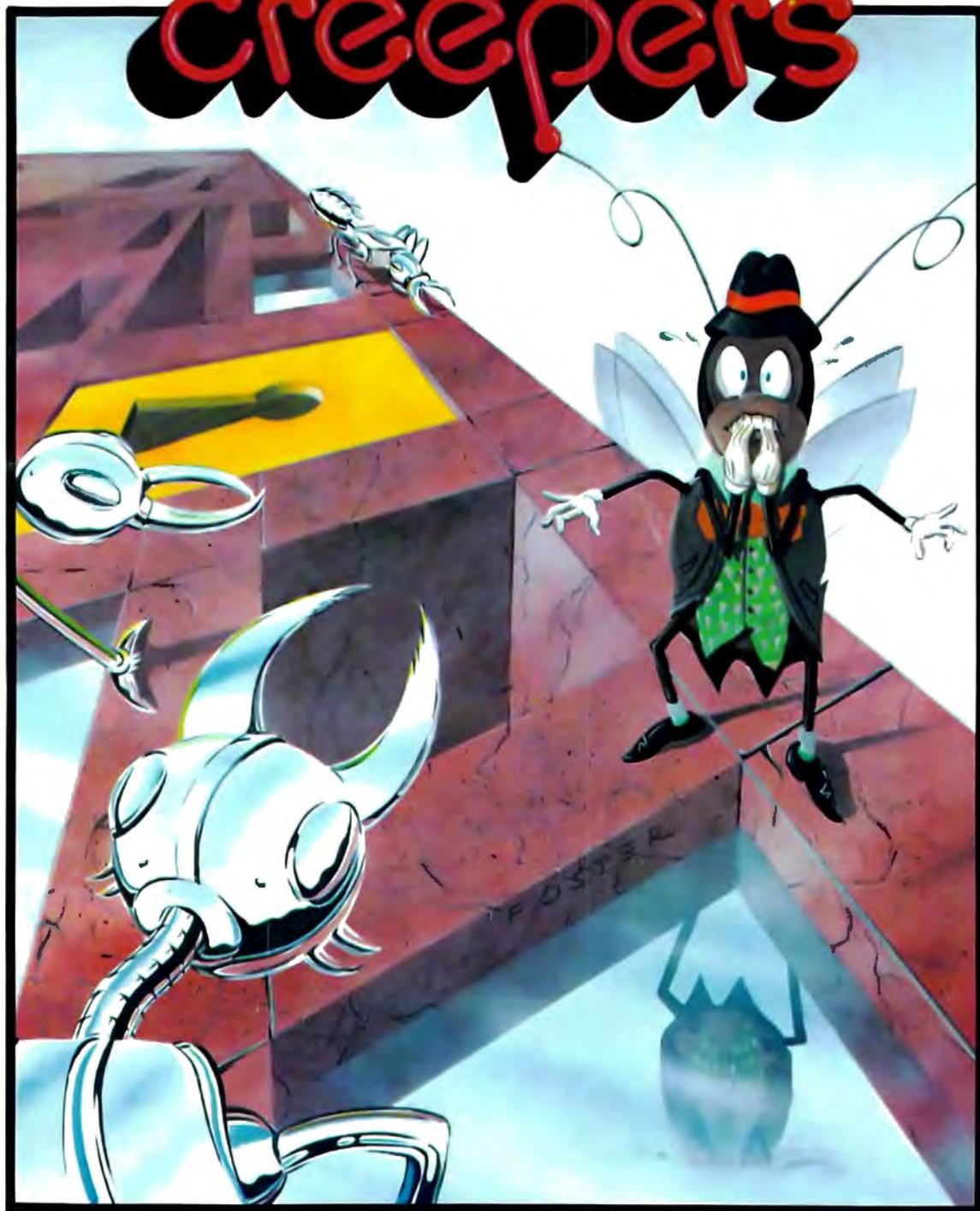
*An excellent solution is the program published in **COMPUTE!** by Chuan Chee, "Running 40 Column Programs On A CBM 8032" (May 1981, p. 130).*

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

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A Monthly Column

Computers And Society

David D Thornburg
Associate Editor

E.T. & T.

I just finished seeing Spielberg's film *E.T.* for the second time. I can't imagine anyone who didn't feel a deep sense of sympathy for the poor creature left on earth by accident. His valiant attempts to contact his ship made this one of the most touching and heartwarming films ever made.

It is interesting, though, to consider just how unsophisticated our own computer-based communications services really are. Those of us who use various information networks and bulletin boards have to carry a collection of phone numbers and log-on procedures. Furthermore, once we are connected, we need to remember the correct command syntax to access services on each of the systems.

While I find that I derive a great deal of value from these services, I can't pretend to say that I am happy with the primitive state of their development. For example, suppose you belong to information utility A and I belong to utility B. Each service has its own electronic mail system, but neither allows us to communicate across the utility boundaries. This makes as much sense as saying that people with phone service provided by G.T. & E. can't contact people on the Bell system.

There are many solutions to this problem. The creation of one massive utility is one solution I don't care for. There is no technical reason that messages destined for one network can't be automatically forwarded to the other networks as needed. Since both sender and receiver pay for this service, the various utilities don't even have to keep track of the balance of message traffic. If such a system becomes commonplace (and it must if electronic mail is to become a commercial reality), then we would be free to subscribe to one utility on the basis of the services it provides and know that our decision would not preclude our communication with someone who made a different selection.

I am a strong proponent of computer-based message systems, but until the various utilities let people communicate across their boundaries, it will

be hard to think of these utilities as more than hobbyist ventures.

More Movie Magic

There are a few reasons I haven't reviewed movies in this column. First, most films are long gone by the time this column gets into print and, second, I hate standing in lines.

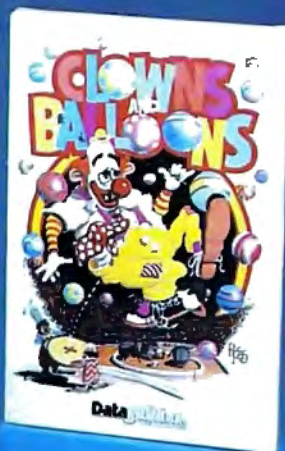
Nonetheless, I find that I have been going to movies more often — if for no other reason than to see the commercial use of computer animation. Conventional animation techniques (such as cel animation using hand-painted celluloid sheets) have long been used to create the illusion of computer graphics, but until recently, the actual use of computer generated imagery has been limited to very short segments. Note that I am restricting my comments to big box-office films. Numerous films using computer-generated images have been around for years. Anyone who has not seen John Whitney's *Arabesque*, for example, should watch for it. It is sometimes shown on PBS and is very much worth seeing.

Prior to this year, one of the most successful films to use computer-generated imagery was *Star Wars*, specifically the "Death Star sequence," in which the attackers are briefed on their strategy for the destruction of Death Star. This monochrome sequence was made for Lucasfilm by artist/computerist Larry Cuba. From this beginning Lucasfilm has built up a computer graphics group that includes talented people like Loren Carpenter. Loren has made extraordinary practical use of fractal geometry in the generation of landscapes and planet land masses. His work is so realistic that, given the pace of an action film, it is virtually impossible to tell that the image has been synthesized.

While the new wave of young film makers is perhaps more inclined to make use of new technology, the old established studios clearly do not want to be left behind. In Walt Disney's *TRON*, for example, a significant portion of the film (about one half hour) was made from computer-generated images. I saw this film along with a group of teenagers. After the film one of the kids said "Boy! You sure enjoyed yourself. How come? After all, it's a pretty dumb story."

Well, the "how come" part is pretty easy. I wasn't paying much attention to the plot (that being all too easy to follow). I was paying a lot of attention to some of the most spectacular computer graphics I have ever seen. Two graphics groups were involved in making the bulk of the images: Information International, Inc., and MAGI. Each seemed to be trying to show the other how good they were. The result is that the viewer is the real

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winner. Whether the effect was the partial transparency of a craft's wing, the subtle shading and reflection from a spherical surface, or any of the other myriad effects in the film, the use of computer animation in *TRON* created a film that would have been totally different had it been made any other way.

This brings me back to an old topic. The computer animation in *TRON* is a new art form distinct from any other. The goal was not to have the computers replicate scenes that would be the natural result of hand sketches or photographs, but rather to let the computer generate images of a highly fantasized model of its own inner workings. This aspect of the computer graphics was so important that those scenes using conventional sets were painted to resemble the computer-generated imagery as closely as possible.

This doesn't mean that computers can't generate realistic images. They can. It remains to be seen in which direction the continued creativity of film makers will push this new medium.

For a glimpse into the world of high resolution computer graphics, you might want to read *The Computer Image* (by Donald Greenberg, Aaron Marcus, Allan Schmidt, and Vernon Gorter, Addison-Wesley Publishing Co., 1982), a new book that not only presents a beautiful sampler of computer-generated images, but also provides a good description of the techniques used in computer graphics. Although outside the capabilities of the computer systems found in most homes, the illustrations point the way toward the day when resolutions on the order of 2048 by 2048 pixels will be affordable to the average computer artist. Until that time, books like *The Computer Image* and films like *TRON* will provide clearly marked goals towards which we home computerists can reach. ©

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Most people, after working with their computer for awhile, would like to add some major accessories: a disk drive, a printer, or more RAM memory. This can be a difficult decision. Which one should you buy first? And, after that's decided, how do you select the best model? Here are some guidelines which might help you to clarify your needs.

What To Buy Your Computer For Christmas

Tom R. Halfhill
Features Editor

Whether they know it or not, personal computer enthusiasts and amateur photographers have a lot in common. After they acquire their shiny new equipment, they quickly start wondering what accessories they should buy.

Shutterbugs: "Should I get a wide-angle lens first, or a telephoto? Or maybe a strobe?"

Computerists: "Should I get a disk drive first, or a printer? Or maybe a modem?"

Along the way, the shutterbug learns that a good lens can cost more than the camera, and the computerist discovers that a disk drive can cost more than the computer. Such is life.

Some people can afford to equip themselves with complete systems from the beginning. For the rest of us who were born with polystyrene spoons in our mouths, choices must be made. Should I buy that new peripheral this month, or make the mortgage payment? Obviously, in a situation such as this, the only sensible choice is to buy the peripheral. But which one?

The typical dilemma faced by many newcomers to personal computing is whether to add a disk drive first or a printer. Others grow hungry for

more memory. Still others want to let their computers talk to the world outside and wonder if they can make use of a modem. This last group should see "A Buyer's Guide To Modems" elsewhere in this issue.

Disk Drives

Before buying any peripheral, you should first evaluate exactly what it is you want to do with your computer. Then you can decide if the peripheral will help accomplish it or not. This might sound elementary, but it's surprising how many people wander around computer stores with no clear idea about what they want from a gadget.

For example, one purchaser of a \$1,000 computer got upset recently when he learned that no simple, plug-in system of home-control equipment was available yet for his machine. "What good is a computer if it can't talk to the outside world?" he demanded. "What else is a computer for?"

You would think that someone investing \$1,000 in a computer would take the time to insure that the accessories he wanted were available. But he didn't. What's more, the application this man had in mind was to hook up his computer to his garage door opener so it would automatically open for him when he came home from work every day at 5:30 — an application more suited to a \$15 timer than a \$1,000 computer. This sort of mistake, though on a less obvious scale, is committed by people all the time.

So the key is to identify your application, then narrow down your alternatives.

For typical home computing — game-playing, simple home budgeting, educational uses for children, average programming, and just plain fooling around — you may not need a disk drive or a printer at all. A cassette-based system is fine for all these applications. Cassettes are cheap, rugged, can store lots of information, and are generally reliable. With most computers they can store both programs and data files.



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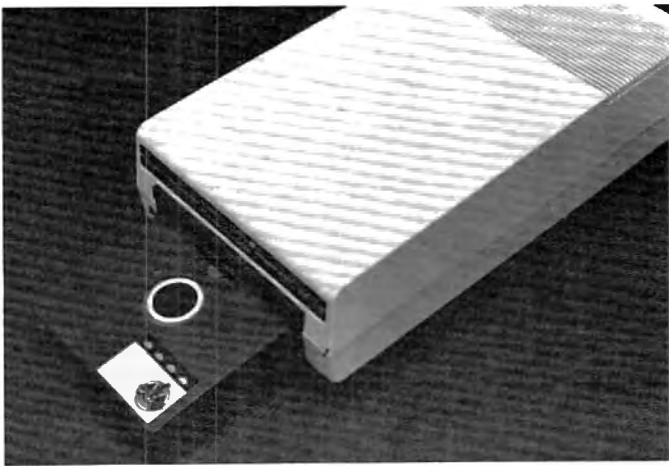
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The main problem with cassettes, of course, is that they're slow. It can easily require five or ten minutes to load or save a program that could be handled by a disk drive in seconds. How valuable is your time to you? A little waiting may be worth saving the cost of a disk drive — \$400 to \$600.

But don't forget that a disk drive is more than just a fast cassette machine. Disk drives can open up new avenues of computing. Certain programs are available only on disk — sophisticated games, business-type software, whole new languages. In addition, disks differ from tapes in another very important way: disks are *random access* devices while tapes are limited to *sequential access*. To find a certain piece of data in the middle of a cassette, you (or the computer) must search through all the intervening tape. However, the read/write head of a disk drive can be directed by the computer to access the exact spot on the disk where the information is stored. Anything you want is only seconds away. Add a 2040 disk drive to a 16K PET, for example, and it's almost like adding about 340K to your RAM memory.

A good analogy is that of records and tapes with a stereo system. To find a certain song on a tape, you must manipulate the fast-forward and rewind buttons until you zero in on the right spot.



A 5 1/4" disk drive permits very fast, random access of programs and data.

Some cassette decks have automatic search systems which do this much faster than you can, but they still do it the same way — searching sequentially through the tape until they sense the "dead spot" before the target song. But with a record, you can lift the tone arm, skip all the intervening songs, and set it down on just the right band. This is how the read/write head of a disk drive works.

Random access makes it much easier to maintain data bases and other programs which regularly update information. You can quickly retrieve one

record from a large data file, edit or review it, and put it back again. A cassette version might require you to retrieve the entire file, make your changes or additions, and then re-SAVE the whole file.

While there's no denying the convenience and flexibility of a disk drive, you must balance it against the cost and consider whether your application really justifies it. For instance, if you're interested in word processing at home, a disk drive will be a great help, but may not be strictly necessary. You might be able to get by with a cassette-based word processor and save your money for a printer instead; buying a disk later.

If you do decide to buy a disk drive, selecting which one to buy probably won't be a problem. For many computers there is only one model to choose from, the one sold by the computer manufacturer. If an independent company makes a disk drive for your computer, make sure it is fully compatible, and ask whether disks recorded on the manufacturer's drive will work on the independent drive and vice versa. Sometimes the formats or Disk Operating Systems (DOS) are different and the disks are not interchangeable. This may or may not be important to you.

You might also have a choice between *single-density* and *double-density* drives, or between single and dual drives. A double-density drive costs more, but stores twice as much data on a disk than a single-density drive, which cuts your costs in half for the disks themselves. Double-density also puts that much more "disk memory" immediately available to access by a program. A dual drive (two drives in one housing) speeds up disk duplicating, file copying, and backups, and is indispensable for many business applications.

Printers

The most common applications for printers are word processing and program listings. It's important to pin down your application as much as possible, because that will largely determine what type of printer you should buy.

For word processing, a printer is essential. You may be able to get by without a disk drive for casual word processing, but the whole point is to get printed output. Furthermore, you'll need an 80-column printer. The next question usually faced is whether to buy a *dot matrix* or a *letter quality* printer.

Dot matrix printers form their characters with very small, tightly grouped dots. The more tightly grouped the dots, the easier the characters are to read. Thus, a printer with a 9x9 matrix will generally print more legibly than a printer with a 7x7 matrix. Some printers have *double-strike* or *emphasized* modes; after printing a character, the

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printhead backs up a fraction of an inch and prints it again, filling in the gaps between the dots. This can produce highly legible type (the Atari program listings in **COMPUTE!** are examples of emphasized printing).



An 80-column dot matrix printer.



An example of a 40-column dot matrix printer.

Another thing to check for when looking at dot matrix printers is whether the lowercase characters have true *descenders*. The descender is that part of a "y" or "g" or "," and similar characters which dips below the type line. Some dot matrix printers lack a large enough matrix to print descenders. Instead, the character is printed slightly higher so the descender does not actually dip below the type line. Typographical studies have shown that true descenders are easier to read. But you can often save some money by doing without them.

Letter-quality printers, on the other hand, form their characters the same way typewriters do: by striking the paper with a fully formed typeface. But unlike typewriters, almost all letter-quality

printers use something called a *daisy wheel*. This is just a metal or plastic wheel with "petals," like a daisy, on which the characters are impressed. The wheel rotates to position the correct petal in front of the striker. This is faster and more efficient than the individual striking arms on typewriters, and the daisy wheels are interchangeable for switching character sets. Daisy wheels are similar in concept to the striking balls on IBM Selectric typewriters.

Daisy-wheel printers produce the highest-quality type, but also cost more than dot matrix printers – usually much more. Dot matrix type, especially the emphasized style, is becoming more acceptable, but some word processing applications demand nothing less than letter-quality type. Be absolutely certain what you need before investing in a printer.

One other difference is speed. A daisy-wheel is often slower than a dot matrix printer. Speed is calculated in CPS (Characters Per Second). An average daisy-wheel printer might have 12 to 25 CPS where a dot matrix would print at, say, 50-80 CPS. At an average of six letters per word and 225 words per typed, double-spaced 8½ x 11" page, you can calculate how long it would take to print a normal page.

Divide the CPS figure given in the manufacturer's specifications into 1350. That gives you a rough estimate of the number of seconds it will take to print out an average page. At 25 CPS, the page would take 54 seconds.

For program listings, dot matrix type is almost universally acceptable, since the only people interested in looking at listings are computerists, who are accustomed to it. If you have no interest in word processing, you might also find that a 40-column, instead of an 80-column, printer is adequate. The price difference used to be wider, but recently the prices of 80-column printers have been dropping, so they are becoming more popular.

For even greater economy, you can also consider *thermal* printers. Instead of using ink, thermal printers "burn" their characters onto heat-sensitive paper. This is the same silvery paper used by some printing calculators, and it costs more than rolls of plain white paper. But the printers are cheaper – and, incidentally, quieter – than dot matrix devices.

The large 132-column printers are mainly for business users who need financial data printed out in many columns, and on special forms. Rarely would a home user need a 132-column printer. Some 80-column printers have condensed type modes which can squeeze 132 columns on a standard sheet of paper.

Of course, the typical home computerist may find that he can put off buying a printer for now.

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Printers do come in handy for serious programming, however (especially when debugging); it's nice to get printed output from some programs; and word processing can open up entire new vistas.

Memory

It's easier to determine if you need more memory than it is to decide whether you should buy a disk drive or a printer. If you can hardly write a program without bumping into "ERROR - OUT OF MEMORY," then you probably need more memory.

Luckily, the price of memory chips has been dropping more dramatically than almost anything else in the past ten years. But how much do you really need?

Most personal computers these days are expandable to 32K or 48K of Random Access Memory (RAM), where 1K = 1024 bytes, or characters. You'll need the full amount if you're running sophisticated programs or disk-based languages. Word processing and high-resolution graphics also need lots of memory. The best guide here is to consider how often memory has proven to be the limiting factor, and then buy what you need.

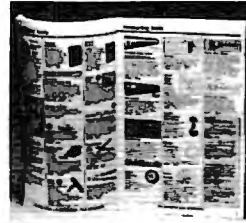
Comparison-shopping for memory is quite different than for printers and disk drives. Generally, the only "features" to compare are the amount of memory and the price. Memory chips do vary somewhat in quality, but for the most part, they either work or they don't. Memory test programs are available for many computers so you can check this out. Memory is less prone to require servicing than are disk drives and printers, which depend on many precisely fitted moving parts. About the only maintenance a memory board needs is occasional cleaning of the contacts - if it's a plug-in board you can reach - although rarely a chip will work loose. You might even consider whether it would be worth it to you to invest in a memory board with gold-plated contacts, which conduct better and corrode less than tin-plated contacts.

Some memory board manufacturers claim superior screen clarity for their products. Sometimes extra memory overburdens the computer's power supply, which can degrade screen quality. Improper installation, dirty contacts, and increased Radio Frequency (RF) interference are other causes of screen problems. It is possible that low quality components or a poorly assembled board can affect screen clarity, so if this concerns you, investigate the product, read reviews, and get opinions, before buying.

Whatever peripherals or accessories you decide to buy, evaluate them as carefully (or more carefully) as you did your computer. Peripherals determine the "personality" of your system. ©

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A Buyer's Guide To Modems

Tom R. Halfhill
Features Editor

Modem sales are climbing along with those of personal computers, and more people every day are asking themselves: "Could I make use of a modem?" and "If so, which one should I buy?"

The question of whether you could use a modem in the first place depends a lot on what you plan to do with your computer. Maybe you're not even sure exactly what a modem is, or what it can do. Here's a quick rundown:

- An acronym for *modulator-demodulator*, a modem is an electronic device which allows a computer to communicate with other computers over ordinary telephone lines. This can be from one room to another, or around the world.
- Modems can connect two personal computers, or, with the proper software, can turn a personal computer into a remote terminal for use on a large mainframe computer at a central location. Computers whose languages and programs are normally incompatible can communicate freely through modems.
- Modems allow remote access to data bases or information services, sort of like "electronic libraries." These consist of large computers which store a wide variety of information which is available to members of the service, usually for an hourly fee.
- Modems make possible such things as electronic mail, shopping and banking at home, constantly updated news bulletins from major wire services, electronic newspapers, stock market reports, and even telegaming.
- Modems are available for virtually every type of microcomputer, and their features vary widely. Some can even automatically dial or answer a phone, and can turn a microcomputer into an unattended "bulletin board system" accessible to other computers with modems.

If you're interested in any of these possibilities, you've answered the question "Could I make use of a modem?" If you still aren't sure, consult the sidebar to this article which summarizes some of

the services now available on-line.

If you've decided that a modem might be in your future, but you aren't sure how to go about buying one, you'll find that the charts on the following pages contain a great deal of valuable information. We've included all the important features for the major brands of modems, at prices ranging from less than \$100 to more than \$500. If you narrow down your choice to a certain model or two and want still more information, you can write to the company for a brochure, because we've also compiled a list of modem manufacturers and distributors.

First, however, we should review some of the features of microcomputer modems for those who aren't well versed in telecommunications terminology. Not all modems work with all computers, and there are compatibility questions that must be answered before plugging into the phone lines. An understanding of these concepts is necessary to make full use of the charts. (For a fuller discussion of the technical points, see Michael E. Day's two-part series, "What Is A Modem And Why Do I Need One?", **COMPUTE!**, September-October 1981, #16 and #17.)

Questions To Ask

Modems can be divided into a couple of broad categories based on how they connect to the phone lines and how fast they communicate.

Coupling Methods. The three main types are acoustic, direct-connection, and inductive. The inductive method is the least common. Acoustic-coupled modems used to be the most popular because they cost less, but recently the price of direct-connect modems has been falling to the point where they are more competitive.

Acoustic modems are readily recognized by their pair of soft rubber cups. The telephone handset is shoved into the cups, forming a tight seal around the mouthpiece and earpiece. A tight seal is important, because extraneous noises interfere

More Apple II owners choose Hayes Micromodem II than any other modem in the world. Compare these features before you buy. You should. It's your money. Thousands of other Apple II owners have already compared, considered, and are now communicating — all over the U.S.A. — with Micromodem II. The best modem for the Apple II. The most modem for your money.

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mission rate of 300 bps. And it's Bell 103 compatible and FCC approved.

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choose from a wide variety of options to set your communication parameters — as well as change hardware configuration — directly from the keyboard. It even allows you to generate ASCII characters that are normally not available from Apple

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with the data transmission, a persistent problem with some acoustic modems. An advantage of acoustic modems is that they don't require any special connections to phone lines, but a disadvantage is that a standard telephone handset is mandatory. Phones with odd-shaped mouthpieces or earpieces, such as Princess models, do not fit the ear cups.

Direct-connect modems circumvent both this and the noise problem by hooking the modem directly to the phone jack in the wall. However, here a modular jack is usually required.

Baud Rates. Baud rates simply measure how fast modems communicate. In effect, baud means bits per second. Most modems for personal computers are limited for technical reasons to 300 baud. This translates into about 30 characters per second. There are faster modems which run at 1200 baud and even 9600 baud, but generally they cost at least \$500.

Communication Standards. The three main standards you're likely to encounter are the Bell 103, the 202, and the 212. Most of the less-expensive, home computer modems use the 103 standard, the most common. The 103-type modems are designed to work at zero to 300 baud, though a few work (less reliably) at 600 baud. The 202-type modems work at zero to 1200 baud, but can communicate in only one direction at a time. The 212 standard combines the two-way communication of the 103 with the 1200-baud rate of the 202. You might also run into the Bell 113A and 113B standards. These are normally included in the 103 group – the 113A standard is for originate and the 113B is for answer.

Duplexing. Communications can be either half-duplex or full-duplex. There's a lot of unnecessary confusion over these terms, largely because they aren't always used to mean the same things. When used to describe communications modes, half-duplex and full-duplex refer to whether transmission is possible in two ways *simultaneously*. Half-duplex has been compared to Citizen's Band radio, where two-way talk is possible, but in only one direction at a time.

An example of *full-duplex* communication would be a telephone conversation. Although modems also use telephone lines, some are not capable of receiving while they transmit. Some computers, when receiving information from a remote terminal via modems, confirm the reception by "echoing" the characters back to the sending terminal. Obviously, this requires full-duplex communication. Some modems are switchable between half- and full-duplex for greater compatibility.

Voice/Data Selection. Modems with this feature usually have a switch so you can use your telephone

without having to unplug the modem. For example, a direct-connect modem might have an extra modular jack into which you plug the telephone headset. The phone cord plugs into another jack on the modem. Switching to "Voice" allows you to place calls on the phone, and switching to "Data" lets you use the modem.

Auto-Answer. This feature enables the computer to answer the phone automatically when called by another computer. This is the heart of the bulletin board systems (BBS) often operated by users' groups. An unattended computer can answer calls, upload (receive) programs from the sender, or download (send) programs as requested.

Auto-Originate. Also known as "auto-dial," this feature is basically the opposite of auto-answer: the computer can place calls as well as receive them. Both of these features can be useful, but you can save money here by buying a modem without them if you don't really need them. If you need auto-dial, make sure it works with your type of phone, either "pulse" (rotary dial) or touch-tone. Touch-tone is not available in all areas. Also, if you're buying an auto-answer/originate modem, be aware that some models switch between the modes automatically and others manually.

Self-Test. Some modems have a test switch so you can determine whether everything is hooked up correctly or if a problem lies elsewhere. A few models come with a short program for this purpose.

Carrier Detection. When you call up another computer, it responds with a "carrier signal" that indicates it is ready to receive. Many modems have some sort of tone, light, or LED that lets you know when the carrier signal has been detected.

Parity Checking. This is a form of error-detection that looks for missing bits of data.

Power Supply. Most modems simply plug into an AC wall outlet, but some draw their power from the host computer or from the phone lines. Others run on batteries, and AC may be an option.

Terminal Software. It takes special software to operate a personal computer with a modem. Believe it or not, the problem is that your computer is "too smart"; a program is needed to fool the computer into thinking it's a relatively stupid remote terminal. (A *dumb terminal*.)

As a terminal, your computer will send and receive data; the other computer, especially if it's a mainframe at an information service, handles processing tasks. In fact, using your computer as a remote terminal, you can program the central mainframe computer in its own language and take advantage of its massive storage capacity. Terminal software, like modems, varies widely when it comes to features. Some software allows you to upload and download programs with distant computers;

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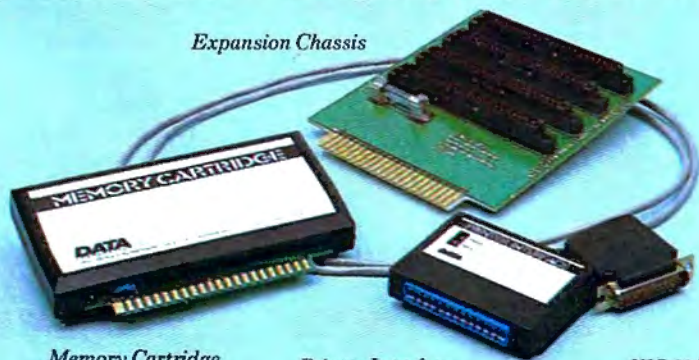
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What's (On) My Line

Tom R. Halfhill
Features Editor

Oilseed futures prices...citations to worldwide literature on mathematical didactics...classified ads from the Middlesex News...letters-to-the-editor from the Columbus Dispatch...weather reports for South America...extracts of financial reports filed with the U.S. Securities and Exchange Commission by publicly held corporations....

These are some of the more unusual things you can get when you plug a telephone modem into a computer. And there are thousands more.

But why, you might ask, would the average person care about oilseed futures or extracts from General Motors' SEC Form 10-K Report?

Well, the average person probably doesn't care. But somewhere, somebody does. The point is that there's something to interest almost anybody. The amount of information available by computers over telephone lines is already massive and is growing daily. For example, The New York Times Information Service updates its index of 11 newspapers and 49 magazines at the rate of 12,000 records per month. On-line data bases are now a \$1 billion-a-year industry growing at an annual rate of 38 percent. There are well over a thousand of them, and every day a new data base comes on-line.

However, a great many of these data bases, particularly the highly specialized ones, can be quite expensive — such as \$300 per hour to access a data base containing all the chemical and chemical-related U.S. patents awarded since 1950. Be thankful if you're an average person who doesn't care about this one. But if you're a research and development director at a major chemical corporation, it might well be worth \$300 an hour to check out some patents which could save thousands of dollars in redundant laboratory time.

For home users, there are information services which generally cost about \$5 an hour to access during off-hours — after 5 p.m. on weekdays and on weekends and holidays. The most popular are the CompuServe Information Service and The Source.

To use any of these services, you first must become a subscriber. Usually there's an initial membership fee. You get documenta-

tion on how to use the service and a password. The hourly on-line connection fee is charged to a credit card account for monthly billing based on how much you've used the service. Some information services charge minimum monthly fees, and others do not. If you live in a major city, there's a good chance you can access one of the leading information services without a long-distance telephone call. Subscribers in smaller cities or remote areas may have to pay phone tolls on top of the hourly connection fees.

What sorts of things are available from these services? A recent CompuServe subject index lists several hundred items: news and advertising from newspapers such as the *Los Angeles Times*, *Minneapolis Star*, *New York Times*, *San Francisco Chronicle* and *Examiner*, *Washington Post*, *Norfolk Virginian-Pilot* and *Ledger-Star*, the *Columbus Dispatch*, and others. Telegames such as *Adventure*, *Eliza*, *Star Trek*, *Space War*, and *Football*. A Citizen's Band Radio simulation that sets up a nationwide "party line." Associated Press wire reports, covering world and national events, financial news, and the latest sports scores. Aviation and marine weather. *Better Homes & Gardens*. Shop-at-home services. Airline schedules. Advice columnists. Interactive tests. Stock prices from the American and New York Stock Exchanges. Electronic banking and electronic mail. Federal government news and corporate newsletters. And yes, oilseed futures prices.

One new information service, Talktex, even offers synthesized speech in addition to text on the TV screen. Owned by General Videotex Corporation of Cambridge, MA, Talktex requires special hardware that is designed to be portable.

Besides the major information utilities, there are a large number of bulletin board systems (BBS) springing up around the country. Often these are operated by users' groups or other organizations. Sometimes they are run by lone computerists who just leave their systems switched on with a disk drive or two and an auto-answer modem. Members of users' groups can download programs from the club's software library this way, and other bulletin boards offer all kinds of unusual stuff. For example, the "Starbase 12" bulletin board in Boston (617-876-4885 after 6 p.m. Eastern time) is for science fiction fans who crave the latest news on SF books, films, re-

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utility stepping-up transformers to add power at peak load times or an electrical storm passing through can trigger surges. Such surges can cause equipment to falter at times, not to work at peak performance or fail completely. An entire data base can be lost.

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When you compare the cost of computer hardware, software and your time with the price of a Protector (from \$59.95 to \$139.95), you'll want to sour your surges with one of the AC Surge Protectors from EPD, which are available through your local dealer.

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Waltham, Massachusetts 02154

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Outside Massachusetts Call:
1-800-343-1813

Dealer Inquiries Invited

continued

views, conventions, and so forth. It's even possible to leave messages of your own and engage in running debates with other users. This BBS, like many others, is open to all computers, requires no password, and is operated nonprofit by a band of enthusiasts.

Many of these bulletin boards are relatively unknown. A good way to find out about them is to consult *The On-Line Computer Telephone Directory*, a quarterly telecomputing newsletter published by Jim Cambron (Box 10005, Kansas City, MO 64111). In addition to telecomputing news, the newsletter also

lists phone numbers of more than 450 free-access bulletin board systems throughout North America and Europe.

For a listing of the more specialized (and expensive) data bases, try the *Directory Of On-Line Databases*, published by New York Zoetrope (80 East 11th Street, New York, NY 10003). It has prices, contents, addresses, producers, and analyses of more than 1200 on-line data bases.

The only hazard with telecomputing is that if you get carried away accessing all these bulletin boards and data bases, you'll need your computer just to keep track of your long-distance telephone bills.

other software does not. A few modems, as a special package deal, come with their own terminal software. Most do not, so remember to consider this expense when pricing them.

General Compatibility

Above all, when shopping for a modem, make sure it will work not only with your computer, but also with your particular system configuration. For example, some modems for Atari computers require the Atari 850 Interface Module, which, if you have to buy one, might cost you more than the modem. Other modems use the Atari joystick ports and bypass the module. Modems which use the

module's RS-232 ports need the RS-232 driver software, which comes with the revised Disk Operating System (DOS 2.0S), and you might not have this, either.

The situation is similar for other computers. The terminal software you want might require more memory than your computer has. Or it may be available only on disk, and your system is limited to cassettes. It's a good idea to decide on the modem *and* the terminal software you'll use before buying either. Just because your computer has an RS-232 port, and the modem you want is RS-232 compatible, don't assume it will work with the terminal software you have in mind until you know for sure.

Major Modem Manufacturers And Distributors

Anderson Jacobson, Inc.
227 Devcon Drive
San Jose, CA 95112

Commodore International
487 Devon Park Drive
Wayne, PA 19087

ESI Lynx
123 Locust Street
Lancaster, PA 17602

Hayes Microcomputer Products, Inc.
5885 Peachtree Corners East
Norcross, GA 30092

Kesa Company
774 San Miguel Avenue
Sunnyvale, CA 94086

Leading Edge Products, Inc.
225 Turnpike Street
Canton, MA 02021

Lexicon Corporation
1541 N.W. 65th Avenue
Ft. Lauderdale, FL 33313

MFJ Enterprises, Inc.
921 Louisville Road
Starkville, MS 39759

Microbits
434 W. 1st Street
Albany, OR 97321

MicroMate
P.O. Box 5011
Indianapolis, IN 46256

Micromint, Inc.
917 Midway
Woodmere, NY 11598

The Microperipheral Corporation
2643 151st Place N.E.
Redmond, WA 98052

Novation, Inc.
18664 Oxnard Street
Tarzana, CA 91356

Prentice Corporation
266 Caspian Drive
Sunnyvale, CA 94086

Racal-Vadic
222 Caspian Drive
Sunnyvale, CA 94086

Tandy Corporation/Radio Shack
Fort Worth, TX 76102

TNW Corporation
Modem Dept.
3444 Hancock Street
San Diego, CA 92110

Universal Data Systems
5000 Bradford Drive
Huntsville, AL 35805

U.S. Robotics, Inc.
1035 West Lake
Chicago, IL 60601

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PET SPEED (8000 or 4000 series)	\$300
INTEGER BASIC (8000 or 4000 series)	\$175
SPECIAL OFFER: Petspeed PLUS Integer Basic	\$435

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Notes On The Buyer's Guide To Modems

Some companies sell additional models of modems than those listed here, but they were omitted from the charts because of similarities to included models, or because they are intended for high-end users.

Many of the modems have additional features not reflected in the charts, mainly for space considerations. We included what we felt were the most important features. All the prices are suggested retail. Discounts are common.

MODEMS	Cat	Auto-Cat	Apple-Cat II	TRS-80 Lynx	Microconnection D1	Microconnection T1	PConnection Modem Card	Microconnection A1A	Microconnection TC1	Microconnection A1	Microconnection T1A	Hayes Micro-modem 100R	Stack Smart-modem 300
	D-Cat	212 Auto-Cat	212 Apple-Cat II	Apple Lynx	R1			A2A	AP1	R1A	A2	II	Smart-modem 1200
Manufacturer/Distributor	Novation, Inc.	Novation, Inc.	Novation, Inc.	Emtrol Systems, Inc.	The Microperipheral Corp.	The Microperipheral Corp.	The Microperipheral Corp.	The Microperipheral Corp.	The Microperipheral Corp.	The Microperipheral Corp.	The Microperipheral Corp.	Hayes Microcomputer Products, Inc.	Hayes Microcomputer Products, Inc.
Compatibility	RS-232	RS-232	Apple II, II+	TRS-80 I, II, III, 16	Osborne RS-232	TRS-80 Model I	IBM PC	Atari w/850	TRS-80 Color	Atari w/850	TRS-80 II, III, 16	S-100 Bus	RS-232
Communication Standard	Bell 103	Bell 103	Bell 103 & 202	Bell 103	Bell 103	Bell 103	Bell 103/113	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103
Coupling Method	Acoustic	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect	Direct-Connect
Baud Rate	0-300	0-300	0-300 & 1200	300	300	300	300	300	300	300	300	45-300	0-300
Duplexing	Both-Switchable	Both-Switchable	Both	Both-Switchable	Both-Switchable	Both-Switchable	Both-Switchable	Both-Switchable	Both-Switchable	Both-Switchable	Both-Switchable	Full-Duplex	Both
Voice/Data Selection	None	Switchable	Switchable	Switchable Or Auto	Switchable	Switchable	Auto	Auto	Switchable	Switchable	Auto	None	None
Auto-Answer	No	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes
Auto-Originate	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes
If Auto-Originate, Pulse Or Tone	N/A	Pulse	Both	Pulse	N.A.	N.A.	Both	Pulse	Pulse	Pulse	Pulse	Pulse	Both
Auto/Originate Selection	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Switchable	Auto	Auto
Self-Test	Yes	Yes	Yes	None	None	None	Yes	None	None	None	None	None	None
Carrier Detection Indicator	LED	LED	Light	LED	LED	LED	On Screen	LED	LED	LED	LED	None	LED
Parity Checking	None	None	Yes	Yes	None	None	Yes	None	None	None	None	None	None
Power Supply	AC	AC	Host Computer	AC	AC	AC	Host Computer	AC	AC	AC	AC	Host Computer	AC
All Necessary Cables/Connectors Included?	Yes	Yes	Yes	Yes	\$24.95 Option	Yes	Yes	Yes	Yes	Yes	\$24.95 Option	Yes	No
Terminal Software Included?	No	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	No
Sample Access Time Included?	No	No	No	No	No	No	No	No	No	No	No	No	No
Warranty	1 Year	1 Year	1 Year	1 Year	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days	2 Years	2 Years
Price	\$189	\$249	\$389	\$299.95	\$159	\$209	\$350	\$239	\$199.50	\$199	\$259	\$399	\$289
	\$199	\$695	\$725					\$279	\$299		\$249	\$379	\$699

MODEMS	Modem	VA103 Modemphone	VA315 VA317	VA355	1250/55 VA1251/52	VS300P VS1200P	AutoVIC 1650 VICmodem	UDS- 212LP UDS- 103JLP	UDS-103 O/A LP	TNW-103	Anchor Mark I Anchor Mark II	Lexicon Lex II	Star Acoustic Modem P-113D
		Racal-Vadic	Racal-Vadic	Racal-Vadic	Racal-Vadic	Racal-Vadic	Commodore Business Machines	Universal Data Systems	Universal Data Systems	TNW Corp.	Leading Edge	Leading Edge	Prentice Corp.
Compatibility	Atari (no 850 needed)	RS-232	RS-232	RS-232	RS-232	RS-232	VIC-20 & Commodore 64	RS-232	RS-232	PET/IBM IEEE-488	RS-232 Atari 800 w/850	RS-232	RS-232
Communication Standard	Bell 103	Bell 103/113	Bell 103- 113 Bell 113B/113C	Bell 103-113	Bell 202	Bell 103/ 113 Bell 202	Bell 103	Bell 212A Bell 103	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103
Coupling Method	Direct- Connect	Direct- Connect	Direct- Connect	Direct- Connect	Direct- Connect N.A.	Direct- Connect	Direct- Connect	Direct- Connect	Direct- Connect	Direct- Connect	Direct- Connect	Acoustic	Acoustic Direct- Connect
Baud Rate	300	0-300	0-300	0-300	1200 1200 & 1800	0-300 1200	0-300	1200 0-300	0-300	300	300	300	300
Duplexing	Switchable Half- and Full-Duplex	Full-Duplex	Full-Duplex	Full-Duplex	Half-Duplex Both	Full- Duplex Half- Duplex	Both Full- Duplex	Full-Duplex	Full-Duplex	Half- and Full-Duplex	Full Both- Switchable	Both	Both- Switch- able Both
Voice/Data Selection	Switchable	Switchable	None	None	None	None	Switchable None	Switchable	Switchable	None	Switchable	Switchable	None
Auto-Answer	No	Yes	Yes	Yes	No	Yes	Yes No	No Yes	No	Yes	No	No	Yes
Auto-Originate	No	N.A.	Yes	N.A.	No	N.A.	Yes No	No	No	Yes	No	No	No
If Auto-Originate, Pulse Or Tone	N.A.	N.A.	N.A.	N.A.	*	N.A.	Pulse *	*	*	Pulse	*	*	*
Auto/Originate Selection	Auto	N.A.	N.A.	Yes	Yes N.A.	Yes	Switchable	Switchable Auto & Switchable	Switchable	Auto	Auto	Switchable	Switchable N.A.
Self-Test	None	None	Yes None	None	None	None	None	None	None	Yes	None	Yes	Yes
Carrier Detection Indicator	Tone	None	None Yes	None	None	None	LED	None	None	On Screen	Tone	Light	LED
Parity Checking	None	N.A.	N.A.	N.A.	N.A.	N.A.	None	None	None	Yes	None	Yes	None
Power Supply	Battery/AC	N.A.	N.A.	N.A.	N.A.	N.A.	Host Computer	Telephone Line	Telephone Line	AC	Battery/AC	Battery/AC	AC
All Necessary Cables/Connectors Included?	Yes	N.A.	N.A.	N.A.	N.A.	N.A.	Yes	Yes	Yes	Yes	Yes	No	Yes No
Terminal Software Included?	Yes	N.A.	N.A.	N.A.	N.A.	N.A.	No Yes	No	No	Yes	No	No	Yes
Sample Access Time Included?	No	N.A.	N.A.	N.A.	N.A.	N.A.	Yes	No	No	No	No	No	No
Warranty	1 Year	N.A.	N.A.	N.A.	N.A.	N.A.	90 Days	1 Year	1 Year	1 Year	1 Year	1 Year	1 Year
Price	\$199	\$250-\$380	\$375 \$250	\$375	\$425 \$425- \$525	\$210 N.A.	\$179.95 \$109.95	\$495 \$245	\$195	\$548	\$99	\$159 \$199 w/battery	\$199 N.A.

* denotes "Category Not Applicable."

N.A. means "Information Not Available."



For PET/CBM Upgrade and 4.0 BASICs (5K RAM) and Atari, this arcade-style game achieves an impressive graphics animation without the use of any machine language. Also, the Atari version introduces a new Player-Missile technique (also entirely BASIC) which results in excellent vertical motion.

Laser Gunner: BASIC Animation

Gary R. Lecompte
Lewiston, ME

Laser Gunner is an arcade-type action game. The player controls a laser gun which moves up and down on the left of the screen behind a force field and fires at invading enemy spaceships. The invaders also fire lasers and attempt to open holes in the force field. Every hit weakens the force field until an entire hole is made. A hit through a hole ends the game.

Laser Gunner is written for PET/CBM. It is an example of animation accomplished without the use of machine language routines. The drawback of this type of coding is obvious. Only one string may be animated at a time with any speed. However, by working your game format around this, you can still make action games fast and challenging.

The animation of the laser gun and the position of laser fire, as well as the location of the invaders, are controlled with the use of the location routines. The row and column values are POKEd into memory locations 216 and 198. A print statement following these routines will print that string beginning at the location determined by the row and column values. Changing the row and column value and printing the same string again accomplishes animation.

The force field changes are made by PEEKing the location of the hit, determining the character at that location, and POKEing the value of the next character to that location.

Invader explosions are done by coding cursor movements and printing characters from the invader string.

Sound routines are intermixed with laser and explosion routines. This assures that animation and sound will blend.

Invader ship location and laser fire are determined by randomizing routines. Skill level is provided by giving the player a minimum preset delay. Actual time before invader laser blasts is always unpredictable.

Stars are created with simple POKE statements to predetermined locations.

All routines are placed in order of importance, with those used most at the beginning. This allows for the fastest program execution possible to increase animation speed. REM statements should be

deleted for best effect. The key to speed is simplicity. The shorter the program statements, the greater the speed.

Readers who want a copy of the PET/CBM version may send a stamped, self-addressed mailer and a blank tape or 8050 disk, with \$3, for a copy of the program.

Gary R. Lecompte
1093 Main St.
Lewiston, ME 04240

Program 1: PET/CBM Version

```

9 REM*****LOCATION ROUTINES*****
10 POKEROW,X:POKECOL,Y:PRINT"{UP} ";:RETURN
11 POKEROW,A:POKECOL,B:PRINT"{UP} ";:RETURN
12 POKEROW,Z:POKECOL,B:PRINT"{UP} ";:RETURN
13 GOSUB10:PRINTG1$;
14 GOTO38
15 REM****RANDOM INVADER FIRE*****
16 TT=TT+1:R=1+INT(RND(1)*10):IFTT>TDTHENIFR=
  10GOTO43
17 REM*****CHECK KEYBOARD INPUT*****
18 IFPEEK(166)=6GOTO29
19 IFPEEK(166)=50GOTO23
20 IFPEEK(166)=18GOTO26
21 GOTO16
22 REM*****UP MOVEMENT*****
23 X=X-1:IFX<1THENX=1
24 GOSUB10:PRINTG1$;:GOTO16
25 REM*****DOWN MOVEMENT*****
26 X=X+1:IFX>21THENX=21
27 GOSUB10:PRINTG2$;:GOTO16
28 REM*****LASER FIRE*****
29 POKEE,16:POKEF,15:REM*****SOUND
30 X=X+1:Y=3:GOSUB10:FOR I=1TO185STEP5:PRINT"
  @";:POKEG,I:NEXT:POKEE,0:GOSUB10
31 FORI=1TO37:PRINT" ";:NEXT:X=X-1:Y=0
32 REM*****CHECK FOR HIT*****
33 IFX+1=AGOTO60
34 IFX+1=A+1GOTO60
35 IFX+1=A+2GOTO60
36 GOTO16
37 REM*****LOCATE INVADER SHIP*****
38 A=1+INT(RND(1)*20):IFA<3THENA=3
39 IFA>18THENA=18
40 REM*****PRINT INVADER SHIP*****
41 GOSUB11:PRINTIN$:GOTO16
42 REM*****INVADER LASER FIRE*****
43 POKEE,16:POKEF,15:REM*****SOUND
44 Z=A+1:B=B-1:GOSUB12:FORI=1TO72STEP2:PRINT"
  @{02 LEFT}";:POKEG,I:NEXT:POKEE,0
45 PRINT"{RIGHT}{UP}N{02 DOWN}{LEFT}M":GOSUB1
  2:FORI=1TO36:PRINT" {02 LEFT}";:NEXT:
  PRINT"{RIGHT}{UP} {02 DOWN}{LEFT} "":B
  =B+1
46 REM*****FORCE FIELD WEAKEN*****

```



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```

47 HT=SR+((Z-1)*40):RD=PEEK(HT)
48 IFRD=160THENRN=1:GOTO57
49 IFRD=231THENRN=2:GOTO57
50 IFRD=234THENRN=3:GOTO57
51 IFRD=246THENRN=4:GOTO57
52 IFRD=97THENRN=5:GOTO57
53 IFRD=117THENRN=6:GOTO57
54 IFRD=116THENRN=7:GOTO57
55 IFRD=101THENRN=8:GOTO57
56 IFRD=32THENRN=8:GOTO68
57 FORI=1TORN:READFE:NEXT:POKE HT,FE:RESTORE
:GOTO16
58 DATA 231,234,246,97,117,116,101,32
59 REM****INVADER SHIP EXPLOSION****
60 GOSUB11:POKEE,16:POKEF,15:PRINT" {02 LEFT}
{REV}{OFF}{UP}{REV}{OFF}{02 DOWN}{L
LEFT}{02 LEFT}{DOWN}{02 LEFT}{DOW
DOWN}":POKEG,40
61 GOSUB11:PRINT" {02 LEFT}{REV}{OFF}{UP}{RE
REV}{OFF}{02 DOWN}{LEFT}{02 LEFT}{
DOWN}{02 LEFT}{DOWN}":POKEG,150
62 FORI=1TO100:NEXT
63 GOSUB11:PRINT" {UP}{UP}{LEFT}{REV}{OFF}{0
2 DOWN}{03 LEFT}{REV}{OFF} M{02 DOWN
DOWN}{03 LEFT}{DOWN}{LEFT}{DOWN}{
LEFT}":POKEG,250
64 FORI=1TO100:NEXT:REM****DELAY
65 GOSUB11:PRINT" {02 UP}{02 DOWN}{03 LEFT}{
RIGHT}{02 DOWN}{03 LEFT}{RIGHT}{02
DOWN}{LEFT}":POKEE,0:GOSUB77
66 REM*****SCORE*****
67 SC=SC+1:TT=0:GOTO38
68 FORI=1TO500:NEXT:REM****DELAY
69 REM*****END SCORE STATEMENT*****
70 PRINT" {CLEAR}{03 DOWN} YOU HIT"SC
" INVADERS
71 PRINT" {03 DOWN} TRY AGAIN?
72 GETC$:IFC$=""GOTO72
73 IFC$<>"Y"ANDC$<>"N"GOTO72
74 IFC$="N"THENPRINT" {CLEAR}":END
75 SC=0:GOTO123
76 REM****GENERATE STARS*****
77 SR=SR-2:P=46
78 POKESR+15,P:POKESR+28,P:POKESR+127,P:POKES
R+158,P:POKESR+175,P:POKESR+230,P
79 POKESR+444,P:POKESR+460,P:POKESR+474,P:POK
ESR+500,P:POKESR+575,P
80 POKESR+605,P:POKESR+628,P:POKESR+708,P:POK
ESR+715,P:POKESR+740,P
81 POKESR+804,P:POKESR+828,P:POKESR+835,P:POK
ESR+868,P:POKESR+888,P
82 POKESR+904,P:POKESR+928,P:POKESR+947,P:POK
ESR+967,P:POKESR+980,P
83 SR=SR+2:RETURN
84 REM*****SET VARIABLES*****
85 ROW=216:COL=198:X=5:Y=. :IN$="{REV}{D
DOWN}{LEFT}{REV}3{OFF}{DOWN}{LEFT}":
B=39:G1$="&{DOWN}{LEFT}+{DOWN}{LEFT}&
{DOWN}{LEFT}"
86 G2$="{UP}{DOWN}{LEFT}&{DOWN}{LEFT}+{DOWN}
{LEFT}&":SR=32770:M=21:E=59467:F=5946
6:G=59464
87 GOSUB77:GOTO91
88 REM*****LOCATION ROUTINE*****
89 POKEROW,M:POKECOL,Y:PRINT" {UP}":RETURN
90 REM***PRE-PROGRAMED TITLE*****
91 M=M-1:GOSUB89:PRINTG1$:
92 IFM>7GOTO91
93 FORI=1TO200:NEXT:POKEE,16:POKEF,15:GOSUB89
94 PRINT" {DOWN}{02 RIGHT}":FORI=1TO120STEP10
:PRINT"@":POKEG,I:NEXT:PRINT"LASER G
UNNER";
95 FOR I=1TO130STEP10:PRINT"@":POKEG,I:NEXT:
POKEE,0
96 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO1
2:PRINT" ";:NEXT:PRINT" {12 RIGHT}";
97 FORI=1TO13:PRINT" ";:NEXT
98 GOSUB89:M=M+1:PRINT" {DOWN}"G2$:
99 IFM<12GOTO98
100 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO2
00:NEXT:POKEE,16:POKEF,15
101 FORI=1TO170STEP10:PRINT"@":POKEG,I:NEXT:P
RINT"BY";
102 FORI=1TO170STEP10:PRINT"@":POKEG,I:NEXT:P
OKEE,0
103 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO1
7:PRINT" ";:NEXT:PRINT" {02 RIGHT}":F
ORI=1TO17
104 PRINT" ";:NEXT
105 GOSUB89:M=M+1:PRINT" {DOWN}"G2$:
106 IFM<16GOTO105
107 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO2
00:NEXT:POKEE,16:POKEF,15
108 FORI=1TO120STEP10:PRINT"@":POKEG,I:NEXT:P
RINT"GARY LECOMPTE";
109 FORI=1TO110STEP10:PRINT"@":POKEG,I:NEXT:P
OKEE,0
110 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO1
2:PRINT" ";:NEXT:PRINT" {13 RIGHT}";
111 FORI=1TO11:PRINT" ";:NEXT
112 GOSUB89:M=M+1:PRINT" {DOWN}"G2$:
113 IFM<22GOTO112
114 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO2
00:NEXT:POKEE,16:POKEF,15
115 FORI=1TO100STEP10:PRINT"@":POKEG,I:NEXT:P
RINT"WANT INSTRUCTIONS?";
116 FORI=1TO90STEP10:PRINT"@":POKEG,I:NEXT:PO
KEE,0
117 GOSUB89:PRINT" {DOWN}{02 RIGHT}":FORI=1TO1
0:PRINT" ";:NEXT:PRINT" {18 RIGHT}";
118 FORI=1TO9:PRINT" ";:NEXT
119 REM***WANT INSTRUCTIONS*****
120 GETC$:IFC$=""GOTO114
121 IFC$="Y"GOTO134
122 REM***SET LEVEL OF PLAY*****
123 PRINT" {CLEAR}{06 DOWN} WHAT LEV
EL(1-3)
124 GETC$:IFC=0GOTO124
125 IFC>3GOTO124
126 PRINT" {CLEAR}{05 DOWN} {REV} PRESS
SPACE TO BEGIN {OFF}"
127 GETC$:IFC$=""GOTO127
128 IFC=1THEN TD=15
129 IFC=2THEN TD=8
130 IFC=3THEN TD=0
131 REM***BUILD FORCE FIELD*****
132 PRINT" {CLEAR}":FORI=1TO23:PRINTTAB(2)" {RE
REV}{OFF}":NEXT:GOSUB77:GOTO13
133 REM***INSTRUCTIONS*****
134 PRINT" {CLEAR}{DOWN} YOU ARE LASER GUNNER
ON A STARSHIP."
135 PRINT" {03 DOWN} YOU ARE UNDER ATTACK BY AL
IEN INVADERS.
136 PRINT" {03 DOWN} YOU MUST MOVE YOUR LA
SER INTO
137 PRINT" {03 DOWN} POSITION,AND FIRE IT T
O DESTROY
138 PRINT" {03 DOWN} THE INVADER.
139 PRINT" {03 DOWN} {REV} PRESS SPACE T
O CONT {OFF}"
140 GETC$:IFC$=""GOTO140
141 PRINT" {CLEAR}{DOWN} YOU ARE PROTECTED BY
A FORCE FIELD
142 PRINT" {03 DOWN} BUT,THE FORCE FIELD IS ~
WEAKENED
143 PRINT" {03 DOWN} WITH EVERY HIT BY AN ~
INVADER.
144 PRINT" {03 DOWN} A HIT IN A HOLE ENDS ~
THE GAME.
145 PRINT" {02 DOWN} TO FIRE,HIT SPACE.TO MOV

```


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GHATTAWAY

Notes On The Atari Version:

In your corner of the universe, a zone of high-pressure radioactive plasma is contained by a platinum-iridium "wall." Your ship, immersed in the red zone, is charged with a vital duty: defend the wall. The vengeful enemies of your civilization send wave after wave of attack ships in an effort to breach the wall. These semi-smart robot ships will concentrate their firepower on your weakest spot, and mercilessly try to fire their way into the wall.

Your only defense is your powerful particle beam which you use to fend off the attacking drones. The enemy ships are wary of your power, so if you move too close to an attack point, you can spook the enemy ship into picking another target. Move to shoot at the new position, and it will just cruise back to another vulnerable spot. You must not let the enemy blast a hole in the wall since, like a balloon stuck with a pin, the radioactive plasma will explode, reducing your ship to an expanding shell of iridescent particles.

As the Laser Gunner, try to quickly react to your enemy's shots. Follow the ship as well as you can, and do not stray too far from a weak spot. When you destroy one ship, another will appear at a random position, and will home in on a vulnerable spot in the wall.

A Novel Player/Missile Technique

For a game written in BASIC, "Laser Gunner" is reasonably fast and smooth. The smoothness of motion comes from player-missile graphics, but the speed comes from an unusual technique that lets you move player-missile graphics at machine language speed. That's right — no machine language is used in Laser Gunner, yet the vertical motion is quite satisfactory.

A special graphics technique is used here. Instead of storing the player/missile graphics at the top of memory, a large string is dimensioned to hold the player/missile data. When a string is dimensioned, a block of memory is reserved for it. The starting address of the string can be determined by using the ADR function. The problem is that player/missile graphics must start on an even 1K boundary (the address must be a multiple of 1024), or a 2K boundary (divisible by 2048) for a single-resolution

player/missile graphics. Strings are given the next available address when dimensioned, which would only be on an even kilobyte address by sheer coincidence.

So when the ADdRess of the string is determined, we must find what offset to add to the address to reach the next boundary. It can be shown that in "worst case" conditions (i.e., the address is just one byte past a 1K or 2K boundary), we must allow for an offset of at least 1023 bytes for double resolution, or 2048 bytes for single resolution P/M graphics. So, although double-resolution P/M graphics require only 1024 bytes, we must dimension the holding string at least 2048 bytes. Then, a simple calculation (lines 150-160 of "Laser Gunner," Atari version) will give us the starting address within the string of the P/M base address, PMBASE. This value is then used to "set up" P/M graphics as usual.

The advantage of using a string is twofold: one, we know that BASIC is covetously protecting the string from the "RAM-TOP Dragon" (see **COMPUTE!**, October 1981, Issue 17) and other nasties. Second, we can use BASIC's fast string manipulation commands to move segments of strings around, "scroll" a string, erase a string, copy one string to another, and more. Since the memory being moved in the string is the P/M memory, these manipulations directly modify the players and missiles. And since these string operations internally proceed at machine language speed, we get fast P/M animation using BASIC. Although the code is not as straightforward as dedicated P/M commands such as PMMOVE or PMGRAPHICS, it sure beats cryptic USR statements. As a matter of fact, since BASIC permits such flexibility with strings, it may be the best solution to using P/M graphics from BASIC.

It is also possible to "fool" BASIC into believing that another section of memory is a string by modifying a string's Variable Value Table, but it's pretty tricky. The method described above is preferred, although it's a bit wasteful of memory. Watch upcoming issues of **COMPUTE!** for a complete explanation and guide to using this string technique for fast arcade-style animation. Meanwhile, type in and look at the coding of "Laser Gunner." The technique might be of use in your own programming and you'll also have fun playing the game!

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```

E UP,HIT 8
146 PRINT"{DOWN}          TO MOVE DOWN,HIT 2
147 PRINT"{02 DOWN}      {REV} PRESS SPACE -
      TO CONT {OFF}"
148 GETCS:IFCS="GOTO148
149 GOTO123

```

Program 2: Atari Version

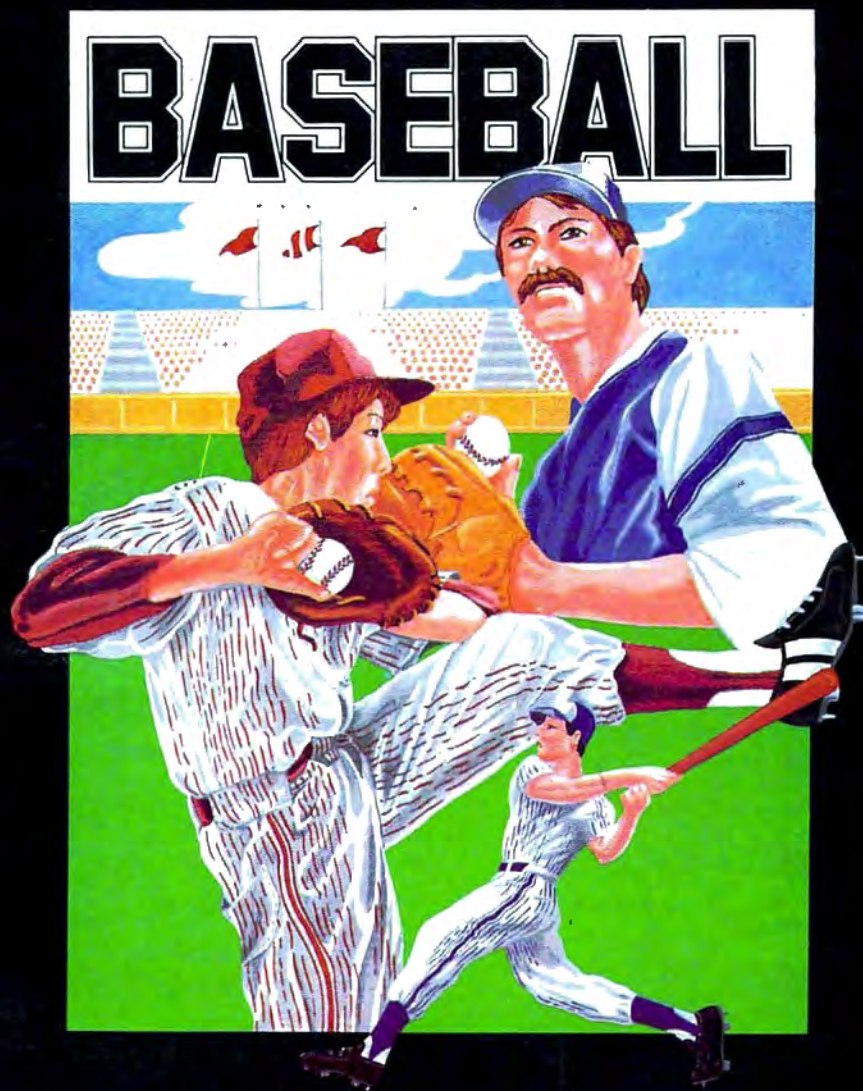
```

100 DIM PM$(2048):GRAPHICS 2+16
110 DIM ALIEN$(11),PLAYER$(9),NULL$(1
1),EXPLODE$(12*9),TARGET(20)
120 FOR I=1 TO 11:NULL$(I)=CHR$(0):NE
XT I
130 LEVEL=15:CNT=15:REM DECREASE LEVE
L FOR A HARDER GAME
140 A=ADR(PM$):REM RAW ADDRESS
150 PMBASE=INT(A/1024)*1024:REM NEARE
ST 1K BOUNDARY
160 IF PMBASE<A THEN PMBASE=PMBASE+10
24:REM IF BELOW STRING, GO TO NEX
T 1K BOUNDARY
170 S=PMBASE-A:REM START OF PMBASE IN
STRING (OFFSET)
180 POKE 559,46:REM SET DOUBLE-LINE R
ES.
190 POKE 54279,PMBASE/256:REM TELL AN
TIC WHERE PMBASE IS
200 POKE 53277,3:REM TURN ON PLAYER/M
ISSILE DIRECT MEMORY ACCESS (DMA)
210 PM$(2048)=CHR$(0):PM$(2048)=CHR$(0):PM$
(2)=PM$:REM CLEAR OUT ALL P/M MEM
ORY
220 POSITION 4,0: ? #6;"laser gunner"
230 ? #6:FOR I=1 TO 10: ? #6;"█":NEXT
I:POSITION 0,0
240 REM STRING POS OF PLAYER 0-3, AN
D MISSILES IN STRING:
250 P0=S+512:P1=P0+128:P2=P1+128:P3=P
2+128:MS=S+384
260 PM$(P2+32)=CHR$(255):PM$(P2+127)=
CHR$(255):PM$(P2+33,P2+127)=PM$(P
2+32):REM CREATE WALL
270 PM$(P3,P3+127)=PM$(P2,P2+127):REM
CREATE "ZONE"
280 POKE 53250,92:REM POSITION PLAYER
2, THE WALL
290 POKE 53251,60:REM POSITION PLAYER
3, THE ZONE
300 POKE 53258,0:POKE 53259,3:REM MAX
IMUM WIDTH
310 POKE 706,14:POKE 707,66:REM SET C
OLOR OF PLAYERS 2 AND 3
320 DATA 0,8,28,62,255,62,255,62,28,8
,0
330 FOR I=1 TO 11:READ A:ALIEN$(I)=CH
R$(A):NEXT I:REM READ "SHAPE" OF
ALIEN
340 AY=32:REM ALIEN VERTICAL LOCATION
350 PM$(P1+AY,P1+AY+11)=ALIEN$:REM PL
ACE INTO STRING, HENCE INTO P/M M
EMORY
360 POKE 705,6*16+10:REM SET COLOR OF
ALIEN TO PURPLE
370 POKE 53249,180:REM SET HORIZONTAL
POSITION
380 POKE 53257,1:REM SET ALIEN TO DOU
BLE-WIDTH
390 REM SET UP EXPLODE$, USED FOR EXP
LOSION OF ALIEN
400 FOR I=1 TO 108:READ A:EXPLODE$(I)
=CHR$(A):NEXT I:REM EXPLODE DATA:
410 DATA 8,28,62,255,54,255,62,28,8,8
,28,62,235,54,235,62,28,8,8,28,54
,227,34,227,54,28,8
420 DATA 8,24,34,227,34,227,18,24,8,8
,24,34,194,32,163,18,8,8
430 DATA 0,0,0,0,24,24,0,0,0,0,0,0,32
,8,24,0,4,0,0,0,0,36,0,16,0,36,0,
0,128,10,128,0,16,0,16,65
440 DATA 0,9,0,0,32,0,32,0,8,0,0,0,64
,0,0,64,0,4,0,0,0,0,0,0,128,0
450 RY=INT(78*RND(0)+32):MH=190+RY*2:
REM ATTRACT MODE:
460 FOR I=32 TO 110:PM$(P1+I,P1+I+11)
=ALIEN$:IF I=RY THEN PM$(MS+RY+10
,MS+RY+10)=CHR$(12)
470 IF I>RY THEN POKE 53253,MH-I*2
480 IF PEEK(53279)>6 THEN NEXT I
490 PM$(MS+RY+10,MS+RY+10)=CHR$(0)
500 FOR I=110 TO 32 STEP -1:PM$(P1+I,
P1+I+11)=ALIEN$:IF PEEK(53279)>6
THEN NEXT I
510 IF PEEK(53279)>=7 THEN 450
520 IF PEEK(53279)=3 THEN FOR I=0 TO
4:POKE 53248+I,0:NEXT I:GRAPHICS
0:END
530 DATA 0,224,48,120,63,120,48,224,0
540 FOR I=1 TO 9:READ A:PLAYER$(I)=CH
R$(A):NEXT I
550 PY=60:REM PLAYER'S VERTICAL LOCAT
ION
560 PM$(P0+PY,P0+PY+9)=PLAYER$
570 PM$(P1,P1)=CHR$(0):PM$(P1+127,P1+
127)=CHR$(0):PM$(P1+2,P1+127)=PM$
(P1):REM CLEAR OUT ALIEN
580 AY=INT(78*RND(0)+32):PM$(P1+AY,P1
+AY+11)=ALIEN$:REM RESET ALIEN
590 POKE 53256,1:REM PLAYER 0 DOUBLE
WIDTH
600 POKE 53248,64:REM HORIZONTAL POSI
TION OF PLAYER 0
610 POKE 704,26:REM COLOR OF PLAYER 0
620 POKE 53260,1:REM MISSILE 0 DOUBLE
-WIDTH
630 ST=STICK(0):IF ST<>15 THEN DIR=ST
:SOUND 0,100,0,8
640 PY=PY-(DIR=14)*(PY>32)+(DIR=13)*(
PY<110):REM UPDATE PLAYER
650 PM$(P0+PY,P0+PY+9)=PLAYER$:SOUND
0,0,0,0
660 IF STRIG(0) THEN 790:REM FIRE?
670 PM$(MS+PY+5,MS+PY+5)=CHR$(3):REM
CREATE MISSILE
680 FOR I=72 TO 184 STEP 2:POKE 53252
,I:NEXT I:REM SHOOT MISSILE
690 POKE 53278,0:REM CLEAR COLLISION
REGISTERS
700 POKE 53252,184:REM NUDGE MISSILE
OVER
710 PM$(MS+PY+5,MS+PY+5)=CHR$(0):REM
CLEAR OUT MISSILE
720 IF PEEK(53256)=0 THEN 790:REM NO
COLLISION
730 SCR=SCR+10:POSITION 11-LEN(STR$(S
CR))/2,5: ? #6;SCR:REM DISPLAY SCO
RE
740 AY=AY+1:P=PEEK(705):REM PRESERVE
COLOR OF ALIEN
750 FOR I=0 TO 11:Z=I*9:PM$(P1+AY,P1+
AY+9)=EXPLODE$(Z+1,Z+9)
760 POKE 705,PEEK(53770):POKE 53279,0
:SOUND 0,I*2,0,15-I:FOR W=1 TO 2:
NEXT W:NEXT I
770 POSITION 5,5: ? #6;"(10 SPACES)":RE
M ERASE SCORE
780 SOUND 0,0,0,0:POKE 705,P:GOTO 570
790 IF AY=PY THEN 870:REM TOO CLOSE F
OR COMFORT

```

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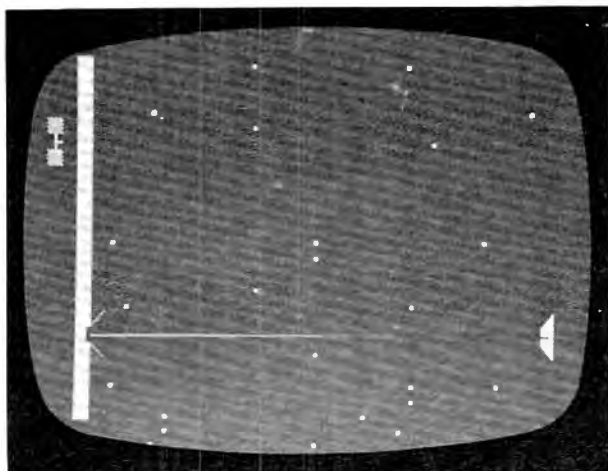
800 IF TARGET=0 THEN GOSUB 950:TARGET
   =TARGET(INDEX):REM SELECT A TARGET
810 IF AY<>TARGET THEN 840
820 CNT=CNT-1:IF CNT THEN 630
830 CNT=LEVEL:GOTO 870
840 AY=AY+SGN(TARGET-AY):REM MOVE TOW
   ARDS TARGET
850 PM$(P1+AY,P1+AY+11)=ALIEN$
860 GOTO 630
870 IF ABS(AY-PY)<10 THEN GOSUB 970
880 PM$(MS+AY+5,MS+AY+5)=CHR$(12):REM
   CREATE ALIEN MISSILE
890 FOR I=180 TO 91 STEP -2:POKE 5325
   3,I:NEXT I:PM$(MS+AY+5,MS+AY+5)=C
   HR$(0)
900 P=ASC(PM$(P2+AY+5))*2-256:REM CUT
   HOLE IN WALL
910 IF P<0 THEN 990:REM WALL DESTROYED
920 PM$(P2+AY+5,P2+AY+5)=CHR$(P)
930 GOTO 630
940 REM PICK A TARGET
950 INDEX=INDEX+1:TARGET(INDEX)=INT(7
   8*RND(0)+32):RETURN
960 REM TIME TO MOVE
970 IF INDEX=1 THEN 950
980 TARGET=TARGET(INT(INDEX*RND(0)+1
   )):RETURN
990 REM DESTRUCTION OF PLAYER
1000 FOR I=1 TO 100:Z1=AY+5+I:Z2=AY+5-I

```

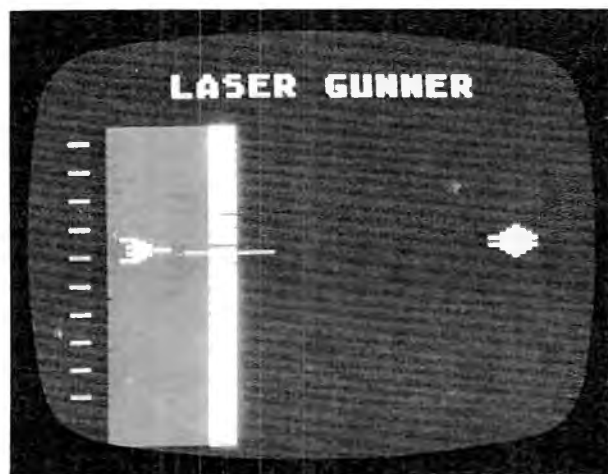
```

1010 IF Z1<126 THEN PM$(P2+Z1,P2+Z1)=
   CHR$(0):REM ERASE WALL
1020 IF Z2>30 THEN PM$(P2+Z2,P2+Z2)=C
   HR$(0)
1030 IF Z1<126 OR Z2>30 THEN NEXT I
1040 FOR I=30 TO 1 STEP -1:FOR J=0 TO
   20 STEP 3:SOUND 0,J+1,10,8:POKE
   707,PEEK(53770):NEXT J:NEXT I
1050 SOUND 0,0,0,0:SOUND 1,0,0,0:POKE
   707,14:FOR W=1 TO 50:NEXT W:POK
   E 707,0
1060 FOR I=0 TO 15 STEP 0.2:SOUND 0,I
   ,8,I:POKE 704,16+I:NEXT I
1070 SOUND 0,0,0,0
1080 Z1=PY:Z2=PY:INCR=0
1090 Z1=Z1+INCR*(Z1<128):Z2=Z2-INCR*(
   Z2>=0):POKE 704,PEEK(53770)
1100 PM$(P0+Z1,P0+Z1)=CHR$(255):PM$(P
   0+Z2,P0+Z2)=CHR$(255):POKE 53279,0
1110 INCR=INCR+0.5:IF Z1<127 OR Z2>0
   THEN 1090
1120 FOR I=1 TO 100:POKE 704,PEEK(537
   70):NEXT I:REM FLASH PLAYER
1130 FOR I=0 TO 7:POKE 53248+I,0:NEXT
   I:GRAPHICS 2+16
1140 POSITION 4,0:?"#6;"DESER GUNNER
   ":POSITION 3,5:?"#6;"your score w
   as:";
1150 POSITION 10-LEN(STR$(SCR))/2,7:?"
   #6;SCR
1160 FOR I=15 TO 0 STEP -0.2:SOUND 0,
   10+10*RND(0),0,I:SOUND 1,100+10*
   RND(0),16,I
1170 SETCOLOR 4,3,14*RND(0):NEXT I
1180 RUN

```



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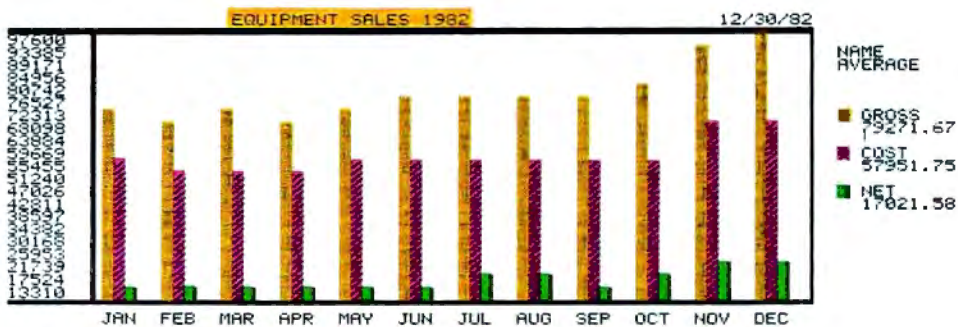
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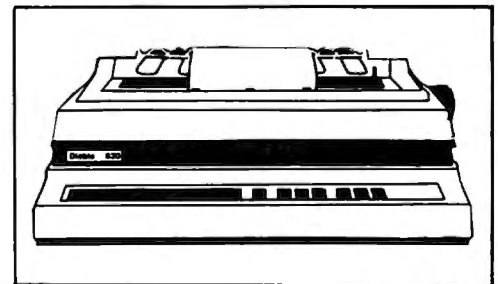
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UXB

Roger Hagerty, Auburn, AL

World War II. London is battered and scorched. And although there is a pause in the fighting, a peril remains among the rubble: UXB's, Unexploded Bombs. These are shells that failed to detonate, but remain a danger, their unstable nature making them literally time bombs.

Your Mission

You are an explosives expert, charged with the vital duty of defusing or harmlessly detonating the UXB's. Using your joystick (Atari version), move your flashing marker about the screen. For the VIC version, use the keys I, J, K, and M to move, where I is up, M is down, J is left, and K is right. Touch your marker to a UXB to render it harmless.

A Few Complications

Your job is not as easy as it may sound. First, you have only 30 seconds to perform your task. Second, the field you're working in is also a minefield. Littered about the playfield are numerous colored bombs that you must avoid, lest you meet an untidy

fate.

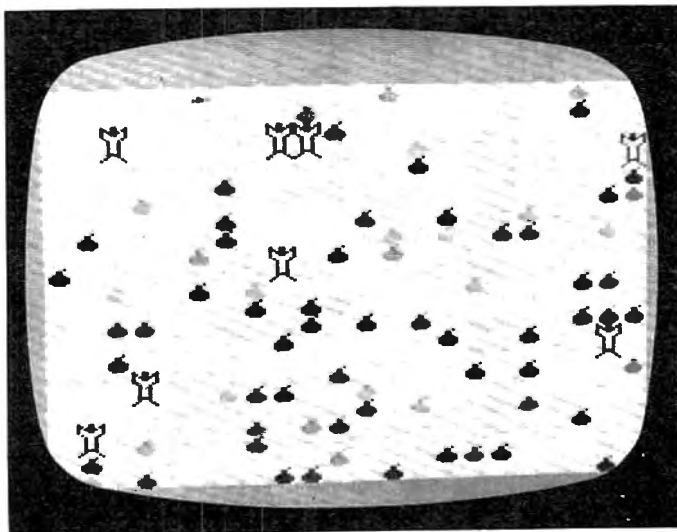
Using the keyboard for movement makes the game quite challenging for VIC owners, since it takes a while to get used to such movement. Hold a key down to continue movement in the selected direction, but let go before you hit a mine! A joystick makes movement much easier so an extra incentive was added to the Atari version: the faster you clear out the UXB's, the better your score. Your score (the number of UXB's you hit) is multiplied by 30, less the number of seconds you take. So if you take 20 seconds, your score is multiplied by 10.

Program 1: VIC Version

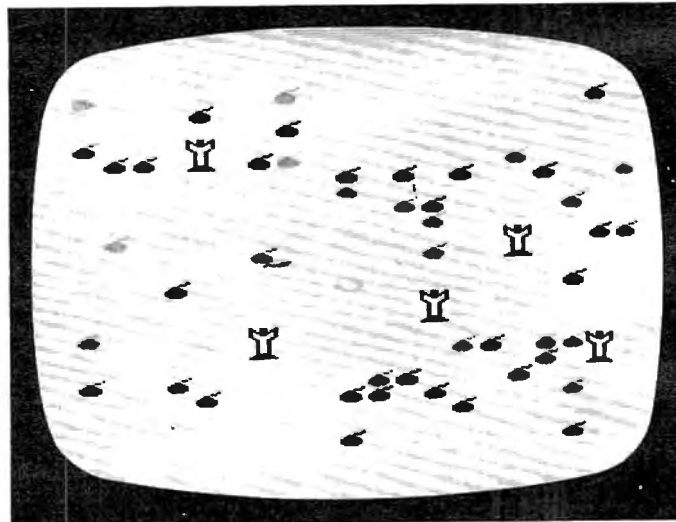
```

300 PRINT" {CLEAR}"
310 POKE56,28
320 CH=32776
330 FORX=7184TO7600STEP2
340 POKEX,PEEK(CH):POKEX+1,PEEK(CH)
350 CH=CH+1:NEXTX
360 POKE36879,25
370 POKE36869,255
371 POKE36867,47
375 POKE36878,10
376 FORL=240TO180STEP-1
377 POKE36876,L
378 FORM=1TO20:NEXTM:NEXTL
379 POKE36876,0:POKE36877,200
380 FORL=5TO0STEP-2
381 POKE36878,L:NEXTL
382 POKE36877,0
390 PRINT"{09 RIGHT}{02 DOWN}UXB"
400 FORI=1TO100
420 POKE36869,240
430 POKE36869,255
435 POKE36879,47
440 NEXTI
441 POKE36867,46
442 POKE36879,154:GOTO800
445 POKE36869,242:POKE36879,154
450 PRINT"{CLEAR}YOU HAVE BEEN SOMEHOW TRANSPOR
RTED INTO THE MIDDLE OF A FIELD
WHICH";
460 PRINT" CONTAINS BOTH ANTIQUATED BOMBS AN

```

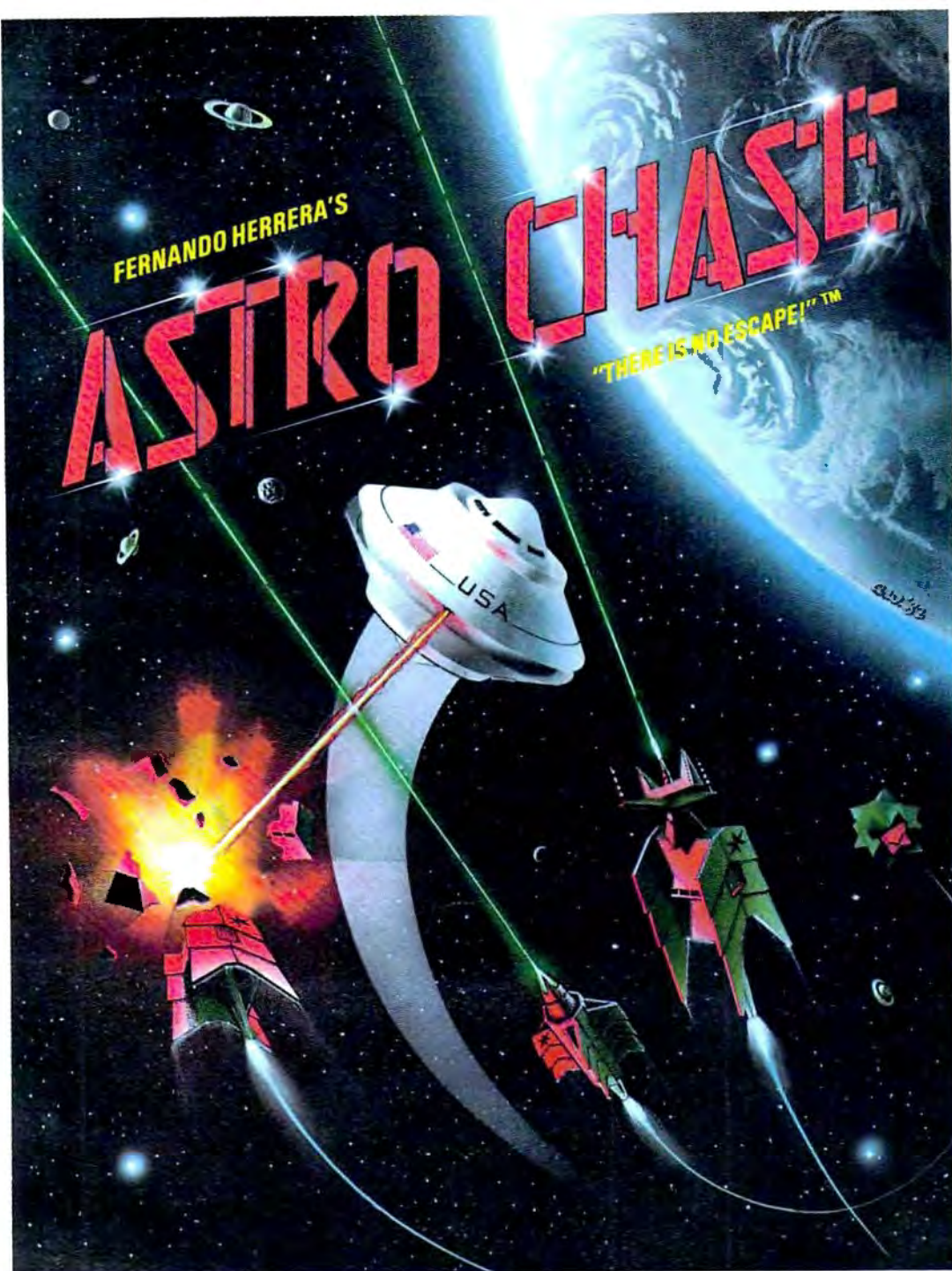


Unexploded bombs in the VIC-20 version of "UXB."



"UXB": Atari version.

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```

D WWII UXB'S (UNEXPLODED GERMAN ROCKE
T";
470 PRINT " BOMBS). YOU MUST DE-FUSE THE UXB'S
BY SIMPLY RUN- NING INTO THEIR TAIL
S.";
480 PRINT "IF YOU HIT AN OLD BOMBYOU WILL BE BL
ASTED!! IF YOU GET ALL THE "
490 PRINT "UXB'S YOU WILL GET TWOMORE ON THE NE
XT ROUND-IF YOU DON'T MAKE IT";
500 PRINT " YOU GET TWO LESS (DOWNT0 ZERO).{05
LEFT}{03 DOWN}PRESS ANY KEY"
510 GET A$:IF A$=""THEN510
511 PRINT "{CLEAR}"
520 PRINT " THERE IS SCREEN WRAP-AROUND FROM SI
DE TO SIDE, BUT IF YOU RUN OVER TH
E ";
530 PRINT "TOP OR BOTTOMYOU WILL BE RETURNED T
O THE UPPER LEFTHAND CORNER."
540 PRINT "{DOWN}{02 RIGHT}MOVEMENT KEYS ARE:{D
DOWN}
550 PRINTTAB(10) "{REV}I{OFF}(UP)
560 PRINT "{DOWN}{05 RIGHT}{L}{REV}J{OFF}{04 RI
RIGHT}{REV}L{OFF}(RT)
570 PRINTTAB(10) "{DOWN}{REV}M{OFF}(DOWN)
580 PRINT "{04 DOWN}{04 RIGHT}PRESS ANY KEY
590 GETA$:IFA$=""THEN590
595 PRINT "{CLEAR}":POKE36879,27
600 PRINT "{02 DOWN}{03 RIGHT}PLEASE WAIT FOR
TAPE TO LOAD"
610 POKE198,1:POKE631,131:END
800 POKE36869,240:PRINT "{03 DOWN}{05 RIGHT}INS
TRUCTIONS?"
810 GETA$:IFA$=""THEN810
815 IFA$="N"THEN 595
820 GOTO445

```

Program 2: VIC Version

```

1 POKE45,121:POKE46,21:POKE51,0:POKE55,0:CLR
3 POKE36869,255:QQ=10
4 A=30720:C=0:K=0:TI$="000000":CH=7954:Q=20
5 PRINT "{CLEAR}"
15 FORL=1TOQQ
16 M= 7680+INT(RND(1)*506)
17 POKEM,1:POKEM+A,C:POKEM+22,24:POKEM+22+A,C
18 NEXT L
19 GOSUB1000
25 IFCH+D>8186 THENCH=7680:D=0
26 IFCH+D<7680 THENCH=7680:D=0
27 IFPEEK(CH+D)=1THENPOKECH+D,32:POKECH+D+22,
32:GOTO200
28 IFPEEK(CH+D)=26THEN2000
29 IFTI>=2000THEN299
30 POKECH+D,17
31 POKE36878,15:POKE36876,220
32 FORP=1TO5:NEXTP
33 POKE36878,0:POKE36876,0
40 POKECH+D+A,C
41 FOR R=1TOQ :NEXTR
45 POKECH+D,32
70 IFPEEK(197)=12THEND=D-22
75 IFPEEK(197)=36THEND=D+22
80 IFPEEK(197)=21THEND=D+1
85 IFPEEK(197)=20THEND=D-1
90 IFTI<=500THENQ=10
100 IFTI=>1000THENQ= 8
110 IFTI=>1500THENQ= 5
120 IFTI=>1700THENQ=2
121 GOTO25
200 K=K+1
210 POKE36877,220
215 FORL=14 TO 5STEP-1
220 POKE36878,L

```

```

230 FORM=1TO50
240 NEXTM
250 NEXT L
260 POKE36877,0
270 POKE36878,0
275 IFK=QQTHEN300
280 GOTO25
299 POKE36869,240:PRINT "{CLEAR}{DOWN}{RIGHT}{D
DOWN} YOUR TIME IS UP":FORT=1TO1500:N
EXTT
300 POKE36869,240: PRINT "{CLEAR}{04 DOWN}{04 R
RIGHT}YOUR SCORE=";K
301 PRINT "{02 DOWN}NUMBER OF UXB'S WAS";QQ
302 IFK>HSC THEN 340
335 PRINT "{02 DOWN}{04 RIGHT}HIGH SCORE=";HSC:
GOTO342
340 PRINT "{02 DOWN}{04 RIGHT}HIGH SCORE=";K"{0
4 DOWN}{09 RIGHT}{REV}A NEW HIGH{OFF}
"
341 HSC=K
342 FORDR=1TO3000:NEXT
344 IFK=QQTHENQQ=QQ+2:GOTO346
345 IFK<QQTHENQQ=QQ-2:GOTO346
346 IFQQ=0THEN3
350 D=0:POKE36869,255:GOTO4
1000 FORL=1TO85
1010 R=7680+INT(RND(1)*506)
1015 IFPEEK(R)=1THENPOKER,1:POKER+A,C:GOTO1030
1020 POKER,26
1025 POKER+A,INT(RND(1)*6)+2
1030 NEXTL
1036 POKE7954,32
1040 RETURN
2000 POKE36869,240:PRINT "{CLEAR}{REV}{RIGHT}{09
DOWN}YOU'VE BEEN BLASTED!{OFF}"
2010 POKE36878,15
2020 FORI=225TO128STEP-2
2030 POKE36877,I
2040 FORD=1TO50:NEXTD
2050 NEXTI
2055 FORX=14TO0STEP-.1
2060 POKE36878,X
2065 NEXTX
2066 POKE36878,0:POKE36877,0
2080 GOTO300
33873

```

Program 3: Atari Version

```

130 GRAPHICS 2+16:POSITION 7,5:? #6;"
DANGER":POSITION 8,7:? #6;"uxb"
140 FOR I=1 TO 100:IF PEEK(20)<15 THE
N 160
150 SETCOLOR 4,Z*3,Z*10:Z=1-Z:SOUND 0
,Z*50+100,10,8:SOUND 1,Z*50+102,1
0,8:POKE 20,Z*5
160 POKE 708,PEEK(53770):POKE 709,PEE
K(53770)
170 NEXT I:SOUND 0,0,0,0:SOUND 1,0,0,
0
180 GRAPHICS 17:SETCOLOR 4,0,12:SETCO
LOR 3,4,10:SETCOLOR 2,9,6
185 GOSUB 1000:POKE 756,CHSET/256
190 SCR=PEEK(88)+256*PEEK(89)
195 POS=SCR+249:DUXBS=0
200 UXBS=INT(8*RND(0)+2)
210 FOR I=1 TO UXBS
220 RSCR=SCR+INT(460*RND(0)):IF RSCR=
POS OR RSCR+20=POS THEN 220
230 IF PEEK(RSCR) OR PEEK(RSCR+20) TH
EN 220
240 POKE RSCR,4+128:POKE RSCR+20,5+12
8

```

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245 FOR W=15 TO 0 STEP -0.5:SOUND 0,1
    0*RND(0),0,W:NEXT W
250 NEXT I
260 FOR I=1 TO 30*RND(0)+20
270 RSCR=SCR+INT(480*RND(0))
280 IF PEEK(RSCR) OR RSCR=POS THEN 27
    0
290 R=INT(4*RND(0)):POKE RSCR,6+192*(
    R=1)+64*(R=2)+128*(R=3)
300 SOUND 0,255*RND(0),10,8
310 NEXT I
320 SOUND 0,0,0,0:POKE 20,0:POKE 19,0
    :REM RESET RTCLOCK
330 ST=STICK(0)
340 TI=PEEK(20)+256*PEEK(19):IF TI>=1
    800 THEN 600:REM HALF MINUTE
345 POKE POS,7*Z+128:Z=1-Z:SOUND 0,Z*
    20+20,10,8
350 IF ST=15 THEN 330
360 SOUND 0,0,0,0:POKE 77,0
365 NPOS=POS+20*(ST=9 OR ST=5 OR ST=1
    3)-20*(ST=6 OR ST=10 OR ST=14)-(S
    T>8 AND ST<12)+(ST>4 AND ST<8)
367 IF NPOS<SCR OR NPOS>SCR+479 THEN
    330
370 P=PEEK(NPOS)
380 IF P=0 THEN POKE POS,0:POS=NPOS:G
    OTO 330:REM NO COLLISION
390 IF P=132 OR P=133 THEN POKE POS,0
    :POS=NPOS:GOTO 500:REM A UXB
400 REM NOT A SPACE OR A UXB, SO MUST
    BE A MINE!
405 POKE POS,0:POKE NPOS,0
410 FOR I=15 TO 0 STEP -0.5
420 SOUND 0,I/2,0,I:SOUND 1,100+10*RND
    (0),2,I
430 SETCOLOR 4,16*RND(0),10+4*RND(0)
440 NEXT I
450 GRAPHICS 17:? #6;" you hit a min
    e(A)"
460 ? #6:? #6:? #6;" YOU HIT ";DUXBS
    ;" UXB'S"
462 SCR=INT(DUXBS*(30-TI/60))+100*(DU
    XBS=UXBS)
465 ? #6:? #6;"(3 SPACES)SCORE:";SCR
470 IF SCR>HI THEN HI=SCR:? #6:? #6;"
    a new high score(Ⓡ)":GOTO 490
480 ? #6:? #6;"(3 SPACES)high score
    (Ⓡ)":HI
490 POSITION 5,23:? #6;"PRESS FIRE";
495 IF STRIG(0) THEN 495
497 GOTO 180
500 POKE POS,0:IF P=132 THEN POKE POS
    +20,0
510 IF P=133 THEN POKE POS-20,0
520 FOR I=15 TO 0 STEP -0.5:SOUND 0,1
    ,0,I:SOUND 1,10,0,I:NEXT I
530 DUXBS=DUXBS+1:IF DUXBS<UXBS THEN
    330
540 GRAPHICS 17:? #6;" you got them
    all(A)"
550 ? #6:? #6;" (Ⓡ)(2 Ⓡ) point bonus
    (Ⓡ)"
560 GOTO 460
600 GRAPHICS 17:? #6;"(5 SPACES)time
    (G)s up(A)"
610 SOUND 0,0,0,0:GOTO 460
999 END
1000 CHSET=(PEEK(106)-8)*256:FOR I=0
    TO 7:POKE CHSET+I,0:NEXT I

```

```

1001 RESTORE 1005
1002 READ A:IF A=-1 THEN RETURN
1003 FOR J=0 TO 7:READ B:POKE CHSET+A
    *8+J,B:NEXT J
1004 GOTO 1002
1005 DATA 4,153,219,189,153,129,66,36
    ,36
1006 DATA 5,36,36,36,36,36,60,126,255
1007 DATA 6,1,6,24,60,126,126,126,60
1008 DATA 7,0,126,195,207,243,195,126
    ,0
1009 DATA -1

```

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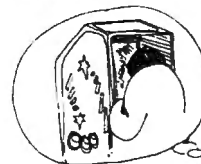
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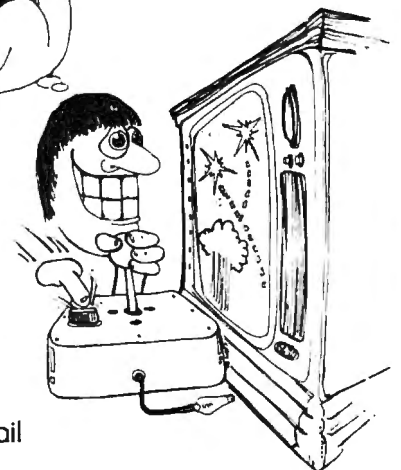
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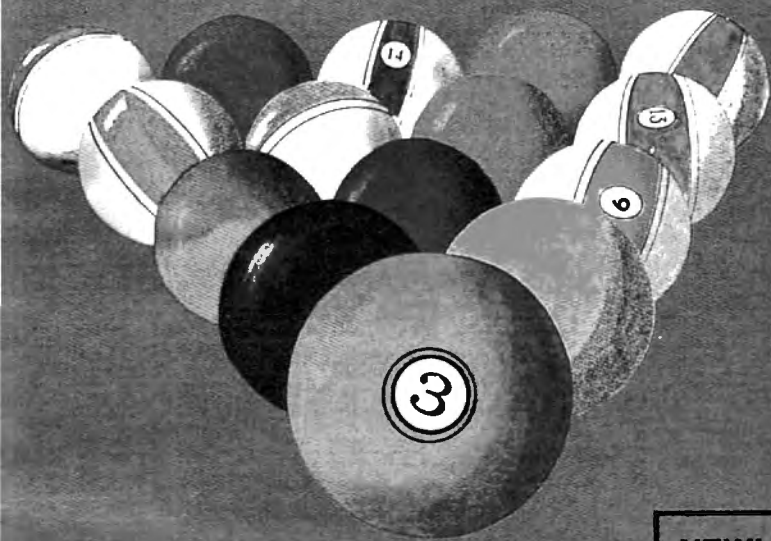
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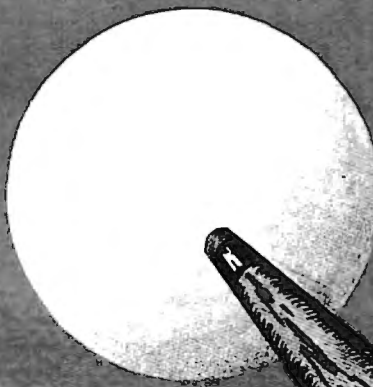
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Part I

How to build the world's most intelligent Christmas card. This program involves several of the Atari's special features to attract young people and involve them right away in the computer they're getting as a present. This two-part article concludes in the December issue with an expanded version of the program.

An Atari For Christmas

Brenda Balch
Redondo Beach, CA

An Atari 400 is on sale, and Seymour Papert's ideas on educating children are still floating in my head. A quick call to my sister confirms that she would love a computer for Christmas and would spend time with her daughters learning how to use it. Who knows? My nieces may be hidden computer geniuses, just waiting for the chance.

The thing I need now is a friendly, personalized introductory program. ("Turtle graphics" can come later.) Given the graphics and music strengths of the Atari, everyone seeing the computer on Christmas day should have a personalized picture and melody (at least as many as will fit in 16K).

Getting Started

I begin to verbalize the dialog I would like my friendly computer to have:

Merry Christmas (something graphic would be nice)

I am your friendly computer.

Will you talk to me?

(yes – *I'm glad*, no – *You must have gotten out of the wrong side of bed this morning*, none of the above – *Any answer is a good sign*)

My name is Atari

What is your name?

(name not found in table – *Hmmm...I don't know you. Are you sure you spelled your name right?* – and go back to "what is your name",

name confusing (such as Mom) – *There are too many ---'s here. Try again.* – and go back to "what is your name",

name found – name, *I know something about you.* – goto subroutine for each person – show picture and play song (only one voice to save memory).

Check if I have talked to everyone. (Don't count the same person twice)

(no – *I haven't talked to everyone yet. I hope someone else wants to talk to me.* – and go back to "what is your name",

yes – *It has been nice talking to everyone. Merry Christmas.*)

So far, so good. Nothing seems too difficult. I'll assign line numbers to my framework:

- 100 – General Subroutines (subroutines run faster at the beginning)
- 1000 – Initialization
- 2000 – Greeting
 - 2900 – Begin dialog
- 3000 – "What is your name"
 - 31 x 0 – DATA for recognizing names
- 11000 – Subroutine for person 1
- 12000 – Subroutine for person 2
-
- 20000 – Subroutine for person 10

I should make it easy to add or subtract people. Someone might come for Christmas at the last minute. Two things can help this:

PEOPLE – a variable for the number of people expected (see lines 1000, 3060 and 3070)
GOSUB expression instead of ON GOSUB in line 3050

Now to add a person all I need to do is add 1 to PEOPLE (line 1000), add a data statement at 31x0 for names, and add the appropriate subroutine.

The Wonderful RESTORE Command

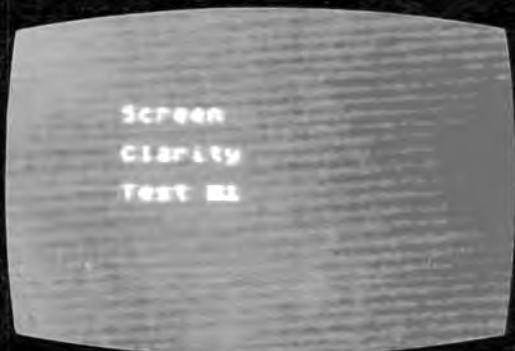
Is there any problem with the flow? People's names will come in any order; therefore, each subroutine must be self-contained and independent of the general order. Graphics and sound routines often use DATA statements. But DATA statements are read in order. Back to the manual! Saved. "RESTORE" takes an argument to set the start of data for the next read. Now the data in the subroutines can be used in any order. The manual says "this statement permits repetitive use of the same data," but it will solve my problem nicely anyway. (I'll find a need to re-use data later.) In fact, the "RESTORE" command makes this whole program structure possible.

Pictures

Now for my first picture; something should be on the screen the first time anyone sees it. A Christmas

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INTERFACE AGE said after replacing the Atari memory board with a Mosaic 32K RAM: "Once in place there is no noticeable change in screen clarity" and "in view of its excellent performance it should be a serious choice for those Atari owners intending to expand their memory."

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For your nearest Mosaic dealer call toll free

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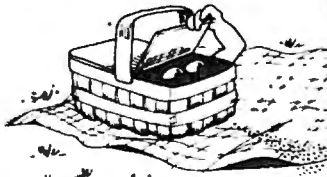
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Christmas Favorites: Tapes and Disks For Your Atari 400/800

STELLAR SHUTTLE

From Broderbund
Your people are stranded on Titan. Can you guide your STELLAR SHUTTLE to the star, rescue the refugees and return them to the mother ship? Of course, it won't be easy! There is an asteroid belt to maneuver around, comets to avoid, and a wayward space ship to stay away from. If you think you're up to the mission, your people are waiting! Requires joystick. *Save 20%!*
16K Tape or 32K Disk, \$24.95
Now Thru Dec. 1 You Pay Only \$19.96



PICNIC PARANOIA

From Synapse
Your man at the picnic must keep a swarm of ants from stealing all the food. He's armed with a fly swatter, and must avoid the attacking wasps as he swats at the flies. Then there are the spiders, spinning webs in his path. Great sound and graphics; 1 or 2 players. Requires joystick.
16K Tape or Disk, \$34.95



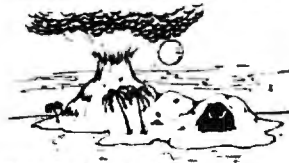
KNOCKOUT

From Avalon Hill
Can be played by two players simultaneously.
This computer boxing game has the exciting graphics you can expect from the whole Sports Illustrated Series from Avalon Hill. This one's a real KNOCKOUT, as you control the movements of your boxer with your joystick. For one or two players... or try the computer against itself, as you watch and learn. Requires joystick.
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From Computar
At last! Now you can track your spending habits; plan effective budgets, flag tax deductible expenses. Search entries by single or multiple parameters — up to 7 at a time. You can list out—or print out—expenses vs. budget by month or by year to date. Best of all, it will print checks on your 80-column printer!
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ESCAPE FROM VULCAN'S ISLE

By Mark Benioff From Epyx
You're shipwrecked on VULCAN'S ISLE, home of hidden tombs, caves, a volcano and strange beasts like the flesh-eating Harrises, and Winged Demons who kill with a touch. But don't despair — the magical treasures you find will give you special powers, and the diary of Alcamnon will give you the clues you need to escape. Requires joystick.
40K Disk, \$29.95 *Save 20%!*
Now Thru Dec. 1 You Pay Only \$23.96



SNEAKERS

From Sirius
One of the most popular Apple games is now available for the Atari! Get ready for wave after wave of Sneakers, Cyclops, Saucers, Fangs and Scrubs... all trying to stomp you into submission. Eight separate attacks and five levels of difficulty make this forty games in one! Requires joystick.
48K Disk, \$29.95



KING ARTHUR'S HEIR

From Epyx
Arthur, King of the Britons, has named you his heir to the crown of Camelot. To prove yourself worthy, you must find the Scroll of Truth, hidden by the wizard Merlin. Your journey will take you through forests, castles, caves and cities, fighting off the evil with the magical powers you discover. Be brave and wise, and you will return safely to Camelot. Requires joystick.
32K Disk, \$29.95



CYCLOD

By Hunter Hancock from Sirius
Your one mission in life is to destroy snakes. Sound too ordinary? That's only if you've forgotten that you're an Eyeball, and the snakes' only goal is to kill Eyeballs! You can defend or attack with bricks. Will you build a snake trap or a fortress to defend yourself? 20 skill levels for plenty of challenges.
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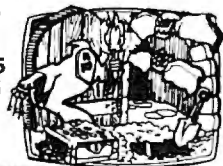
CLAIM JUMPER

From Synapse
There's gold out there, but finding it is just the beginning. First, collect the gold as it appears on the screen. Take it to the assay office to get paper money that you then must safely deposit in your bank. Be sure to avoid the snakes and tumbleweeds that get in your way. 4 game options.
16K Tape or Disk, \$34.95 *Save 20%!*
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HAZARD RUN

By Dennis Zander from Artworx
That sheriff ain't just whistling "Dixie"! You gotta make the jump at Hazard Creek to be safe. Can you even get there?? Making the run through Crooked Canyon requires dodging rocks and trees and—worst of all—chickens! But, you have no choice! Requires joystick.
24K Tape, \$27.95
24K Disk, \$31.95



GHOST ENCOUNTERS

From JV Software
You're a ghost in this real-time adventure, trying to find the 20 treasures hidden a network of 30 rooms. You may have to transmutate into other forms in order to solve the puzzles and avoid the dangers. You'll have to be fast and clever to figure this one out! Requires joystick.
16K Tape or Disk, \$29.95



SHAMUS

From Synapse Software
It's the 21st century, and you're the SHAMUS, looking for your arch-enemy, the Shadow, to destroy him. You're armed with Ion-Shivs, the most powerful weapons in the galaxy. Can you handle the Shadow's henchmen: Robo-Droids, Whirling Drones and Snap-Jumpers, all armed and evil? Can you find the Shadow in his lair of 4 levels with 32 rooms each... every one of them dangerous? Intensive arcade action; requires joysticks.
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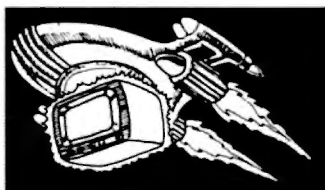
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BANDITS

From Sirius
You'll find lots of excitement and non-stop action in this colorful space game. The SPACE BANDITS are trying to steal your supplies, and may even try to kill you! You'll have to think quickly, and use your laser gun and protective energy shield to defend yourself. Requires joystick.

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POGO MAN

From Computer Magic
You're on a pogo stick, jumping through the city, turning off the lights as you go. In the first phase the objects to jump are stationary; in phase two they are moving; in phase three there are attack birds to avoid as you jump. Requires joystick.

16K Tape or Disk, \$39.95

MOONBASE 10

By John Konopa from PDI
Three separate, machine language arcade games to dazzle and challenge you while a voice cassette narrates the adventure. There are 3 bases on the moon of Jupiter: 10, Europa and Ganymede, which you must reach, protecting their sensors from enemy aliens that have invisible scout ships! Keep moving and shooting, and you'll do well. Requires joystick.

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VAULTS OF ZURICH

By Felix & Greg Herilthy from Artworx
You are a master thief, about to attempt the greatest feat of your career—robbing the VAULTS OF ZURICH, where the richest people in the world deposit their wealth. It's protected by the most sophisticated security system in the world. Can you find your way along the corridors of row upon row of vaults to the Chairman's Chamber that contains your special goal: The OPEC Oil Deeds???

24K Tape, \$21.95 24K Disk, \$25.95



FORMULA 1

By Sid Meier from Acorn
Shift into gear—your FORMULA ONE Racer is ready to go! You compete against three other computer-controlled cars on the high resolution, scrolling screen. Select from five courses: Indy, Monza, Watkins Glen, Monaco, or the special Killer Course. Not for the timid!

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THE NIGHTMARE

From Epyx
You're trapped in the castle, and there's only one way out. Can you find it, and return to reality from THE NIGHTMARE? There are magical aids to help you escape, if you can find them before the terrifying creatures find you! Beware of the gargoyle, the headless man, and the screams in the night! Requires joystick.

32K Disk, \$29.95



Family Fun Feud!

Each of these games can be played by two people simultaneously
—great for the whole family!



DOG DAZE

From APX
Fast-paced, 2-player game that fulfills every dog's fantasy—it gives him a collection of fire hydrants!! When a hydrant pops up on the screen, the dogs are off and running. Run into hydrant, or shoot your bone at it, and it's yours, turning into your color. Continuous scoreboard display; time limit option and handicap option. Requires 2 joysticks.

8K Tape
or 24K Disk, \$22.95



MOUSKATTACK

From On-Line by John Harris
You are Larry Bain, ace plumber, trying desperately to finish installing a pipe through the dangerous corridors of Rat Alley, before the legendary man-eating rodents can stop you! The last plumber that entered disappeared without a trace, so be careful!

48K Disk, \$34.95



PACIFIC COAST HIGHWAY

From DataSoft by Ron Rosen
Fast-action game with good graphics for 1 or 2 players. You're a tortoise, trying to cross the Highway without getting hit by the rush hour traffic. Once across, you're at the shore, and must leap from boats to rafts on the Pacific Ocean. Be careful 'cause you can't swim! Requires joystick.

16K Tape or Disk, \$29.95

NAUTILUS

From Synapse by Mike Potter
Two-player interaction combat game: the underwater cities and their destroyers against the helicopters and submarines. The helicopters bomb the ships; the subs fire torpedoes at the cities and surface to fire at the destroyers. The destroyers fire at the helicopters and drop depth charges on the subs. They can also lower men into the ocean to rebuild cities hit by torpedoes. Top and bottom halves of screen scroll separately for maximum field of play. Great graphics. Requires joystick.

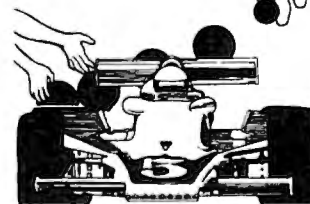
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MAD NETTER

From Computer Magic
The screen is a-swarm with insects, and you're armed with a net. Catch the butterflies and other insects ... but avoid the attacking bees! Requires joystick.

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ROADRACER/BOWLER

By Bill Hood from Avalon Hill
ROADRACER: Test your driving skills on 3 different track layouts: Oval, Figure-8, Grand Prix. Race against another player or the computer. Requires good eye-to-hand coordination.

BOWLER: Control the ball's curve, and learn to spare off an even 4-10 split on this computer version for 1 to 4 players. The computer will even score for you.

Two-game package that's part of the Sports Illustrated Series. Joystick required for each player.
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MINER 2049ER

By Bill Hogue from Big Five

This is the author's first game for the Atari—he's already well known for his bestsellers for the TRS-80—and we think you'll really enjoy it. There are more than ten screens of colorful mining-related machinery that you'll move around the screens, ducking, dodging and bobbing your way to a high score. Requires joystick.

ROM Cartridge, \$49.95 16K Required



SPEEDWAY BLAST

By Dave Morock from IDS!

Racing game with a twist: you must guide your racer on an overland trip, dodging (or blasting) the asphalt-eating monsters that try to keep you from capturing their precious diamonds. Steer carefully! Requires joystick.

ROM Cartridge, \$39.95 16K Required



DEADLY DUCK

From Sirius

The Crabs have taken to the air, armed with bricks and bombs, to drive our friend, DEADLY DUCK, out of his pond. But Deadly's gonna fight back, with a gun tucked into his bill. Lots of fun and action; 6 levels of play. Requires joystick.

ROM Cartridge

Also available for VCS.



DELUXE INVADERS

From Roklan

All the fun, excitement and video quality of an arcade game in your home! If you hate Alien Invaders, you'll love this one! Battle the Invaders, and as your speed and defense skills improve, the aliens get meaner. With each successful defense you'll be challenged to an even tougher competition. Not for the timid! Requires joystick.

ROM Cartridge, \$39.95 16K Required



FAST EDDIE

From Sirius

On your mark; get set; go Eddie!! FAST EDDIE's off and running, dashing up and down every ladder he can find, hunting for prizes. Quick, there's a heart floating on the 2nd floor! Ooops, look out—there's a Sneaker, sneaking up on you—Jump, Eddie! Great animation; 8 skill levels; lots of action. Requires joystick.

ROM Cartridge

GORF

From Roklan

A unique sight and sound adventure in the interstellar war against the Gorfian Empire. You must repel attacks by Droids, Anti-Gravity Bombs, Anti-Particle Lasers, Gorfian fighters and torpedos, etc. Four levels, from an Astrobattle to a full-flledged Space War. Requires joystick.

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FISHES

From Epyx

You lead your school of fish through the pleasures and perils of oceanic life. As you find food, your school will grow. But hungry sharks and other predators also inhabit this tranquil world, so swim carefully. Requires joystick.

ROM Cartridge, \$39.95 16K Required



K-RAZY SHOOT-OUT

From K-Byte/CBS

The object of the game is to advance your Space Commander into the Alien Control Sector, eliminate the Alien Forces and escape to the next (more difficult) sector. No two games are alike, since the Alien Control Sectors are created at random, giving you millions of combinations of barriers and escape routes. Requires joystick.

ROM Cartridge, \$49.95 8K Required



WORM WAR I

From Sirius

Hordes of gigantic worms are slithering around the city of Teriyaki. . . WORM WAR I has begun! Much of the city has been crushed under the weight of these mutant creatures, and the only thing that can stop them is the specially armed anti-worm tank. Are you brave enough to drive it, and make Teriyaki safe again? 9 play options; great color and sound; for 1 or 2 players. Requires joystick.

ROM Cartridge

Also available for VCS.

EMBARGO

By Bill Hooper from Gebelli

There is a strict trade embargo on Zorel 6. The Council has ruled that all foodstuffs, materials, trade goods and fuel must pass the close scrutiny of the Orelian Guards. Only goods essential for galactic security are guarded; all others are disbursed to the Council's overflowing warehouses. Select from 9 levels of play. Requires joystick.

ROM Cartridge, \$44.95 8K Required

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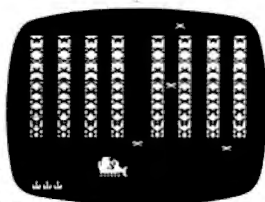
ROM Cartridges For Your Atari 400/800



PLATTERMANIA

From Epyx
If you've always wanted to juggle, here's your chance. Start with 3 spinning plates, and juggle your way up to expert status: keeping 18 plates going at once! You'll have to concentrate: spin too fast and they fly off the screen; spin too slowly and they fall. Requires joystick.

ROM Cartridge, \$39.95 16K Required



K-RAZY KRITTERS

From K-Byte/CBS
Your Command Ship is faced with eight columns of Alien Kritters. You have Regular or "Supermissiles" to eliminate the Kritters, descending on your Star Base at various speeds and frequencies. Ten levels of play—great fun for the nimble-fingered! Requires joystick.

ROM Cartridge, \$49.95 8K Required



CRYPT OF THE UNDEAD

From Epyx
The night air is cold and damp in the cemetery, and you have only 12 hours to escape and return to the land of the living. Meanwhile, you'll find yourself among blood-thirsty vampires, zombies and other inhabitants of the world of the undead. Keep yourself alive by finding edible treasures and clues. If you fail, your grave is ready and waiting! Requires joystick.

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Disk, \$29.95 40K Required

SOLDIERS OF SORCERY

From Epyx
A multi-player fantasy role-playing game in which you, as a warrior or wizard, search the land for wealth and experience. The game is different each time you enter the world of wolves, bats, dragons, and more! Requires joystick.

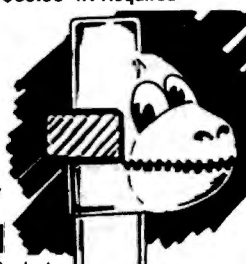
ROM Cartridge, \$59.95 16K Required



FIREBIRD

From Gebelli
You are Piggo the Firefighter in this fast-action game. The firebird drops fire on buildings in your district. You must put out the fires; try to save the people who jump, and get them on rescue helicopters. Accumulate points for each successful action. Requires joystick.

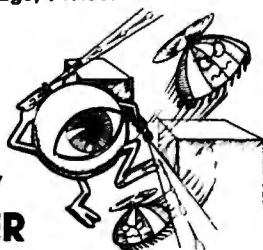
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MONKEY WRENCH

From Eastern Data Products
A BASIC and machine language programmers' aid for the Atari 800. Works with BASIC, adding 9 new direct mode commands including: auto line numbering, delete lines, change margins, memory test, hex/dex conversion, renumber BASIC, cursor exchange and machine language monitor. Monitor contains 15 commands used to interact with the 6502.

ROM Cartridge, \$49.95.



BEANY BOPPER

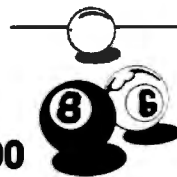
From Sirius
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ROM Cartridge

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From Epyx
This fantasy world is inhabited by a collection of "Incredible Edibles": some delicious, some poisonous, some explosive. You must discover the best way to eliminate them from the garden—without eliminating yourself! The faster you go, the more points you earn. Requires joystick.

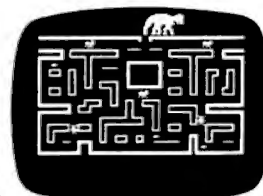
ROM Cartridge, \$39.95 16K Required



POOL 400

From IDSI
Looks and plays just like the real thing! With straight pool, nine ball, eight ball and rotation. Features include: instant replay, slow motion, 5 friction levels, and choice of colored or numbered balls. Play against a friend or the computer. Requires joystick.

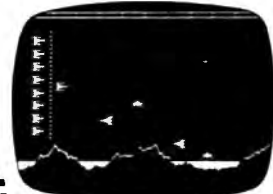
ROM Cartridge, \$39.95 16K Required



K-RAZY ANTIKS

From K-Byte/CBS
The White Ant needs all your help! You must guide it safely through the maze of tunnels in the Anthill; help it deposit and protect its White Eggs—while looking out for the Anteater and Enemy Ants who are trying to hatch their Enemy Eggs. Choice of 6 mazes and 99 levels of difficulty. Requires joystick.

ROM Cartridge, \$49.95 8K Required



K-STAR PATROL

From K-Byte/CBS
Your lead Star Ship must destroy the Alien Attack Ships, and eliminate the Intergalactic Leeches that are invading your territory. You must also replenish your Force Field Energy periodically by diving between jagged mountains into the lakes below. 10 levels of difficulty. Requires joystick.

ROM Cartridge, \$49.95 8K Required



WIZARD OF WOR

From Roklan
Can you defeat the WIZARD OF WOR? First you must descend into the ever-changing maze of Dungeons with your Warriors, and do battle with the monsters you encounter, like the Burwors, Garwors, Worluk and enemy Warriors. Only then can you turn your attention to the Wizard, who can teleport magically around the screen, hurling lightning bolts as he moves. Simultaneous 1 or 2 player action.

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tree with blinking lights seems appropriate. I may not have enough memory, so graphics mode 3 (or 19) will have to do. What do those tables on "COLOR," "SETCOLOR," and graphics modes mean? It takes me four or five tries to get it right. But this is how it works out.

Each color is made up of a hue and a luminance:

Color 0, Setcolor 4: provides hue and luminance (color) for the graphics area background (top of the screen).

Color 3, Setcolor 2: provides one graphics color; also the color of the text area background (bottom of the screen), and the hue of the text.

Color 2, Setcolor 1: provides one graphics color; also the luminance of the text.

Color 1, Setcolor 0: provides one graphics color.

I would like a green tree, with red or yellow blinking lights, and fixed lights of the other color. Blinking can be done by changing one color to background color and back. I would also like the text to be light on dark. Experimenting with colors, I find that both the red and green I like have dark luminances. Therefore, yellow must be "Color 2, Setcolor 1" in order to provide light text. This implies that yellow cannot blink, or the text area would blink also. Therefore, red must blink and be "Color 1, Setcolor 2" (or else the text background would blink). This leaves "Color 3, Setcolor 2" as green, and my text background is green.

What Does FILL Do Anyway?

My next step is to mark off a Christmas tree on graph paper. I add yellow and red lights. This could all be plotted using data statements of x,y coordinates and lengths, but that is a lot of data. Wasn't there a FILL command somewhere? Back to the manual.

Now I need a lot of experimenting. Although triangles draw easily, I want to understand how FILL works for future uses. My final hypothesis is that XIO 18 ... draws a line from the last plotted point to the cursor position, using the current plotting color. Then, starting at each point on this line, top to bottom, left to right, it fills in with the color stored in location 765. This color does not have to be the one you were plotting with. The short Program 1 shows an example. Note that XIO 18 ... leaves the last plotted point in the lower right corner. Also, when no non-zero point is found on the right end, the fill starts again on the left.

Explanation Of Program 2

Line 10:

Skips subroutines and goes to initialization.

Line 200:

Subroutine PLOT to plot a list of points preceded by a count.

Lines 700 - 720:

Subroutine CHECKI to check the input string against a table of acceptable values, and return an INDEX value for which string was found. An INDEX of zero indicates not found.

Line 960:

Subroutine LDELAY to delay long enough for a first grader to read one or two lines. (I hope.)

Lines 1000 - 1040:

Initialization. All initialization is included even though some of it is not used until PART II.

Lines 2000-2300:

Greeting and blinking Christmas tree.

Colors used are:

Setcolor x,3,4 - red

Setcolor x,13,12 - yellow

Setcolor x,12,2 - green

Setcolor x,0,0 - black

(These colors work on my TV. The yellow may be too green on a color monitor or some other TVs.)

Lines 2900-2960:

Initial dialog as outlined earlier.

Lines 3000 - 3090:

Remaining dialog and call of individual subroutines. The NAME array is used to keep track of those I've talked to and still allow them to look at their picture twice.

Lines 3110 - 3300:

Data for recognizing names, with alternate spellings (nicknames, etc.).

Lines 11000 - 20010:

Skeleton for individual subroutines. These subroutines will execute correctly and will print out the preamble. Later I will add a picture and melody for each.

Note: "Merry Christmas" in line 2010 and "Atari" in line 2950 are in inverse video.

Finally the framework works!

Part II of this article will fill in the subroutines for each person. For example, it will cover simple animation, more pictures, and music.

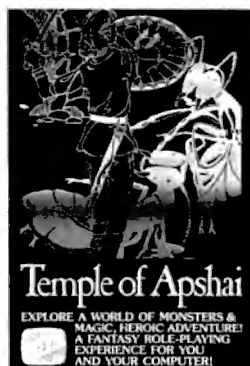
My thanks to the people at HW Computers in Redondo Beach for the use of their printer.

Program 1.

```
10 GRAPHICS 3:REM SET UP GRAPHICS MOD
   E
20 COLOR 1:REM SET PLOTTING COLOR - D
   EFAULT ORANGE
30 POKE 765,2:REM SET FILL COLOR - DE
   FAULT GREEN
```

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The Game Manufacturer's Association named The Temple of Apshai the computer game of the year. The Temple is the very first computer game—ever to win the Hobby Industry award for excellence. There can be only one reason for that: it's a great game.

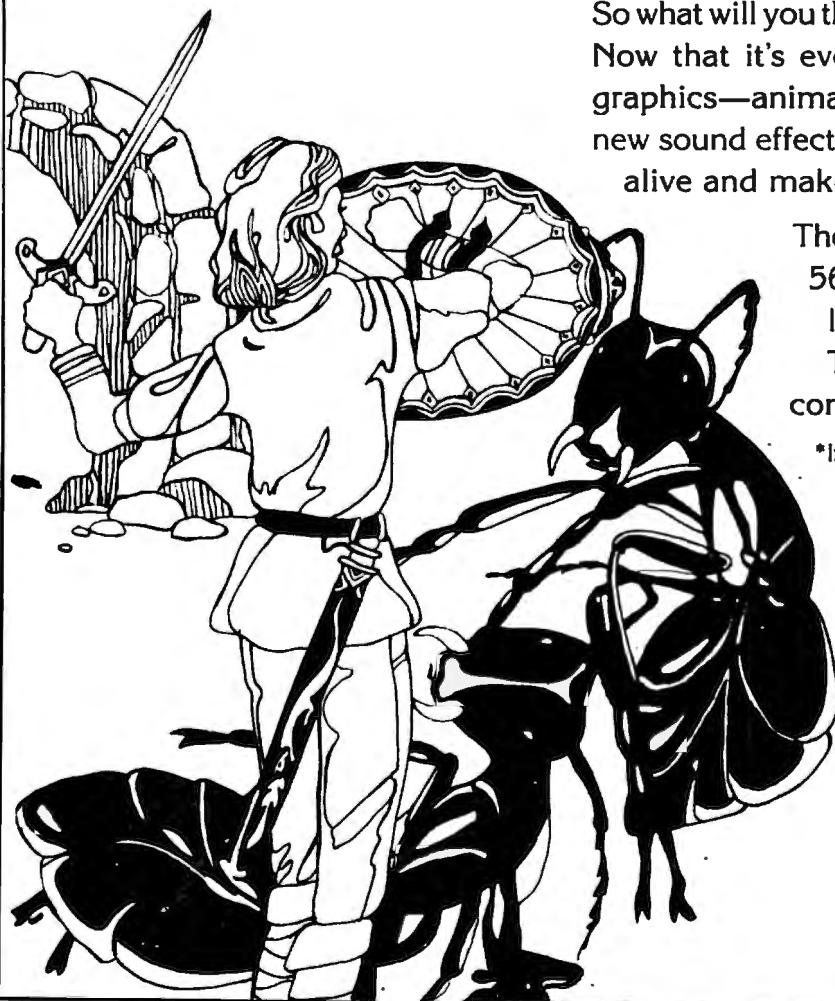
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```

40 PLOT 3,15:DRAWTO 3,19:REM SET UP T
  O STOP 2ND XIO
50 PLOT 25,15:DRAWTO 20,10:REM SET UP
  2ND XIO
60 DRAWTO 10,0:POSITION 5,10:XIO 18,#
  6,0,0,"S:":REM FIRST XIO
70 POSITION 5,19:XIO 18,#6,0,0,"S:":R
  EM 2ND XIO
80 GOTO 80

```

Program 2.

```

10 GOTO 1000
200 READ NUM:FOR L=1 TO NUM:READ X,Y:
  PLOT X,Y:NEXT L:RETURN
700 READ COMPARE$,INDEX:IF INDEX=0 TH
  EN RETURN
710 IF COMPARE$=INPUT$ THEN RETURN
720 GOTO 700
960 FOR DELAY=1 TO 2000:NEXT DELAY:RE
  TURN
1000 DIM INPUT$(25);COMPARE$(25),NAME
  (20),HUE(2),LUM(2),ANOTE(3),VOL(
  4):PEOPLE=10:POKE 53277,0
1010 FOR I=1 TO 20:NAME(I)=0:NEXT I
1020 HPLOT=100:VLOT=150:PLOT=200:HP
  LOTT=250:HPLOTTFR=300:SQPLOT=350
  :CLICK=400:SIREN=450
1030 CHECKI=700:PNOTE=800:PCHORD=850:
  SDELAY=900:MDELAY=930:LDELAY=960
  :S11050=11050
1040 HUE(0)=3:LUM(0)=4:HUE(1)=0:LUM(1
  )=14:HUE(2)=8:LUM(2)=4
2000 GRAPHICS 3:SETCOLOR 0,3,4:SETCOL
  OR 1,13,12:SETCOLOR 2,12,2:SETCO
  LOR 4,0,0
2010 ? "MERRY CHRISTMAS!":? "CAROLYN,
  JERRY, KATHY, AND SUZANNE":? "I
  AM YOUR FRIENDLY COMPUTER"
2020 ? "WILL YOU TALK TO ME?";
2030 COLOR 3:PLOT 26,15:DRAWTO 18,0:P
  OSITION 10,15
2040 POKE 765,3:XIO 18,#6,0,0,"S:"
2050 PLOT 19,18:DRAWTO 19,16:DRAWTO 1
  7,16:POSITION 17,18
2060 XIO 18,#6,0,0,"S:"
2070 RESTORE 2200:COLOR 2:GOSUB PLOT
2080 RESTORE 2300:COLOR 1:GOSUB PLOT
2090 POKE 764,255
2100 IF PEEK(764)<>255 THEN 2900
2110 FOR L=1 TO 100:NEXT L:SETCOLOR 0
  ,12,2
2120 FOR L=1 TO 100:NEXT L:SETCOLOR 0
  ,3,4:GOTO 2100
2200 DATA 11,18,0,19,3,17,5,20,7,16,8
  ,19,10,23,11,17,12,12,13,22,14,1
  5,15
2300 DATA 5,20,5,15,10,20,12,19,14,12
  ,15
2900 GRAPHICS 0:INPUT INPUT$:RESTORE
  2960:GOSUB CHECKI
2910 IF INDEX=0 THEN ? "ANY ANSWER IS
  A GOOD SIGN":GOTO 2950
2920 IF INDEX=1 THEN ? "I'M GLAD":GOT
  O 2950
2930 ? "YOU MUST HAVE GOTTEN OUT OF T
  HE WRONG SIDE OF BED THIS MORNIN
  G"
2940 ? "ANYWAY, ":GOTO 2950
2950 ? "MY NAME IS ALICE":GOTO 3000
2960 DATA YES,1,Y,1,YEAH,1,NO,2,N,2,E
  ND,0
3000 ? "WHAT IS YOUR NAME":INPUT INP
  UT$
3010 RESTORE 3100:GOSUB CHECKI
3020 IF INDEX=0 THEN ? "HMM ... I DON
  'T KNOW YOU.":? "ARE YOU SURE YO
  U SPELLED YOUR NAME(4 SPACES)RIG
  HT?":GOTO 3000
3030 IF INDEX=20 THEN ? "THERE ARE TO
  O MANY ":? INPUT$;? "'S HERE":
  ? "TRY AGAIN":GOTO 3000
3040 NAME(INDEX)=1;? :? INPUT$;? ",
  I KNOW SOMETHING ABOUT YOU.":?
3050 GOSUB 10000+INDEX*1000;TOTAL=0
3060 FOR I=1 TO PEOPLE;TOTAL=TOTAL+NA
  ME(I);NEXT I
3070 IF TOTAL=PEOPLE THEN ? "IT HAS B
  EEN NICE TALKING TO EVERYONE.":G
  OSUB LDELAY;GOTO 3090
3080 ? "I HAVEN'T TALKED TO EVERYONE
  YET":? "I HOPE SOMEONE ELSE WANT
  S TO TALK TO ME.":GOTO 3000
3090 GRAPHICS 18:SETCOLOR 4,12,2:SETC
  OLOR 0,3,4:POSITION 2,5;? #6;"ME
  RRY CHRISTMAS"
3095 GOSUB LDELAY:END
3110 DATA BRENDA,1,BB,1
3120 DATA JIM,2,JAMES,2
3130 DATA PRUE,3,PRUDY,3,PRUELLA,3,NA
  NA,3
3140 DATA RALPH,4,GRANDDADDY,4
3150 DATA CAROLYN,5
3160 DATA JERRY,6
3170 DATA KATHY,7,KATHERINE,7
3180 DATA SUZANNE,8
3190 DATA RUTH,9,GRANDMA,9
3200 DATA CLIFF,10,GRANDPA,10
3300 DATA MOM,20,MOTHER,20,MOMMY,20,D
  AD,20,DADDY,20,FATHER,20,END,0
11000 ? "YOU PLAY RENAISSANCE INSTRUM
  ENTS.":GOSUB LDELAY
11010 RETURN
12000 ? "YOU WOULD LIVE IN LAS VEGAS
  - ":? :? "IF YOU COULD AFFORD I
  T!":GOSUB LDELAY
12010 RETURN
13000 ? "YOU LIKE TO TRAVEL":GOSUB LD
  ELAY
13010 RETURN
14000 ? "YOU WOULD PLAY BRIDGE ALL DA
  Y LONG IF YOU COULD.":GOSUB LDE
  LAY
14010 RETURN
15000 ? "YOU TEACH CHILDREN.":GOSUB L
  DELAY
15010 RETURN
16000 ? "YOU SEARCH FAMILY TREES -":?
  :? "TO FIND DAR'S.":GOSUB LDEL
  AY
16010 RETURN
17000 ? "YOU LIKE TO DANCE.":GOSUB LD
  ELAY
17010 RETURN
18000 ? "YOU LIKE ANIMALS -":? :? "FR
  OM BUNNIES TO BLUEBIRDS.":GOSUB
  LDELAY
18010 RETURN
19000 ? "YOU LIKE TO BAKE -":? :? "CO
  CONUT CAKE.":GOSUB LDELAY
19010 RETURN
20000 ? "YOU DELIVER MILK!":GOSUB LDE
  LAY
20010 RETURN

```


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Would you like to teach your VIC to sing in three-part harmony? Here's a program, called the Harmonizer, that makes training your VIC easy.

VIC Harmony

Henry Forson
New Monmouth, NJ

Believe it or not, it's the data statements that make this program so friendly. In fact, they were given *prime* consideration in the design. The data statements tell the Harmonizer how to play your song. These statements change with each song, although the rest of the program stays pretty much the same. The data statements contain three kinds of information: voice commands, notes, and separators. These are described separately below.

Voice Commands: The VIC has three voices – Soprano, Alto, and Tenor. The voice command tells which voice we want to play the following notes. A voice command consists of the letter "V" followed by an "S", "A", or "T" for Soprano, Alto, or Tenor, respectively. The "VS" on line 10 is a voice command meaning soprano.

Notes: In a data statement, a note consists of an "A", "B", "C", "D", "E", "F", "G", or "R", followed by a number from 1 to 9. The letters "A" to "G" are the standard music names for notes. The "R" (for *rest*) means silence. The number following the letter tells how many counts the note or rest lasts. A count is *not* always the same as a musical beat; the shortest note in a song has a value of *one count*. This eliminates the need for a notation involving fractions.

Separators: Separators are just commas and spaces. You can put them in the data strings whenever you want. You might find them useful to keep track of musical groupings, to make your data more readable.

Other Data Features: An "X" indicates the end of your data, to save you the trouble of counting notes. It makes no difference what order you put the voices in, and you can change voices whenever you want. So, you could build up a complete tune a short phrase at a time using one or all voices, and check it as you go by *listening*, instead of *listing*.

Operation

When the Harmonizer is started, it seems to pause at first because it is reading the input data, sorting the notes by voices, and determining the internal note codes. Suddenly, it prints out how many notes were found for each voice, and plays the music. When it finishes, it prints out how much memory was free, and silences all the voices.

The first time you try it, remember to turn up the TV volume. For a quick test, you may want to leave out the data statements 12 to 20, 24 to 32, and 36 to 44. Also, you can leave out some of the REM statements to save space.

The key to understanding how it works inside is to study the two-dimensional array, "N%". The "N" stands for *note* and the "%" means *integer*. The N% array is like a table containing three rows and 81 columns of integers. The rows are numbered 0, 1, and 2; one row for each voice. Each row has 81 columns, numbered 0 to 80. Columns 1 to 80 store each voice's notes in an internal form in sequential order. See line 480. Both the pitch and duration are packed into a single integer. So, you have a maximum of 80 notes per voice. If you get more memory, you can have a larger array just by changing the 80 in line 130. Column 0 keeps track of how many notes each voice actually uses in a particular piece.

When playing begins (around line 500), two other one-dimensional arrays are also used to keep track of where the Harmonizer is. The SP% (for *stack pointer*) array keeps track of the column of the current note for a given voice. Likewise, the TM% (for *timer*) array keeps track of how long, in counts, the current note for a given voice has been playing.

All input comes from the subroutine at line 800, which gets a single character from the data statements and returns it in the variable "C\$". This routine lets you use arbitrary length data strings and also takes care of the separators.

Enhancements

Once you have the standard program working, you will probably want to make changes. One of the first might be to add sharps and flats. These may be added using lines 350 to 410 as a guide. I've used the graphics on the front of the keys for this purpose; the one on the right means sharp, and the one on the left means flat. I've left this feature out of the article listing mainly so I could type it. Look at your VIC keyboard and imagine trying to figure out the difference between my hand-drawn C sharp and D sharp!

Other minor changes I might suggest would be to vary the tempo (line 680) or make the tune repeat (change line 740 to GOTO 510). A finishing touch would be to paint a picture on the screen to match the tune.

The Harmonizer was designed to be friendly; it's easy to use and modify. It works well. If you like music, I think you'll like the Harmonizer.

Mr. Forson has offered to make copies of this program. Enclose an SASE tape mailer, a tape, and \$3. His address is:

5 Ward Place
New Monmouth, NJ 07748


```

1 REM THE HARMONIZER
2 REM THE TUNE IS
3 REM "SILENT NIGHT"
4 REM
10 DATA "VS G3A1G2E6, G3A1G2E6"
12 DATA "VS D3R1D2B6, C3R1C2G6"
14 DATA "VS A3R1A2C3B1A2, G3A1G2E4
R2"
16 DATA "VS A3R1A2C3B1A2, G3A1G2E5
R1"
18 DATA "VS D3R1D2F3D1B2, C6E4R2"
20 DATA "VS C3G1E2G3F1D2, C6C4R2"
22 DATA "VT C3R1C1R1C5R1, C3R1C1R1
C6"
24 DATA "VT G3R1G1R1G6, C3R1C1R1C6
"
26 DATA "VT F3R1F1R1F6, C3R1C1R1C5
R1"
28 DATA "VT F3R1F1R1F6, C3R1C1R1C6
"
30 DATA "VT G3R1G1R1G6, C6C5R1"
32 DATA "VT G3R1G1R1G6, C6C4R2"
34 DATA "VA E3F1E2C6, E3F1E2C6"
36 DATA "VA F6D6, E6E6"
38 DATA "VA F4C2A3G1F2, E3F1E2C6"
40 DATA "VA F6A3G1F2, E3F1E2C6"
42 DATA "VA F6D3F1D2, E6G5R1"
44 DATA "VA E4C2E3D1B2, E6E4R2"
46 DATA "X": REM END OF DATA SECT
ION
100 REM START OF PROGRAM
110 NS%=2: REM NUMBER OF VOICES - 1
120 VT = 36874: REM TENOR VOICE LOC
ATION
130 DIM N%( NS%, 80 ): REM NOTE ARR
AY
140 DIM TM%( NS% ): REM TIMER ARRAY
150 DIM SP%( NS% ): REM STACK POINT
ERS
160 FOR I = 0 TO NS%
170 N%( I, 0 ) = 0
180 NEXT I
190 SH% = 16: REM SHIFT CONSTANT
200 CV = 2: REM CURRENT VOICE
210 IN$ = "": REM INPUT STRING
220 C$ = "": REM INPUT CHARACTER
230 GOSUB 800
240 IF C$ = "X" THEN GOTO 510
250 IF C$ <> "V" THEN GOTO 340
260 GOSUB 800
270 REM SET THE CURRENT VOICE
280 IF C$ = "S" THEN CV = 2
290 IF C$ = "A" THEN CV = 1
300 IF C$ = "T" THEN CV = 0
310 GOTO 230
320 REM TRANSLATE NOTE TO CODE
330 REM FOR THE FREQUENCY
340 FR = -1
350 IF C$ = "C" THEN FR = 225
360 IF C$ = "D" THEN FR = 228
370 IF C$ = "E" THEN FR = 231
380 IF C$ = "F" THEN FR = 232
390 IF C$ = "G" THEN FR = 235
400 IF C$ = "A" THEN FR = 237
410 IF C$ = "B" THEN FR = 239
420 IF C$ = "R" THEN FR = 0
430 IF FR = -1 THEN PRINT "?";C$; "
IN"; IN$
440 GOSUB 800: REM GET THE COUNT IN
C$
450 I% = N%( CV, 0 ) + 1
460 N%( CV, 0 ) = I%
470 REM STORE THE COUNT AND NOTE
480 N%( CV, I% ) = VAL( C$ ) + SH% ~
* FR
490 GOTO 230
500 REM START PLAYING TUNE
510 FOR I = 0 TO NS%
520 SP%( I ) = 1
530 TM%( I ) = 0
540 PRINT "VOICE"; I; "HAS"; N%( I,
0 ); "NOTES"
550 NEXT I
560 REM SET INITIAL VOLUMES
570 FOR I = 0 TO 4: POKE VT + I, 8:
NEXT I
580 FOR D = 0 TO 1: REM UNTIL DONE
590 FOR I = 0 TO NS%
600 J = SP%( I )
610 IF J > N%( I, 0 ) THEN GOTO 670
620 D = 0
630 NT% = ( N%( I, J ) / SH% - INT(
N%( I, J ) / SH% ) ) * SH
%
640 IF TM%( I ) >= NT% THEN GOTO 75
0
650 TM%( I ) = TM%( I ) + 1
660 POKE VT + I, INT( N%( I, J ) /
SH% )
670 NEXT I
680 FOR J = 0 TO 70: NEXT J: REM TE
MPO CONTROL
690 NEXT D
700 FOR I = 0 TO 4
710 POKE VT + I, 0: REM ALL QUIET
720 NEXT I
730 PRINT FRE( X ); "BYTES LEFT"
740 END: REM GOTO 510 FOR REPEAT
750 SP%( I ) = J + 1: REM NEXT NOTE
760 TM%( I ) = 0
770 GOTO 600
780 REM INPUT A CHARACTER IN C$

```

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```

790 REM "X" STOPS INPUT
800 IF C$ = "X" THEN RETURN
810 IF LEN( IN$ ) = 0 THEN READ IN$

820 C$ = LEFT$( IN$, 1)
830 IN$ = RIGHT$( IN$, LEN( IN$ ) -
      1 )
840 REM IGNORE SPACES AND COMMAS
850 IF C$ = " " OR C$ = "," THEN GO
      TO 800
860 RETURN

```

©

A short program to make the VIC screen a digital clock with rapidly changing background and border colors.

Rainbow Clock

Joel Swank
Rockaway, OR

This program turns VIC into a rainbow digital clock. It's simple, but it demonstrates many of VIC's features. The time is displayed in the center of the screen every second. A tick-tock is sounded in the TV speaker. Every second the random number generator is used to generate a new background/border combination. Between seconds, a random color is POKEd into a random spot on the screen.

The area of the screen around the time is protected from this. The color of the time itself rotates through the eight VIC colors. You might notice that occasionally the time disappears. This happens when the color of the time happens to match the screen color. It never disappears for a whole second.

Rainbow clock used VIC's internal clock to keep the time. Each time you turn on VIC, you must set the clock to the current time. The time is kept in the special BASIC variable TI\$. The time is a string of six decimal digits representing hours, minutes, and seconds. This variable is automatically updated every second by VIC. To set the time, just assign a string of six digits to TI\$. The time must be entered in 24-hour format and all six digits

must be entered. For example: TI\$="060000" for 6 a.m. and TI\$="180000" for 6 p.m. Rainbow clock converts the time back to 12-hour format. VIC's internal clock is fairly accurate. I tested mine for 24 hours, and it gained about two seconds. Once you have set the time, any BASIC program can get the current time from TI\$.

```

40 S1$=""
50 L=1
60 L$="{BLK}{WHT}{RED}{CYN}{PUR}
  {GRN}{BLU}{YEL}"
70 C$="{BLK}"
80 PRINT"{CLEAR}";
90 T=36874:T1=1
100 POKE36878,15
110 H$=MID$(TI$,1,2)
120 H=VAL(H$)
130 IFH<12THENP$="AM"
140 IFH>12THENP$="PM"
150 M$=MID$(TI$,3,2)
160 S$=MID$(TI$,5,2)
170 IFH>12THENH=H-12
180 IFH=0THENH=12
190 H$=MID$(STR$(H),2,2)
200 IFLEN(H$)<2THENH$=" "+H$
210 PRINTC$;"{HOME}{10 DOWN}{08
  RIGHT}";H$;":";M$;":";S$;
220 PRINT"{03 DOWN}{05 LEFT}";P$;
230 M=INT(RND(1)*506)
240 IFM>204ANDM<215THEN230
250 IFM>226ANDM<237THEN230
260 IFM>248ANDM<259THEN230
270 N=INT(RND(1)*7)+1
280 J=160
290 IFRND(1)<.15 THENJ=32
300 POKE7680+M,J
310 POKE38400+M,N
320 GETQ$:IFQ$=""THEN340
330 GETQ$:IFQ$=""THEN330
340 IFS1$=S$GOTO110
350 POKE T,200
360 S1$=S$
370 C$=MID$(L$,L,1)
380 L=L+1
390 IFL>7THENL=1
400 BS=INT(RND(1)*15)*16+8+INT(RND
  (1)*7)
410 POKE36879,BS
420 POKET,0
430 T=T+T1
440 T1=-T1
450 GOTO110

```

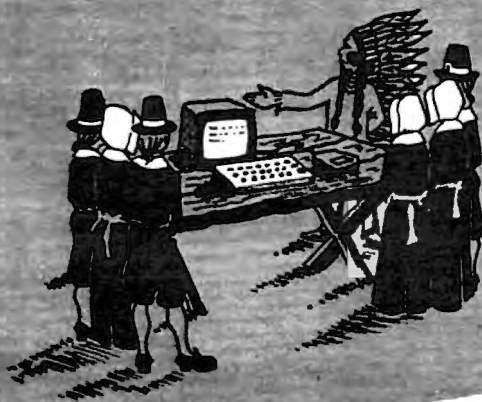
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For Apple, Atari, and Commodore computers – learn and examine statistics the easy way with this handy program.

Statistician

Louis F. Sander
Pittsburgh

Statistician is a useful program for handling and analyzing the statistical data that many of us encounter in our work and home life. Written in formats for several home computers, it can be useful to teachers in analyzing test scores, to businessmen in analyzing sales, to the curious in learning about statistics, or to any one whose life involves coping with more than a handful of numbers. Any time you're called on to cope with up to a 100 or so, call on Statistician and stand by.

The program lets you enter a series of numbers in any sequence. It quickly analyzes them, giving them back to you sorted and grouped, along with their total, their mean and median, and half a dozen other useful statistical measurements. Although the program is self-explanatory, this article explains it further and provides some examples.

Entering Data

Key in your version of the program, and follow us through the screens. The first one asks whether your data are "special" in any way. If you have more than 99 entries to make, you'll have to estimate how many; be generous, because the program won't take any more items than you prepare it for. If your data consist of groups with the same value, e.g., "4 grades of 95" rather than four single entries of 95, you must say so in advance. Likewise, you must let the computer know if your data are a sample from a population, since this makes a difference in calculating standard deviation. Most people won't need this feature, but it's there if you want it.

If there's nothing special about your data, just hit a key and you're on your way. Enter one data item at a time in response to each prompt, and hit RETURN when you're finished. Don't worry about the order in which you enter items, but do be careful, since you cannot change a number once it's been input. If you're entering grouped data, the **FREQ** entry is the one for the number of occurrences of each item.

Statistical Measurements

Once you have finished, Statistician will quickly

give you these seven measurements, then take some time to sort your data: **#ENTRIES** is merely the number of items or groups you have put into the computer. **#DATA** is the total number of data points involved. Two entries, each with a **FREQ** of five, would give ten data points. **RANGE** gives the value of the smallest and largest data points you entered. **TOTAL** is the sum of all your data. **MEAN** can be thought of as the average of all the data, and **VARIANCE** and **STD DEV** are statistical measures of how far your data extend from the mean. Any elementary statistics book will explain these terms.

Your machine can't give you the **MEDIAN** until it's finished sorting all the data. Most sorts are finished in just a few seconds, but some can take awhile. One trial sort of 98 random data items took 47 seconds – not too shabby when compared to a manual sort. The **MEDIAN** item in a group of data is the one which is halfway between the smallest and the largest members; half the members are above the median, and half are below, as anyone who's been "graded on a curve" will readily tell you. If there are an even number of data items, it's possible that the median falls between two items. When that happens, Statistician splits the difference between them and tells you that it did so.

As soon as the median is calculated, the program displays the data items in sequence from low to high and shows the frequency of occurrence of each. It also shows the cumulative frequency, in case you want to know something like the 20th item from the bottom of the list. In cases where you have more data than will fit on one screen, you can page through it as many times as you wish.

Examples

So much for the explanations; let's try some examples. The three which follow will illustrate some of Statistician's uses. I hope they will amuse you, and convince you of some of the advantages of computing.

- **Example 1.** These are the prices of the computer accessories on Bill Boole's birthday wish-list: \$75, \$95, \$80, \$22.50, \$149, \$10.95, \$195, \$19.95, \$29.95, \$55, \$5.95. What is the average price of these goodies? Although some of the items are expensive, some are quite reasonably priced. In fact, half of them cost less than what amount? How much would it take to buy everything on the list?

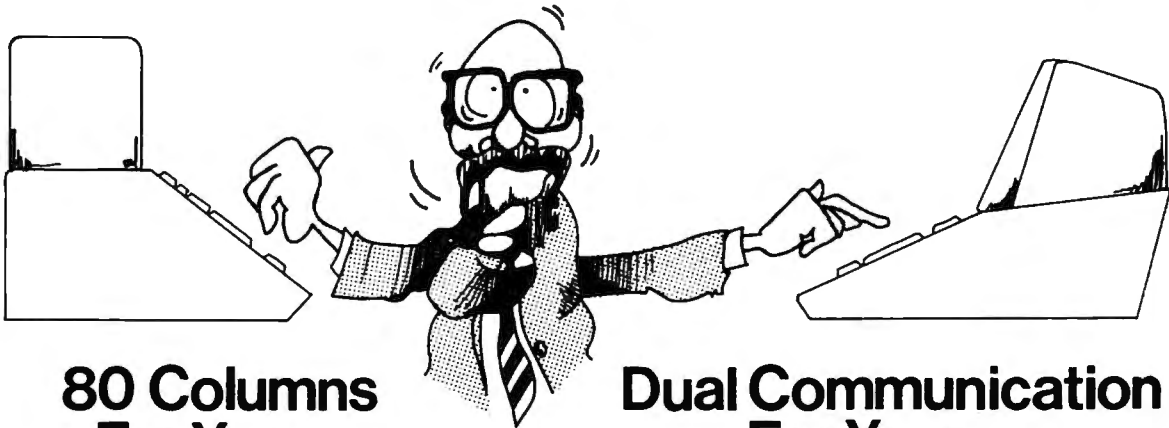
- **Example 2.** These are the ages of the cars parked in the main lot at CD Computer Store:

Age	10	5	4	3	2	1
#Cars	1	2	5	8	4	3

What is the average age of the cars?

- **Example 3.** Here are some numbers from

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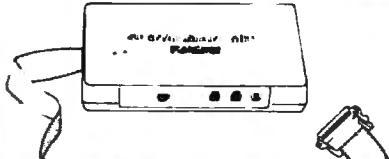
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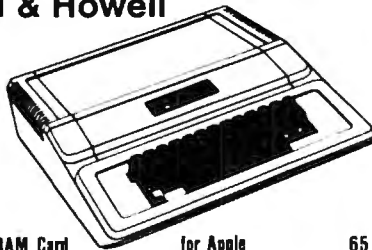
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commodore



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A B Computers

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 - Machine Language P-Code Compiler
 - P-Code to machine language translator for optimized object code
 - Run-time package
 - Floating point capability
 - User manual and sample programs
- Requires 32K Please specify configuration.

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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
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 Battery Backup Option 20

SUBSORT by James Strasza \$35

Subsort is an excellent general purpose machine language sort routine for PET/CBM computers. Sorts both one and two dimensioned arrays at lightning speed in either ascending or descending order. Other fields can be subsorted when a match is found, and fields need not be in any special order. Sort arrays may be specified by name, and fields are random length. Allows sorting by bit to provide 8 categories per byte. The routine works with all PET BASICS, adjusts to any memory size, and can co-exist with other programs in high memory.

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 in ROM \$45

Volume discounts available on ROM version for schools.



for PET/CBM Computers

NEW VERSION II

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 sub-totals 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 on 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 II by Michael Riley \$110

Please specify equipment configuration when ordering.

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Dow Jones Portfolio Mgmt.	110
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FORTH for PET

BY L. C. Cargile and Michael Riley

\$50

Features include:

- full FIG FORTH model.
- all FORTH 79 STANDARD extensions.
- structured 6502 Assembler with nested decision making macros.
- full screen editing (same as when programming in BASIC).
- 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.

Metacompiler for FORTH \$30

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

PaperMate 60 COMMAND WORD PROCESSOR

by Michael Riley



Paper-Mate is a full-featured word processor for CBM/PET by Michael Riley. Paper-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 Professional Software's WordPro 3).

For writing text, Paper-Mate has a definable keyboard so you can use with either Business or Graphics machines. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

Paper-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. Paper-Mate can send any ASCII code over any secondary address to any printer.

Paper-Mate functions with all CBM/PET machines with at least 16K, with any type of printer, and with either cassette or disk.

To order Paper-Mate, please specify machine and ROM type. Paper-Mate (disk or tape) for PET, CBM, VIC, C64 \$40

SM-KIT for PET/CBM \$40

Enhanced ROM based utilities for BASIC 4. Includes both programming aids and disk handling commands.

BASIC INTERPRETER for CBM 8096 \$200

A full interpreter implementation to automatically take advantage of the extra memory available with 8096.

PEDISK II from cgrs Microtech

5.25" 40 track, 1 drive, 143K	\$525
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A B Computers

the throws of a single die: 6,5,3,4,6,1,2,3,1,6,1,4,2,4,2,5,4,4,6,1,4,5,4,1,3,5,4,2,5,6. What is the total of these throws, what is the mean throw, and what is the standard deviation of this group of throws? If you were Bill Boole, and your birthday was six months off, which number do you wish you had been betting on?

Apple Version

```

100 REM *** APPLE STATISTICIAN ***
1000 GOSUB 2100
1010 GOTO 1180
1020 REM *** SHELL MENTZER SORT
1030 M = E
1040 M = INT (M / 2)
1050 IF M = 0 THEN RETURN
1060 J = 1:K = E - M
1070 I = J
1080 L = I + M
1090 IF X (I,0) < X(L,0) THEN 1150
1100 T = X(I,0):X(I,0) = X(L,0):X(L,0) = T
1110 T = X(I,1):X(I,1) = X(L,1):X(L,1) = T
1120 I = I - M
1130 IF I < 1 THEN 1150
1140 GOTO 1080
1150 J = J + 1
1160 IF J > K THEN 1040
1170 GOTO 1070
1180 REM *** DATA ENTRY
1190 E = 101
1200 SX = 1E10
1210 HOME : PRINT : PRINT "ANY OF THESE SPECIAL
CONDITIONS? (Y/N)"
1220 PRINT : PRINT " .MORE THAN 100 ENTRIES"
1230 PRINT : PRINT " .GROUPED DATA"
1240 PRINT : PRINT " . DATA IS A SAMPLE"
1250 VTAB 2: HTAB 39: GET AS: IF AS = "N" THEN
Q = 1: VTAB 9: GOTO 1420
1260 IF AS = "Y" THEN 1280
1270 IF AS < > "Y" THEN 1250
1280 PRINT : VTAB 10: PRINT "ARE THERE MORE THA
N 100 ENTRIES ? (Y/N)";
1290 GET AS: IF AS < > "Y" AND AS < > "N" THEN
1290
1300 IF AS = "N" THEN PRINT : GOTO 1320
1310 PRINT : PRINT : INPUT "ABOUT HOW MANY IN A
LL (GUESS HIGH) ?";A
1320 PRINT : PRINT "ARE THEY ";: INVERSE : PRIN
T "S";: NORMAL
1325 PRINT "INGLE ITEMS, OR ";: INVERSE : PRINT
"G";: NORMAL :PRINT "ROUPED DATA?";
1330 GET AS
1340 IF AS = "S" THEN Q = 1: GOTO 1370
1350 IF AS = "G" THEN G = 1: GOTO 1370
1360 GOTO 1330
1370 PRINT : PRINT :: PRINT "ARE THEY A";: INVE
RSE : PRINT "P";: NORMAL
1375 PRINT "OPULATION OR A ";: INVERSE : PRINT
"S";: NORMAL : PRINT "AMPLE?";
1380 GET AS
1390 IF AS = "P" THEN 1420
1400 IF AS = "S" THEN S = 1: GOTO 1420
1410 GOTO 1380
1420 PRINT
1430 DIM X (E,1):E = 0
1440 PRINT : PRINT "ENTER YOUR DATA:" : PRINT
1450 E = E + 1: IF E < 10 THEN PRINT " ";
1460 PRINT "#E;
1470 INPUT " ";AS
1480 IF AS = "" THEN 1590
1490 I = VAL (AS)
1500 IF I > LX THEN LX = I
1510 IF I < SX THEN SX = I
1520 IF G THEN INPUT "FREQ: ";Q : PRINT
1530 X(E,0) = I
1540 X(E,1) = Q
1550 N = N + Q
1560 T = T + Q * I
1570 TS = TS + Q * I 2
1580 GOTO 1450
1590 PRINT
1600 REM *** CALCULATIONS & DISPLAY
1605 ONERR GOTO 1640
1610 E = E - 1
1620 MN = T / N
1630 V = (TS - N * MN 2) / (N - S)
1640 HOME : PRINT "#ENTRIES: "E
1650 PRINT "# DATA: "N
1660 PRINT " RANGE: "SX" TO "LX
1670 PRINT " TOTAL=" T
1680 PRINT " MEAN=" MN
1690 PRINT "VARIANCE=" V
1700 PRINT " STD DEV=" SQR (V)
1710 PRINT " MEDIAN=" ;: INVERSE : PRINT "SORT
ING": NORMAL
1715 IF MD = 0 THEN GOSUB 1030
1720 J = 0:M = INT (N / 2): L = N - 2 * M
1730 FOR I = 1 TO E
1740 IF X(I,0) = X(I + 1,0) THEN X(I + 1,1) = X
(I,1) + X(I + 1,1):X(I,1) = 0
1750 IF X(I,1) THEN J = J + X(I,1)
1760 IF J = M AND L = 1 THEN MD = X(I + 1,0):M
= 1E10
1770 IF J = M AND L = 0 THEN MD = (X(I,0) + X(I
+ 1,0)) / 2:M = 1E10
1780 IF J > M THEN MD = X(I,0):M = 1E10 : L = 1
1790 NEXT
1800 VTAB 8: HTAB 11: PRINT "
"
1810 VTAB 8: HTAB 11: PRINT MD;: IF L = 0 THEN
PRINT " (NOT A DATA POINT)";
1820 PRINT
1830 PRINT : INVERSE : PRINT "DATUM FREQUENC
Y CUM.FREQ." : NORMAL : PRINT
1840 J = 0:K = 0:CU = 0
1850 FOR I = 1 TO E
1860 IF X(I,1) THEN CU = CU + X(I,1): PRINT X(I
,0); TAB ( 16);X(I,1); TAB( 23);CU
1865 J = J + 1: K = K + 1
1870 IF J < 10 THEN 1920
1880 IF I > = N THEN 1920
1890 PRINT : INVERSE : PRINT " MORE...PRESS A K
EY ";: NORMAL
1900 GET AS
1910 GOSUB 2020
1920 NEXT I
1930 IF K < 11 THEN 1970
1940 VTAB 22: PRINT : PRINT "REVIEW THE DATA? (
Y/N)";
1950 GET AS
1960 IF AS < > "N" THEN GOSUB 2020: GOTO 1840
1970 VTAB 22: PRINT : INVERSE : PRINT " ENTER N
EW DATA? (Y/N)";: NORMAL
1980 GET AS
1990 IF AS = "N" THEN HOME : END
2000 CLEAR : GOTO 1180
2010 REM *** ERASE SCREEN WINDOW
2020 PRINT : VTAB 11
2030 FOR J = 1 TO 12
2040 PRINT "
": REM 39 SPACES
2050 NEXT J
2060 J = 0
2070 VTAB 12
2080 RETURN
2090 REM *** TITLE SCREEN

```

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```

2100 HOME
2110 VTAB 5: HTAB 8: INVERSE : PRINT "**** STAT
      ISTICIAN ****": NORMAL
2120 VTAB 9: PRINT " A PROGRAM TO HELP YOU HAND
      LE NUMBERS."
2130 PRINT : PRINT TAB( 17)"BY"
2140 PRINT : PRINT TAB( 11)"LOUIS F. SANDER"
2150 PRINT : PRINT : HTAB 9: PRINT "APPLE TRANS
      LATION BY"
2160 PRINT : HTAB 11: PRINT "CHRIS GLANSDORP"
2170 VTAB 23: PRINT "      PRESS ANY KEY TO CONTI
      NUE ->"; GET A$: RETURN

```

```

1525 PRINT "#";E;
1530 INPUT A$
1540 IF A$="" THEN 1650
1550 TRAP 1530:I=VAL(A$):TRAP 32768
1560 IF I>LX THEN LX=I
1570 IF I<SX THEN SX=I
1580 IF G THEN PRINT "FREQ";:INPUT Q:
      PRINT
1590 X(E,0)=I
1600 X(E,1)=Q
1610 N=N+Q
1620 T=T+Q*I
1630 TS=TS+Q*I^2
1640 GOTO 1520
1650 PRINT
1660 REM *** CALCULATIONS & DISPLAY
1670 E=E-1
1680 MN=T/N
1690 V=(TS-N*MN^2)/(N-S)
1700 PRINT "{CLEAR}{DOWN}#ENTRIES:";E
1710 PRINT " # DATA:";N
1720 PRINT "{3 SPACES}RANGE:";SX;" TO
      ";LX
1730 PRINT "{3 SPACES}TOTAL=";T
1740 PRINT "{4 SPACES}MEAN=";MN
1750 PRINT "VARIANCE=";V
1760 PRINT " STD DEV=";SQR(V)
1770 PRINT " MEDIAN= SORTING":IF MD
      =0 THEN GOSUB 1100
1780 J=0:M=INT(N/2):L=N-2*M
1790 FOR I=1 TO E
1800 IF X(I,0)=X(I+1,0) THEN X(I+1,1)
      =X(I,1)+X(I+1,1):X(I,1)=0
1810 IF X(I,1) THEN J=J+X(I,1)
1820 IF J=M AND L=1 THEN MD=X(I+1,0):
      M=1E+10
1830 IF J=M AND L=0 THEN MD=(X(I,0)+X
      (I+1,0))/2:M=1E+10
1840 IF J>M THEN MD=X(I,0):M=1E+10:L=
      1
1850 NEXT I
1860 POKE 85,11:?"{UP}{9 SPACES}"
1870 POKE 85,11:?"{UP}";MD;:IF L=0 T
      HEN PRINT "{NOT A DATA POINT}";
1880 PRINT
1890 PRINT "{DOWN} DATUM{5 SPACES} FREQ
      UBEXCY{4 SPACES} CUM.FREQ{DOWN}"
1900 J=0:K=0:CU=0
1910 FOR I=1 TO E
1920 IF X(I,1) THEN CU=CU+X(I,1):PRIN
      T X(I,0);:POKE 85,15:?"X(I,1),"
      ";CU:J=J+1:K=K+1
1930 IF J<10 THEN 2030
1940 IF I>=N THEN 2030
1950 PRINT "MORE . . PRESS A KEY";
1960 GET #1,ZZ:A$=CHR$(ZZ)
1970 GOSUB 3000
2030 NEXT I
2040 IF K<11 THEN 2080
2050 PRINT "{DOWN}REVIEW THE DATA? (Y
      N)"
2060 GET #1,ZZ:A$=CHR$(ZZ)
2070 IF A$<>"N" THEN GOSUB 3000:GOTO
      1900
2080 PRINT "{DOWN}ENTER NEW DATA? (Y
      N)"
2090 GET #1,ZZ:A$=CHR$(ZZ)
2100 IF A$="N" THEN POKE 752,0:END
2110 RUN
2999 REM *** ERASE SCREEN WINDOW
3000 POSITION 2,11
3010 FOR J=1 TO 12
3020 PRINT "{36 SPACES}"
3030 NEXT J
3040 J=0

```

Atari Version

```

1000 REM *** STATISTICIAN ***
1010 REM ATARI VERSION
1070 REM
1080 GOTO 1250
1090 REM *** SHELL MENTZER SORT
1100 M=E
1110 M=INT(M/2)
1120 IF M=0 THEN RETURN
1130 J=1:K=E-M
1140 I=J
1150 L=I+M
1160 IF X(I,0)<X(L,0) THEN 1220
1170 T=X(I,0):X(I,0)=X(L,0):X(L,0)=T
1180 T=X(I,1):X(I,1)=X(L,1):X(L,1)=T
1190 I=I-M
1200 IF I<1 THEN 1220
1210 GOTO 1150
1220 J=J+1
1230 IF J>K THEN 1110
1240 GOTO 1140
1250 REM *** DATA ENTRY
1255 DIM A$(12):GRAPHICS 0:POKE 752,1
1257 OPEN #1,4,0,"K:"
1260 E=100
1270 SX=1E+10
1280 PRINT "{CLEAR}{DOWN}ANY OF THESE
      SPECIAL CONDITIONS? (Y/N)"
1290 PRINT "{DOWN}{3 SPACES}. MORE TH
      AN 100 ENTRIES"
1300 PRINT "{DOWN}{3 SPACES}. GROUPED
      DATA"
1310 PRINT "{DOWN}{3 SPACES}. DATA IS
      A SAMPLE"
1320 GET #1,ZZ
1330 IF ZZ=ASC("Y") THEN 1350
1340 Q=1:GOTO 1490
1350 PRINT "{DOWN}ARE THERE MORE THAN
      100 ENTRIES? (Y/N)"
1360 GET #1,ZZ:A$=CHR$(ZZ)
1370 IF A$="N" THEN 1390
1380 ? "{DOWN}ABOUT HOW MANY IN ALL (
      GUESS HIGH)";:INPUT A
1390 PRINT "{DOWN}ARE THEY SINGLE ITE
      MS, OR GROUPED DATA?"
1400 GET #1,ZZ:A$=CHR$(ZZ)
1410 IF A$="S" THEN Q=1:GOTO 1440
1420 IF A$="G" THEN G=1:GOTO 1440
1430 GOTO 1400
1440 PRINT "{DOWN}ARE THEY A POPULATI
      ON OR A SAMPLE?"
1450 GET #1,ZZ:A$=CHR$(ZZ)
1460 IF A$="P" THEN 1490
1470 IF A$="S" THEN S=1:GOTO 1490
1480 GOTO 1450
1490 PRINT
1500 DIM X(E,1):E=0
1510 PRINT "{2 DOWN}ENTER YOUR DATA:
      {DOWN}"
1520 E=E+1:IF E<10 THEN PRINT " ";

```


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3050 POSITION 2,11
3060 RETURN

Commodore Version

```

1080 GOTO1250
1090 REM *** SHELL MENTZER SORT
1100 M=E
1110 M=INT(M/2)
1120 IFM=0THENRETURN
1130 J=1:K=E-M
1140 I=J
1150 L=I+M
1160 IFX(I,0)<X(L,0)THEN1220
1170 T=X(I,0):X(I,0)=X(L,0):X(L,0)=T
1180 T=X(I,1):X(I,1)=X(L,1):X(L,1)=T
1190 I=I-M
1200 IFI<1THEN1220
1210 GOTO1150
1220 J=J+1
1230 IFJ>K THEN1110
1240 GOTO1140
1250 REM *** DATA ENTRY
1260 E=100
1270 SX=1E+10
1280 PRINT"{CLEAR}{DOWN}ANY OF THESE SPECIAL CO
NDITIONS? ({REV}Y{OFF}/{REV}N{OFF})"
1290 PRINT"{DOWN} . MORE THAN 100 ENTRIES
1300 PRINT"{DOWN} . GROUPED DATA
1310 PRINT"{DOWN} . DATA IS A SAMPLE
1320 GETA$:IFA$=""THEN1320
1330 IFA$="Y"THEN1350
1340 Q=1:GOTO1490
1350 PRINT"{DOWN}ARE THERE MORE THAN 100 ENTRIE
S? ({REV}Y{OFF}/{REV}N{OFF})"
1360 GETA$:IFA$=""THEN1360
1370 IFA$="N"THEN1390
1380 INPUT"{DOWN}ABOUT HOW MANY IN ALL (GUESS H
IGH)";A
1390 PRINT"{DOWN}ARE THEY {REV}S{OFF}INGLE ITEM
S, OR {REV}G{OFF}ROUPED DATA?"
1400 GETA$:IFA$=""THEN1400
1410 IFA$="S"THENQ=1:GOTO1440
1420 IFA$="G"THENQ=1:GOTO1440
1430 GOTO1400
1440 PRINT"{DOWN}ARE THEY A {REV}P{OFF}OPULATIO
N OR A {REV}S{OFF}AMPLE?"
1450 GETA$:IFA$=""THEN1450
1460 IFA$="P"THEN1490
1470 IFA$="S"THENS=1:GOTO1490
1480 GOTO1450
1490 PRINT
1500 DIMX(E,1):E=0
1510 PRINT"{02 DOWN}ENTER YOUR DATA:{DOWN}"
1520 E=E+1:IFE<10THENPRINT" ";
1525 PRINT"#E";
1530 INPUT"_{03 LEFT}";A$
1540 IFA$=""THEN1650
1550 I=VAL(A$)
1560 IFI>LXTHENLX=I
1570 IFI<SXTHENSX=I
1580 IFGTHENINPUT"REQ";Q:PRINT
1590 X(E,0)=I
1600 X(E,1)=Q
1610 N=N+Q
1620 T=T+Q*I
1630 TS=TS+Q*I^2
1640 GOTO1520
1650 PRINT
1660 REM *** CALCULATIONS & DISPLAY
1670 E=E-1
1680 MN=T/N
1690 V=(TS-N*MN^2)/(N-S)
1700 PRINT"{CLEAR}{DOWN}#ENTRIES:"E
1710 PRINT" # DATA:"N
1720 PRINT" RANGE:"SX"TO"LX
1730 PRINT" TOTAL="T
1740 PRINT" MEAN="MN
1750 PRINT"VARIANCE="V
1760 PRINT" STD DEV="SQR(V)
1770 PRINT" MEDIAN= {REV}SORTING{REV}":IFMD=0T
HENGOSUB1100
1780 J=0:M=INT(N/2):L=N-2*M
1790 FORI=1TOE
1800 IFX(I,0)=X(I+1,0)THENX(I+1,1)=X(I,1)+X(I+1
,1):X(I,1)=0
1810 IFX(I,1)THENJ=J+X(I,1)
1820 IFJ=MANDL=1THENMD=X(I+1,0):M=1E+10
1830 IFJ=MANDL=0THENMD=(X(I,0)+X(I+1,0))/2:M=1E
+10
1840 IFJ>MTHENMD=X(I,0):M=1E+10:L=1
1850 NEXT
1860 PRINTTAB(9)"{UP} "
1870 PRINTTAB(9)"{UP}"MD;:IFL=0THENPRINT"(NOT A
DATA POINT)";
1880 PRINT
1890 PRINT"{DOWN}{REV}DATUM{OFF} {REV}FREQU
ENCY{OFF} {REV}CUM.FREQ.{DOWN}"
1900 J=0:K=0:CU=0
1910 FORI=1TOE
1920 IFX(I,1)THENCU=CU+X(I,1):PRINTX(I,0)TAB(13
)X(I,1),CU:J=J+1:K=K+1
1930 IFJ<10THEN2030
1940 IFI>NTHEN2030
1950 PRINT"{DOWN}{REV}MORE{OFF} . . PRESS A KEY
"
1960 GETA$:IFA$=""THEN1960
1970 GOSUB3000
2030 NEXTI
2040 IFK<11THEN2080
2050 PRINT"{DOWN}REVIEW THE DATA? ({REV}Y{OFF}/
{REV}N{OFF})"
2060 GETA$:IFA$=""THEN2060
2070 IFA$<>"N"THENGOSUB3000:GOTO1900
2080 PRINT"{DOWN}ENTER NEW DATA?"
2090 GETA$:IFA$=""THEN2090
2100 IFA$="N"THENEND
2110 RUN
2999 REM *** ERASE SCREEN WINDOW
3000 B$="{HOME}{11 DOWN}":PRINTB$
3010 FORJ=1TO12
3020 PRINT"
"
3030 NEXTJ
3040 J=0
3050 PRINTB$
3060 RETURN

```

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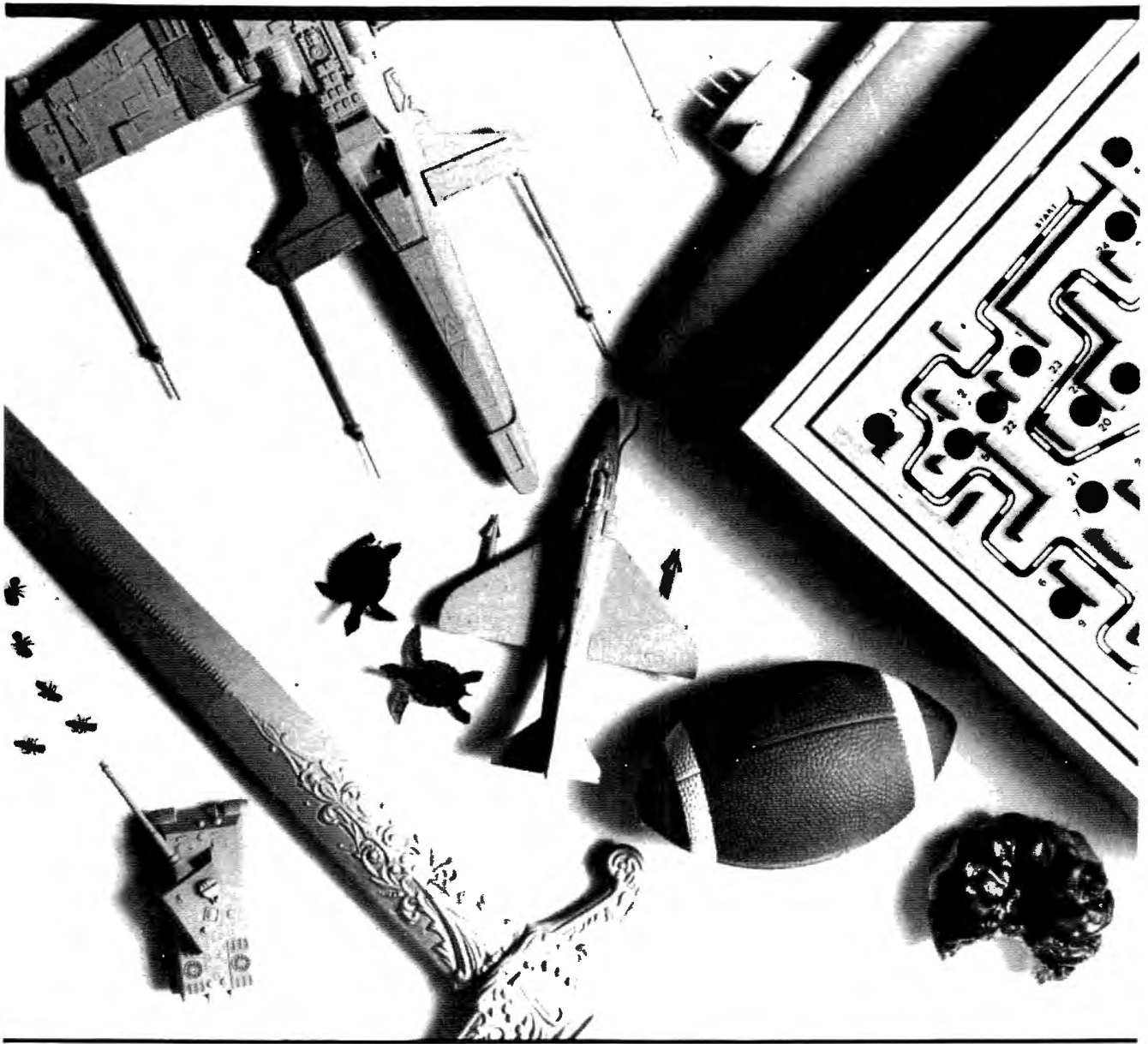
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In addition to providing an introduction to the use of SYS which allows you to take advantage of the machine language routines in your BASIC's ROM chips, this article also demonstrates a way to pass information between BASIC and machine language.

Written for the CBM/PET (all BASIC versions), the accompanying table makes this article useful to Apple users as well. A companion article, "Getting The Most Out Of USR," expands on some of these topics as they apply to Atari BASIC.

Next month, the tutorial concludes by detailing how to handle complex multiplication from BASIC, but via machine language, as an illustration of the techniques introduced in Part I.

Part I: How To Use SYS And USR

J. C. Johnson
McKinney, TX

BASIC is a powerful language and is easy to use, but it has limitations. Fortunately, there is a SYS command that can be used to access machine language subroutines. This command is among the most powerful commands in BASIC.

With the SYS command it is possible to generate FORTRAN-like subroutines that allow the user the luxury of defining the variables passed at the line that calls the subroutine. This feature will greatly reduce the manipulation required to set up the variables for a subroutine call. It is also possible to write a subroutine that can be used with many different programs without the need to carefully select variables in such a way that the subroutine and the main program do not interfere with one another.

All of this power is available when the machine language subroutine is called, but it isn't without its price. The penalty is in programming difficulty. When working with machine language, it is necessary to know (or at least be able to find out) all actual machine addresses for each subroutine or variable. Fortunately, this is not too difficult, as will be evident. That, in fact, is the purpose of this article: to define the entry points and the use of some of the commonly needed utilities available in BASIC ROMs, and to show how to pass parameters between machine language and BASIC programs using these subroutines.

It is essential, of course, to define the operating system used. All entry points discussed in the article

are for the Commodore Upgrade ROMs. Equivalent entry points for most of the utilities exist in Commodore's Original and 4.0 BASICs and can be found in Table 1. Table 1 also includes the equivalents for Applesoft in ROM.

With the information presented here, it is hoped that the interested reader will be able to realize more of the capabilities of his BASIC and will find it somewhat easier to understand the use of the utilities that are available in the ROMs.

To start with, the SYS command is nothing more than a GOSUB statement. The important difference is that the subroutine GOSUBed to is written in machine language. The form of the statement is:

```
10 SYS A
```

where A is a decimal address referencing the location in memory of the first instruction of the machine language subroutine. Another typical example would be:

```
20 SYS 826
```

The 826 means that the machine language subroutine starts at decimal address 826, which is the Commodore second cassette buffer.

Since the subroutine called by the SYS command is written in machine language, the capabilities are limited only by the system capabilities, not by the language implementation. FORTRAN-like subroutines can be implemented where the arguments are transferred in a "transparent" manner. Such a call might look like this:

```
100 SYS 826,A,B(K),2*INT(Y),3*LOG(A)+SIN(X),A,2
```

where the parameters between the commas are transferred to the machine language subroutine for processing. The next time the call is made the statement might look slightly different, like this:

```
576 SYS 826,P1,C,3.6*TAN(Q),A(6),3.1,S(I,J)
```

The arrangement of the parameters is left up to the user. In the above examples (and throughout the remainder of this article) it is assumed that the first two, P1 and C in line 576, are the outputs and the remainder are the input arguments. It should be obvious that the number and arrangement of outputs and inputs can be defined as needed by any given problem.

Parameter Passing Via CHRGET

If it is desired to have a set of subroutines callable by a single SYS, then the particular subset can be flagged by one of the parameters:

```
200 SYS 826,*,A,B,C,D,E,F
```

The "*" might signal a complex multiplication. The remainder of this article will deal with the use of some of the ROM utilities required to pick up

top titles in programming

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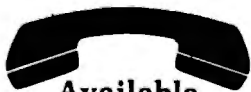
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THOUGHT PROVOKERS

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- FLIGHT SIMULATOR** (Available for all computers) Price: \$19.95 Cassette \$23.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real aircraft. You can practice instrument approaches and navigation using radials and compass headings. The more advanced files can also perform loops, hair-turns and similar acrobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTERWORLD. Runs on 16K Atari.
- VALDEZ** (Available for all computers) Price: \$17.95 Cassette \$21.95 Diskette
VALDEZ is a computer simulation of super-tanker navigation in the Prince William Sound, Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric display. The motion of the ship itself is accurately modeled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software review in 80 Software Critique, Personal Computing and Creative Computing.
- BACKGAMMON 2.0** (Available for all computers) Price: \$19.95 Cassette \$23.95 Diskette
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself! Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon fun.
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- FOREST FIRE** (Atari only) Price: \$14.95 Cassette \$18.95 Diskette
Using Hi-Res graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations in put out the fire while compensating for changes in wind, weather and terrain. Not protecting available structures can result in starting penalties. Like-like variables are provided to make FOREST FIRE very suspenseful and challenging. The two games have the same setting and there are 2 levels of difficulty.
- CRANSTON MANOR ADVENTURE** (North Star, SuperBrain, CP/M only) Price: \$19.95 Cassette \$23.95 Diskette
At last! A comprehensive adventure for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the more difficult adventures are much more elaborate than the current popular series of adventure programs, making this game the top in its class. You can be stopped at any time and the status stored on diskette.
- SPACE EVACUATION!** (Available for all computers) Price: \$15.95 Cassette \$19.95 Diskette
Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE!
- MONARCH** (Atari only) Price: \$14.95 Cassette \$18.95 Diskette
MONARCH is a fascinating economic simulation requiring you to survive as a tycoon in your nation's leader. You determine the amount of average demand for industrial and agricultural goods, you must find to distribute to the population and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs on 16K Atari.
- RUBIK'S CUBE SOLVER** (Available for all computers) Price: \$14.95 Cassette \$18.95 Diskette \$21.45 Disk
Solving the Rubik's cube puzzle is an exercise in algorithmic logic, and is a "natural" for computer calculation. The RUBIK'S CUBE SOLVER permits you to input the starting state of the 23 facing permutations of the cube. It then solves the problem one step at a time, with each step shown on a simulated view of the cube. Can you solve the cube in fewer steps in any case or save time disassembling the cube or putting it and replacing the colors? Requires 16K.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run on any 16K programmable, voice (ATARI requires 24K). Except where noted programs are available on TRS-80, TRS-90, Level II, NEC and Apple II/Apple III cassette and diskette as well as North Star single density, double density, compatible diskette. Additionally, more programs can be obtained on standard IBM 3740 single density, double density, compatible 5 1/4" CP/M floppy disks in systems running under MBASIC or CPASIC. (See example, Altos, Xerox 801 Heathfront and many others.) CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

*ATARI PET/CBM, NORTH STAR, CP/M IBM, OSBORNE, SUPERBRAIN, NEC PC-8000 and XEROX are registered trademarks and trademarks.
**Except as here noted, all TRS-80 based software is available on a cassette (only) for the TRS Model III. Exceptions: VALDEZ, CRIBBAGE, GAFFER, CHECKMATE, TRS-80 diskettes. All other software is supplied with either DOS or BASIC.
***For most North Star disk-based systems.
****For Altos systems having MicroV BASIC.
*****The SUPERBRAIN system running under MBASIC or CPASIC (note which).

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- Fastest delivery
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AND MORE...

- STARBASE 3.2** (Available for all computers) Price: \$13.95 Cassette \$17.95 Diskette
This is the classic space simulation, but with several new features. For example, the Cylonian now shoot at the friendly ship using a tracking system in other quadrants. The Cylonian also attack with both light and heavy cruisers and more when shot. The Cylonian is better in a N.A.L.O.G. 80 software critique and Game Merchandising.
- L.I.L. MEN FROM MARS** (Atari only) Price: \$19.95 Cassette \$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.
- ALVIN** (Atari only) Price: \$17.95 Cassette \$21.95 Diskette
ALVIN is a great arcade game. You are commanding a highly maneuverable ship seeking to destroy evil aliens. You are attempting to launch their cities while at the same time trying to avoid their defenses (the MISSILE COMMAND) in reverse? Also, your radar has been damaged so that you can only see dimensions. This would normally be another game concept that you also have to contend with high flying enemy aircraft. As long as you are above these aircraft you have the advantage and are safe. However, high level bombing takes considerable skill. Therefore to achieve your goal the best strategy is to swoop down into a bombing run while the enemy craft is out of range, and quickly retreat to the skies. A fun game. Requires 16K.
- ESCAPE FROM VOLANTUM** (Atari only) Price: \$15.95 Cassette \$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTUM! To escape you must maneuver your space ship around obstacles and laser blast the guardian without being eaten. If he is killed with a direct shot (not just a leg tripped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by repeatedly chopping away at it. Other times it is impregnable. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs on 16K.
- ALPHA FIGHTER** (Atari only) Price: \$13.95 Cassette \$17.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; in the UFO's get to the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.
- THE RINGS OF THE EMPIRE** (Atari only) Price: \$14.95 Cassette \$18.95 Diskette
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.
- INTRUDER ALERT** (Atari only) Price: \$15.95 Cassette \$19.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Intruder" having just stolen its plans. The odds have become very difficult and you must find and destroy the intruder. You must apply and execute your plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.
- MIDWAY** (Atari 32K only) Price: \$14.95 Cassette \$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs on 16K.
- GOLF PRO** (Atari only) Price: \$17.95 Cassette \$21.95 Diskette
Both realism and beautiful graphics are joined together in GOLF PRO to produce the best golf simulation available. To really appreciate this game, you should have an TV with hi-res video so you can see the green of the grass, the blur of the fairway, and the white swirl of the traps. You see all of this, your user set up in the sand trap, and put on the green just as would be done on the course. Show off the Atari in your friends with GOLF PRO. Requires 16K and one joystick.
- GAMES PACK I** (Available for all computers) Price: \$14.95 Cassette \$18.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSESHOE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually stored by a conventional name. This criteria is worth the price just for the DYNACOMP version of BLACKJACK.
- GAMES PACK II** (Available for all computers) Price: \$14.95 Cassette \$18.95 Diskette
GAMES PACK II includes the games CRAPSLIGHTS, JOTTO, ACEY-DUCKY! WIF, WUMPHS and others. Also, GAMES PACK I all the games are loaded as new programs and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS. Why pay \$5.95 or more per program when you can buy a DYNACOMP collection for just \$14.95?
- MOON PROBE** (Available for all computers) Price: \$12.95 Cassette \$16.95 Diskette
This is an extremely challenging "space lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and navigation of your craft plus direct the rate of descent and approach angle. Runs on 16K Atari.
- SPACE TRAP** (Atari only, 16K) Price: \$14.95 Cassette \$18.95 Diskette
This galactic "shoot 'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.
- SUPER SUB CHASE** (Atari only) Price: \$19.95 Cassette \$23.95 Diskette
SPEEDY SUB CHASE is a search and destroy mission. Set your course and keep an eye on all the computers currently supported by DYNACOMP. Because our increasing and developing costs were so low, DYNACOMP offers these programs two in a diskette for only \$19.95 diskette, \$23.95 disk. If you like our games, then this is a bargain you can't pass up.

TWO PLAYER GAMES

- TWO PLAYER GAMES** (Available for all computers; 32K disk diskette only)
DYNACOMP has acquired the distribution rights to the best of Xerox's two player games. These two-player games were originally developed for the North Star computer, but have since been converted to use on all of our computers currently supported by DYNACOMP. Because our increasing and developing costs were so low, DYNACOMP offers these programs two in a diskette for only \$19.95 diskette, \$23.95 disk. If you like our games, then this is a bargain you can't pass up.
- #1 PANZER and BLITZKRIEG**
PANZER (Date: 23 Nov. 1943 Place: Several miles west of Kiev, Russia. The Russians have just liberated Kiev and are moving quickly to reach the German forces which are preparing for a last desperate attempt to halt the Russian advance.) BLITZKRIEG (Date: 1940 Place: Northern France. The German blitzkrieg in the east was complete. Germany had turned its attention to the west. France. The German forces have penetrated the Ardennes and Meuse. The horizon of Dunkirk, the defense of the Aachen-Somme position, and the final collapse of the French armies in the south has all passed. And now the drive on Paris.)
- #2 STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE**
Date: Fourteenth Century. Place: Aarched plain of Shovel. The first all-out battle on the planet Shovel which will match equal forces of Terran and alien units. The outcome will set the course of the conflict; if the planet of Shovel is a key position in the solar war.
- INVASION OF THE MUD PEOPLE**
A Persian army, battalion has been dispatched to a remote village area to investigate the destruction of many local dwellings and the disappearance of most of the villagers. Live-experiments have reported strange creatures appearing from scores of slums, mud holes which have clogged, being formed across the terrain.
- #3 FALL OF THE THIRD REICH and ARMORCAR**
Date: March, 1945. Place: Remagen, Germany. The allies under General Eisenhower had reached the Rhine. The Germans had failed in destroying the Ludendorff railroad bridge, allowing soviet allied divisions to cross before it finally collapsed on March 17 and on the allies began their drive on Berlin.
- ARMORCAR**
Date: Feb. 1944. Place: Nivak. Enroute A German front-line unit is held prepared for radio equipment and mobile supplies. A rebel company of armored cars must reach them through partisan-infested territory.
- #4 MOUNT SURIBACHI and MIDDLE EARTH**
MOUNT SURIBACHI (Date: 1945. Place: Iwo-Jima. The Japanese opened fire from Mount Suribachi as the marines landed on the peach-leaf-shaped island. Gunfire from the hill could cover the entire island. Thus it was a critical objective. If the Americans were to capture and utilize the all-important airfield, Mount Suribachi proved to be one of the most strongly defended positions in the Japanese theater of war.)
- MIDDLE EARTH**
Date: 1997. Place: MIDDLE EARTH. Through a maze of tunnels, crevices, and rocky passageways discovered leading from an inactive volcano in southern America, a team of DYNACOMP "recon" men have undertaken a mission to an uncharted frontier: the center of the Earth. This journey promises a period of several months, but the mission has arrived at the Earth's core: a land of flames, steam vents, and unforgiving vegetation. And then the creatures of MIDDLE EARTH appeared - uncontrolled by the most frightening horror stories created by man.

MISCELLANEOUS

- CRYSTALS** (Atari only) Price: \$13.95 Cassette \$18.95 Diskette
A unique algorithm randomly produces learning graphs displays each with each color, such as the patterns are built. No run patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs on 16K.
- NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY**
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection. Price: \$9.95 each, \$8.95 each (6 or more). The complete collection may be purchased for \$159.95.
- DISKETTES** (soft sector, ten sector) Price: \$39.95 20 Diskettes
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

BUSINESS AND UTILITIES

- PORTFOLIO MANAGEMENT (Apple only)** Price: \$69.95 Two Diskettes
The PORTFOLIO MANAGEMENT package was written by a stock broker to help manage portfolios for individual customers. With this program data files can be easily created and kept up to date. A variety of reports can be generated for clients which are attractively and professionally laid out. The user may define his own investment categories.
- PORTFOLIO MANAGEMENT** is a top quality, professional tool which will not only provide you with new convenience but will also serve to enhance your appearance as an efficient and up to date advisor to your clients. Comes complete on two diskettes along with a 30 page instruction manual.
- PERSONAL FINANCE SYSTEM (Available for all computers)** Price: \$39.95 Diskette
PFS is a convenient system composed of five different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payer, and display information on expenditures by any of 26 user defined codes by month or by payer. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will allow you to add or delete up to 1000 records per day by making a simple check change to the program. You can re-visit checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations! Contains high speed machine language code. PFS has been demonstrated on network (CBS) TV.
- FAMILY BUDGET (Apple and Atari only)** Price: \$34.95 Diskette
FAMILY BUDGET is a general purpose record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries by any of 21 different expense accounts as well as payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and expensive!) subject.
- TEXT MASTER (Apple 32K, diskette only)** Price: \$49.95 Diskette
TEXT MASTER is a general purpose text editor for the Apple II computer. It features powerful English-oriented commands which permit the complete manipulation of textual information. The information treated may be correspondence, computer programs, data to be used by other programs, and more. TEXT MASTER also interfaces with any printer connected to the Apple II. The maximum system requirements are 32K of RAM, AppleSoft on ROM at least one disk, and a lower case adapter. TEXT MASTER can process any length file segment by segment. Thus it is possible to process files as large as a diskette. Comes complete with an efficient 16 page manual. TEXT MASTER is equivalent in capability to many word processing systems costing 3 or more in price. The commands available in TEXT MASTER are: COLLECT LIST, SECURE, NONUM, INSERT, MERGE, STOP, RENAME, DELETE, SAVE, COPY, FREE, REPLACE, WAIT, MOVE, LENGTH, LIST, RESAVE, CLEAR, AUTO, RETRY, APPEND SET, MANUAL CHANGE, SCRATCH, SHOW CATALOG, MODIFY, COMPARE, NUM DISPLAY, HELP.
- INTELINK (Atari only)** Price: \$49.95 Diskette
This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex terminal. It is a menu of operations you may execute to transfer a file to the SOURCE (MicroVirt) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communication session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a very smart terminal. Even Atari BASIC programs may be updated. Further, a command file may be built off-line and used later as a controlling input for a time-share system. Thus, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed, batch processing. All this adds up to saving both connect time and your time.
- PAYFIVE (Apple II plus diskette, two drives required)** Price: \$149.95
This is the most flexible payroll package available with extraordinarily good human engineering. The program PAYFIVE prints checks and completes the required federal, state and local forms for up to 148 employees. The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and the pay may also be used in any combination. PAYFIVE includes many other features and comes extremely well documented with a 300 page manual. The manual may be purchased separately for \$30 and that payment later applied to the software purchase.
- SHOPPING LIST (Atari only)** Price: \$12.95 Cassette \$16.95 Diskette
SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with TK8.
- TAX OPTIMIZER (Available for all computers)** Price: \$59.95 Diskette
The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides convenient methods for analyzing various income tax strategies. The program is designed to provide a quick and easy entry. Income taxes are computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in 16 states and comes complete with the current tax tables in its data file. TAX OPTIMIZER is tax deductible!
- STOCK MASTER STOCK PLOT (Apple 48K)** Price: \$59.95 Diskette
This is a full-featured stock portfolio management and analysis system. Ten years of records on up to thirty stocks may be maintained. You may record prices, revenue, earnings, share, ROE, quarterly earnings and dividends, transactions, long short term gains, P/E, indexes (DJI, S & P, NASDAQ) and MORE! You may plot (HIRE) 50 the price history of any stock against any other stock, or the index. Portfolio value may be evaluated at any time. Comes complete with superbly written instructions and sample files on a second diskette.
- TURNKEY AND MENU (Atari only)** Price: \$17.95 Diskette
TURNKEY is a utility program which allows you to create automatic answer diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.
- STOCKAID (Atari only)** Price: \$29.95 Diskette
STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with overviews. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a simple diskette storage capability of 259 days x 16 ticks. Included are stock dividend and split adjustment capabilities. A very professional package!
- NYINDEX (Atari only)** Price: \$19.95 Diskette
NYINDEX is a comprehensive software package for storing, printing and plotting New York Stock Exchange information. The daily data treated includes the composite index, advances, declines, new highs and new lows. Graphical displays include the volume plus the index oscillation, cumulative advances declines and moving averages. Data entry and editing is easy. The diskette includes more than two years of daily data. NYINDEX is an excellent companion to STOCKAID.
- PLAYER-MISSILE GRAPHICS TABLET (Atari only)** Price: \$19.95 Diskette
The PLAYER-MISSILE GRAPHICS TABLET was designed to take the drudgery out of developing four color displays in GRAPHICS MODE 'P'. No longer will you have to read the locations of those tiny blinks on your graph paper and calculate PLT's and DRABT's. With PMS you will be able to do each, develop colorful graphic displays with your joystick and save them on diskette for later use!
- LIFE CYCLE ANALYSIS AND DEPRECIATION (Apple diskette only)** Price: \$39.95 Diskette
This software package creates a data file of business expenses for the present which can later be used to calculate and display a variety of reports. You may project annual costs, find equipment worth, create depreciation schedules and analyze tax deduction strategies. The program conforms to standards set by federal agencies. This is an invaluable package for any businessman who has invested in equipment. LIFE CYCLE ANALYSIS features an easy to use data file creation section and provides formatted hardcopy reports for use in presentations or for tax record keeping purposes. When used for generating tax information, this package is tax deductible! Requires 48K. Comes on two diskettes.
- MICROMAGIC (Apple diskette only)** Price: \$39.95 Diskette
The emphasis of this program is clearly the MAGIC: MICROMAGIC offers outstanding versatility in its ability to function as a stand alone entertainment package or as a utility program in creating stunning animated graphics for use in other programs. The secret lies in MICROMAGIC's special on screen graphics editor. You control a graphics cursor directly from the keyboard, creating high resolution images using any of 16 available colors. You may do with a picture it can be saved on disk with a single key command. Up to 24 images can be saved as "frames" of an movie, and then played back at high speed to create short animated sequences. The effects are truly stunning!
- This package comes complete with demonstration programs that even non-verse users can get immediate results. No programming skills are necessary to use MICROMAGIC. If you have been frustrated by the effort required to create graphics images with your computer, MICROMAGIC will delight you!
- SHAP MAGICIAN (Apple II, 48K, diskette only)** Price: \$29.95
As fast as a utility for painlessly creating graphics shapes for the Apple. Create, edit and save up to 30 shapes which can then be used to develop arcade games or to simply enhance your programs. Add that professional touch!

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please include payment with order and include the appropriate computer information. If paying by VISA or MasterCard, include all numbers on card. Purchase orders accepted.

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8 1/2" CP M Disk
Add \$2.50 to the listed diskette price for each 8 1/2" floppy disk (IBM soft sector) CP M format. Programs run under Microsoft BASIC or BASIC-CP.

5 1/4" CP M Disk
All software available on 5 1/4" CP M disks is also available on 5 1/4" disks. North Star, Osborne, Superbrain and NEC format.

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New York State residents please add 7% sales tax.

EDUCATION

- HODGE PODGE (Apple 48K only)** Price: \$14.95 Cassette \$18.95 Diskette
Let HODGE PODGE be your child's teacher. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the keyboard. The program's graphics, color and sound are a delight for children from ages 1 to 7. HODGE PODGE is a fun, understanding teaching device which brings a new dimension to the use of computers in education. See the excellent reviews of this very popular program in INFOWORLD and SOFTALK.
- TEACHER'S AIDE (Atari and PET only)** Price: \$13.95 Cassette \$17.95 Diskette
TEACHER'S AIDE consists of three basic modules contained in one program. The first module provides addition and subtraction exercises of varying levels of difficulty. The second module consists of multiple choice problems in which the student may be required to answer questions based on the subtopic answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems, one particularly new feature of the division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate the procedure by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill, but rather a learning experience.

STATISTICS AND ENGINEERING

- DIGITAL FILTER (Available for all computers)** Price: \$39.95 Cassette \$43.95 Diskette
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function and choose from a menu of filter functions. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may, optionally also be smoothed with a Hamming function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.
- DATA SMOOTHER (Not available for Atari)** Price: \$19.95 Cassette \$23.95 Diskette
This special data smoothing program may be used to rapidly derive useful information from noisy, historical and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed data and second derivative calculation. Also included is automatic plotting of the input data and smoothed data.
- FOURIER ANALYZER (Available for all computers)** Price: \$19.95 Cassette \$23.95 Diskette
This program examines the frequency spectra of sampled duration signals. The program performs fast Fourier transform and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.
- TFA (Transfer Function Analyzer)** Price: \$19.95 \$23.95 Diskette
This is a special software package which may be used to evaluate the transfer functions of systems such as both amplifiers and filters by means of guided reports. TFA is a major modification to the program FOURIER ANALYZER and contains an engineering-assisted digital versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and low cost use, TFA is an engineering tool. Available for all computers.
- HARMONIC ANALYZER (Available for all computers)** Price: \$24.95 Cassette \$28.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage as well as data and spectrum plotting. The parameter tuning facility is that the input data need not be equally spaced in order. The original data is stored and a cubic spline interpolation is used to create the data file required by the FFT algorithm.
- FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of \$51.95 (three cassettes) and \$63.95 (three diskettes).**
- REGRESSION I (Available for all computers)** Price: \$19.95 Cassette \$23.95 Diskette
REGRESSION I is a statistical tool which requires virtually one-dimensional linear regression. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data entry and residual plotting; a statistical analysis of g standard deviations, correlation, coefficient, etc. and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is currently the comprehensive program in any data analysis software library.
- REGRESSION II (Available for all computers)** Price: \$19.95 Cassette \$23.95 Diskette
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly non-linearly) in the fitting function. The user simply inserts the functional form, including the parameters (A1, A2, etc.) or one or more BASIC statements. Data, results and residuals may be manipulated and plotted as with REGRESSION I. Use REGRESSION I if you are completing the course.
- MULTILINEAR REGRESSION (MLR) (Available for all computers)** Price: \$24.95 Cassette \$28.95 Diskette
MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data sets is limited only by the available memory.
- REGRESSION I II and MULTILINEAR REGRESSION may be purchased together for \$51.95 (three cassettes) or \$63.95 (three diskettes).**
- ANOVA (Not available on Atari cassette or for PET CBM)** Price: \$19.95 Cassette \$43.95 Diskette
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and use the parameters that are transferred by the BASIC program. A description of a subroutine to perform complex multiplication and division will be given as an example.

In PET's BASIC implementation there is a line scanner at address \$70 called CHRGET. This subroutine picks up the next character in the line being executed. An alternate entry point at \$76 called CHRGOT retrieves the last character that was accessed on the BASIC line. To use this subroutine one simply calls with a jump subroutine:

```
JSR CHRGET
```

or

```
JSR CHRGOT
```

where the character accessed is returned in the 6502 accumulator. In addition, the carry flag is cleared if the accessed character is an ASCII number 0-9. Otherwise, the carry flag is set. All blanks are ignored. If the character is a colon or null the Z-flag is set; otherwise it is clear. Should it be necessary to change the line scan address, this can be done by putting the new address in TXTPTR, \$77 and \$78, in the standard 6502 LO,HI byte format. The line scanner subroutine is reproduced in Program 1 for reference.

The significance of this subroutine can be fully appreciated when one realizes that the line scanner is left positioned at the first character beyond the SYS call whenever the machine language subroutine is started. This first character would correspond to the comma after the 826 in line 100. Therefore, the user does not need to know the machine location of the calling statement in the program because the CHRGET subroutine contains that information automatically.

An essential requirement for using the line scan subroutine to fetch input information is that it be left in a position ready for BASIC to continue processing. This almost happens naturally, but is no accident. The scanning of a line, say line 100, is done to gather all parameters on that line that apply to a particular subroutine. When the subroutine is finished, BASIC will assume that the program has obtained all characters up to, and including, the last two, and the line scanner will then be positioned on the character following the two. This character should be one of two possible characters. If the SYS was the last statement on the line, the terminating character will be a null (\$00). This character signals the end of a BASIC line and is present whether the SYS was entered from a running program or from the keyboard in the immediate mode.

If the SYS statement is not the last statement on the line, then the statements will be separated by a colon, and this character will be the one that is encountered. Returning to BASIC with the line

scanner on either of these characters will allow a normal continuation of BASIC processing.

If the line scanner is left positioned on any other characters, then BASIC will respond with SYNTAX ERROR. If the subroutine needs to be terminated for any reason before encountering these characters, then it must call CHRGET to "clean-up" before returning to BASIC. It is as important to BASIC to leave the line scanner in the right place as it is to leave the 6502 stack properly positioned for a machine language program.

Using LOOKUP

The second subroutine needed is one to fetch the addresses of the variables used such as A and B in line 200. This subroutine, called LOOKUP, is located at \$CF6D. This subroutine will activate the line scanner, find the variable, determine its address, and leave the address in zero page memory.

After calling this utility the address of the variable is located in memory locations \$44 and \$45 with the variable name in \$42 and \$43. The format for the variable name is the standard BASIC interpreter format listed in Table 1 for reference. If the variable was floating point, address \$8 will be set to \$00; if integer, \$8 will be set to \$80. If the variable was numerical (integer or floating), \$7 will be set to \$00 and if string \$7 will be set to \$FF. The address returned in \$44 and \$45 is the actual location in memory where the binary representation of the number exists. If the result was string, however, the address is the location where the string descriptor (3-byte sequence of length, address LO, address HI) can be found.

Table 1. PET Variable Name Format

	\$42	\$43
FLOATING	msb clr	msb clr
INTEGER	msb set	msb set
STRING	msb clr	msb set

To use this utility, just position the line scanner to the first character of the variable name (in ASCII) and execute a jump subroutine to \$CF6D. When the subroutine returns, the line scanner will be positioned to a terminating character (comma, colon, or null). The calling subroutine may then check \$7 and \$8 to determine the type of result before proceeding. The floating accumulator is altered if the variable is subscripted. A summary of the operational features is given in Figure 1.

The third subroutine needed is an expression evaluator. PET BASIC has one located at \$CCA7, EXEVAL. This subroutine is a very powerful and versatile one. Its purpose is to evaluate any expression that is used as an argument. The subroutine retrieves variables, converts numbers, performs function evaluations, and any operations located between the separators (commas) in the calling

statement.

This utility operates in much the same way as the LOOKUP subroutine. The line scanner is used to fetch the expression from the input line, is again left on the terminating character (comma, colon, or null), and will therefore be ready for processing the next piece of information when returning.

If the user's machine language subroutine scans each argument for special characters, such as "\$" for hex input, before evaluating the expression, then the line scanner will be left one address beyond the correct starting position. An alternate entry point at \$CC9F will take care of this situation by subtracting one from the line scanner address before executing the evaluate routine. To use this subroutine, just jump subroutine to \$CCA7, and the utility does the rest.

Since this subroutine can evaluate any expression that can be used on the right hand side of an equal sign, it will evaluate both strings and numerics. While this article is primarily concerned with numerical work, a brief description of both will be presented.

For numerical expressions the result is located in the floating accumulator, FACC, in floating binary format. The FACC is located at \$5E to \$63. If the desired result is integer, a conversion must be performed. The result can be stored in a variable, at a temporary memory location, transferred to the alternate floating accumulator AFAC at \$66 to \$6B, or left in the FACC for further processing. The flag at \$7 can be tested to determine the type of result (numeric or string).

If the result is string, then the FACC is not used. The string result is placed in upper memory with the string variables. A table is built in zero page starting at \$16 containing three bytes of information for each result. The first byte is the string's length, and the next two are the string's address in high memory. The format, of course, is the standard 6502 "LO,HI" byte format. The table may contain two such string descriptors. To determine which one was the last result, another two bytes are provided at \$14 and \$15, which are the address of the string descriptor. The table is large enough for only two descriptors without overflowing. At this point an example is in order to show how it works.

Suppose that an evaluation of the string "ABC" + "DEF" is accomplished. The result is obviously a string and can be verified by testing location \$7 for a value of \$FF. Upon examination of \$14 we find a value of \$16, and \$15 contains \$00. This means that the string descriptor starts in \$16 with the length and continues at \$17 and \$18 with the address. If this intermediate result is not cleared, then the next temporary result will leave \$14, \$15

and \$19, \$00 respectively, meaning that the length is in \$19, and the address is in \$20, \$21. Once the string result is used and stored or discarded, it is necessary that the pointer at \$14 be reset. One caution: the string evaluation can proceed to calculate additional intermediate results, but table space is not provided for the temporary descriptors. The resulting descriptors will be stored on top of the indirect index registers and will ultimately cause problems. If a return to BASIC is attempted with three or more string temporaries pending, then a "FORMULA TOO COMPLEX ERROR" will result. All string temporaries should be cleared before returning to BASIC. APPENDIX B summarizes the operation of the expression evaluator.

The fourth utility needed is actually a set of subroutines to transfer numerical results into and out of the floating accumulators and perform the arithmetic operations. Their names and entry points are listed in Table 2. These subroutines all have simple operating instructions. The STFACC subroutine causes the FACC contents to be stored into memory. The location in memory is specified by the contents of the 6502 Y and X registers with the most significant byte in Y. The LDFACC and LDAFAC subroutines cause the contents of memory to be loaded into the FACC and AFAC respectively. Here the address of memory is in the Y and A registers with the Y register again being the most significant. The last subroutine to move data causes the contents of the FACC to be transferred to the AFAC. To execute these subroutines, just load X, Y, and A as appropriate and execute a JSR to the subroutine's address.

Table 2. Some Useful PET Subroutines

NAME	ADDRESS	FUNCTION
STFACC	\$DAE3	STORE FACC INTO MEMORY
LDFACC	\$DAAE	LOAD FACC FROM MEMORY
LDAFAC	\$D998	LOAD AFAC FROM MEMORY
FACALT	\$DB18	TRANSFER FACC TO AFAC
FADD	\$D773	ADD MEMORY TO FACC
FSUB	\$D733	SUBTRACT FACC FROM MEMORY
FMUL	\$D934	MULTIPLY FACC BY MEMORY
FDIV	\$DA1B	DIVIDE MEMORY BY FACC
FDIV1	\$DA20	DIVIDE FACC BY MEMORY WITHOUT SIGN

The remaining subroutines in Table 2 are the dyadic arithmetic subroutines. There are several entry points to each subroutine that can be used, but only a few will be discussed here. The basic function of these subroutines is to perform the desired arithmetic operation in floating point binary format between the FACC and memory. The LDFACC or LDAFAC is part of each subroutine so the address of the number in memory is loaded into Y,A before each call. The FACC is

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Table 3: ROM Entry Points

APPLE-SOFT In ROM	Original (2.0) BASIC	Upgrade (3.0) BASIC	4.0 (Disk) BASIC	LABEL or Description
\$B1	\$C2	\$70	\$70	CHRGET
\$B7	\$C8	\$76	\$76	CHRGOT
\$B8-B9	\$C9-CA	\$77-78	\$77-78	TXTPTR
\$DFE3	\$CFD7	\$CF6D	\$C12B	LOOKUP
\$83-84	\$96-97	\$44-45	\$44-45	Address of current variable
\$81-82	\$94-95	\$42-43	\$42-43	Name of current variable
\$12	\$5F	\$08	\$08	Variable type
\$11	\$5E	\$07	\$07	Variable type
\$DD7B	\$CCB8	\$CCA7	\$BDA0	EXEVAL
\$9D-A2	\$B0-B5	\$5E-63	\$5E-63	FACC (Floating Acc. #1)
\$A5-AB	\$B8-BD	\$66-6B	\$66-6B	AFAC (Acc. #2)
\$55-5B	\$68-6F	\$16-1C	\$16-1C	String table
\$53-54	\$66-67	\$14-15	\$14-15	Last string
\$EB1E	\$DAAB	\$DAE3	\$CDOD	STFACC
\$EAF9	\$DA74	\$DAAE	\$CCD8	LDFACC
—	\$D95E	\$D998	\$CBC2	LDAFAC
\$EB63	—	\$DB18	\$CD42	FACALT
\$E7B9	\$D73F	\$D773	\$C99D	FADD
\$E7A7	\$D728	\$D733	\$C986	FSUB
\$E982	\$D900	\$D934	\$CB5E	FMUL
\$EA55	\$D9E4	\$DA1B	\$CC45	\$FDIV
\$EA60	—	\$DA20	\$CC4A	FDIVI

Program 1. PET Line Scan Subroutine

```

0070 E677   CHRGET  INC  $77
0072 D002           BNE  $76
0074 E678           INC  $78
0076 AD0704 CHRGT   LDA  $0407
0079 C93A           CMP  #$3A
007B B00A           BCS  $87
007D C920           CMP  #$20
007F FE0F           BEQ  $70
0081 38             SEC
0082 E930           SBC  #$30
0084 38             SEC
0085 E9D0           SBC  #$D0
0087 60             RTS

```

added to or subtracted from the number in memory in the first two, and the number in memory is multiplied by or divided by the FACC in the latter two cases. The alternate entry point for FDIV1 causes the FACC to be divided by memory; however, the sign of the result will always be positive due to the way the FACC is loaded. The sign can be manipulated separately if necessary.

Figure 1. Variable Fetch Subroutine Summary

1. Uses the line scanner to obtain input.
2. Starts with CHRGOT (i.e., must begin with the line scanner on the first character of the variable name).
3. Uses the standard PET variable format of ABBB...CDDD where A is an alphabetic character A-Z, B is an alpha-numeric A-Z or 0-9, C is a type symbol \$ of % if appropriate, D is the subscript information if appropriate.
4. Returns with the address in \$44 and \$45.
5. The converted variable name is left in \$42 and \$43.
6. Sets \$7 and \$8 to flag the result type (numeric/string or floating/integer).
7. The FACC is altered if the variable is subscripted.
8. The line scanner is left on the terminating character or "parameter separator" (comma, colon, or null).

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Getting The Most Out Of USR

Charles Brannon, Editorial Assistant

The Atari USR command is very powerful and flexible. Its strength is in *parameter passing*, the ability to directly communicate with a machine language routine using standard variables and arithmetic expressions.

A simple task for the USR command is to merely transfer control from BASIC to machine language:

```
X = USR(1536)
```

This would simulate a JSR (Jump to Sub-Routine) to location 1536, or \$0600. The value returned in X is meaningless here. The machine language routine must begin with a PLA (Pull Accumulator) to "clear" the count byte (discussed later) and, when finished, return to BASIC with a RTS (ReTurn from Subroutine).

The real power of USR, however, is that it can pass a series of 16-bit binary integers. These are specified as a list after the address:

```
X = USR(1536,1,3,5,7)
```

Any arithmetic expression can be used, even variables and functions:

```
X = USR(1536,A*B,ASC("+"))
```

From the machine language program's point of view, where are these numbers stored? How about the stack? The Atari USR command "pushes" the high and low bytes of each number onto the stack, and "tops it off" with a count byte. The count byte is the number of values passed. The machine language program would use PLA to read each byte into the accumulator. For example, a routine to simulate the Atari POSITION command might look like:

```
; A = USR(1536,X,Y)
* = $600
PLA      ;Count byte
PLA      ;MSB of X
STA 86   ;COLGRS + 1
PLA      ;LSB of X
STA 85   ;COLGRS
PLA      ;MSB of Y (zero)
          ;so ignore it
PLA      ;LSB of Y (0-191)
STA 84   ;ROWGRS
RTS      ;Return to BASIC
```

Notice the order of the high byte (MSB) and low byte (LSB) of each argument on the stack. Also, the first argument (X) will be the first value on the stack.

Machine language routines can also work on strings, via the ADR function. ADR(A\$) will return the memory location of the contents of A\$. Using the LEN function, BASIC can tell the "whole story." For example, this routine transfers the contents of any string to any memory location (useful for player/missile graphics, or custom characters). The length of the string should be limited to 255 bytes.

```
A = USR(1536,ADR(X$),LEN(X$),MEM)
* = $0600
ADRL = $CB
ADRH = $CC
DESTL = $CD
DESTH = $CE
PLA      ;Count byte
PLA      ;MSB of address
STA ADRH ;zero page loc.
PLA      ;LSB
STA ADRL
PLA      ;MSB of length
          ;(ignore it)
PLA      ;LENGth
TAY      ;Use it for loop
PLA      ;MSB of destination
          ;address
STA DESTH ;Another z-page loc
PLA      ;LSB
STA DESTL
LOOP LDA (ADRL),Y ;Get byte
      STA (DESTL),Y
      DEY          ;check loop
      BNE LOOP    ;If not 0,
                  ;continue loop
RTS          ;Return to BASIC
```

Going Back To BASIC

How can a routine pass a value back to BASIC? It could save the values in an area of memory and have BASIC PEEK them out. If only one value (one 16-bit integer) needs to be returned, you can use locations \$D4-\$D5 (212,213). Store the result using the standard 6502 low/high byte format. The destination variable (X in X = USR(1536), Z in Z = USR(1536,3,2), or any variable) will take on the value placed in \$D4-\$D5 (labeled FR0). So, to quickly add two numbers, you could use: A = USR(1536,1,2) (any two arguments). "A" will contain the answer.

```
FR0 = $D4      ;Low byte of return value
* = $0600
PLA          ;Throw away count
```

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```

PLA
STA FIRSTH
PLA
STA FIRSTL
PLA
STA SECONDH
PLA
STA SECONDL
CLC
LDA FIRSTL
ADC SECONDL
STA FR0
LDA FIRSTH
ADC SECONDH
STA FR0 + 1
RTS

```

In many programs, we want to make sure that the proper number of arguments has been sent. For example, if we have a routine that plays a musical tone on the internal speaker for a specified duration,

A = USR(1536,note,duration)

we may want to only accept exactly two values. We can use the first byte, the count byte, to monitor this. If the count is wrong, we must pull all the arguments off the stack and return to BASIC. We could even ring the bell and print an error message.

* = \$0600

```

PLA
CMP #2
BNE ERROR
.
.
.

```

(Routine continues normally)

RTS

```

ERROR ;The error-handling
      ;routine
      ;Count is in A
      ;If zero, don't pull
ERRLOOP ;ERROR loop
PLA
PLA ;Pop an argument
DEX ;Continue
BNE ERRLOOP ;Until X = 0
NOPULL
LDA #253 ;BELL character
JSR $F6A4 ;Print it
LDA #03 ;ERROR - 3
          ;(VALUE ERROR)
STA $B9 ;Error number
JMP $B940 ;Print error

```

Machine language programmers have a friend in USR. If you have an Assembler, type in the examples. And when BASIC bogs you down, remember this motto: Use USR!

C

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Review:

VisiCalc Home And Office Companion

Terry Nelson
Camas Valley, OR

The paragraph began, "If your computer can run the VisiCalc program, you can enter and use any of these 50 models immediately."

I thought: "All I need is another book of useless, simplistic cookbook routines that have no application to real life!"

My past experiences with books of "popular routines in ABC BASIC" were far from satisfying. Their dusty covers are a constant reminder to me of how not to spend my money. I soon discovered, however, that the *VisiCalc Home and Office Companion* (henceforth VHOC) was not quite what I had expected, both in the type of applications addressed and in their usefulness to my business.

The Approach

For each of the 50 applications a VisiCalc spread sheet is shown, along with a listing of the VisiCalc instructions which will produce it. For instance, in the "Grade Book" model, a spread sheet is shown formatted to resemble a typical grade book. Along the left column are the students' names, and to the right are columns titled "SCORE FOR TEST 1, SCORE FOR TEST 2," etc. On the far right is a column which reports each student's test average. The last row of the page displays the class average for each of the tests. If you boot VisiCalc and type in the listing, the blank worksheet will be formatted to resemble this grade book. Once you have typed the listing in, you just change the names and scores to your class data, save the file, and the grade book is ready to use. Each time you want to look at it you boot VisiCalc, enter the storage command: /SL GRADE BOOK, and the book is displayed on the screen. Since the book is a VisiCalc file, any time you enter a new name or change a score or put in a new column, you do it through VisiCalc.

The listing for each model is easy to follow. VisiCalc commands and data are entered by column; therefore, column A is entered first, then column B, etc. The commands are mixed with the data, so care must be taken to follow the listing

exactly. For instance, portions of the listing for the D column in "Sales Commission Register" look like this:

```
>D 1:"MISSIONS
>D 4:"      (SALES
>D 6:/FL"  TO
>D 7:1
>D 8:3001
.....
>D29:@SUM(D23...D27)
```

The Selection

The VHOC contains a number of useful models which enable the user to quickly set up meaningful, attractive VisiCalc files. The models are organized into seven categories: loans and investments, general business, inventory control, advertising and sales, personnel and departments, personal finance, and household aids. I was pleasantly surprised to find the majority of the models devoted to business and finance. It's hard for me to get excited about recipe conversion programs, tire rotation reminders and other so-called household computer applications. There are certainly home applications for computers, but they're a bit more substantive than these, I hope. Of the three models presented in the household aids section, "Events Scheduling" is trivial. "Paint a Room" is too complicated for a simple room painting job.

Out of the 50 models presented, about 20 of them are generally helpful. These make effective use of VisiCalc's features. The others either tend to be directed to a small audience or are more trouble to set up than they are worth in terms of the jobs they perform. "Business Startup Worksheet" might be helpful to someone who regularly starts businesses, but if and when I ever start another business I won't spend an hour typing in a model when I can jot down the same expense categories and total them in 15 minutes. Similarly, I'm not interested in "Travel Log." My little auto record book in the glove compartment keeps sufficient records of my trips without my having to type in all that information again at the computer just to get it neatly categorized on a printout.

I will probably use several of the better models in my own business. "Professional Service Fee Analysis" is very helpful for setting reasonable fee rates for your own consulting business. The "Sales Commission Register" elegantly calculates sales commissions on a sliding scale and keeps a running year-to-date tally on both commissions and draws. If you've been wondering what your net worth is, "Net Worth Statement" will remind you of the important assets and liabilities to consider and then assemble them into a convenient report. There are stock and bond portfolios, a rental property evaluator, a cash flow analyzer and various financial

schedules for retail and manufacturing businesses. Basic accounts receivable and payroll and inventory control models are presented as well as several project schedules.

A word of caution is appropriate here, I think. If I were in the market for a bookkeeping system, I would look for one with as little damage potential as possible. All of these models fail in this regard since the systems themselves can be easily modified by the same VisiCalc commands that are being used to update data. In conventional computer bookkeeping systems, the only way the operator can mess the results up is by entering erroneous numbers. In a VisiCalc based system, a few simple one-button commands can wipe out entire columns of data and programmed commands. Not only that, but a few more one-button commands will wipe out the original file! These are serious limitations. Office environment pressures are often intense, and, if careful concentration must be maintained to operate a system, there will come a day when it's not maintained and the results can be disastrous. If you plan to use any of these models for bookkeeping, train the operator carefully, make periodic file printouts, hide a backup disk for your own peace of mind and provide the operator with a library atmosphere to work in.

The documentation supplied with each application, in general, is sufficient to explain ambiguous data titles and operation procedures; however, the VHOC is not a business or investment primer. The "Mini Accounts Receivable" model is a workable ledger, but don't expect to learn bookkeeping procedures for accounts receivable from the half-page of documentation given with it.

The majority of the models presented in the VHOC are useful and practical helps for investment analysis and business planning. Every VisiCalc user could probably apply at least two or three of these. The models themselves are excellent examples of how to format the VisiCalc worksheet to print professional looking expense reports and balance sheets. With careful consideration of the limitations inherent in the VisiCalc "operating system," several of these models can be used effectively for bookkeeping. The authors have effectively shown how to use VisiCalc in applications for which I never would have considered VisiCalc. If none of the models had been useful to me, the book would still have been a valuable purchase for that education alone.

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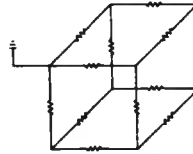
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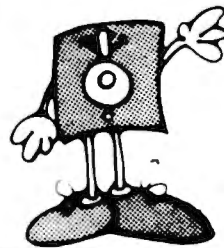
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Review:

Speech Synthesizers For Atari And Apple

Charles Brannon, Editorial Assistant
Tom R. Halfhill, Features Editor

Let's be honest. How many of us have watched *Star Trek* on TV without wishing that *our* computers could talk, too?

Synthesized speech has been around for a few years now, but has cost hundreds of dollars, even on microcomputers. That's why two new speech products for the Atari and Apple have stirred so much interest — their quality sets a new high, their prices a new low.

The Alien Group's new Voice Box ranges from \$139 to \$215, while Don't Ask Computer Software's revolutionary synthesizer on a disk — *Software Automatic Mouth (S.A.M.)* — checks in for even less at \$59.95 (Atari version) and \$124.95 (Apple version). Both are capable of startlingly human-like speech.

The two products approach the problems of speech synthesis in quite different ways, however. The Voice Box is a plug-in "little black box" supported by machine language programs that allow you to create and store dictionaries of frequently used words. *S.A.M.*, however, is entirely software-based, using no hardware at all (except for a simple digital-to-analog converter and amplifier board in the Apple version).

Since both products hit the market at almost the same instant, and since both are for two of the most popular personal computer systems, there's bound to be brisk competition as people line up on each side of the which-is-best fence. Therefore, we'll state up front that neither will be declared the clear-cut victor here; both are good products, and each has its strengths and weaknesses.

Keeping that in mind, we can explore several criteria for evaluating microcomputer-based speech synthesizers. These include speech quality, versatility, and the ease of incorporating speech into user-written programs.

Is It Human?

Speech quality is probably the most important of these. How closely does the synthesized speech simulate human speech? Both *S.A.M.* and the Voice Box speak in recognizable tones which approach human speech very closely. Both voices are male, not because the programmers were sexist, but because female voices are harder to synthesize due to their wider dynamic range.

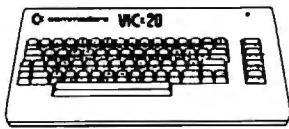
S.A.M. speaks with a definite accent, although the nationality is hard to place. To some it sounds somewhat Scandinavian, perhaps Swedish. Then again, it might be East European. At any rate, *S.A.M.* speaks English as if it were a second language. This is not intended as criticism; on the contrary, *S.A.M.* talks very brightly, enunciating words and syllables with a sense for inflection and accent that is quite amusing. Some syllables sound sort of thick or fuzzy (especially a "th"), as *S.A.M.* struggles to do with silicon chips what a person does with a tongue and palate.

The Voice Box is distinctly different. It speaks in a smoother voice than *S.A.M.*, without as many fuzzy syllables, although it, too, has trouble with certain sounds (a "g" resembles a "d"). However, the Voice Box tends to speak in a monotone when converting plain English to speech, while *S.A.M.* adds its own unique intonation. If the Voice Box speaks with any accent at all, it is "computerese": neutral, unemotional. The nuances are hard to describe, but the results are that the Voice Box tends to offer the more human-like *tones*, while *S.A.M.* tends toward more human-like *speech patterns*.

To put this another way, if you were to have each synthesizer read a plain English sentence over the telephone to a person who was unaware that a computer was speaking, the Voice Box would be quickly identified as a computer, while *S.A.M.* might more easily pass as a human, albeit one with a heavy foreign accent.

Remember, though, we're talking about each product's ability to interpret plain English. English is a formidable challenge because it is a language of as many exceptions as rules. To program a computer with a complete knowledge of English pronunciation — to distinguish between *though*, *bough*, and *tough*, for example, would require massive amounts of time and memory.

Considering this difficulty, *S.A.M.*'s text-to-speech "Reciter" program works surprisingly well. Given ordinary English text, the Reciter will pronounce it, even adding inflection automatically. The Voice Box uses a "dictionary" to memorize words you "teach" it. If it learns many common patterns such as "ch", "ou", etc., it can simulate a simple text-to-speech algorithm. The advantage of



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such a dictionary is that you can be sure it will pronounce a memorized word correctly.

The Atoms Of English

Much higher quality speech is attainable by using *phonemes*. Phonemes are the "atoms of English," as *S.A.M.*'s manual puts it – the basic sounds upon which all spoken words in the language are based. There are only about 50 or 60 of these.

Both products allow you to define words using special combinations of letters, numbers, and symbols representing these phonemes. For instance, *S.A.M.*'s Reciter has a little trouble pronouncing the word "synthesizer." A much more accurate result can be obtained by leaving the Reciter program and entering the word as a series of phonemes: "SIH4NTHAXSAYZER."

The Voice Box uses a similar set of phonemes. An example for the same word would be "SI2N-TH-ES-UH3-AH2-Y-ZER." Hyphens are used with the Voice Box to separate the phonemes. To add inflection to words and syllables, you use slashes – a forward slash (/) raises the pitch and a backward slash (\) lowers it.

Yes, the phonemes look like alphabet soup, but you must use them for tricky English words if you want accurate speech. Each product lets you vary the pitch, speed, and inflection of speech in enough ways so that virtually any English word is pronounceable. Again, *S.A.M.* does this entirely with software, while the Voice Box has an additional tuning knob which lets you adjust the overall speed and pitch of the speech from slow and guttural to fast and squeaky, very much like changing the speed of a tape recorder.

In addition to pitch control, *S.A.M.* also lets you vary overall speed, and independently stress words or syllables with eight levels of emphasis. Such phoneme-based text is hard to program and read, but it produces some incredibly high-quality speech.

The Voice Box's ten pages of documentation include a phoneme list with example words. *S.A.M.*'s 40-page manual has a very helpful 15-page dictionary of common words and their phoneme equivalents pre-defined for you.

Programs That Talk

Both products allow you to incorporate speech into your own BASIC language programs. You can now have talking aliens, game instructions, audible error messages, and practically anything else you can think of.

Both synthesizers require that their machine language programs be loaded along with your BASIC program and called as subroutines. The text to be spoken is contained in a string variable. Software included with the Voice Box provides a

"skeleton" program, complete with the machine language necessary to use the "black box," that you can add to your own program. Alternatively, you could start with the framework program and build your application around it.

S.A.M. "boots" (automatically loads) from a copy-protected diskette. It is simpler to interface with your BASIC program, requiring only one setup statement, and two statements to "call" *S.A.M.* Remember, however, that you must always load the actual *S.A.M.* synthesizer from the special disk. The text-to-speech Reciter program is just as simple to use, but must be accessed from a separate disk you prepare. And since *S.A.M.* is all software, it consumes much more user memory than the Voice Box.

The Atari version of *S.A.M.* blanks out the screen as it speaks, precluding the possibility of synchronizing speech with graphics. However, the original screen image always returns when *S.A.M.* has finished. The Voice Box does not blank the screen, but the software which drives it waits until the speech is done, causing a similar freeze while the box is talking. This can be circumvented with tricky machine language, and documentation is provided to help advanced users access the Voice Box from the machine language level. There also is a way to stop *S.A.M.* from blanking its screen, using a simple POKE, but the result is extremely distorted speech that is impractical for most applications.

Synthetic Shakespeare

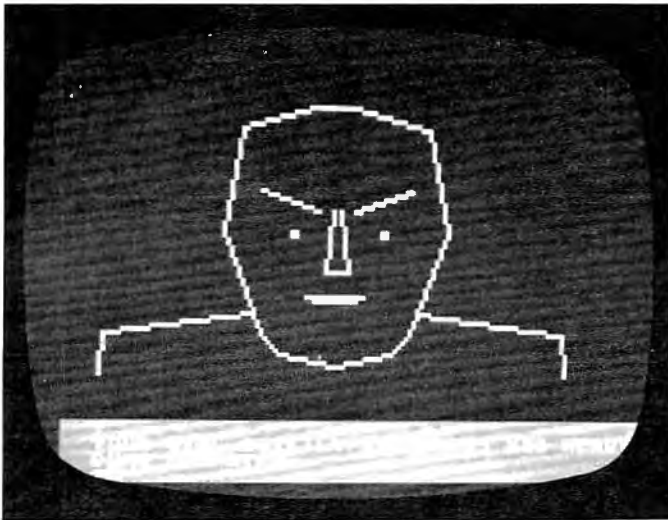
Aside from the machine language driver programs, both products supply various utilities and demos. *S.A.M.* provides a guess-the-number game, a simple talker program, and a set of four famous speeches – from the Gettysburg Address to Hamlet's soliloquy.

The disk or cassette supplied with the Voice Box includes the aforementioned skeleton program; a "help" demo that shows how to program accurate speech; a "talking head" that lip-syncs with the voice; and two versions of a talker program for 16K or 32K RAM machines. The extended 32K version includes a random sentence generator which utters outrageous phrases, not unlike some of the stream-of-consciousness poetry popular in the 50s and 60s. An example: "That desk quickly loves your rabbit if a ham sandwich sits on my big small girl when your rabbit sleeps."

The Voice Box is (at the moment) the only product usable on cassette-based systems, with abridged support software available on cassette.

A Singing Computer?

Although untested, a singing version of the Voice Box is available for the Apple at a higher price.

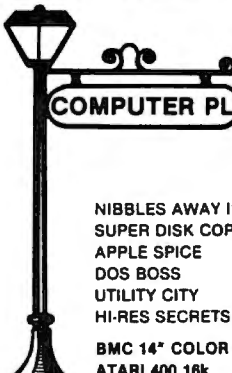


The Voice Box's "Talking Face" program babbles in lip-sync with the random sentence generator.

Speech synthesis is remarkable, but a crooning computer is radical. This represents what is sure to be a fascinating future for microcomputers. Who knows? Within a few years, maybe your computer will be reading **COMPUTE!** to you!

Software Automatic Mouth
 Don't Ask Computer Software
 2265 Westwood Blvd., Suite B-150
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 \$59.95 Atari (Requires 32K)
 \$124.95 Apple (Requires 48K)

Voice Box
 The Alien Group
 27 W. 23rd St.
 New York, NY 10010
 \$169 Atari (Requires 16K or 32K)
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Review:

VIC-20 Cartridge Games (VIC Firmware)

Harvey B. Herman
Associate Editor

In recent months, a flood of new VIC games has hit the market. Two excellent ones from UMI could keep the kids busy for weeks, or at least until better ones come along.

Spiders Of Mars

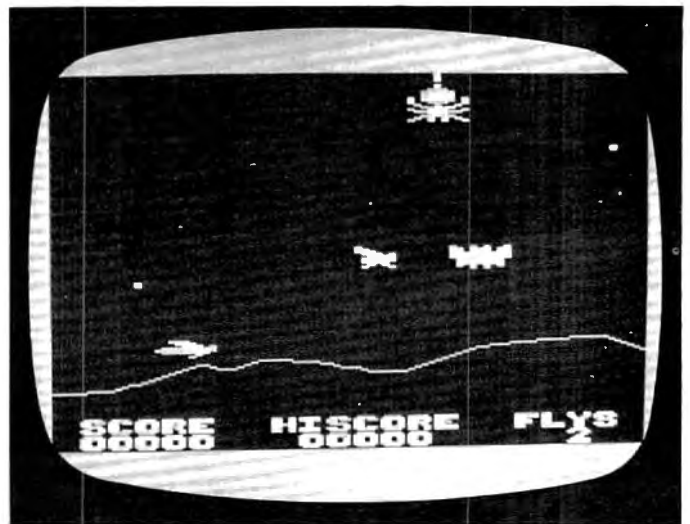
This game is reminiscent of the arcade version of *Defenders*. It begins with a demonstration of the action and allows a choice of skill levels. I like these features in any program. This program also uses color and sound quite effectively, something I look for in all VIC software.

Your character is a fly on the planet Mars. (I normally would not pick a fly as my role model, but this did not detract from the game.) Spiders, hornets, bats, and dragonflies are out to get you, as they would be on Earth. You get three flies (turns) at the start and an extra fly every 10,000 points. The fly is controlled by either the keyboard or a joystick (user's choice).

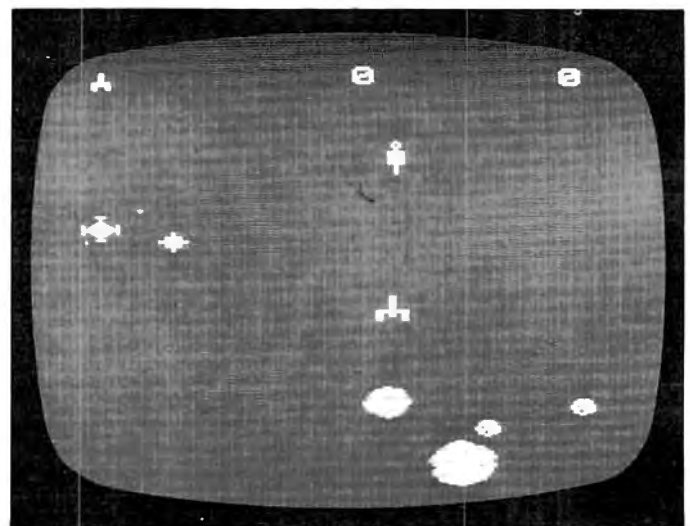
You shoot neutron missiles at the other characters (joystick button or space bar or both), while trying to avoid touching them or being hit by their missiles or smart bombs. Each character hit earns points, and a multiplier is applied at the higher skill levels. When you clear the screen of opponents, the background colors change and the difficulty level increases. Current background colors change and the difficulty level increases. Current score and previous high are displayed continuously. However, during the game the current level of difficulty is not shown.

Let me offer a few hints:

1. My second son believes you can fire faster with the space bar than with the joystick button. He sometimes collaborates with one of his friends, one firing with the bar and the other controlling with the joystick, to rack up some really good scores.
2. Watch out for the bats at the highest skill levels; they get very nasty.
3. Stay away from the top and bottom of the display. Spiders randomly descend from the sky, and fallen ones shoot webs up from the ground.
4. Use the pause button if you develop an acute case of space wrist.



Insect-like aliens on the attack in Spiders Of Mars.

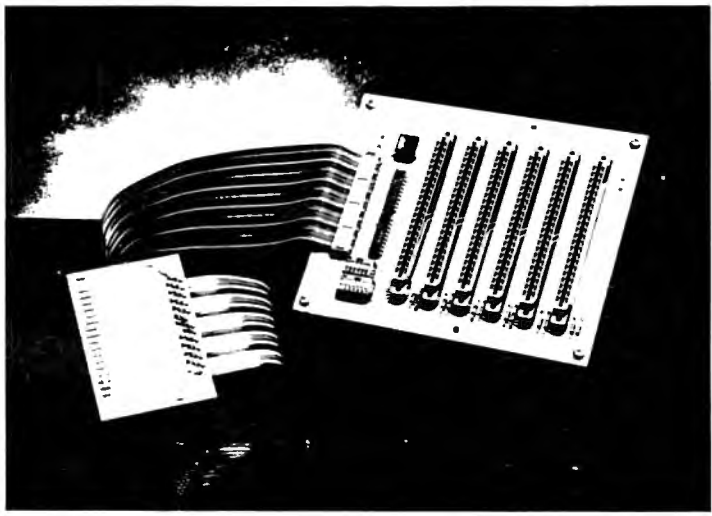


Drifting space rocks and spacecraft in Satellites And Meteorites.

Satellites And Meteorites

This game appears to be modeled after the arcade game *Asteroids*. It begins abruptly without any

An Expansion Interface for the VIC-20



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- ± Allows the user to switch select various utility programs (ie: programmer's aid, machine monitors and basic utility programs) now available in the cartridge (ROM) format
- ± Includes a system reset button (the one thing the VIC-20 doesn't have but really needs)
- ± Allows the capability for future expansion by providing "DAISY CHAINING" capability
- ± Uses an 18" ribbon cable for hook-up (included) allowing positioning of the unit in a convenient location for easy access to the switches
- ± Includes a 36 page user's guide which is easy to understand and tells you how to do things that would seem quite impossible but are easy when using the "CARDBOARD/6"

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An Economy Expansion Interface for the VIC-20



preliminaries. Your spaceship is being menaced by meteors, satellites (pulsating and twirling ones), and black holes. You shoot and maneuver your ship with a choice of keyboard or joystick. As before, you can see your current score and the previous high. Points are awarded for destroying the attackers, and, if you're good enough, at 10,000 points, a free ship is awarded. (Three are given at the start of the game.)

The game has excellent graphics, but only fair to good sound effects. I was impressed by the explosions of struck meteors into smaller chunks and the 3-D effect as meteors slide by each other. An aggressive satellite has even been known to hide behind an innocuous meteor and spring out at you when the meteor is hit, a nasty surprise.

Two factors make the game difficult to master:

1. The satellites do not move in straight lines.
2. One satellite is shooting randomly, which can cause unexpected hazards (flying chunks).

My testers liked the fact that you are given a new man only after the immediate danger has passed. They felt that the black holes are a unique feature of the game. As you can imagine, it is very difficult to escape from one, but my youngest son claims he did (as yet unverified). They did miss a hyperspace feature which can get you out of some tight spots. Overall, they gave the program a very good rating.

Of the two games, *Spiders of Mars* was the favorite of the kids. An adult would be hard pressed to choose between them. They are excellent games.

Spiders of Mars, \$59.95

Satellites and Meteorites, \$49.95


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...PET/CBM/VIC? SEE SKYLES...

Review:

This program can transform any BASIC program into a compiled version that RUNs far faster. For any 4000 or 8000 series models, 4.0 BASIC, except the 8096. There is a version for the new Commodore 64 as well.

Petspeed, An Optimizing Compiler For PET/CBM

Richard Mansfield
Assistant Editor

I have a version of the game "Othello," in BASIC, which is several years old. It's a good opponent, but I avoided playing it very often because it would take so long to figure out its move. After I made a move, a cursor would appear and slowly travel to each square on the board, in an infuriatingly leisurely way. It was like playing with someone who gently put a finger on each square before making a move in checkers.

After it was transformed with *Petspeed*, an optimizing compiler sold by Small Systems engineering, it became a far faster player. Now the cursor flies across the squares in a most computer-like fashion, making up its mind much more quickly than I ever could, as nature intended.

A compiler takes an ordinary BASIC program and creates a second, faster version. The new program is either in machine language or a special machine-language-like code. In either case, the goal is to create a highly efficient program that will RUN far more rapidly.

Petspeed succeeds. Depending on the nature of the program, *Petspeed* can RUN up to 40 times the speed of ordinary PET BASIC. The following simple benchmark took four minutes and one second to RUN in BASIC. The *Petspeed* version took one minute, 33 seconds.

```
10 TI$="000000"
20 FORI=1TO50000
30 X=X+1
```

```
40 NEXTI
50 PRINTTI$
```

In operation, *Petspeed* uses a dual disk drive with the target program on a disk (4000 or 8000 series, BASIC 4.0) in Drive One and the special *Petspeed* disk in Drive Zero. It takes over the computer and asks you just one question: what is the filename of your BASIC program? Then, for about 3 1/2 minutes it builds a new version on Drive One in a pseudo-code called "Speedcode" which, when RUN, is used by a *pseudo machine*. In essence, a compiled program is appended to a special "interpreter" program, 8K long, which is loaded into RAM with it. This pseudo machine takes control when you type RUN to use the compiled program.

The compiled program RUNs like a machine language program. If you LIST it, all you see is: "10 SYS (1040) COMPILED IN PETSPEED." The STOP key is disabled (though you can enable it by putting an Enable-Stop instruction in the BASIC program: 10 REM ! ES). You can't use DIM A(N). The N must be a number so the compiler can know in advance how much space to reserve. Since it's no longer BASIC, there is no point to the words RUN or LIST appearing within the program and they, too, are disallowed. These are the only restrictions, however.

Special Options

There are some additional programming techniques not allowed in BASIC. You can use DEF FN with mixed string and numeric arguments. In this way a quick PRINT USING function can be set up. You can declare that *all* characters in a variable name are significant, not just the customary first two. Integer FOR/NEXT loops are permitted. All numeric values are, whenever possible, translated into the faster "integer" type by the compiler anyway.

The "optimizing" feature of this compiler includes the floating point to integer conversion as well as many other improvements. REMs are, of course, dropped, GOTOs and GOSUBs are positioned for maximum efficiency, and all array references are resolved during compilation.

The 32 most frequently used variables in your program are given particular attention. They are set up to be accessed using a rapid addressing mode similar to machine language's zero page addressing. The one most frequently used variable is simply put into zero page.

BASIC programs with machine language patches added to them require special handling. For example, you might need to modify a line which changes the Limit Of Memory pointers to reserve space for machine language. BASIC and

Petspeed use up different amounts of memory. If a machine language subroutine is required, it can be loaded into free RAM space during the program RUN. If the routine involves using BASIC's variables, it will have to be modified to reflect the way that *Petspeed* stores variables. Maps, tables, and descriptions are provided in the *Petspeed* manual to assist machine language programmers with this conversion.

To use the compiler, you must attach a small black plastic box, the "Speedkey," to the First Cassette Drive port on the back of your machine. However, any programs which are compiled into *Petspeed* can run on any machine and do not require the key. If you are interested in selling a program you've compiled with *Petspeed*, you are free to do so. The manufacturer makes no claim on the compiled software and no special keys, boxes, or security devices are necessary.

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@ L- Allows the students to load protected files if the password code is known.

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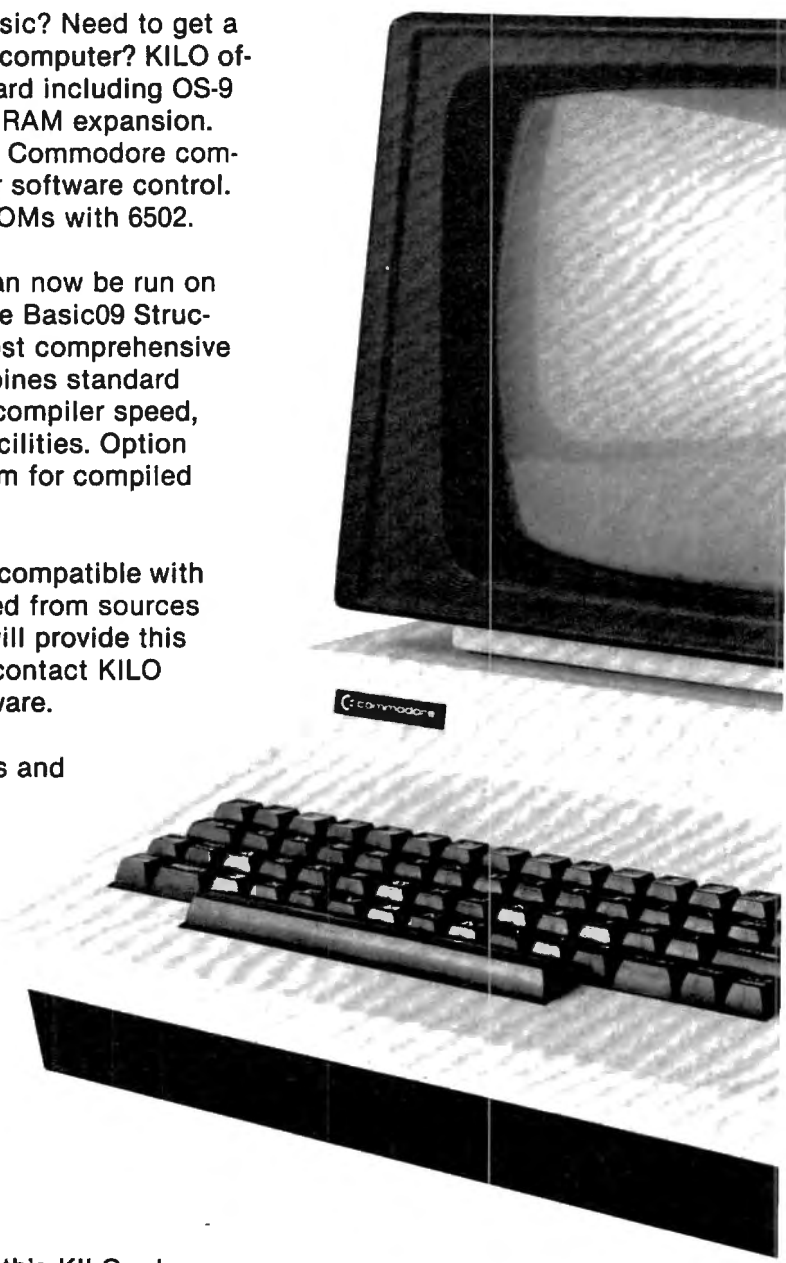
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A Monthly Column

The World Inside The Computer



Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. He is presently working on two major projects: he is writing a series of books on how to create graphics-and-sound adventure games.

He is also working on a computer mystery-and-adventure series for young people.

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!**

Hey, Computer! Wanna Play?

Fred D'Ignazio
Associate Editor

In the September column, I showed you how to develop a computer "friend" program for your child. In the October column, I described computer MAD LIBS® and "dark stories" and included a sample program that encouraged a child to invent his or her own fractured fairy tales. Now, this month, we're going to hook the friend program up to the story-game program – or to any game that will run on your computer.

The entire friend program is included in this column. This new version of the program has been modified and significantly expanded.

The new version of the friend program runs on an Atari 400 or 800 computer. It is written in Atari BASIC and takes up 7217 bytes of memory.

Teaching The Friend To Play Games

The easiest way to teach your computer friend to play games is to make the games part of the friend program.

This seems like a practical solution. You can use empty line numbers 15000 to 32767 for game subroutines. The friend can jump to the games

instantly at the child's request.

For short games or for a small number of games, this solution is best. But what happens when you want the friend to play complicated, long games? What happens when you want the friend to know how to play five games, ten games, or more? Then, each time you code a game, you have to code it into the friend. And each time you get a new game, you have to code *it*, too, into the friend. Pretty soon, your program is no longer a friend; it is a blimp.

The solution I have chosen here is to have the friend know the names of up to 50 game programs. If they are stored on disk, the friend calls them and runs them automatically.

At the end of each disk game, you can add a line or two of code that returns control to the friend. When the game is over, the friend automatically wakes up and talks to the child. The friend remembers the child's name and knows he or she has just finished playing a game.

If you have a tape drive (Atari 410 Program Recorder) instead of a disk, you can't easily automate the game-playing process – especially if the child is given the opportunity to select games at random. If each tape contains only one game, the child would have to insert a new tape for each game. If, on the other hand, each tape contained several games, the child would have to wait a long time for a tape indexing program to search through a tape for the chosen game.

Besides, you don't want to completely separate

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your kids from the computer. Even preschoolers can be taught the basics of operating a tape drive. After all, they need to know only three commands: CSAVE, CLOAD, and RUN. And they need to know only five buttons: REWIND, PLAY, STOP/EJECT, and RECORD on the recorder, and RETURN on the computer. I believe it is better to teach the kids how to run the recorder and the computer, and let them load the game tapes themselves.

I do recommend one thing, though: buy ten-minute tapes (five minutes to a side) and store only two games per tape — one per side. You can keep the tapes in cases inside the kid's Buster Brown shoe box. Each tape case should have a bright, colorful label on the top. For toddlers, you might use geometric shapes instead of words as labels.

Why use such short tapes? I once asked the same question. That was before I tried to store 25 game programs on a 60-minute tape. Finding and using all the games was a nightmare, even with up-to-date pointers to the game locations. And it took forever. If you try this, your child might, at the beginning of a tape search, be on the seat waiting eagerly for a game, but he won't be at the end. He'll be gone.

Kids don't have the patience to locate and load programs stored on long-playing tapes. And neither should you. Besides, positioning the tape using the tape counter, the REWIND button, the ADVANCE button, and the STOP/EJECT button is hard! It can be a supremely frustrating experience for little kids.

So loosen your purse strings and buy a bag of short tapes. After just a few games, you and your kids will be glad you did.

One more thing. The friend program could have been more automated, even using tapes. On the Atari computer, you can save your game programs onto tape using the SAVE "C:" command. And you can run programs stored this way by typing RUN "C:". These commands can be built right into the friend program and at the tail end of all the game programs.

This method would save children from having to type CLOAD and RUN. They would just have to load a tape into the recorder, rewind the tape to the beginning, and press the PLAY button. The computer would do the rest.

On the other hand, using this method, the programs load much slower than the normal method. (Sometimes it takes them almost twice as long.)

I think speed is critical for a young child. Wherever possible, the child should not be kept waiting while the computer goes about its chores. Thus, in the friend program in this article, I chose

the quicker normal method (CSAVE/CLOAD).

A Face Liff For An Old Friend

This section is for those of you who have already loaded the September version of the friend into your Atari computer. There are many changes to the old program, but there is no point in entering in the entire program a second time.

On the other hand, if you haven't loaded the old version of the friend program into your computer, that's fine. The entire program is listed at the end of this column. Just type it in.

Program Documentation (lines 10-95): REM comment lines introduce the friend and describe its major functions.

Dimension Variables (lines 100-130): Delete old line 120. Add new lines 120, 125.

Friend Master (lines 500-600): It is probably better just to retype these few lines. Almost all are changed in some way.

Pay special attention to the new line 510. This line checks to see if the friend has already been called on. If so, the friend locates the child's name in RAM and skips the normal wake-up routine.

The new line 550 calls the game-playing subroutines.

Friend Wake-Up/Talking (lines 1000-3110): This section is almost identical to the old version of the friend program. It causes the friend to wake up and gives the friend the ability to talk using DATA statements stored at the tail end of the program.

Move old line 1010 to 2012.

Move old line 2006 to 2011.

Delete old line 2005.

Add new line 2010.

New lines 2010 and 2011 turn this subroutine into a general-purpose "friend-talker." The friend can now get "talk" messages (DATA statements) at any location.

Subroutines that call the "friend-talk" subroutines point them to the right location. For example, the game subroutine points the friend to lines 12000-12999 to talk about games. The wake-up subroutine points the friend to lines 10000-10999 to give its wake-up greetings. If the friend is already awake, another subroutine points the friend to lines 11000-11999 to greet the child after a game. The tape-load subroutine points the friend to lines 13000-13999 so the friend can tell the child how to load a game tape.

Whenever you add new messages for the friend to tell the child, just add the messages at an unoccupied set of line numbers (anywhere from 14000 on up), and remember to call the friend-talk subroutine at line 2010. But before you call the subroutine, set the individual-message pointer, N, to 1; and set the type-of-message pointer, DAT-

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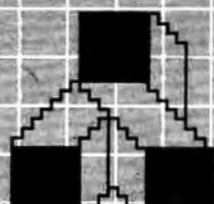
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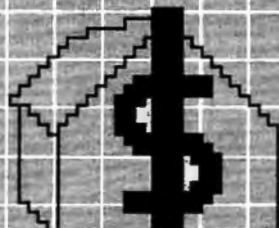
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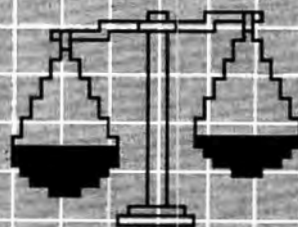
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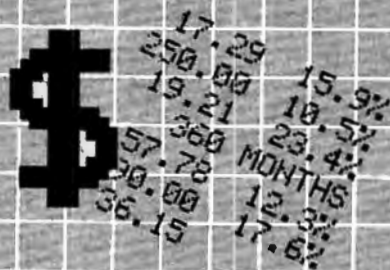
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NUM, to the line number where you've added new messages (e.g., DATNUM = 14000).

On line number 2033, I changed the delay loop from 800 to 200. This adjusts the amount of time a single friend message will remain on the TV screen. You can decide how long the messages should stay, based on the reading level of your child.

Friend Asks a Question (lines 3200-3620): Several lines have changed, so it's easiest to delete all old lines, from 3200-3390. Then type in all new lines, from 3200-3620. These new lines convert the subroutines into general-purpose question-askers.

Also, they add a significant improvement to the old friend program. When children type in an answer – say their name – and make a mistake typing, they can now type the DELETE key, erase the erroneous characters, and type their answer correctly.

Wake-Up Bell/Friend Voice (lines 4000-4880): These subroutines are almost identical to the old version of the friend program.

Delete old lines 4625 and 4770. These lines are fossils from a much older friend program that is now extinct.

Friend's Face (lines 5000-5550): Identical to the old version of the friend program. (So no face lift is required, after all!)

These subroutines draw the friend's face. They animate its eyes for sleeping, winking, and waking. They animate its mouth for talking.

Lines 6000 and Up: This part of the program is completely new, with one exception: the old DATA statements, lines 6000-6022. Renumber statements 6010-6022 to 10010-10022 by changing the "6's" to "10's".

Next change line 6000 to 10005.

Add new line 10000.

Remember to add new lines 10030-10032.

Friend's Games (lines 6000-7070): On lines 6000-6220 the friend asks the child to play a game. If the child wants to play, the friend displays the list of up to 50 games you have placed (at ten-line intervals) on lines 12030 to 12520.

The friend displays the name of each game and waits to see if the child wants to play the game. If not, the friend goes on to the next game. If the child doesn't like any of the games, the friend prints an "I'm sorry" message and says good-bye.

If the child *does* want one of the games, the friend goes to the subroutine at 6310 and stores the child's name in a secure spot in the computer's memory. Then it goes to the subroutine at 6410 to see if the child needs help loading the game tape. If the child needs help, the friend explains the steps the child must follow to load a tape. The friend goes over the instructions until the child has

them all straight. Then the friend says good-bye.

After playing a game, the child reloads and runs the friend program. On line 510, the friend automatically checks to see if it has spoken to the child earlier. If so, the friend jumps to the subroutine at line 7010 and retrieves the child's name. The friend appears on the screen already awake and greets the child by name. Then it goes back to the friend master to see if the child wants to play another game (see line 550), or to do some future activity (empty lines 560-999) that you can add later on.

Friend Messages (lines 10000-10341): The wake-up messages are on lines 10000-10032.

The friend's greeting messages after the child returns from a game are on lines 11000-11015.

The friend's list of games and its "I'm sorry" message are on lines 12000-12536.

The friend's instructions for loading a tape are on lines 13000-13041.

The messages are structured as in the old friend program. A new message begins on every tenth line number. The message begins with a DATA statement and a single number (like 1, 2, 5, or 6). The number indicates the number of screens (see SNUM on line 2012) in the current message.

Following the DATA statement with the number of screens are the DATA statements which contain the message text. Each DATA statement contains one screen of messages: from one to four message lines, each line containing a maximum of nine characters. Each DATA statement (screen) ends with a marker – a minus one (-1). The child's name can be included in the message by placing the asterisk token (*) at the appropriate place. (For example, see lines 10022 and 12531.)

When you are building messages, a good rule of thumb is to display only one word on each line. This makes it easier for the child to read the message, and makes the screen look simpler and less cluttered. You do this by following each word with a comma. For example, the command DATA I, HOPE, YOU, -1 will cause the friend to display one screen with only one word per line.

Returning From A Fairy Tale

Last month's column included a "fractured fairy tale" program for you and your kids to try. The program ran independently of the computer friend. Now I'm going to show you how to modify the program so it can point the child back to the computer friend.

First, delete the old lines beginning with line 1435. Then add the following lines:

```
1435 GRAPHICS 0
1436 REM ***
1437 REM *** RETURN TO FRIEND
1438 REM *** PROGRAM--ON TAPE
```

Recreational Computing Back Issues

Recreational Computing was the first and only personal computing magazine when it started in 1972 (it was called the *PCC Newspaper* back then). Bob Albrecht, David Thornburg, Isaac Asimov, Don Inman, Ramon Zamora, Robert Jastrow, Mac Oglesby, Adam Osborne – the list of authors reads like a Who's Who of microcomputing. These and many other authors contributed some of the finest articles about computers and now-classic games to the pages of *Recreational Computing*.

Last fall, *Recreational Computing* was merged into **COMPUTE!** and we are now offering available back issues. Whatever your interest, you'll find something here – from Spanish BASIC to Computers in Sports Medicine, from Future Fantasy Games to Robot Pets.

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```

1439 REM ***
1440 PRINT "TIME TO WAKE UP YOUR FRIEN
ND!":PRINT
1442 PRINT "DO YOU NEED INSTRUCTIONS"
;:INPUT ANSWER$
1443 IF ANSWER$="N" THEN GRAPHICS 0:G
OTO 1530
1445 IF ANSWER$<>"Y" THEN 1435
1446 GRAPHICS 0
1450 PRINT "PUT 'FRIEND' TAPE INTO"
1460 PRINT "PROGRAM RECORDER."
1465 PRINT
1470 PRINT "REWIND TAPE TO BEGINNING.
"
1475 PRINT
1490 PRINT "TYPE 'CLOAD' AND PRESS RE
TURN."
1495 PRINT
1496 PRINT "PRESS PLAY BUTTON"
1497 PRINT "ON THE PROGRAM RECORDER."
1498 PRINT
1499 PRINT "PRESS RETURN AGAIN."
1500 PRINT
1505 PRINT "WHEN COMPUTER IS FINISHED
"
1506 PRINT "LOADING THE 'FRIEND' TAPE
"
1508 PRINT "THE COMPUTER WILL TYPE 'R
EADY'."
1509 PRINT
1510 PRINT "THEN YOU TYPE 'RUN'"
1515 PRINT "AND PRESS RETURN."
1520 PRINT
1530 END

```

The above commands help the child exit from the fairy-tale program and reload the computer friend – *if the friend and the fairy tale are stored on tape.*

On the other hand, if you have a disk drive, you can make all transfers to and from the friend automatic. The friend can start games automatically. And the games can automatically reload and run the friend.

To modify the *friend* program is simple.

First, you change line 90 to read:

```
90 REM *** DISK VERSION OF FRIEND
```

Second, you change line 6180 to read:

```
6180 IF M$(1,1)="Y" THEN GOSUB 6310:GOTO 6410
```

Third, you delete old lines 6400-6470 and add the following new lines:

```

6350 RETURN
6400 REM *** DISK VERSION OF FRIEND
6405 REM ***
6408 REM *** SELECT GAME PROGRAM/EXIT
FRIEND
6410 GOTO 6410+Z*10
6420 RUN "D:TELLTALE"

```

The only game program currently referenced is "Telltale," at line 6420. Telltale is the name I have given the fairy-tale program (from last month's column) that is stored on disk.

You can have the friend automatically run up to 50 game programs by adding their full (English) names to the friend's game list on lines 12030-

12520. You add each new game after an interval of ten lines (12040, 12050, 12060, etc.). The format you follow is the same as in the fairy-tale game, Telltale, listed at lines 12030 and 12031:

```

12030 DATA 1
12031 DATA STORY,GAME?,-1

```

At 12030, the Data statement tells the message-display subroutine at line 2010 that there is only one screen in this message. At 12031 is the English name of the game as it will be displayed on the screen by the computer friend. The game name is followed by a question mark since the friend is asking if the child wants to play this particular game.

Next, so the friend can actually load and run the new game, you need to add the game's *program name* to lines 6430 and up. You separate each program name by ten lines (6430, 6440, 6450, etc.). You follow the same format as the fairy-tale program, Telltale, on line 6420:

```
6420 RUN "D:TELLTALE"
```

Remember, you can add up to 50 game programs for the friend to automatically run.

Calling On A Friend

Now you know how the computer friend automatically loads and runs a game. But how does a game reload and run the friend?

You can learn how by changing the fairy-tale program, Telltale. First, delete old lines 1460 and 1470. Second, add the following new lines:

```

1480 REM ***
1490 REM *** RETURN TO FRIEND
1500 REM *** PROGRAM--ON DISK
1510 REM ***
1520 RUN "D:FRIEND"

```

As you can see, it's simple. The only real command you add is RUN "D:FRIEND".

By following the instructions above, you can add dozens of games to your computer friend's repertoire. The friend runs the games automatically, and the games automatically return control to the friend when your child is through playing them.

Acknowledgments And Predictions

I admit I haven't been too good about predicting where this column is going each month. Like a red-faced weather forecaster, I apologize for the times my predictions haven't come true.

Unlike the weather forecasters, I am going to stop making long-range forecasts. I'm going to stick to the near-term – namely, next month. Next month I plan to show you how to teach the computer friend how to remember things. After you modify the program, the friend will remember facts about itself (its name, shape, hair color, favorite jokes,

etc.) and facts about the child. When the child tells the friend something important, the friend will remember.

I'd like to thank Bruce Mitchell for his valuable programming assistance. Bruce is the chief "big-person" programmer at the Small World Preschool and Kindergarten in Durham, North Carolina.

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```

10 REM *****
20 REM COMPUTER FRIEND
30 REM *****
40 REM
50 REM *** WHEN PROGRAM BEGINS,
55 REM *** THE FRIEND'S FACE
60 REM *** APPEARS. THE FRIEND
65 REM *** WAKES UP AND GREET'S
70 REM *** THE CHILD. THE FRIEND
75 REM *** THINKS UP COMPUTER GAMES
80 REM *** THE CHILD CAN PLAY.
85 REM
90 REM *** TAPE VERSION OF FRIEND
95 REM
100 REM *** DIMENSION VARIABLES
110 DIM M$(9):REM * MESSAGE
120 N=1:REM * INDIVIDUAL-MESSAGE POIN
TER
125 DATNUM=10000:REM * TYPE-OF-MESSAG
E POINTER/10000 = FRIEND WAKE-UP
130 DIM NAME$(9):REM * CHILD'S NAME
500 REM *** FRIEND MASTER
505 GRAPHICS 2+16
510 IF PEEK(1791)=1 THEN GOSUB 7010:G
OTO 550
515 GOSUB 1010:REM * FRIEND WAKE-UP
520 GOSUB 2010:REM * FRIEND INTRODUCE
S HIMSELF/HERSELF
530 ANSWER=2:GOSUB 3210:REM * FRIEND
LEARNS CHILD'S NAME
540 GOSUB 2010:REM * FRIEND HAPPY TO
SEE CHILD
550 GOSUB 6010:REM * PLAY GAME?
600 END
1000 REM *** FRIEND WAKE-UP
1010 GOSUB 5010:REM * DRAW FACE
1020 GOSUB 5410:REM * DRAW SLEEP EYES
1030 GOSUB 5210:REM * DRAW CLOSED MOU
TH
1035 FOR P=1 TO 800:NEXT P
1040 GOSUB 4010:REM * WAKE-UP BELL
1050 GOSUB 5460:REM * DRAW OPEN EYES
1060 FOR P=1 TO 600:NEXT P
1070 GOSUB 5320:REM * WINK EYE
1080 FOR P=1 TO 100:NEXT P
1085 M=0:GOSUB 4820:REM * WINK NOISE
1090 GOSUB 5460:REM * DRAW OPEN EYES
1100 FOR P=1 TO 800:NEXT P
1120 RETURN
2000 REM *** FRIEND TALK
2010 RESTORE DATNUM+N*10:REM * SELECT
MESSAGE
2011 N=N+1:REM * SET POINTER TO NEXT
SET OF FRIEND MESSAGES
2012 READ SNUM:REM * SNUM = NUMBER OF
SCREENS IN CURRENT SET OF FRIEN
D MESSAGES
2015 FOR K=1 TO SNUM
2020 GOSUB 3010:REM * FRIEND TALK--1
SCREEN

```

```

2033 FOR P=1 TO 200:NEXT P
2035 GOSUB 5510:REM * CLEAR MESSAGE W
INDOW
2040 NEXT K
2050 RETURN
3000 REM *** FRIEND TALKING--1 SCREEN
3010 PY=2:REM * MESSAGE VERTICAL (Y)
START LOCATION
3020 PY=2:REM * MESSAGE VERTICAL (Y)
START LOCATION
3030 PX=14:REM * HORIZONTAL (X) CENTE
R OF MESSAGE ON SCREEN
3040 READ M$
3050 IF M$="-1" THEN RETURN
3051 IF M$="*" THEN M$=NAME$
3055 GOSUB 5260:REM * OPEN MOUTH
3060 POSITION INT(PX-(LEN(M$)/2)+0.5)
,PY:REM * CENTER LINE
3070 PRINT #6;M$
3075 GOSUB 4810:REM * FRIEND SOUND
3080 FOR P=1 TO 10:NEXT P:REM * KEEP
MOUTH OPEN
3090 GOSUB 5210:REM * CLOSE MOUTH
3095 FOR P=1 TO 50:NEXT P:REM * KEEP
MOUTH CLOSED
3100 PY=PY+2
3110 GOTO 3040
3200 REM *** FRIEND ASKS CHILD A QUES
TION
3210 OPEN #1,4,0,"K:"
3212 M$=""
3215 POSITION 11,4
3217 FOR I=1 TO 9
3220 GET #1,A
3222 IF A=126 AND I=1 THEN 3220
3225 IF A=126 THEN GOSUB 3310
3230 IF A=155 THEN 3265
3240 PRINT #6;CHR$(A);
3250 M$(LEN(M$)+1)=CHR$(A)
3260 NEXT I
3265 FOR P=1 TO 75:NEXT P
3267 GOSUB 5510:REM * CLEAR MESSAGE W
INDOW
3270 CLOSE #1
3280 GOSUB 3410:REM * EVALUATE ANSWER
3290 RETURN
3310 POSITION I+9,4:PRINT #6;" ";
3312 POSITION I+9,4
3315 M$(LEN(M$))=""
3317 I=I-1
3320 GET #1,A
3330 IF A<>126 THEN 3390
3350 IF I<2 THEN 3320
3360 GOTO 3310
3390 RETURN
3400 REM *** EVALUATE ANSWER
3410 ON ANSWER GOSUB 3510,3610
3420 RETURN
3500 REM *** NO NEED TO STORE ANSWER
3510 RETURN
3600 REM *** ANSWER=CHILD'S NAME
3610 NAME$=M$
3620 RETURN
4000 REM *** WAKE-UP BELL
4010 BEL=105:TIM=7.5:GOSUB 4040
4020 BEL=132:TIM=8.5:GOSUB 4040
4030 SOUND 0,0,0,0:RETURN
4040 VLM=15:INC=0.79+TIM/50
4050 SOUND 0,BEL,10,VLM
4060 VLM=VLM*INC
4070 IF VLM>1 THEN 4050
4080 RETURN
4800 REM *** FRIEND VOICE
4810 M=INT(RND(1)*51)+15
4820 FOR A=M+25 TO M STEP -8

```

```

4830 SOUND 0,A,10,10
4840 FOR T=1 TO 10
4850 NEXT T
4860 NEXT A
4875 SOUND 0,0,0,0
4880 RETURN
5000 REM *** FRIEND'S FACE
5010 GRAPHICS 2+16
5040 POSITION 2,1:PRINT #6;"
      (3 SPACES)*"
5050 POSITION 2,2:PRINT #6;" / \"
5060 POSITION 2,3:PRINT #6;" ====="
5070 POSITION 2,4:PRINT #6;"/
      (5 SPACES)\ "
5090 POSITION 1,6:PRINT #6;"< ^ >:"
5100 POSITION 2,9:PRINT #6;"\ _ _ _ _ /"
5110 RETURN
5200 REM *** CLOSE MOUTH
5210 POSITION 2,7:PRINT #6;":
      (5 SPACES):"
5220 POSITION 2,8:PRINT #6;": --- : "
5230 RETURN
5250 REM *** OPEN MOUTH
5260 POSITION 2,7:PRINT #6;": _ _ : "
5270 POSITION 2,8:PRINT #6;": \ _ / : "
5280 RETURN
5300 REM *** LEFT EYE WINK
5320 POSITION 2,5:PRINT #6;": 0 - : "
5330 FOR P=1 TO 150:NEXT P
5340 RETURN
5400 REM *** EYES ASLEEP
5410 POSITION 2,5:PRINT #6;": - - : "
5440 RETURN
5450 REM *** EYES AWAKE
5460 POSITION 2,5:PRINT #6;": 0 0 : "
5470 RETURN
5500 REM *** CLEAR MESSAGE WINDOW
5510 FOR Y=2 TO 8 STEP 2
5520 POSITION 10,Y
5530 PRINT #6;"{9 SPACES}"
5540 NEXT Y
5550 RETURN
6000 REM *** FRIEND'S GAMES
6010 GOSUB 2010:REM * FRIEND ASKS CHI
      LD: PLAY A GAME?
6020 ANSWER=1:GOSUB 3210:REM * GET CH
      ILD'S ANSWER
6030 IF M$(1,1)="N" THEN 6080
6040 IF M$(1,1)<>"Y" THEN N=N-1:GOTO
      6010
6050 GOSUB 6110:GOTO 6090:REM * SELEC
      T GAME
6080 N=4:DATNUM=13000:REM * GOOD-BYE
6090 GOSUB 2010:REM * FRIEND SAYS GOO
      D-BYE!
6095 RETURN
6100 REM *** SELECT GAME
6110 DATNUM=12000:N1=N:N=1:REM * RESE
      T DATA POINTERS
6120 GOSUB 2010:REM * GENIE BEGINS GA
      ME-SELECTION QUESTION
6130 READ GAMENUM
6140 N=N+1
6150 FOR Z=1 TO GAMENUM
6160 GOSUB 2010:REM * DISPLAY GAME NA
      ME
6170 GOSUB 3210:REM * GET CHILD'S ANS
      WER
6180 IF M$(1,1)="Y" THEN GOSUB 6310:G
      OSUB 6410:GOTO 6220
6190 IF M$(1,1)<>"N" THEN N=N-1:GOTO
      6160
6200 NEXT Z
6210 DATNUM=12000:N=53:RETURN :REM *
      NO GAMES SELECTED/GOOD-BYE!
6220 DATNUM=13000:N=4:REM * GOOD-BYE!
      :RETURN
6300 REM *** PREPARE FRIEND'S MEMORY
      FOR EXIT FROM FRIEND PROGRAM
6301 REM *** STORE CHILD'S NAME
6302 REM *** IN LOCATIONS
6303 REM *** 1781-1789
6304 REM *** (LENGTH OF NAME IN 1790
6305 REM *** AND SET LOCATION 1791
6306 REM *** AS FLAG THAT
6307 REM *** FRIEND HAS ALREADY
6308 REM *** BEEN CALLED SINCE
6309 REM *** TURNING ON COMPUTER
6310 REM
6315 FOR I=1 TO LEN(NAME$)
6320 POKE 1780+I,ASC(NAME$(I,I))
6330 NEXT I
6335 POKE 1790,LEN(NAME$)
6340 POKE 1791,1
6350 RETURN
6400 REM *** TAPE VERSION OF FRIEND
6410 DATNUM=13000:N=1
6420 GOSUB 2010:REM * ASK IF CHILD NE
      EDS HELP
6430 ANSWER=1:GOSUB 3210:REM * GET CH
      ILD'S ANSWER
6440 IF M$(1,1)="N" THEN 6500
6450 IF M$(1,1)<>"Y" THEN 6410
6460 GOSUB 2010:REM * TELL CHILD HOW
      TO LOAD TAPE/REPEAT STEPS?
6470 N=2:GOTO 6430
6500 RETURN
7000 REM *** FRIEND CALLED ON BEFORE
7010 FOR I=1 TO PEEK(1790)
7020 NAME$(LEN(NAME$)+1)=CHR$(PEEK(17
      80+I))
7030 NEXT I
7040 GOSUB 5010:GOSUB 5210:GOSUB 5460
      :REM * DRAW FRIEND
7050 DATNUM=11000:GOSUB 2010:REM * NE
      W FRIEND MESSAGES
7060 DATNUM=10000:N=3
7070 RETURN
10000 REM *** WAKE-UP FRIEND
10005 REM *** MESSAGES
10010 DATA 3
10011 DATA HI, I'M, GED,-1
10012 DATA YOU,TURNED,ME,ON,-1
10013 DATA WHO'S,OUT,THERE?,-1
10020 DATA 2
10021 DATA I'M,SO,HAPPY,-1
10022 DATA TO,SEE,YOU,*,-1
10030 DATA 2
10031 DATA DO,YOU,WANT,-1
10032 DATA TO,PLAY,A,GAME?,-1
11000 REM *** FRIEND ALREADY AWAKE ME
      SSAGES
11010 DATA 5
11011 DATA HI,*,-1
11012 DATA I,HOPE,YOU,-1
11013 DATA HAD,FUN!,-1
11014 DATA I,WONDER,WHAT,-1
11015 DATA WE,SHOULD,DO,NOW.,-1
12000 REM *** GAMES
12001 REM
12002 REM *** LIST GAMES ON
12003 REM *** EVERY 10TH LINE--
12004 REM *** LINES 12030-12520
12005 REM *** FOR A MAXIMUM OF
12006 REM *** 50 GAMES.
12007 REM
12010 DATA 2
12011 DATA DO,YOU,WANT,-1
12012 DATA TO,PLAY,-1
12020 DATA 1

```


12030 DATA 1
 12031 DATA THE, STORY, GAME?, -1
 12530 DATA 6
 12531 DATA *, I, AM, SORRY, -1
 12532 DATA NONE, OF, THE, GAMES, -1
 12533 DATA LOOKED, FUN., -1
 12534 DATA MAYBE, WE, CAN, -1
 12535 DATA PLAY, LATER., -1
 12536 DATA BYE!, BYE!, BYE!, -1
 13000 REM *** MESSAGE TO HELP
 13005 REM *** CHILD LOAD GAME
 13006 REM *** TAPE
 13010 DATA 3
 13011 DATA ALL, MY, GAMES, -1
 13012 DATA ARE, STORED, ON, TAPE., -1
 13013 DATA DO, YOU, NEED, HELP?, -1
 13020 DATA 12
 13021 DATA FIRST, PUT, THE, GAME, -1
 13022 DATA TAPE, ON, THE, RECORDER., -1
 13023 DATA SECOND, REWIND, THE, TAPE., -1
 13024 DATA THIRD, TYPE, 'CLOAD', THEN, -1
 13025 DATA PRESS, THE, 'RETURN', BUTTON.,
 , -1
 13026 DATA FOURTH, PRESS, THE, 'PLAY', -1
 13027 DATA BUTTON, ON, THE, RECORDER., -1
 13028 DATA LAST, PRESS, 'RETURN', AGAIN.,
 , -1
 13029 DATA WHEN, THE, PROGRAM, IS, -1
 13030 DATA LOADED, TYPE, 'RUN'., -1
 13031 DATA WANT, ME, TO, REPEAT, -1
 13032 DATA THE, STEPS?, -1
 13040 DATA 1
 13041 DATA BYE!, BYE!, BYE!, -1

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This series concludes with a comparison of Atari and Apple PILOT instructions, the program variables within the languages, and a table summarizing PILOT commands. The Turtle PILOT language, a version for the VIC and the PET, will be published next month. Last month the Atari version of the language was published and there was a version for the Apple in the September issue.

Turtle PILOT

Alan W. Poole
Loomis, CA

Welcome back for the third and final article about Turtle PILOT. If you haven't seen the last two articles, I would suggest you do that now, unless you are willing to miss out on a powerful new language for your Apple. [*The Atari version of PILOT was published in the October 1982 issue of COMPUTE!, and the language for the Apple appeared in the September issue.*] In Parts I and II we dealt with all the commands and instructions in Turtle PILOT. Translating an Atari PILOT program to Turtle PILOT will be the main topic of this article, along with a few miscellaneous notes and some documentation on the Editor and Translator programs. At the end of this article you will find a summary of all the commands and instructions in Turtle PILOT.

The program we are going to convert from Atari PILOT to Turtle PILOT first appeared in David Thornburg's "Friends Of The Turtle" column in the April 1982 issue of **COMPUTE!** magazine. Both versions of the program are listed below, along with a list of the changes made to the program to convert it to Turtle PILOT.

1. Line 3 was added to clear the screen and place the cursor in the text window below the high resolution graphics.
2. The symbol placed at the end of a Type instruction to continue the next printed character on the same line is the ampersand instead of the backslash used in Atari PILOT.
3. Turtle commands are preceded by a G: instruction in Turtle PILOT instead of the GR: used in Atari Pilot.
4. Numeric variable names are not preceded by a pound sign (#) in Turtle PILOT, except in a Type instruction, where they are preceded and followed by a pound sign.
5. White was the only color used in the Turtle PILOT version because colors are plotted only at every other coordinate on the Apple.

Turtle PILOT version

```

1 *VISITURT
2 U:*ERASE
3 B:HOME:VTAB 21
4 T:WELCOME TO THE
  VISIBLE TURTLE
5 T:
6 J:*STARTHERE
7 *MASTERLOOP
8 T:TURN &
9 U:*ACCEPT
10 G:PEN ERASE
11 U:*TURTLE
12 G:TURN A
13 *STARTHERE
14 G:PEN WHITE
15 U:*TURTLE
16 T:DRAW &
17 U:*ACCEPT
18 G:PEN ERASE
19 U:*TURTLE
20 G:PEN WHITE
21 G:DRAW A
22 G:PEN WHITE
23 U:*TURTLE
24 J:*MASTERLOOP
25 E:
26 *ERASE
27 G:GOTO 0,0; TURNT0 0;
  CLEAR
28 U:*TURTLE
29 E:
30 *ACCEPT
31 A:A
32 M:E
33 UY:*ERASE
34 E:
35 *TURTLE
36 G:GO 4; TURN -90; GO 1;
  TURN 180
37 G:30(DRAW 2; TURN 12)
38 G:GO 1; TURN 180
39 G:10(DRAW 2; TURN 36)
40 G:TURN 90; GO -4
41 E:

```

Atari PILOT version

```

*VISITURT
U:*ERASE

T:WELCOME TO THE
  VISIBLE TURTLE
T:
J:*STARTHERE
*MASTERLOOP
T:TURN \
U:*ACCEPT
GR:PEN ERASE
U:*TURTLE
GR:TURN #A
*STARTHERE
GR: PEN YELLOW
U:*TURTLE
T:DRAW \
U:*ACCEPT
GR:PEN ERASE
U:*TURTLE
GR:PEN RED
GR:DRAW #A
GR:PEN YELLOW
U:*TURTLE
J:*MASTERLOOP
E:
*ERASE
GR: GOTO 0,0; TURNT0 0;
  CLEAR
U:*TURTLE
E:
*ACCEPT
A:#A
M:E
UY:*ERASE
E:
*TURTLE
GR:GO 4; TURN -90; GO 1;
  TURN 180
GR:30(DRAW 1; TURN 12)
GR:GO 1; TURN 180
GR:10(DRAW 1; TURN 36)
GR:TURN 90; GO -4
E:

```

Miscellaneous Notes On Turtle Pilot

1. It is not necessary to include the asterisk in front

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of a label used in the object of a Jump or Use instruction.

2. A Jump instruction without an object will jump back to the last Accept instruction.
3. One dollar sign or pound sign may be used in a Type instruction, but don't use two unless a variable is being Typed.
4. All spaces on the left side of the colon in every instruction will be ignored when the program is translated. Spaces on the right of the colon will be ignored with the G: instruction.
5. When you first run a program, the turtle will be automatically initialized to the middle of the screen, an angle of zero, and the color white.

Program Documentation

So far I have not provided any documentation for the Editor and Translator programs other than the REMarks included in the programs. Lines 50000 to 55060 do not contain any REMarks. These lines are never executed while the Translator is RUNNING. Some PILOT instructions require a subroutine to perform the same task in BASIC. This is the purpose of the lines greater than 50000. These lines are included in every translated program. Below is a list of the functions of these subroutines and lists of the variables used in the Editor and Translator programs.

Lines 50000-50050: Initialization. Lines 50020-50025 set the pitch values for notes. Lines 50030-50040 POKE a machine language sound routine into memory.

Lines 51000-51130: Type instruction. QT\$ is string to be Typed.

Lines 52000-52220: Accept instruction. Uses the GET command to allow any character to be typed without an error occurring. QI\$ is string typed.

Lines 53000-53030: Match instruction. Q\$(25) is list of items to be Matched.

Lines 54000-54020: TURN command. QT is number of degrees to turn.

Lines 55000-55060: DRAW command. QL is length of line.

Editor Variables

- BELL\$: CTRL-G
- C: Editor command number.
- C\$(9): List of Editor commands.
- D\$: CTRL-D.
- F: Temporary flag.
- FL: First line number.
- I\$: General input.
- IN\$(11): List of PILOT instructions.
- K\$: Key pressed.
- K: ASCII code of K\$.

- L, L1, L2: Temporary loop counters.
- LL: Last line number.
- LN: Number of last line in program.
- LT: Number of line being typed.
- N\$: Name of program to be LOADED.
- P: Parentheses counter.
- P\$(2500): Program lines.
- RES: "LINE NO. OUT OF RANGE"
- SE\$: "SYNTAX ERROR"
- T, T\$: Temporary variables.

Translator Variables

- C: Conditioner, 0 = none, 1 = Y, 2 = N.
- D\$: CTRL-D.
- EX\$: Expression.
- F: Flag to indicate if turtle commands are in a loop.
- GC: Number of turtle graphics command.
- G\$(6): List of turtle commands in one line of PILOT program.
- I: Instruction number.
- I\$: Line of PILOT program input from disk.
- IS(12): List of PILOT instructions.
- K\$: Character read from PILOT program on disk.
- L\$: Part of instruction left of colon.
- LN: Line number being translated.
- LN\$: Translated line.
- M\$(25): Items in object of Match instruction.
- N\$: Name of program being translated.
- NL: Number of lines in PILOT program.
- P\$(2500): PILOT program lines.
- R\$: Part of instruction right of colon.
- T1\$: T\$ with spaces removed.
- L, T, T\$, 11: Temporary variables.

Now that you have learned all the commands and features of Turtle PILOT, you can start writing programs and experimenting with the language. I'm sure you will find that the power and simplicity of Turtle PILOT far outweigh the inconvenience of having to wait a couple of minutes while your program is translated to Applesoft.

Summary Of Turtle PILOT

Editor Commands

- ADD – Start or continue program.
- LIST – List program.
- EDIT – Change line(s) of program.
- INSERT – Add a line.
- DEL – Delete line(s) of program.
- NEW – Erase program in memory.
- LOAD – Load program from disk.
- SAVE – Save program on disk.
- MEM – Display free bytes.
- CAT – Catalog disk.
- PR# – Change output slot.
- ESC – Key to exit Editor.

PILOT Instructions

- T: Type
 A: Accept
 M: Match
 J: Jump
 U: Use
 E: End
 C: Compute
 R: Remark
 S: Sound
 G: Turtle graphics
 B: BASIC commands
 * - Used in front of label.
 Y - Yes conditioner.
 N - No conditioner.

Turtle Commands

- CLEAR - Turn on and erase hi-res graphics.
 TURN - Add to turtle's angle.
 TURNT0 - Reset turtle's angle.
 DRAW - Draw line at angle turtle is headed.
 GO - Move turtle without drawing.
 PEN - Change color.
 SCREEN - Clear screen to a color.
 GOTO - Change coordinates of turtle.
 FULL - Full screen graphics.
 MIX - Mixed graphics and text.
 QUIT - Return to text mode.

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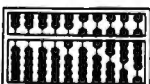
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A Monthly Column

The Beginner's Page

Arrays

Richard Mansfield
Senior Editor

One way to make your computer useful around the house is to have it take over some chores. It could easily do the work of your alarm clock, appointment book, address book, or yearly calendar. What's more, it could combine two jobs into one. To see how one program could do two things at once, let's construct a program which combines the functions of a calendar with an address book. We can also look at how *arrays* work. They can be a most valuable programming tool when you are working with lists. Because Atari BASIC follows nonstandard rules in the construction of arrays, it will not be covered here. The discussion below applies to Microsoft BASIC, which includes Apple, VIC, PET, and many other computers.

When two lists are related to each other, you can put them into a multi-dimensional array and they can work together to provide information. Arrays have *dimensions*, usually one or two. A one-dimensional array is just another word for a common list. In our example program, there is a list of first names (Mary, Bob, Joe, Alice, Mindy) which could be a one-dimensional array. Arrays give the same variable name to a group or list of items. You might think of an array as a massive variable.

The DIM statement creates an array. Line 100 shows how you can DIM an array called A\$ to contain "N" by eight items. This is a two-dimensional array. Since we want to allow for expanding the list of people (and their addresses and birthdays), we use the variable N at the start of the program which can easily be changed to show the total.

So, we presently have five people, each listed in a separate DATA statement. The way we are setting up this array, we allow eight pieces of information about each person. These categories are

listed in the REM statement in line 5. Imagine a honeycomb of little boxes like those on walls in the post office. Think of each row being used by just a single person. In our DIM, the computer is instructed to set aside enough memory to build five rows. And each row has to be wide enough to hold eight boxes. This is an N X 8 array.

	1st Name	Last Name	Street	City	State	Zip	Month	Day
Mary	Jones	15 AL						
Bob	Riley	37 RE						
Joe	Cargile							
Alice	Somme							
Mindy	Clorox							

If we didn't have arrays to work with, we would have to give a different variable name to each item of data. That would mean 40 variable names in this small example program. If you put your own address book into the DATA statements here (and change N in line 5 to equal the total number of people), you might end up with 400 or more pieces of information. Clearly, it is more practical to call Bob Riley's last name A\$(2,2) than to give it a unique variable name.

What's more, we can now easily use this array, this expanded A\$, as part of a loop. (Keep in mind that A\$() is not the same as A\$. You can use both of them in a program and they won't interact; they are two entirely separate variables.) Notice how lines 100-120 quickly and easily fill up the honeycomb of the array, putting each item into its slot. Then, depending on what kind of information we are requesting — addresses or birthdays — X will point to the second or seventh column in the array. X will let us search through the last names or through the months to find the information desired.

Arrays can make it very easy to solve certain kinds of programming problems. How fast could we change our program to tell us all the people who lived in a particular state? Just change line 300 to:

```
300 ?" WHAT STATE": X=5
```

and the array will be searched for matches in the "states boxes," column five. How would you get information on matching zip codes? You can quickly change the entire function of this program by

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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.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players — This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

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.



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 ingenious 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.

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.

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.



NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWII.

Editors note to players — This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

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changing the value of X in line 300. To make all this even more useful, program it to let the user decide which column should be searched.

Have your computer put on screen a list of the categories available (change line 5 to PRINT instead of REM) and then INPUT the user's selection. Then use the number that's INPUT as your X. This would be a short step away from a complete, cross-referenced catalog of your library, stamp collection, or whatever. The programming is easy with arrays. The harder part is the time it would take to type in the name and six items of descriptive information about each record in your collection.

```

2 N = 5 : REM THE TOTAL NUMBER OF PEOPLE
5 REM 1ST NAME--LAST--STREET--CITY--STATE--Z
  IP--MONTH--DAY
10 DATA MARY,JONES,15 ALHAMBRA CT.,SLOMO,ARIZ
  ONA,95221,OCT,10
20 DATA BOB,RILEY,37 REVELO DR.,BIXBY,CA,8100
  0,DEC,23
30 DATA JOE,CARGILE,188 S. TATE ST.,NEW YORK,
  NY,10022,APR,11
40 DATA ALICE,SOMMERVILLE,222 DEVLIN,MAXAPAXA
  ,KY,78215,JUNE,15
50 DATA MINDY,CLOROXEUSE,84 MARKMELLO AVE.,SA

```

```

NDY RIDGE,PA,16864,DEC,1
100 DIMA$(N,8):FORI=1TON:FORJ=1TO8
110 READA$(I,J)
120 NEXTJ:NEXTI
130 PRINT" WOULD YOU LIKE TO SEE:  1. ADDRESSE
  S OR 2. BIRTHDAYS"
140 INPUTK$
150 K=VAL(K$)
160 ONKGOTO200,300
200 PRINT"WHAT IS THE PERSON'S LAST NAME":X=2
210 GOTO400
300 PRINT"WHAT MONTH":X=7
400 INPUTK$
410 FORI=1TON
420 IFA$(I,X)=K$THENQ=1:GOSUB500
430 NEXTI
450 IFQ<>1THENPRINTK$" NOT FOUND. PLEASE CHECK
  SPELLING"
460 Q=0:GOTO130
500 Q=1:FORJ=1TO8:PRINTA$(I,J):NEXT:PRINT:RETU
  RN

```

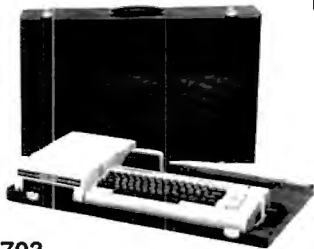
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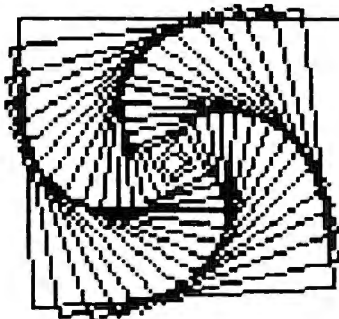
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A Monthly Column



Friends Of The Turtle

David D. Thornburg
Associate Editor

Recursion – Part I

I saw a comic strip recently that showed a sleeping cat having a dream. The dream was of a sleeping cat having a dream, and so on. The final sleeping cat was dreaming of food. This dream of a dream of a dream is an example of recursion.

In computer languages, recursion can take several forms. Recursion is probably the most powerful and least understood programming tool in existence. Because LOGO is a marvelous language for exploring this topic, *and* because recursion can let you generate some beautiful pictures with programs only a few lines long, I have decided to devote this and next month's columns to this topic.

The philosophy behind this treatment of recursion is based on my forthcoming book (tentatively titled *Discoveries of Beauty*, Addison-Wesley, 1983) that will be appearing in your neighborhood bookstores very soon.

If you have LOGO on an Apple, TI, or Radio Shack computer, you will be able to experiment with the topics covered in this month's column. If you do not yet have LOGO, this column may help you make a decision to get it.

What is recursion in computer programming? Recursion is the process by which a procedure can use itself repetitively. The simplest type of recursion (supported by every computer language I have ever used) is called *tail-end recursion*. A simple example of tail-end recursion can be seen in this procedure for drawing a square:

```
TO SQUARE
FORWARD 40
RIGHT 90
SQUARE
END
```



If you entered this procedure and then started it by typing SQUARE, the turtle would move forward 40 units, turn right by 90 degrees, and then use the SQUARE procedure again. Each time the procedure is used, the turtle adds one more side to the square. After the turtle has drawn four sides, the square is finished, but the turtle will keep re-

tracing its path until you interrupt the program (or until your version of LOGO decides it can't keep track of multiple uses of SQUARE any more).

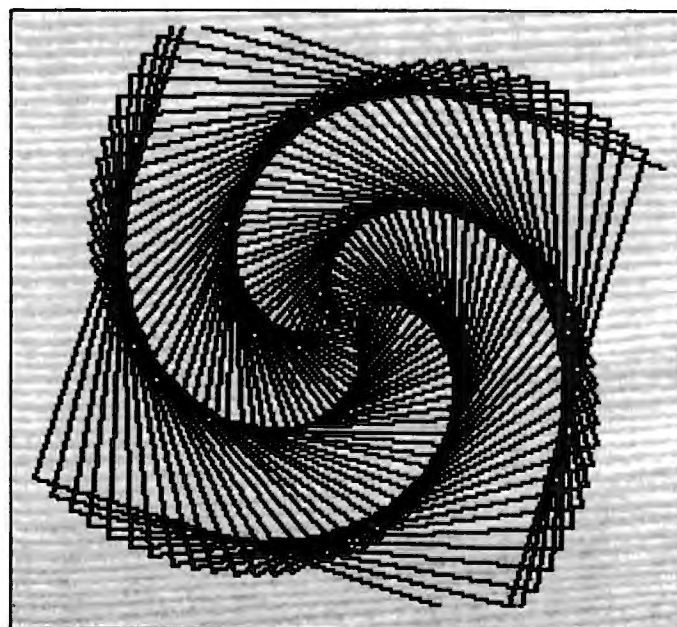
This type of tail-end recursion is available in languages like PILOT through the use of the jump (J:) command, or in BASIC through the GOTO command. The equivalent SQUARE procedure in Atari PILOT looks like this:

```
*SQUARE
GR: DRAW 40
GR: TURN 90
J: *SQUARE
E:
```

Tail-end recursion can also be used to create figures that grow. For example, if we create the LOGO procedure SQUIRAL by entering:

```
TO SQUIRAL :SIZE
FORWARD :SIZE
RIGHT 91
SQUIRAL :SIZE + 1
END
```

then when we enter, for example, SQUIRAL 1, the turtle first moves forward by one unit, turns 91 degrees, and then repeats the procedure with the



new value of :SIZE equal to the old value plus one. The reason that variables can be "passed" to procedures this way is that each time a LOGO procedure is used, the contents of the variables are maintained locally to that use of the procedure. LOGO provides the internal bookkeeping to insure that the value of :SIZE in the second use of SQUIRAL is kept apart from the value of :SIZE we started with. Local variables are a most important feature of languages like LOGO.

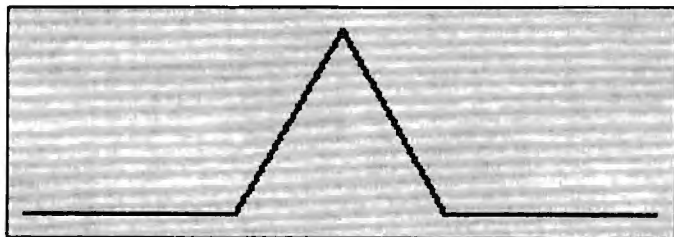
The SQUIRAL procedure also repeats forever, but it does not retrace its own path. This type of tail-end recursion is also possible in languages that have only global (rather than local) variables. In Atari PILOT, for example, this procedure would look like this:

```
*SQUIRAL
GR: DRAW #S
GR: TURN 91
C: #S = #S + 1
J: *SQUIRAL
E:
```

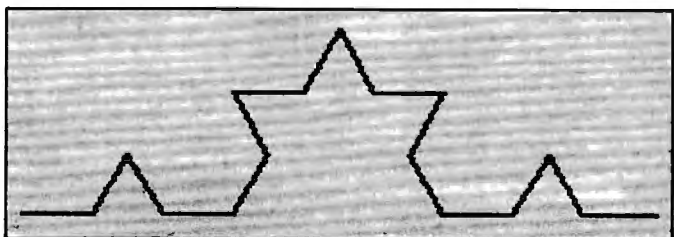
The use of the compute (C:) command allows us to change the value of the numeric variable #S.

As you can see, tail-end recursion is both useful and easy to understand. This form of recursion is just a simple loop from the back of the procedure to the front. Generalized recursion is not so limited.

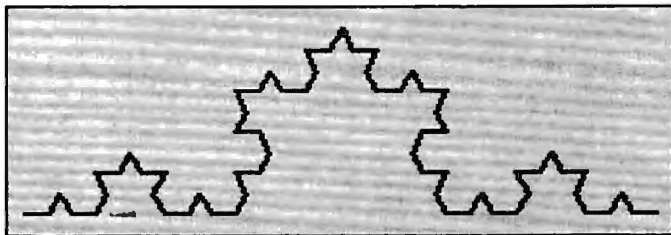
In order to show how general recursion works, we will explore some curves that we described a few columns back – the fractals. Fractal curves are generated by the continued repetition of a simple motif within each portion of an overall curve. For example, suppose we start with the same curve we used in the article on fractals:



By repeating this motif within each straight line segment, we can generate the next pattern in the sequence:



This process can be repeated as many times as we want to get even more complex renditions of the curve:



Explicit Procedures For Drawing Fractals

Before developing a single recursive procedure for drawing this curve, we will explore some explicit methods that will help us understand the recursive form later.

The first procedures we will create are based on the basic triangular bump pattern. To draw this figure, we can use the following two procedures:

```
TO K0 :SIZE
FORWARD :SIZE
END

TO K1 :SIZE
K0 :SIZE/3
LEFT 60
K0 :SIZE/3
RIGHT 120
K0 :SIZE/3
LEFT 60
K0 :SIZE/3
END
```

(This may appear to be a hard way to draw this figure, but the power of this method will become obvious soon.)

To see the result of this procedure, we should start with the turtle near the left edge of the screen and facing to the right. The following setup procedure should do the job nicely:

```
TO SETUP
PENUP
SETPOS [-120 -60]
RIGHT 90
PENDOWN
END
```

Now enter:

```
CLEARSCREEN
SETUP
K1 243
```

You should see the first level curve on the screen.

We chose 243 for the length of the curve because it fills the screen nicely and because it is a power of three. This last characteristic insures that our more complex renditions of this figure will be drawn with integer line lengths. This is especially valuable for those of you using TI or Radio Shack LOGO.

Suppose we want to draw the next level of this curve. To do this, we need to replace each straight line segment with a replica of the figure generated by K1 with the value of :SIZE reduced by a third. The following procedure does this for us:

```
TO K2 :SIZE
  K1 :SIZE/3
  LEFT 60
  K1 :SIZE/3
  RIGHT 120
  K1 :SIZE/3
  LEFT 60
  K1 :SIZE/3
  END
```

As you can see, K2 is identical to K1 except that K2 uses the procedure K1, and K1 uses the procedure K0. To see the result of this procedure, enter:

```
CLEARSCREEN
SETUP
K2 243
```

By now it should be pretty clear that we can generate the next level of the Koch curve by creating the procedure:

```
TO K3 :SIZE
  K2 :SIZE/3
  LEFT 60
  K2 :SIZE/3
  RIGHT 120
  K2 :SIZE/3
  LEFT 60
  K2 :SIZE/3
  END
```

By making a simple modification to K3, we can create the procedure K4 that gives yet another level of detail to our figure, and so on.

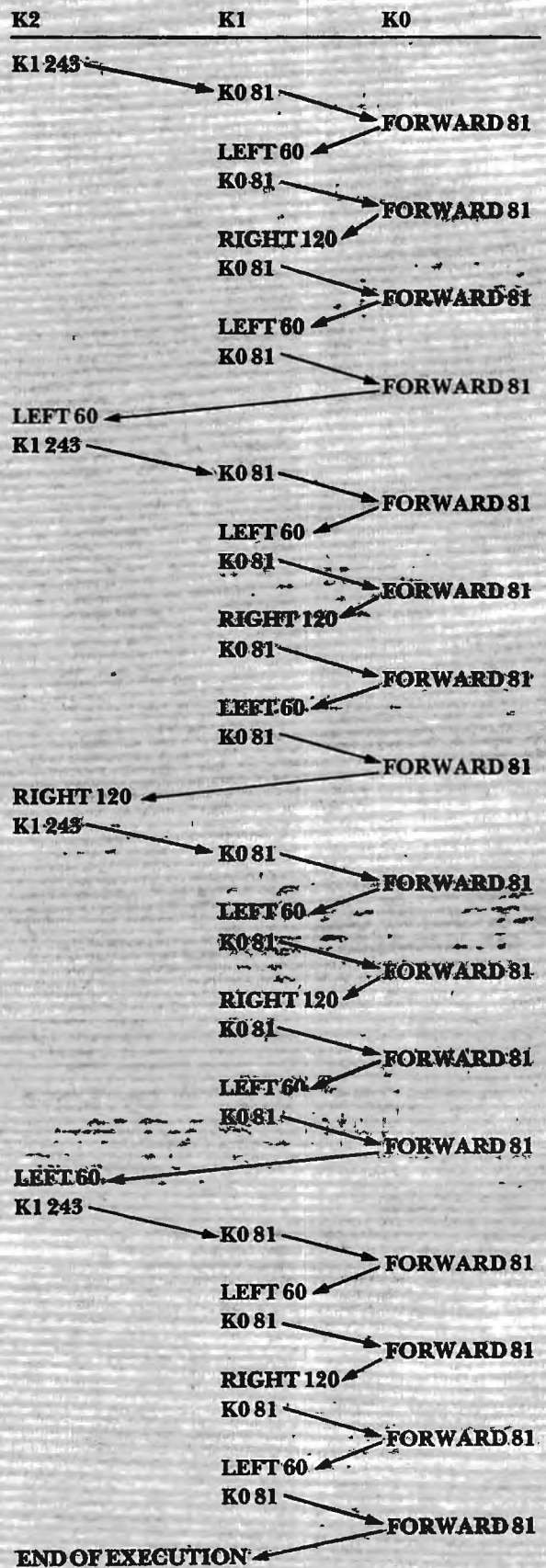
How far do we need to continue this process? We could easily create procedures up to K20 or so, but do we really need to? Since our original procedure (K1) drew lines that were $243/3$, or 81 units long, then the lines drawn by K2 were 27 units long. K3 used nine unit lines, K4 used three units and, if we were to define it, K5 would use lines one screen unit long. Since the computer display screen can't handle lines less than one unit long, it hardly makes sense to try to create this curve with any more resolution than that.

Because of LOGO's ability to use recursion, we will be able to create a single compact procedure that represents this type of curve to any level of accuracy we wish.

Recursive Procedures For Drawing Fractals

If we look at the procedure K0 through K4, we can see a clue that will show us how to create these fractal curves with only one procedure. The first thing to notice is that K0 is the only procedure that actually draws any lines. The other procedures

Table of Command Sequences for K2



only use lower numbered procedures themselves, or turn the turtle. By writing the actual steps as they are executed, we can show how these procedures work. Let us examine K2, for example. If we expand the steps, we can see the sequence of commands as they are carried out. Each column in the table below shows a different procedure. Since K2 uses K1 and K1 uses K0, this table needs only three columns. The arrows show the direction in which control is passed from one procedure to the other.

When we used K2, it used K1 four times, and K1 used K0 16 times to actually draw the lines. A table for K3 would be four times longer than this and would require four columns. If you decide to construct such a table yourself, you will see that by the time K3 has finished, it will have used K2 four times, K1 16 times, and K0 64 times.

Because of the similarities between K1, K2, K3, etc., we should be able to use one procedure to create these curves with any level of complexity we want. We can do this because when LOGO procedures use themselves recursively, LOGO creates as many new copies of the procedure as are needed to keep the levels uniquely identified.

The only procedure we created that is markedly different from the rest is K0, because it only draws lines. The following procedure incorporates all the features of K0, K1, K2, etc., into one compact form that lets us generate any level of this curve we desire.

```
TO TRIAD :SIZE :LIMIT
IF :SIZE < :LIMIT [FORWARD :SIZE STOP]
TRIAD :SIZE/3 :LIMIT
LEFT 60
TRIAD :SIZE/3 :LIMIT
RIGHT 120
TRIAD :SIZE/3 :LIMIT
LEFT 60
TRIAD :SIZE/3 :LIMIT
END
```

To see how this procedure operates, let's examine it line by line. Suppose you were to give the command TRIAD 243 100, for example. First, the size (243) would be tested to see if it was less than the limit (100). Because it is not, TRIAD would be used again with a size of 243/3, or 81. Since in this new use of TRIAD the size (81) is less than 100, a line will be drawn (just as with the procedure K0). As soon as this happens, the STOP command forces LOGO back to the earlier version of TRIAD to carry out its next command (LEFT 60). This process is continued in just the same way that K1 used K0. The only difference is that we are taking advantage of LOGO's ability to keep track of multiple uses of a procedure we have defined only once. It is as though LOGO makes as many copies of TRIAD as it needs and gives them and their variables special names so that they are used

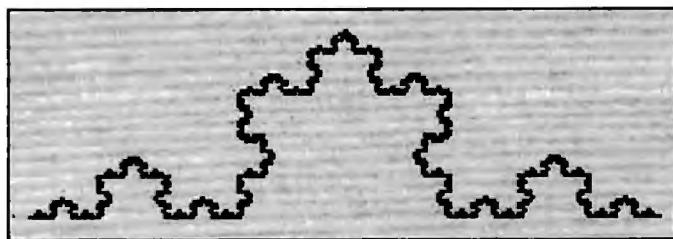
in the right order and without getting the contents of the variables confused.

Experiment with TRIAD (leaving the turtle visible). By watching the figure being drawn, you might gain more insight into the way that recursion is being used to create the figure. To generate the figures we have already drawn, you might use:

```
TRIAD 243 243
TRIAD 243 81
TRIAD 243 27
```

Remember to clear the screen and use SETUP before drawing each curve. To see the most detailed level of this curve that can be shown on the screen, enter

```
CLEARSCREEN
SETUP
TRIAD 243 3
```



Next month we will continue with more examples of fractal curves and explore a few more complex examples of recursion. In the meantime, please feel free to experiment on your own!


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A look at three Apple and Atari programs which assist the computer artist.

A Monthly Column

Learning With Computers:

Computers In The Art Class

Glenn M. Kleiman
Teaching Tools: Microcomputer Services
Palo Alto, CA

An important first lesson in computer literacy is that computers are flexible tools for working with all types of symbols – numbers, words, pictures, and sounds. Many people think of computers as “number-crunching” machines, useful only for business, mathematics, and science. Since computerized word processing has become popular in the last few years, more people have realized that computers can be used for working with words as well as numbers. But few people are aware of the potential of computers for working with pictures and sounds. In this column, I will focus upon *computer graphics* – the use of computers to create pictures.

Computers already influence our visual environment. Movie makers use computers to produce all sorts of special effects. The best example is the movie *TRON*, which contains superb computer-generated animation that appears to be three dimensional. Pictures generated with computers are used in television shows and commercials, magazine advertisements, stadium scoreboards, and, of course, video games. Computer graphics are becoming widely used in business to produce charts, graphs, and other pictorial representations of the results of number crunching. Artists, architects, designers, cartoonists, engineers, and educators are all using computer graphics.

Personal computers capable of high resolution color displays are powerful tools for computer graphics. You will not be able to fully replicate the images of *TRON*, but you can create all sorts of pictures, even three dimensional animations.

You can create pictures on computer screens by writing programs in BASIC, LOGO, or other languages. However, to really explore computer graphics, you will want a program designed to

make it easy to create and manipulate pictures – a graphics editor. As word processing programs facilitate working with written text, graphics editors facilitate working with pictures.

You can use graphics editors to create pictures to be combined with computerized lessons, simulations, or games, to provide visual aids for presentations, and for many other functions. Best of all, you can use these programs to explore this exciting new medium for creativity.

Available graphics editors vary in capabilities, ease of use, necessary hardware, and price. Some are combined with special drawing surfaces, so pictures drawn on the surface are transferred to the computer screen. Others use game paddles, joysticks, light pens, or the keyboard. These editors let you draw pictures quickly and easily and may contain other options for colors, textures, changing sizes, combining pictures, and so on. The following descriptions will give you an idea of how these enjoyable tools can encourage you to explore the exciting world of computer graphics.

The Designer's Toolkit

The *Designer's Toolkit* is a top-of-the-line graphics creation program. Although too expensive for most people, it provides a high standard, both in capability and ease of use, against which other programs can be evaluated.

The *Designer's Toolkit* is for Apple II computers equipped with a graphics tablet. A graphics tablet is a thin, flat device, about 16 inches on each side, with a stylus attached by a cable. Through a special interface and software, the computer can decode where on the tablet the stylus is touching and whether or not the tip on the stylus is pressed.

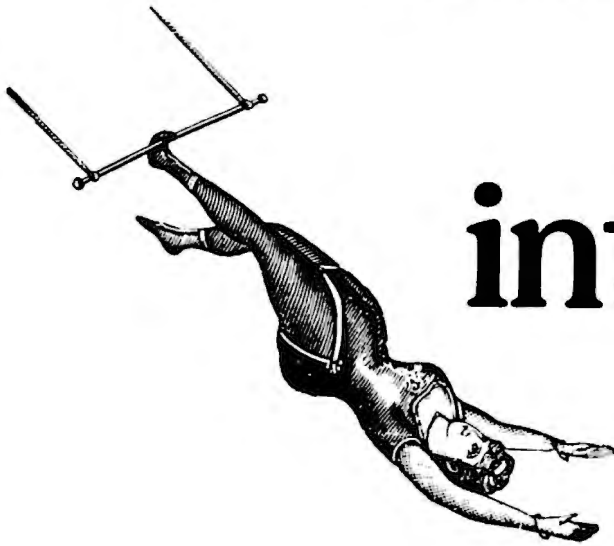
The *Designer's Toolkit* was developed to make all of the graphics capability of the Apple II available and simple to use. The package includes the toolkit disk, a demonstration disk, a 115-page manual with 32 color pictures (all created with the *Designer's Toolkit*), and a plastic overlay to put on the graphics tablet.

Most of the graphics tablet is used as a drawing area, but the top and bottom are used to select options in the program. The overlay contains boxes with colors, shapes, and words. You select each option by touching the stylus to the appropriate box. This lets you use almost all the program's capabilities from the drawing surface, without having to use the keyboard.

The simplest option is drawing. If you hold the stylus near the tablet, a cross mark appears on the screen to show the position that corresponds to the location on the tablet where the stylus is pointed. If you press the stylus down and move it, a line appears. With a little practice, it becomes completely

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natural to move the stylus on the tablet while you are watching the screen.

Ten Permanent Brushes

If you were painting, you would not want to be limited to a single thin brush and white paint on a dark background. The *Designer's Toolkit* provides ways to change the "brush," "paint," and background. Ten permanent brushes are built into the program. These vary in thickness and shape. Some are round and others are long and thin, like a calligraphy pen. You can change your brush at any time by simply touching the stylus to the box representing the brush you would like. Similarly, you can select for either the background or paint color any of 16 colors permanently built into the program.

This selection of brushes and colors is very powerful, but it is just beginning. There are also ten user-defined brushes and ten user-defined colors. The package contains special programs for creating your own brush and color sets. You can make a brush of any shape — a person, letter, pattern, or whatever you like. (For those familiar with Apple programming, the set of user-defined brushes is a shape table.) The color definition program lets you select from 160 possible colors, created by combinations of different dot patterns.

If you were drawing on paper, you might use a ruler, protractor, and compass to create straight lines, angles, and circles. There are options for lines, triangles, rectangles, and circles. Each of these options uses a "rubber-band" technique. For example, after you select the rectangle option, you place the stylus where you want one corner of the rectangle. You then slide the stylus to locate the opposite side. As you move the stylus, the rectangle changes size and shape so you can see exactly where it will appear. When you lift the stylus, the rectangle is automatically drawn with the current brush and color.

There are also options to rotate pictures along the horizontal or vertical axes; to fill enclosed areas with any color; to change colors or to remove colors; to relocate pictures on the screen; to pick up a section of the screen and repeat it elsewhere (a "rubber stamp" option); and to define a temporary "window" to restrict changes to one section of the screen (for erasing or coloring one section only).

The Apple II can hold in memory two pages of high resolution graphics at one time, and you can alternate pages displayed on the screen. The *Toolkit* lets you copy pictures from one page to the other and merge pictures. You can make a set of small pictures, save them on a disk, load one picture at a time to one page, slide, invert, rotate, or color it, and then merge it with the other page. This

makes it possible to create a complete picture from a set of simple ones. There are three merge options, which let you simply combine pictures (OR merge), combine pictures while erasing any parts that overlap (XOR merge), or create a picture with only the parts of the two pictures that overlap (AND merge).

A Magnify Option

There's more. A fantastic magnify option lets you select a section of a picture and magnify it to be anywhere from two to 64 times as large. The original picture appears on one page, and the magnified image appears on the other. You can then change the magnified image, and the changes automatically appear, in reduced size, on the original! This is ideal for making very detailed drawings and for making careful corrections.

You can also add text, in any of 18 type fonts, anywhere on the screen. There is even a review picture program, which lets you create a slide show of pictures on a disk. The extensive manual explains all the options and contains a great deal of information about the capabilities and limitations of Apple graphics.

In sum, simply amazing. Now the bad news: the graphics tablet costs \$800, the *Designer's Toolkit* \$225 (both from Apple dealers).

Paint

Paint is a graphics creation program for Atari computers. It requires joysticks; if you are already a *Pac-Man* or *Asteroids* player, you do not need any new hardware. The *Paint* package includes a disk with three programs (Simple Paint, Super Paint, and Art Show) and a 145-page manual.

The Simple Paint program is designed so most three-year-olds could use it successfully. Once the program is started, only the joystick is used — the keyboard is never needed. The bottom of the screen shows four "paint pots," four "brushes," and an "erase" box. The center of the screen shows a marker which can be moved with the joystick. The child can select a paint color by moving the marker to the paint pot and pressing the button on the joystick.

A brush size is selected by moving the marker to one of the brushes and pressing the joystick button. When the marker is moved and the button held down, a line is drawn in the color and brush size chosen. The joystick controls the direction and length of the line. A new color or brush can be chosen at any time. The erase box is for clearing the entire screen. Sections of the screen can be erased by painting over them with the background color.

Simple Paint makes available all the colors the

Atari can display. To change a color, the child moves the marker to a paint pot and presses the button twice. Then, moving the joystick to the left changes the hue; moving it to the right changes the saturation. When the desired color appears, the child presses the button and resumes painting.

Super Paint adds a number of powerful features to those of Simple Paint. Each option can be selected from the keyboard or by using the joystick to display and choose items on menus. There are nine different shapes of brushes, each of which can be in any of nine sizes. There are options for straight lines, circles, and rectangles. To draw a circle, for example, you select the circle option, move the marker to where you want the center, press the button, and then move the marker to anywhere on the circumference of the desired circle. When you press the button again, the computer completes the circle.

The Zoom Option

You can set the speed of the brush movement to draw quickly or slowly. You can fill areas with a color and change one color on the screen to another. You can select paint colors as in Simple Paint, but Super Paint also lets you draw with plaids, stripes, and other patterns.

A "zoom" option magnifies your picture. When the picture is magnified, the screen functions as a window which can be moved to display different sections of the picture. You can draw on the large picture and then shrink it back to its original size. You can save pictures on disks and use the Art Show program to show them as a series of continuous slides.

The main limitations of *Paint* are due to the hardware used. It is more difficult to draw with a joystick than with a stylus on a surface, and the joystick registers only eight different positions, so you can draw only angles in 45 degree increments. Also, in the graphics mode used, the Atari can display only three colors at a time.

Paint is one of the best designed programs I have seen. I have observed children as young as six master most of the options of Super Paint by exploration, with little help from adults. I have also observed a professional watercolor artist who had never before used a computer become fascinated with creating with *Paint*.

The first 45 pages of the 145 page manual describe the programs; the rest is a well-done description of the way computers work, the history of art, the relation of computer art to other art forms and to our culture, the uses of computer graphics, biographies of computer artists, and ideas for using *Paint*. The book is a valuable introduction to computer art even without the

program.

The *Paint* package sells for \$39.95 (available from Reston Publishing Company, 11480 Sunset Hills Road, Reston, Virginia 22090). Developed at the Capital Children's Museum in Washington, D.C., *Paint* is an outstanding software/book package and an exceptionally good value.

Edu-Paint

Edu-Paint is an inexpensive graphics creation program for the Apple II. It requires game paddles (or a potentiometer-type joystick). You draw with the paddles as if you were using an Etch-A-Sketch. You can choose colors, and there is a "palette" for creating blends and patterns. You can draw lines, circles, and rectangles, fill enclosed areas, and duplicate a section of the screen (like the stamp option in the *Designer's Toolkit*). Each option is chosen from the keyboard. *Edu-Paint* is an easy-to-use graphics creation program. It is available for \$10 from Softswap, Microcomputer Center, San Mateo Office of Education, 333 Main Street, Redwood City, CA 94063. For a catalog only and information, send \$1 to the same address.

VersaWriter

The *VersaWriter* is a hardware and software package available for Apple II, Atari, and IBM computers. (I have not seen the IBM version.) The hardware is a drawing board with a pointer attached. The computer can decode the position of the pointer on the drawing pad.

The *VersaWriter* seems designed primarily for transferring pictures from paper to the computer screen. You can place a picture on the drawing board and trace over it with the pointer. The software lets you change the size of the picture as you trace over it. You can draw with several different brushes and with many colors, fill enclosed areas with color, add text to pictures, and select other functions. The software also lets you create shape tables on the Apple II or player/missile shapes on the Atari. Additional "expansion pack" programs are available for the Apple, to magnify or shrink pictures, combine two screens into one picture, and rotate pictures.

The *VersaWriter* is a good tool for creating graphics to incorporate into your own programs. It has the advantage over *Paint* of providing a drawing tablet which allows better control and the advantage over the *Designer's Toolkit* of being less expensive. However, it is not as smooth or quick to use as the *Designer's Toolkit* or *Paint*. You do have to switch between the keyboard and the drawing board for every command, and if you draw quickly the computer doesn't keep up. The *VersaWriter*, therefore, does not encourage creative art work as well as the

This article describes how a communications system can be set up between a PET (Upgrade ROMs) and a Hewlett-Packard HP3000. The problems solved during the creation of this system suggest solutions to other similar peripheral communications tasks.

A Terminal Operating System For PET To HP3000 +

Penny Peterson
Department of Chemistry
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We have developed a Terminal Operating System (TOS) to link a PET (Upgrade ROMs) to a Hewlett-Packard HP3000 Series III computer. The guiding principle was to implement a link that would permit using the PET as a dumb terminal and that would also permit the transfer of programs and data.

In addition to a standard Model 32N PET, our link made use of a SADI from Connecticut Microcomputers Corporation for the needed conversion from PET IEEE-488 Parallel to RS-232-C Serial. A Bell modem and phone lines provided the remote connection to the main computer. A Toolkit ROM supplement provided some useful software features, but led to some modifications.

The TOS described here was part of a larger project to construct a PET-controlled tunable dye laser spectroscopy system with data acquisition and graphics capability. The TOS provided a link to a larger computer for program editing, major file storage, large scale data processing, and routine terminal access. In particular, the TOS has been used to upload programs from the PET to the HP3000 using the Toolkit APPEND function.

General Idea Of TOS

We want the PET to simply transmit data from the keyboard to the HP3000 via the SADI, and display to the screen data received from the HP3000 via the SADI. There are also some compatibility problems between the PET and the HP3000 which the program must compensate for.

The program first opens a file to the SADI using the options: 300 baud, auto suppression of

line feeds from the HP3000, reversal of upper/lowercase from the PET, and a lot of nulls to be sent by the SADI to the HP3000 after a Carriage Return. The program also POKEs the appropriate values in memory to select the alternate character set (which includes lowercase) and to enable the cursor (needed for use in the HP3000's line-oriented editor).

The main body of the program consists of two loops – one to get a character from the keyboard and send it to the SADI, and one to get a character from the SADI and send it to the screen. In each loop, any conversions of characters necessary to achieve compatibility are made. (Most of these compatibility problems were not evident until the program was in operation.)

In the loop which gets characters from the keyboard, provisions are made to convert PET keys to control keys for the HP3000. PET DELETE is converted to HP3000 BACKSPACE; PET CURSOR RIGHT is converted to HP3000 CONTROL Y (Software Break for use in the Editor). PET CLEARSCREEN (Shift Home) is used to leave the TOS.

In the loop which gets characters from the HP3000, provisions are made to suppress unwanted characters sent by the HP3000. The HP3000 sends XOFF (Control Q) to indicate the end of a message. This control character is an ASCII 17, which happens to correspond to a PET linefeed. The program does not transmit this character, thus avoiding unwanted extra linefeeds. Another compatibility problem was that the HP3000 sends Carriage Return and Linefeed separately, but the PET automatically does a Linefeed upon receipt of a Carriage Return. This was solved by simply ignoring Linefeeds sent by the HP3000. Finally, the PET's blinking cursor caused problems. If the cursor happened to be blinking "on" just before a Carriage Return, a stray cursor would be left behind while the new cursor moved on to the next line. This was prevented by turning off the cursor before executing a Carriage Return from the HP3000, and turning it back on again afterwards.

Speeding Up The Old TOS

The original version of the TOS worked, albeit with some losses of characters in both directions due to speed problems. The BASIC program in the PET that is the TOS must run very quickly in order to catch all incoming characters from the HP3000. A sure-fire way to make the program run fast enough would be to rewrite it in machine language, but this would require a considerable amount of work.

Therefore, I tried all the tricks at my disposal to make the program run fast enough in BASIC.

This involved removing all REMark statements and putting the loops where speed was crucial at the beginning of the program. These loops made liberal use of GOTOs, and, since the execution of a GOTO requires searching sequentially through the program line numbers until the desired one is found, considerable time can be saved by having line numbers frequently jumped to at the beginning of the program. These modifications speeded up the program noticeably.

At this point I discovered that when the "BASIC Programmer's Toolkit" ROM was invoked (SYS 45056), the revised, speed-conscious TOS was not fast enough. Unfortunately, the only documented way to turn the Toolkit off was to turn off the PET, of course resulting in the loss of any programs in the PET. The Toolkit's APPEND function was needed to append programs to be uploaded onto the end of the TOS. (More about the Uploading capabilities of the TOS later).

So until we figured out a software way to turn the Toolkit off, a complicated and time-consuming series of reads and writes to tape was necessary to upload a program to the HP3000 printing (e.g., Load TOS, Append program to be uploaded, Save the TOS + program combination, Turn off the PET to turn off the Toolkit, Reload the TOS + program combination, Run TOS). Disassembling sections of PET BASIC and the Toolkit ROM uncovered the patch which the Toolkit makes to the BASIC Input/Output routines.

In addition to the normal checks for BASIC keywords, the Toolkit adds checks for the Toolkit keywords. These additional checks also slow down BASIC Input/Output. A machine language routine was written which replaced the Toolkit patch with the original BASIC routine. (See Program 2 machine language routine, written by Gary Kaufman, which turns off the Toolkit.) After this routine was incorporated into the TOS, the PET no longer missed characters coming from the HP3000.

The other half of the speed problem – the HP3000 Editor's loss of characters from the PET – occurred because there is a delay between the time that the Editor accepts a line of input (terminated by a carriage return) and the time it starts accepting the next line. This means that any characters sent from the PET to the HP3000 during the delay will be lost. The use of the SADI's ability to send multiple nulls to the HP3000 after a carriage return is an attempt to send only meaningless information during the Editor delay.

This helps alleviate the problem, but does not totally cure it. This loss of characters by the HP3000 Editor is noticeable only when information is being transmitted very quickly, thus ordinary typing into the Editor is not affected. However, the original

Uploading routine, which LISTs information to the HP3000 at about 30 characters per second, was hampered. (See below for instructions for use of original uploading routine.)

Uploading Into The HP3000 Editor

The purpose of the Uploading routine was to transfer a BASIC program from the PET's memory to the HP3000. The original routine works on the premise that the HP3000 Editor neither knows nor cares whether the input it receives from the SADI is being typed in by hand. By using the BASIC commands LIST and CMD, the program to be uploaded can be listed directly to the SADI. First, a file to the SADI must be opened, specifying a non-PET controller and conversion of PET graphics characters to printable mnemonics. Then the command CMD is given, which transfers the PET-User screen dialogue to the HP3000. The subsequent LIST command is performed on the new designated device – the HP3000 Editor.

As mentioned before, the accuracy of the uploading is limited by the time lag in the HP3000 Editor that occurs between the receipt of one line of text and the acceptance of the next. This is a major limitation which cannot be overcome. We thought about developing a handshaking protocol in which the HP3000 Editor would signal when it was ready to accept a new line; but this plan was discarded because it would require each line to be listed individually, and the LIST command is not capable of this. (It is essential to use the LIST command because PET BASIC programs are stored in memory in tokenized form, and LIST is one of the few commands which untokenizes.)

Uploading Into A FORTRAN/3000 File

Even if occasional loss of characters for uploading programs could be lived with, it was certainly unacceptable for the uploading of data. Thus, a completely new uploading routine was designed which did not rely on the HP3000 Editor (Program 3). The new routine lists the program to be uploaded directly into a HP3000 data file via a FORTRAN program.

The data file is created using the :BUILD. The file created must be large enough to hold the programs or data to be loaded into it from the PET. A FORTRAN program (INFILE) reads lines in from the keyboard. Again, lines LISTed from the PET are indistinguishable from lines typed in at the keyboard. These lines are stored into the data file (UPLOAD). A separate FORTRAN program (OUTFILE) allows reading of the data file. Since a FORTRAN program will wait for input as long as necessary, there is no problem with lost characters. This Uploading routine even runs

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faster because it does not require the multitude of nulls to be sent after a carriage return.

Program 1.

```

50000 REM TERMINAL OPERATING SYSTEM
50010 REM PENNY PETERSON
50020 REM PET TO HP3000 VIA SADI
50030 REM MENU
50040 POKE59468,12
      :REM NORMAL CHARSET
50050 PRINT"(H(C> TOS: T)ERMINAL U)PLOAD Q)UIT":
      PRINT
50060 GETA$
50070 IF(A$="T")GOTO50120
50080 IF(A$="U")GOTO50310
50090 IF(A$="Q")GOTO50380
50100 GOTO50060
50110 REM ACT AS A DUMB TERMINAL
50120 CLOSE 5
50130 PRINT"(H(CPET TO HP3000 TERMINAL OPERATING
      SYSTEM"
50140 POKE 59468,14
      :REM AL
      TERNATE CHARSET
50150 POKE167,0
      REM CURSOR ENABLE
50160 D$="EAR"
      :REM SADI DESCRIPTORS E-300 B
      AUD; A-AUTO SUPPRESS
50161 :REM R - REVERSES UPPER/LOWER CASE FROM P
      ET
50170 OPEN 5,4,15,D$
      :REM SADI DEVICE #4; S
      ECONDARY ADDRESS = 15
50179 REM
50180 GET A$:IF A$="" THEN 50240
      :REM GET CHAR FROM PET
50181 :REM IF NOT FOUND, GO CHECK FOR CHAR FROM
      HP
50190 IF ASC(A$)=13 THEN PRINT#5:GOTO50180 :REM
      IF <CR> SEND IT TO HP
50200 IF ASC(A$)=20THENA$=CHR$(8)
      :REM PET DE
      LETE --> HP BACKSPACE
50210 IFASC(A$)=29THENA$=CHR$(25)
      :REM PE
      T CURSOR RT -->CNTRL Y
50220 IFASC(A$)=147THEN50030
      :REM IF PET CLR
      SCREEN, JUMP TO MENU
50230 PRINT#5,A$;
      :REM SEND CHAR FROM PE
      T KEYBOARD TO HP3000
50239 REM
50240 GET#5,A$:IF A$="" THEN 50180
      :REM GET CHAR FROM HP
50241 :REM IF NOT FOUND, GO CHECK FOR CHAR FROM
      PET
50250 IFA$=CHR$(17)THEN50180
      :REM SUPPR
      ESS UNWANTED LINEFEED
50260 IFA$=CHR$(13)THENPOKE167,1:PRINT " :A$="":
      POKE167,0:GOTO50180
50261 :REM WIPE CURSORS FROM END OF LINES SO DON
      'T LITTER SCREEN
50270 IFA$=CHR$(10)THENA$="":REM SUPPRESS LINEFE
      ED FROM HP
50280 PRINT A$;
      :REM SEND
      HP CHAR TO PET SCREEN
50290 GOTO 50180
50300 REM UPLOAD
50310 CLOSE 5
50320 PRINT"(H(CUPLOADING..."
50330 POKE 167,1
      REM DISENABLE CURSOR
50340 OPEN 5,4,15,"EPC997"
      :REM SADI DESCRIPTORS
50341 :REM 300 BAUD/NONPET CONTROLLER/PRINT CONT
      ROL CHARS/
50342 :REM 9+9+7= 25 EXTRA NULLS SENT AFTER <CR
      >
50350 CND 5
      :REM TRANSFER SCREEN DI
      ALOGUE FROM PET TO HP

```

```

50360 LIST
      :REM SENDS PROGRAM TO BE UP
      LOADED FROM PET TO HP
50370 REM LIST KICKS US BACK TO BASIC
50380 CLOSE 5
50390 END

```

Program 2.

```

140 PRINT"(H(C"
150 PRINT"TOOLKIT DISCONNECT ROUTINE"
160 N=832:FORI=57647TO57656
170 X=PEEK(I):POKEN,X:N=N+1:NEXTI
180 FORI=826TO831:READX:POKEI,X:NEXTI
190 FORI=842TO848:READX:POKEI,X:NEXTI
200 DATA165,119,72,165,120,72
210 DATA104,133,120,104,133,119,96
220 POKE833,24:SYS826
230 PRINT"TOOLKIT DISCONNECTED"
240 END

```

Program 3.

```

0 GOTO100
1 GOSUB 29
2 GOTO15
3 GETA$:IFA$=""THEN9
4 IFASC(A$)=13THENPRINT#5:GOTO3
5 IFASC(A$)=20THENA$=CHR$(8)
6 IFASC(A$)=29THENA$=CHR$(25)
7 IFASC(A$)=147THEN15
8 PRINT#5,A$;
9 GET#5,A$:IFA$=""THEN 3
10 IFA$=CHR$(17)THEN3
11 IFA$=CHR$(13)THENPOKE167,1:PRINT " :A$="":
      POKE167,0:GOTO3
12 IFA$=CHR$(8)THENA$=CHR$(20)
13 PRINTA$;:GOTO3
14 RETURN
15 POKE59468,12:PRINT"(H(C> TOS: T)ERMINAL U)
      PLOAD Q)UIT"
16 GETA$:IF(A$="T")GOTO21
17 IF(A$="T")GOTO21
18 IF(A$="U")GOTO24
19 IF(A$="Q")GOTO27
20 GOTO16
21 CLOSE5:PRINT"(H(CPET TO HP3000 TERMINAL OP
      ERATING SYSTEM"
22 POKE59468,14:POKE167,0:D$="EAR":OPEN 5,4,1
      5,D$
23 GOSUB3
24 CLOSE5:PRINT"(H(CUPLOADING..."
25 POKE167,1:OPEN5,4,15,"EPC99997":CMD5
26 LIST
27 CLOSE 5
28 RETURN
29 REM
30 REM MACHINE CODE TO DISCONNECT
31 REM THE BASIC PROGRAMMER'S TOOLKIT
32 REM
33 PRINT"(H(C"
34 PRINT"TOOLKIT DISCONNECT ROUTINE"
35 N=832:FORI=57647TO57656
36 X=PEEK(I):POKEN,X:N=N+1:NEXTI
37 FORI=826TO831:READX:POKEI,X:NEXTI
38 FORI=842TO848:READX:POKEI,X:NEXTI
39 DATA165,119,72,165,120,72
40 DATA104,133,120,104,133,119,96
41 POKE833,24:SYS826
42 PRINT "TOOLKIT DISCONNECTED":FORI=1TO 1000
      :NEXTI
43 RETURN

```

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Computer Controlled Telephone Dialing

Mark Savarese
Livermore, CA

After playing a number of games on my Atari computer, I decided that writing a game with the quality of commercially available products might be pretty time consuming. So, I decided to do what I like best, tinkering.

I wanted a project that would be short but interesting and needed no hardware additions to my basic system. What uses computer-like sounds besides computer music? Why, telephone beeps, of course!

After a little research, I found that Touch Tone phone systems can be dialed by providing pairs of audio tones to the mouthpiece.

	1	2	3	4	Column #
Frequency	1209	1336	1447	1663	Hz.
697	1	2	3	A	1
770	4	5	6	B	2
852	7	8	9	C	3
941	*	0	#	D	4
Hz.					Row #

Notice the fourth column (A,B,C,D). These buttons are not present on regular telephones, but tone pairs have been defined for them.

Suppose you wish to "dial" an 8. Just send two tones (at the same time) to the mouthpiece. An 8 would require one tone at 852 Hz and another tone at 1336 Hz.

Controlling Frequency

The Atari makes this a fairly simple task: simply

send one tone on one voice and the other tone on a second voice. There is a complication, however. With normal tone generation, it is difficult to reproduce the exact frequencies needed. Never fear. The Atari provides a special mode to allow more precisely controlled frequency outputs. Two voices can be joined together to yield one "Double Precision Voice."

Line 370 connects the Atari's four voices and runs them as fast as possible to give a more precisely controlled output.

340 REM CONNECT REGISTERS 1 AND 2 INTO ONE 16-BIT REGISTER.

350 REM CONNECT REGISTERS 3 AND 4 INTO ONE 16-BIT REGISTER.

360 REM CLOCK ALL FOUR REGISTERS AT 1.789790 MHZ (EXACTLY).

370 POKE 53768,120:REM SEE HARDWARE MANUAL.

The needed control rate can be calculated with the following formula:

$$\text{Control Rate} = \frac{\text{Input Frequency} = 1.78979 \text{ MHz}}{2 * \text{Output Frequency Desired}} \cdot 7$$

The control rate is used to produce a specific output frequency. The seven in the above formula is a fudge factor used when two sound registers are connected together.

In order to get the frequencies needed to dial an 8, calculate:

$$\text{Row Control Rate} = \frac{1789790}{2 * 852} \cdot 7 = 1043.3462 = 1043$$

$$\text{Column Control Rate} = \frac{1789790}{2 * 1336} \cdot 7 = 662.8316 = 663$$

Notice that the numbers were rounded to the nearest whole number. This rounding results in an error of less than 0.1 per cent.

Rather than have the Atari calculate two control rates for each digit to be dialed, I pre-calculated the rates needed for the eight possible frequencies and put these values into the array T.

While this technique requires a little more typing, it saves a significant amount of CPU time. (It is rather wasteful to recalculate the same eight values repeatedly. And an array of the eight frequencies would be required anyway.)

170 DIM T(15,2):REM ETC.

The above dimension statement yields 16 sets of three values, which cover the 16 possible buttons on the telephone. Each phone button requires four bytes of information, but only three values need to be stored in the array because the fourth value is always a two by coincidence.

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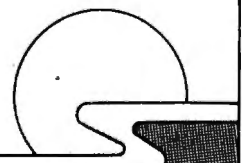
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Here is an explanation of the program:

Lines

- 0-140 Main program which calls two subroutines.
 150-330 Load pre-calculated frequency control values into the array T.
 340-400 Set up audio registers.
 420-460 Get next "digit" to be dialed.
 470-480 Convert "digit" to an ATASCII code number.
 490-580 Convert "digit" to a number between 0 and 15 if it is legal, and call the tone output routine.
 590 Return for a new user input if an illegal "digit" was entered.
 600-700 Load frequency control values into the audio registers and output a tone pair.

These are the steps you take to use the program:

- Type the program in and SAVE it.
- Type RUN.
- The program will prompt you to enter a phone number.
- Type in the phone number you want (I suggest you use your own number to test).
- Make sure your TV volume is set moderately.
- Take your phone off the hook and check for the dial tone.
- Hold (or prop up) the mouthpiece very near your TV speaker.
- Finally, depress the return key on your computer.
- If nothing happens, you may need to adjust the TV volume up or move the phone closer to the TV speaker.
- Remember, only legal digits may be entered, no (,)- characters are allowed.

```

0 REM PHONE DIALING PROGRAM.
10 REM SET UP TONE TABLE AND SOUND REGISTERS.
20 GOSUB 150
30 REM ACCEPT AN INPUT FROM THE KEYBOARD.
40 PRINT
50 PRINT "ENTER PHONE NUMBER (UP TO 10 BUTTONS)"
60 PRINT "FROM 0,1,2,3,4,5,6,7,8,9,A,B,C,D,*,#"
70 PRINT "OR A CONTROL C TO EXIT THE PROGRAM.":PRINT
80 INPUT NO$
90 REM CONVERT CHARACTER TO APPROPRIATE TONE NUMBER AND OUTPUT TONE.
100 GOSUB 430
110 REM IF LAST CHARACTER WAS NOT A CONTROL C, GO BACK FOR THE NEXT CHARACTER.
120 IF ASC(CH$)<>3 THEN GOTO 40
130 SOUND 0,0,0,0:REM RESET SOUND.
140 END
150 REM SET UP THE TONE TABLE.
160 SOUND 0,0,0,0:REM INITIALIZE SOUND REGISTERS,(REQUIRED).

```

```

170 DIM T(15,2):DIM CH$(1):DIM NO$(10)
180 T(0,0)=151:T(0,1)=3:T(0,2)=176
190 T(1,0)=221:T(1,1)=4:T(1,2)=253
200 T(2,0)=151:T(2,1)=4:T(2,2)=253
210 T(3,0)=87:T(3,1)=4:T(3,2)=253
220 T(4,0)=221:T(4,1)=4:T(4,2)=131
230 T(5,0)=151:T(5,1)=4:T(5,2)=131
240 T(6,0)=87:T(6,1)=4:T(6,2)=131
250 T(7,0)=221:T(7,1)=4:T(7,2)=19
260 T(8,0)=151:T(8,1)=4:T(8,2)=19
270 T(9,0)=87:T(9,1)=4:T(9,2)=19
280 T(10,0)=19:T(10,1)=4:T(10,2)=253
290 T(11,0)=19:T(11,1)=4:T(11,2)=131
300 T(12,0)=19:T(12,1)=4:T(12,2)=19
310 T(13,0)=19:T(13,1)=3:T(13,2)=176
320 T(14,0)=221:T(14,1)=3:T(14,2)=176
330 T(15,0)=87:T(15,1)=3:T(15,2)=176
340 REM CONNECT REGISTERS 1 AND 2.
350 REM CONNECT REGISTERS 3 AND 4.
360 REM CLOCK ALL 4 REGISTERS AT 1.789790 MHZ.
370 POKE 53768,120
380 REM SET ALL VOLUMES TO ZERO.
390 POKE 53761,160:POKE 53763,160
400 POKE 53765,160:POKE 53767,160
410 RETURN
420 REM CHECK FOR AN EMPTY STRING.
430 IF LEN(NO$)<=0 THEN RETURN
440 REM STRIP OFF LEFTMOST CHARACTER FROM THE STRING.
450 CH$=NO$(1,1):IF LEN(NO$)=1 THEN NO$=""
460 IF LEN(NO$)<>0 THEN NO$=NO$(2)
470 REM CONVERT CHARACTER TO EQUIVALENT ATASCII CODE NUMBER.
480 CH=ASC(CH$)
490 REM CONVERT TO A NUMBER BETWEEN 0 AND 15.
500 REM ADJUST IF 0 TO 9.
510 IF CH<=57 AND CH>=48 THEN TN=CH-48:GOSUB 610:GOTO 430
520 REM ADJUST IF A TO D.
530 IF CH<=68 AND CH>=65 THEN TN=CH-55:GOSUB 610:GOTO 430
540 REM ADJUST IF a TO d.
550 IF CH<=100 AND CH>=97 THEN TN=CH-87:GOSUB 610:GOTO 430
560 REM ADJUST IF # OR *.
570 IF CH$="#" THEN TN=15:GOSUB 610:GOTO 430
580 IF CH$="*" THEN TN=14:GOSUB 610:GOTO 430
590 RETURN:REM RETURN IF ILLEGAL CHARACTER.
600 REM PUT TONE VALUES INTO SOUND REGISTERS.
610 POKE 53766,2:POKE 53764,T(TN,0):POKE 53762,T(TN,1):POKE 53760,T(TN,2)
620 REM TURN UP THE VOLUME ON REGISTERS 2 AND 4.
630 POKE 53767,168:POKE 53763,168
640 REM WAIT A SHORT TIME.
650 FOR I=1 TO 50:NEXT I
660 REM TURN OFF THE VOLUME ON REGISTERS 2 AND 4.
670 POKE 53767,160:POKE 53763,160
680 REM WAIT A SHORT TIME.
690 FOR I=1 TO 10:NEXT I
700 RETURN

```

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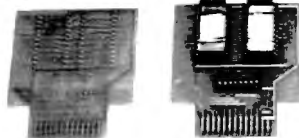
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From VIC-20 To Mainframe

Ulrich Merten
Pittsburgh

We recently wanted to use our VIC-20 to communicate with a mainframe computer running under IBM's VM/CMS interactive system. We wanted to access our files on the mainframe, to write into those files using the system editor, and to list BASIC programs developed on the VIC-20 to the larger system. The system has a 300 baud ASCII port which is accessible by telephone.

For this purpose we used a Bizcomp Versamodem and rewrote the software to fit our situation. In the process, we had to learn to convert a BASIC program listing into a cassette data file on the VIC-20. The methods we used should be of interest to other VIC-20 users with similar communications challenges.

The terminal program we wrote begins by opening a file directed to the VIC-20's RS-232 interface, specifying a "file name" which selects a communications speed of 300 baud. The program has two major segments which work alternately, one looking for input from the VIC keyboard, using the "GETB\$" command at line 160, and the other looking for input from the mainframe, using the "GET#10,C\$" command at line 560. The bulk of the program is concerned with converting the VIC characters to ASCII, and also with translating the ASCII code arriving from the mainframe into the corresponding VIC characters on the screen.

Because we were interested in working with text in the system editor, we set the VIC keyboard in the mode in which it types upper- and lowercase letters to the screen. At lines 305 and 330, the VIC codes for the lower- and uppercase alphabetic characters, respectively, are incremented to give the appropriate ASCII codes for the same letters. The remaining lines from 300 through 335 take care of a variety of problems, two of which deserve mention here.

Line 300 calls a subroutine which sends a quotation mark ahead of the ASCII code for "#", because we found that without this provision, the # symbol was not transmitted. This was the only case we encountered where the quotation mark was necessary, but there may be others. Line 301

sets the F1 key on the VIC for a purpose we'll discuss below. Obviously, additional lines could be written into the program at this point to accommodate other function keys. Line 400 causes our input to be printed on the screen so that we can see what we're doing, and line 500 sends it on to the RS-232 interface and the mainframe.

The codes coming back from the host are pure ASCII and have to be converted to what the VIC uses in this screen mode, and that's what lines 530-610 are all about. Lines 555 and 600 take care of upper- and lowercase alphabetic characters, respectively, and line 540 translates the signal sent out by the mainframe at the end of each line. The rest of the lines in the range 530-610 are for housekeeping.

The program increments most of the ASCII codes which do not represent alphanumeric characters by 160, causing them to print out as VIC graphic characters. This has the advantage that if and when the mainframe sends back one of these characters, you see it on the screen and can identify it. The feature can be eliminated as an unnecessary nuisance once you know what is being sent your way!

Buffer Relief

When we tried to "LIST" to the RS-232 interface using an early version of this program, we found that the buffer quickly overloaded and that our transfer attempts were unsuccessful. So we converted the program we wanted to list into a data file on our cassette, using the command series:

```
CLOSE1:OPEN1,1,1:CMD1:LIST
```

This proved a successful stratagem, except that when we used the "GET" command to read this file, we didn't get the last few program lines. We solved this problem by adding a few lines of "pound signs," CHR\$(92), at the end of the program and sacrificing those.

Lines 190-225 of the terminal program exist to take care of these program listings. If the F1 key is depressed, the variable "z" is set equal to one, and the next time the program passes through line 150 it opens the cassette file at line 190, and starts reading the contents. Lines 215 and 220 tell the

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program what to do with some special VIC characters we had in the programs, which ASCII can't handle, and line 230 makes the program print out in uppercase at the mainframe. Line 210 watches out for those "pound signs" we added at the end of the listed program, and halts the proceedings when it sees the first one.

Our first attempts to run this version of the program were unsuccessful, because data kept going out at the end of each line, before the mainframe was ready for them. That's why we added the "IF" statement to line 510. The mainframe sends out a period when it's ready for a new line, and now the VIC waits for that period to come back before proceeding, after each time it sends out a carriage return.

We've found it possible to work effectively between the VIC-20 and the mainframe using this program, and are very pleased with the ease with which we can modify the "IF" statements to meet various demands such as printing substitute characters for those not available in ASCII.

```

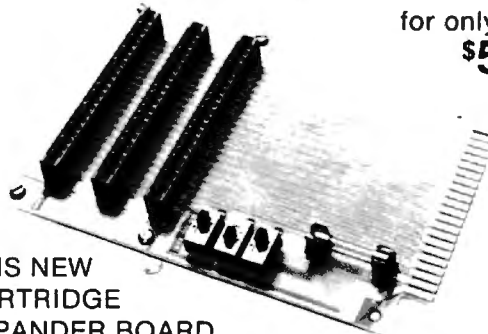
100 OPEN10,2,3,CHR$(38)+CHR$(160)
150 IFZ=1THEN190
155 IFZ=2THEN200
160 GETB$
165 IFB$=' 'THEN510
170 X=ASC(B$)
180 GOTO300
190 CLOSE1:OPEN1,1,0:Z=2:GET#1,B$:GET#1,B$
200 GET#1,B$
205 X=ASC(B$)
210 IFX=92THENZ=0:CLOSE1:GOTO510
215 IFX=180RX=146THEN510
220 IFX=147THENX=99:GOTO400
225 IFX=34THENX=39:GOTO400
230 IFX>64ANDX<91THEN400
300 IFX=35THENGOSUB645:GOTO400
305 IFX>64ANDX<91THENX=X+32:GOTO400
310 IFX>127ANDX<133THENX=X-32:GOTO400
315 IFX=133THENZ=1:GOTO150
325 IFX>133ANDX<192THENX=X-128:GOTO400
330 IFX>192ANDX<224THENX=X-128:GOTO400
335 IFX>224THENX=X+128:GOTO400
400 PRINTB$;
500 PRINT#10,CHR$(X);
510 GET#10,C$:IFX=13ANDZ<>0ANDC$<>' '.'THEN510
520 IFC$=' 'THEN620
525 Y=ASC(C$)
530 IFY=13THEN620
540 IFY<32THENY=Y+160:GOTO615
555 IFY>64ANDY<91THENY=Y+128:GOTO615
560 IFY=96THENY=32:GOTO615
600 IFY>96FANDY<123THENY=Y-32:GOTO615
605 IFY>122ANDY<127THENY=Y-64:GOTO615
610 IFY=127THEN630
615 C$=CHR$(Y)
620 PRINTC$;
630 IFST=0THEN150
640 PRINT'ERROR'
645 PRINT#10,CHR$(34);
646 RETURN
650 END

```

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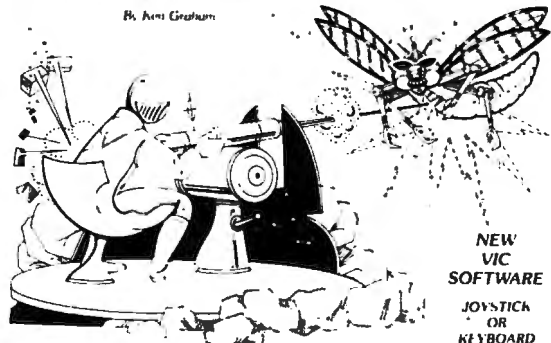


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Two programs in Applesoft to lend variety to your program menus.

Apple Menu

Robert J. Beck
Minneapolis, MN

An often-ignored but essential component of many programs is the menu, or list of options. Here are a couple of variations that may make your programs a bit more interesting. Each of these imaginary menus consists of four choices: "First," "Second," "Third," and "Quit." The first three choices return you to the menu after printing a word; the "Quit" option stops the program.

An Alphabet Menu

```
10 R$ = "FSTQ"
20 PRINT "FIRST, SECOND, THIRD, OR QUIT"
30 PRINT "F,S,T, OR Q?";
40 GET Z$: PRINT
50 FOR I = 1 TO 4
60 IF Z$ = MID$(R$,I,1) <> THEN ON I GOTO 500,600,700,800
70 NEXT I
80 PRINT "PLEASE CHOOSE";
90 GOTO 30
500 PRINT "FIRST": GOTO 30
600 PRINT "SECOND": GOTO 30
700 PRINT "THIRD": GOTO 30
800 PRINT "QUIT": END
```

In the example above, you make a choice by typing a letter. The letter is an abbreviation of the choice. Abbreviations don't use much space; you can use a one or two-line menu, thus preserving previous screen output.

Line 10 sets up a string variable that is a concatenation of the abbreviations. Matching the input from line 40 with this string generates an index value that is used in the ON GOTO of line 60. Essentially, R\$ is used as a table, and lines 50-70 perform a table lookup. An array, such as R\$(1) - R\$(4), could substitute for R\$, but that's a waste of memory. Note that, especially with long option lists, this method is superior to using a series of IF/THEN statements to make the branch.

You type nothing in when using the arrow menu. Instead, you move an arrow until it points at the desired choice, then you press the RETURN key. The only way that you can accidentally make an unwanted choice is by being too hasty with the RETURN key.

Let's take it one line at a time. Line 10 initializes some important variables: HT (horizontal tab) is the number of spaces that the option list is tabbed over, VT (vertical tab) is the vertical line number at which the list begins, N is the number of options,

An Arrow Menu

```
10 HT = 10: VT = 7: N = 4: T = VT
20 HOME: PRINT: "TEST MENU"
30 VTAB VT
40 FOR I = 1 TO N
50 READ CHOICES$: HTAB HT: PRINT CHOICES$: PRINT
60 NEXT
70 DATA FIRST,SECOND,THIRD,QUIT
80 VTAB22: PRINT "TYPE 'D' TO MOVE DOWN, 'U' TO MOVE UP."
90 PRINT "HIT RETURN TO SELECT."
100 POKE 33,3: POKE 32,HT - 5: VTAB VT
110 HTAB 1: PRINT "->" ;; GET C$
120 IF C$ = "D" AND T < N + VT - 1 THEN HTAB 1: PRINT " ":PRINT:T = T + 1:GOTO110
130 IF C$ = "U" AND T > VT THEN HTAB 1:CALL-868: VTAB PEEK(37)-1:T = T - 1:GOTO110
140 IF C$ = CHR$(13) THEN TEXT: ON T - VT + 1 GOTO 500,600,700,800
150 GOTO 110
500 HOME: SPEED = 50: PRINT"FIRST": SPEED = 25
5: GOTO 10
600 HOME: SPEED = 50: PRINT"SECOND": SPEED = 25
55: GOTO 10
700 HOME: SPEED = 50: PRINT"THIRD": SPEED = 25
5: GOTO 10
800 HOME: PRINT "QUIT": END
```

and T is used to keep track of which choice the arrow points at. Line 20 prints the title, line 30 tabs to the preset vertical line, and lines 40-80 print the menu. The first POKE in line 90 sets line width to three spaces; the second POKE sets the left margin five spaces to the left of the menu. A VTAB to the top of the menu list completes the preparations for printing the arrow and GETting a keypress at line 110.

If T equals $N + VT - 1$, the arrow is at the bottom of the list; if T equals VT, then the arrow is at the top. Lines 120 and 130 illustrate two slightly different ways of moving the arrow. Line 120 prints blank spaces over it, while line 130 uses a monitor subroutine to erase it from the screen. Note that, though the cursor is moved two lines upward, the VTAB in line 130 is for PEEK (37) - 1. This is because VTAB numbers the screen lines from 1 to 24, but PEEK (37) uses 0 to 23. Unless your program uses the same line width and margin as the menu, you'll need the TEXT in line 140 to reset the text window. C

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With this program it's much easier to generate sprites on the Commodore 64. You can draw a shape, examine it, modify it, and then save it in DATA statements ready to use anywhere.

A Shape Generator For The Commodore 64

Donald A Pitts
Houston

The sprite graphics of the Commodore 64 is an attractive feature. It allows you to create rapid movement of complex shapes with one shape disappearing behind another in an apparent three dimensional display. The sprite is a 24 by 21 grid with each grid element being one bit. Three bytes are positioned side by side to make up the 24 bits. To manually build a sprite, a user would have to construct the grid on graph paper, draw the desired figure, and then determine the value of each byte according to the bits which are enabled (see Figure 1). Although Commodore set up the sprite system in a way that is very logical, the shape generator program makes the job of generating sprites easier and much faster.

The program, Shape Gen, allows you to draw a shape on a 24 by 21 grid on the screen, preview what the sprite will look like, modify the sprite further, and finally save the sprite information in BASIC DATA statements. To the left of the grid is a menu of available commands. Below that is a space for the sprite to be displayed, in both normal and enlarged sizes. This allows the user to determine the exact way the sprite will be displayed prior to saving it. When the shape is deemed perfect, pressing the "←" key will erase the Shape Gen program and leave behind the data statements that describe the sprite you have just drawn.

Drawing The Shape

Four keys (I = up, J = left, K = right, M = down) are used to move the Shape Gen cursor. Either shift key may be pressed to draw while the cursor is either moving or stationary. The Commodore key works the same way, except its function is to delete pixels on the grid. When you have finished drawing the shape or want to see what the shape would look like as a sprite, press F1 (located in the upper right of the keyboard).

The program will tell you it is compiling the shape at this point. In a few moments the cursor will reappear, and two shapes will appear at the left side of the screen. At this point you may either

change the shape or transform the shape into DATA statements. Should you desire to start over, you may depress the CLR/HOME key.

Once you have compiled the shape for the last time, press "←"; a warning will appear because this option erases the Shape Gen program leaving behind the DATA statements with the data necessary to re-create the sprite in other programs. Press "Y" or "N" in response to "continue?". If you respond "Y" the DATA statements will be listed to the screen, and Shape Gen will end execution. Now you are free to add your own program to the DATA statements to manipulate the shapes on the screen. To do this, it will be helpful to read section six of the *Commodore 64 User's Guide*.

The following is an example of a group of DATA statements generated by the Shape Gen program together with a BASIC program that will move this sprite from the upper middle to the lower left of the screen.

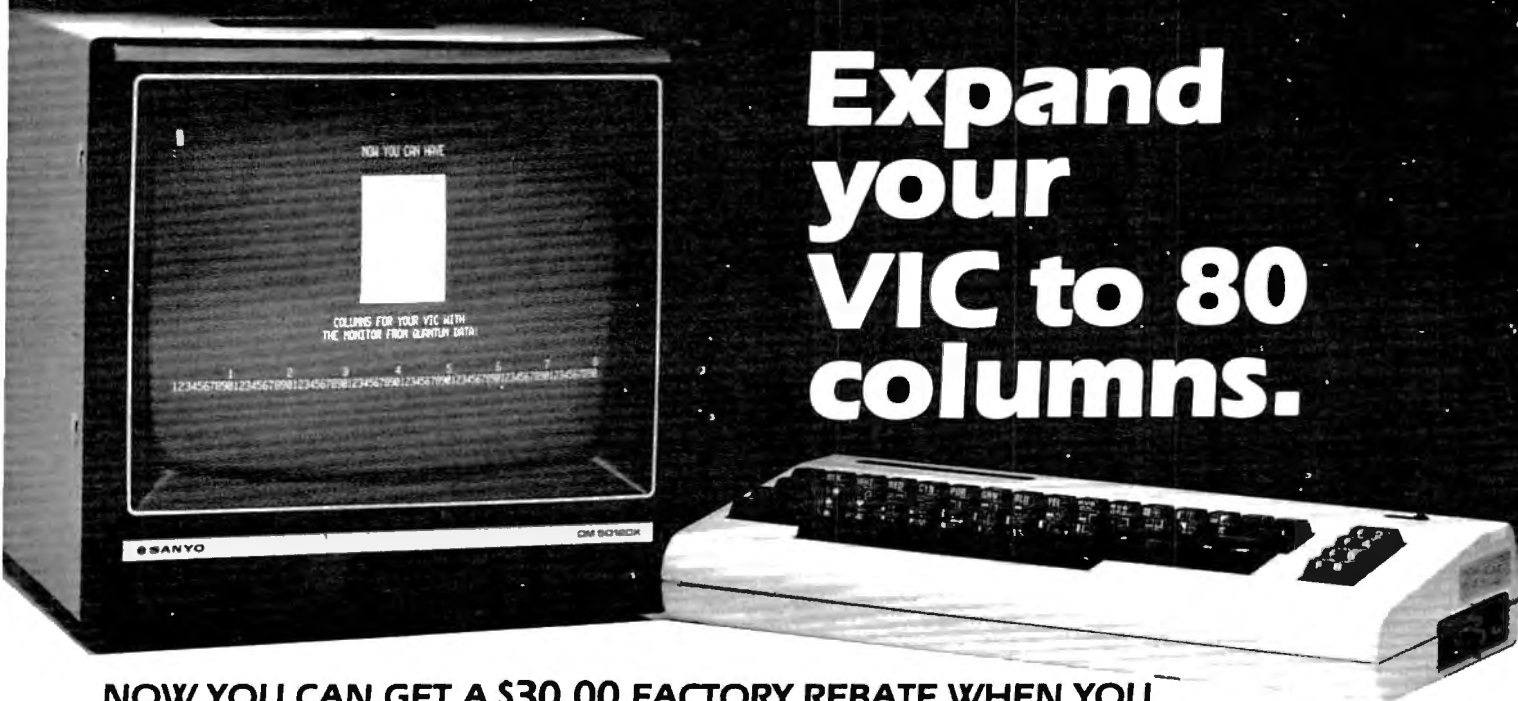
```

1 REMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
2 REMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 REMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
4 REMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
50 REM
60 REM
100 PRINTCHR$(147):FORX=55296TO56295:POKEX,3:N
  EXT
105 PRINTCHR$(145);TAB(13);CHR$(18);"SHAPE GEN
  1.0";CHR$(146)
107 PRINT:PRINT" ";CHR$(18);"I";CHR$(146);"  "
  = UP"
109 PRINT" ";CHR$(18);"M";CHR$(146);"  "
  = DOWN
111 PRINT" ";CHR$(18);"J";CHR$(146);"  "
  = LEFT
113 PRINT" ";CHR$(18);"K";CHR$(146);"  "
  = RIGH
  T"
114 PRINT" ";CHR$(18);"COM";CHR$(146);"  "
  = DELE
  TE"
115 PRINT" ";CHR$(18);"SHFT";CHR$(146);"  "
  = DRAW
116 PRINT" ";CHR$(18);"_" ;CHR$(146);"  "
  = DATA
117 PRINT" ";CHR$(18);"F1";CHR$(146);"  "
  = SHAP
  E"

```

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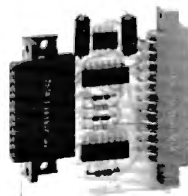
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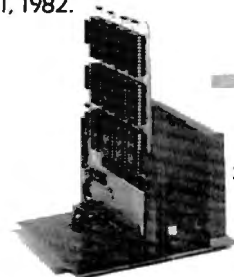
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```

118 PRINT " ";CHR$(18);"HOME";CHR$(146);"= CLEA
R"
119 PRINT:PRINT:PRINT" SMALL":PRINT" SHAPE"
120 PRINT:PRINT:PRINT:PRINT" LARGE":PRINT" SHA
PE"
121 PRINT:PRINT:PRINT:PRINT:PRINTTAB(13);CHR$(
18);"DRAWING MODE ";CHR$(146);
129 DIMG(62):V=53248:UL=1078:FORX=0TO25:POKEUL
+X,42:POKEUL+22*40+X,42:NEXT
130 FORX=0TO22:POKEUL+X*40,42:POKEUL+25+X*40,4
2:NEXT
140 PT=UL+41
150 SL=PEEK(PT):POKEPT,81:FORX=0TO80:NEXT:POKE
PT,SL
160 A=PEEK(197):C=PEEK(653)
162 IFC=1THENPOKEPT,160
164 IFC=2THENPOKEPT,32
170 IFA=33THENM=-40:GOTO300
180 IFA=34THENM=-1:GOTO300
190 IFA=37THENM=1:GOTO300
200 IFA=36THENM=40:GOTO300
210 IFA=51THENPRINTCHR$(147):POKEV+21,0:RUN105

220 IFA=4THEN400
225 IFA=57THEN500
230 GOTO150
300 IFPEEK(PT+M)=42THEN150
310 PT=PT+M:GOTO150
400 FORX=1TO15:PRINTCHR$(157);:NEXT:PRINTCHR$(
18);"COMPILING SHAPE";CHR$(146);
401 N=0:Z=8:FORY=1TO21:FORX=1TO24:P=PEEK(UL+Y*
-40+X):Z=Z-1
410 IFZ=-1THENC=0:Z=7:N=N+1
420 IFP=160THENC=C+2^Z
425 IFZ=0THENPOKE832+N,C:G(N)=C
430 NEXT:NEXT
440 POKEV+21,12:POKE2042,13:POKE2043,13:POKEV+
4,90:POKEV+5,150
445 POKEV+6,80:POKEV+7,180:POKEV+23,0:POKEV+29
,8
450 FORX=1TO15:PRINTCHR$(157);:NEXT
460 PRINTCHR$(18);"DRAWING MODE ";CHR$(146);
:GOTO150
500 DT=0:CU=PEEK(43)+PEEK(44)*256+4:POKEV+21,0

501 FORX=1TO25:PRINTCHR$(157);:NEXT
502 PRINT"DATA WILL ERASE PROGRAM -- CONTINUE?"
:POKE198,0
503 GETA$:IFA$<>"Y"ANDA$<>"N"THEN503
504 IFA$="N"THENFORX=1TO26:PRINTCHR$(157);:NEX
T
505 IFA$="N"THENFORX=1984TO2023:POKEV,32:NEXT:
GOTO460
506 PRINTCHR$(147);TAB(13);"PUTTING SHAPE INTO
"
507 PRINTTAB(13);"DATA STATEMENTS"
510 POKECU,131:CN=1
530 D$=STR$(G(DT)):FORX=2TOLEN(D$):C=ASC(MID$(
D$,X,1))
532 POKECU+CN,C:CN=CN+1:NEXT
535 DT=DT+1:IFDT=63THEN560
540 IFCN>71THENFORX=CNT075:POKECU+X,32:NEXT:PO
KECU+76,0:CU=CU+81:GOTO510
550 POKECU+CN,44:CN=CN+1:GOTO530
560 FORX=CNT075:POKECU+X,32:NEXT:FORX=76TO78:P
OKECU+X,0:NEXT:LIST:END

```

Should you desire to save the DATA statements and merge them with other programs, you should refer to Jim Butterfield's article in the June 1982 **COMPUTE!** (p. 158) on merging VIC-20 programs. His technique will work with one addition. After you have saved the program on tape and are trying to merge it, you will be unable to clear the screen as Butterfield tells you to do. At that point hit the Commodore key and continue with the rest of the

commands.

A Note On Entering The Program

1) The first four REM statements must be typed in, in order to use the data option of the program. They must be typed in with no spaces, exactly as they appear in the listing. Seventy-five A's should follow each REM.

2) When writing the program, I specifically used CHR\$ statements in place of cursor control characters embedded within print statements. I hope this will aid new Commodore 64 users in typing in the program.

3) Please save the program at least once before running it for the first time since the program is designed to erase itself when certain options are exercised.

Program Description

Line no.

- 1-4 REM statements that will contain the shape DATA statements. These four lines must be typed in with no blanks anywhere including between the line # and REM and also between REM and the first A. There must be 75 A's in each line.
- 100 Clears screen; clears color to cyan.
- 105 Moves cursor up one line; turns on reverse print; prints title; turns off reverse print.
- 107-118 Print command keys in reverse lettering with a very brief accompanying description.
- 119-120 Print labels at the places where the shape will be shown if compiled.
- 121 Prints current mode in reverse lettering.
- 129 Sets up array G to store shape data. V is starting memory location in the video chip; UL is upper left of shape drawing region. Draws upper and lower horizontal lines of asterisks to indicate the boundaries of the shape drawing region.
- 130 Draws left and right vertical line of asterisks.
- 140 PT is the cursor position within the drawing region.
- 150 SL is the character underlying the cursor; displays cursor; time delay; redisplay character.
- 160 Looks at keyboard; looks at status of Shift and Commodore keys.
- 162 Fills in area under cursor if either Shift key is pressed.
- 164 Erases area under cursor if Commodore key is pressed.
- 170 Moves up if I key is pressed.
- 180 Moves left if J key is pressed.
- 190 Moves right if K key is pressed.
- 200 Moves down if M key is pressed.
- 210 Erases screen and shapes if CLR/HOME key is pressed.
- 220 Compiles shape if F1 key is pressed.
- 225 Takes shape data and puts into DATA statements if the left arrow key is pressed. This command will erase the program, so make sure that you copy the program before using this option.
- 300 If area cursor is to move to is an asterisk, then do not move cursor.
- 310 Adds movement value to cursor pointer and reenters

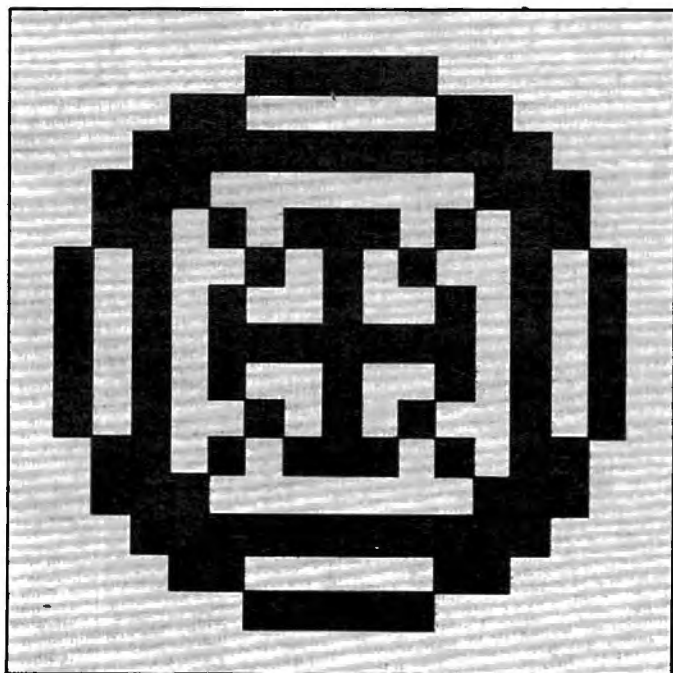
- main routine.
- 400 Moves cursor left until at beginning of mode message; changes message.
- 401 N is the counter for shape data; Z is the bit position within the current byte of shape data being compiled. Scans along shape drawing region, from left to right each row, starting at the top moving toward the bottom. P is the character at the present scan position. Decrements bit position. If finished compiling current byte, then sets bit position to bit 7 and increments shape data count.
- 410 If finished compiling current byte, then resets shape data byte to zero.
- 420 If character at the present scan position is a solid box, then sets current bit position to 1.
- 425 If current byte finished, then POKEs it into memory block 13 and also saves it in array G.
- 440 Activates sprites 2 and 3; sets sprite 2's data pointer to memory block 13; sets sprite 3's data pointer to block 13; sets sprite 2 to coordinates (90,150).
- 445 Sets sprite 3's coordinates to (80,180); expands sprite 3 in both X and Y direction.
- 450 Moves cursor left to start of mode message.
- 460 Changes mode message.
- 500 DT is the count of data stored in BASIC program. Erases any sprites on screen.
- 501 Moves cursor left to beginning of bottom line.
- 502 Prints warning message that only the data statements that are generated will be left.
- 503 Gets response in A\$.
- 504 Moves cursor back to start of mode message.
- 505 Clears bottom line of screen and branches to 460.
- 506-507 Clear screen; print message indicating action.
- 510 POKEs DATA token; CU is position within BASIC line.

- 530-532 Set shape data to string; POKE string character by character into BASIC line while increasing CN.
- 535 Increases data count; if all data finished, then branches to 560.
- 540 If current BASIC line hasn't enough space for any more data, then fills remaining bytes with spaces, adds a zero to the end, and sets BASIC line pointer to next BASIC line.
- 550 Puts comma in line; increases pointer within line.
- 560 Fills remaining locations in last DATA line with spaces; adds three zeroes to end; LIST's program; ends program.

Sprite Byte Map

0	0	0
0	0	0
0	0	0
0	0	0
0	62	0
0	193	128
1	255	192
3	128	224
3	93	96
5	42	80
5	73	80
5	127	80
5	73	80
5	42	80
3	93	96
3	128	224
1	255	192
0	193	128
0	62	0
0	0	0
0	0	0

C



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This will save any standard Atari BASIC screen display very fast. The program is designed for the Atari with cassette (16K) or disk (24K). Once saved, pictures take in six minutes (tape) or in less than 15 seconds (disk).

Atari Screen Save

Richard S. Waller, Seven Hills, OH

The superb graphics capabilities of the Atari are exploited by many programs which create beautiful screen displays. The problem is saving these pictures for quick display at a later time. My Atari Screen Save Utility is one of the fastest ways to save and recall pictures from a disk or cassette.

For example, Mike Kinnamon's "Supercube Update" in **COMPUTE!** (August 1981, #15) claims four and a half minutes to save a Graphics 7 picture to disk. Substituting my Screen Save Utility code at lines 4002 to 5008 should cut the time to under ten seconds. I've chosen a different program which uses Graphics 8 to demonstrate my utility.

The Micro Technology Unlimited advertisement on page 41 of the November 1981 **COMPUTE!** shows, on a modified PET, a hi-res graphics picture that looks like a man's hat. It really intrigued me — could a standard Atari do it? I entered the program listing into my Atari. Slowly the display emerged, but upside down.

It seems that MTU has given the X,Y coordinates their classical position of 0,0 in the lower left corner, you lucky PET people. But after I adjusted the program to the Atari coordinate system with 0,0 in the upper left corner, the program ran and produced the same hi-res picture as the ad. It took almost three and a half hours on the Atari to draw the picture. Mission accomplished, but I wanted my computer back, and three and a half hours were lost at the flick of the off switch.

Add It To Any Program

In the same issue of **COMPUTE!**, I also read Bill Wilkinson's "Insight: Atari" article on the flexibility of I/O with the Atari operating system. Obviously, saving a TV picture should be a piece of cake, so I wrote this Atari Screen Save Utility. Now the 8K hi-res display can be saved to disk in about 15

seconds. Then, by changing one variable from an 8 to a 4, the same routine will read the disk and display the saved picture (that took three and a half hours to draw) back onto the TV again only in a mere 15 seconds.

I've tried to write the program so that it can be added to any program like Supercube. It does require the display to start with a BASIC Graphics command, and it uses the first 20 bytes of page six for the machine language code to get and put multiple bytes to and from the disk or (if D: is replaced with C:) to a cassette.

If you don't want to wait three hours to test the program, just increase the STEPs in lines 60 and 100 from one to some larger number like eight. For the final three hour picture, the time can be reduced to two and a half hours by turning off the screen display. This is done with a POKE 559,0 at the start of the display code, with a POKE 559,34 at the end to turn the screen display back on. (See "Unleash The Power Of Your Atari CPU," by Ed Stewart, in **COMPUTE!**, April 1981, #11.)

Remember, the program is designed to save the entire screen, so the instructions cannot be displayed when appropriate, but must be displayed only before the picture is drawn. The keys that you press will not display, but the computer will follow them anyway. So read the instructions carefully at the start of the program and enjoy fast recall of your TV screen displays from tape or disk.

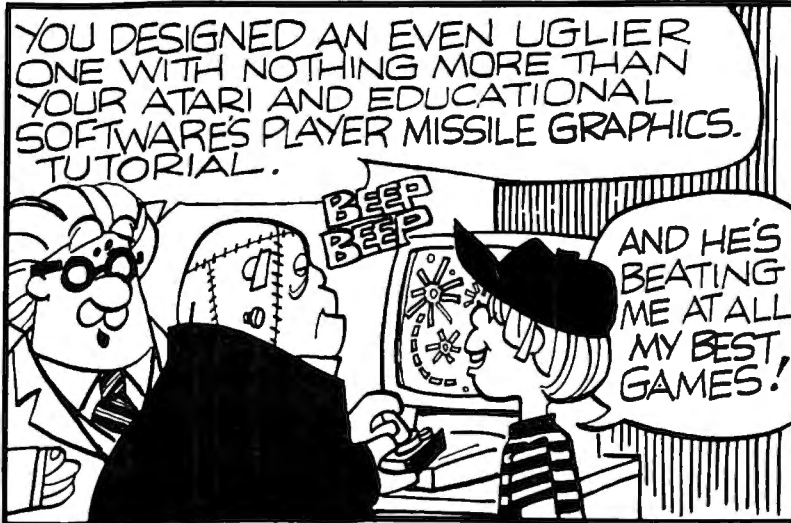
This program will run on an Atari with 16K, and cassette or 24K with DOS. Once an 8K picture is saved, it can be displayed in under six minutes from tape or under 15 seconds from disk. Other graphics modes will take much less time.

Machine Code Listing

PLA	GET # OF ARGUMENTS
CMP #1	CHECK FOR 1 ARG.
BNE ER	RETURN IF NOT 1
PLA	DISREGARD HI BYTE OF ARG.
PLA	LO BYTE OF ARG.
STA \$327	PUT ARG. IN IOCB#3
LDX #\$30	INDEX TO IOCB#3
JSR \$E456	JUMP TO DO I/O
ER STA \$D5	STORE ERROR FLAG FOR BASIC
LDA #0	ZERO OTHER BYTE FOR BASIC
STA \$D4	BECOMES RESULT OF USR CALL
RTS	RETURN TO BASIC

```
0 REM SCREEN SAVE UTILITY PROGRAM BY.
  ..R.S.WALLER 12/26/81
1 DIM FN$(17)
2 IN408=8:POKE 764,255:GRAPHICS 0:?"
  {6 SPACES}SCREEN SAVE OPTION"
```

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TT #1: DISPLAY LISTS—This program teaches you how to alter the program in the ATARI that controls the format of the screen. Normally, when you say "Graphics 8", the machine responds with a large Graphics 8 area at the top of the screen and a small text area at the bottom. Now, you will be able to mix various Graphics modes on the screen at the same time. The program does all of the difficult things (like counting scan lines). You will quickly be able to use the subroutines included in your own programs. **16K Tape or 24K Disk. \$19.95**

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TT #5: PLAYER/MISSILE GRAPHICS—Learn to write your own games and other animated applications! The tutorial begins with many small examples that complement the 50 page manual, then gradually builds up to a complete game where everything you need to know is fully explained. Also included are two machine language utilities that you can use to animate Players with from BASIC. Next we include two of the best editors currently available: one for editing playfield shapes (backgrounds); and one to edit your players, and all in glorious Technicolor!! Everything except the two editors run in 16K Tape or 32K Disk. **\$29.95**

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```

3 ? :? "ENTER FILE NAME BELOW - SCREE
N WILL CLEAR then":? "ENTER L TO GE
T PICTURE FROM DISK FILE or"
4 ? "ENTER R TO RUN PICTURE PROGRAM t
hen"
5 ? "ENTER E TO STOP PICTURE PROGRAM
(OPTIONAL) then"
6 ? :? :? "WHEN PICTURE IS DONE ;"
7 ? "ENTER S TO SAVE IT ON A FILE and
/or"
8 ? "ENTER R TO RESTART PROGRAM"
9 ? :? :? "BUT FIRST ENTER NAME OF FI
LE WHERE PICTURE IS TO BE FOUND OR
STORED as D:NAM or C: =":INPUT FN$
10 REM .. GRAPHICS MODE FOR PICTURE D
ISPLAY MUST BE ISSUED HERE BEFORE
POSSIBLE DISK FILE READ
11 GRAPHICS 24:COLOR 1:RESTORE
12 FOR J=1536 TO 1558:READ A:POKE J,A
:NEXT J
14 IF (PEEK(764)=40) THEN IN408=8:POK
E 764,255:GOTO 20
16 IF (PEEK(764)=0) THEN IN408=4:GOTO
320
18 GOTO 14
20 REM ...PROGRAM THAT PUTS A NEW PIC
TURE ON THE TV SCREEN GOES HERE EX
CEPT SEE LINE 10
23 REM MICRO TECH UNLIM. AD IN 11/81,
,,,,, COMPUTE
25 P=160:Q=100
30 XP=144:XR=1.5*3.1415927
40 YP=56:YR=1:ZP=64
50 XF=XR/XP:YF=YP/YR:ZF=XR/ZP
60 FOR ZI=-Q TO Q-1 STEP 1
70 IF ZI<-ZP OR ZI>ZP THEN GOTO 150
80 ZT=ZI*XP/ZP:ZZ=ZI
90 XL=(SQR(XP*XP-ZT*ZT))
93 XL=INT(0.5+XL)
100 FOR XI=-XL TO XL STEP 1
105 TRAP 120
110 XT=SQR(XI*XI+ZT*ZT)*XF:XX=XI
120 YY=(SIN(XT)+0.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
145 IF PEEK(764)=42 THEN IN408=8:GOTO
300
150 NEXT ZI



160 GOTO 300
170 X1=(XX+ZZ+P)
180 Y1=YY-ZZ+Q:Y1=191-Y1
182 IF X1<0 OR X1>319 THEN RETURN
184 IF Y1<0 OR Y1>191 THEN RETURN
195 COLOR 1:PLOT X1,Y1
200 IF Y1>=190 THEN RETURN
210 COLOR 2:PLOT X1,Y1+1:DRAWTO X1,19
1
220 RETURN
230 REM ... PROGRAM TO PUT PICTURE ON
TV SCREEN ENDS HERE
300 IF PEEK(764)=40 THEN 2
310 IF PEEK(764)<>62 THEN 300
320 POKE 764,255:OPEN #3,IN408,0,FN$
325 POKE 891,128:REM SET SHORT Inter-
Record Gaps FOR CASSETTE I/O
330 TVAT=PEEK(560)+PEEK(561)*256
340 RAMTOP=PEEK(106)*256
350 TVSIZ=RAMTOP-TVAT
370 SIZHI=INT(TVSIZ/256)
380 SIZLO=INT(TVSIZ-256*SIZHI)


```

```


390 TVAHI=INT(TVAT/256)
400 TVALO=INT(TVAT-256*TVAHI)
430 POKE 884,TVALO
440 POKE 885,TVAHI
450 POKE 888,SIZLO
460 POKE 889,SIZHI
500 RES=USR(1536,IN408+3)
510 CLOSE #3:POKE 764,255
520 IF PEEK(764)=40 THEN 2
525 GOTO 520
530 DATA 104,201,1,208,10,104,104,141
,114,3,162,48,32,86,228,133,213,1
69,0,133,212,96,0

```


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For Upgrade and 4.0 BASIC PET/CBM, String Thing solves the problems created by INPUT# and is faster.

Easy File Input: The String Thing

Jim Butterfield
Associate Editor

Files are easy to handle, but sometimes the INPUT# statement is too clever. It looks so carefully at the material coming in from the file that it can overprocess your information. The INPUT# statement:

- trims spaces from the front of the data;
- trims quotation marks from front and back;
- gives trouble if you want to input over 80 characters;
- drops commas and following information; and
- drops colons and following information.

You often don't want such things to happen when you are reading a file. But the alternative is to use GET# statements, and they are slow.

Some years ago, Bill McLean, of B.M.B. Compuscience, wrote a String Thing to get around these problems and speed up input. It worked well on Upgrade ROMs, but the transition to 4.0 systems was uncomfortable; strings are stored in a different way in the newer BASIC, and the code needed major surgery. Extra code is needed in order to avoid falling prey to a berserk garbage collection routine. This made the job rather complex and called for two different versions for the two different ROM sets.

New And Improved?

It seems to be time to unearth a new String Thing, one that will work without change on both Upgrade and 4.0 BASIC PETs and CBMs. This way, your program can still move between machines without difficulty. But there's a problem: since different BASIC versions store strings in different ways, how can we make one program compatible with all?

The trick is this: instead of trying to build a

new string, we'll re-use an old one. We must be careful: if the string we are recycling is only ten characters long, we must be sure we don't try to put 11 new characters into it.

How To Use It

The program listing comes in two parts: setting up the String Thing and using it. There are two things we need to do in order to set up: define the program's first variable as a string (in the example, A\$), making sure that it's long enough to hold any input that we might want to catch (in this case, up to 255 bytes); and then POKEing the String Thing program into place. This setup takes place in lines 70 to 260.

Now that we have String Thing in place, we need to use it. That's the easy part: we just give SYS 896, and the program performs the equivalent of INPUT#1,A\$ without the problems of INPUT#. You may remember that we set A\$ to a very long string; it will keep its length, but we can find out how many characters have been read by checking PEEK(139). String Thing uses location 139 to record how many characters it has received. If the first thing to come from the file is a RETURN character, this value will be zero, indicating no data characters received. On the other hand, if we fill the string space completely and still have not seen a RETURN, we'll stop at that point. The next call to String Thing will get more of the same sequence.

Some usage hints: Try to leave a string that is at least one character longer than the data you expect. If PEEK(139) ends up equal to the string length, we haven't seen the RETURN character yet — better to leave extra room. Remember that all the things that happen with an INPUT# will happen with String Thing, such as ST signalling end of file. Don't try to change your string variable (in this case, A\$) as the program runs; copy the information out to another variable if you need it, e.g., X\$ = LEFT\$(A\$,PEEK(139)). String Thing isn't location sensitive; you can move it to some other location with little trouble.

String Thing will work correctly in reading files from cassette tape or disk. Just change the OPEN statement to suit. You won't notice the speed advantage on tape, of course, but you may still benefit from the improved logic handling. String Thing works splendidly with Relative disk files. Position to the record you want in the usual way, with RECORD#1, and then substitute the SYS statement for the INPUT#1.

Try the following demonstration program. You can change the file name in line 400 to any sequential file of your own, or you can write a demonstration file using the following direct statements:

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```

OPEN 1,8,3,"file,s,w"
PRINT#1,"line 1, with comma"
PRINT#1,"mission: impossible"
PRINT#1,CHR$(34);"quotes";CHR$(34)
FOR j=1 to 40:PRINT#1j;:NEXT j:PRINT#1
PRINT#1," spaced out "
CLOSE 1

```

If you like, try getting this DATA back using INPUT# statements.

Now for String Thing:

```

70 REM ** STRING THING (PET/CBM) **
75 REM ** UPGRADE AND 4.0 BASIC **
80 REM ** JIM BUTTERFIELD **
90 REMARK: STRING MUST BE FIRST VARIABLE
100 A$="ABCDEFGHJKLMNOPQ"
110 A$=A$+A$+A$+A$+A$
120 A$=A$+A$+A$
130 REM ABOVE SETS STRING FOR MAX (255)
200 DATA 160,2,177,42,153,134,0,200,192,6
210 DATA 208,246,162,1,32,198,255
220 DATA 32,228,255,201,13,240,11,164,139,145
230 DATA 137,200,132,139,196,136,208,238,76,20
4,255
250 FOR J=896 TO 933:READ X:POKE J,X:T=T+X:NEX
T J
260 IF T <>5517 THEN STOP
400 OPEN 1,8,2,"FILE" (OR DOPEN#1,"FILE")
410 REM: NEXT SYS SAME AS 'INPUT#1,A$'
420 SYS 896
425 REM: 1=SIZE OF INPUT (COULD BE 0)
430 L=PEEK(139)
440 PRINT LEFT$(A$,1)
450 IF ST=0 GOTO 420
460 CLOSE 1 (OR DCLOSE)

```

Alternate Versions

For VIC and Commodore 64 machines, we may once again choose between cassette tape and disk. I've written the disk version below; to get a cassette version, you'll need to do a little juggling. That's because the String Thing program sits in the cassette buffer; it will need to be moved elsewhere if you need to use tape.

Now for the String Thing program:

```

70 REM ** STRING THING **
75 REM ** VIC AND COMMODORE 64 **
80 REM ** JIM BUTTERFIELD **
90 REM STRING MUST BE FIRST VARIABLE
100 A$="ABCDEFGHJKLMNOPQ"
110 A$=A$+A$+A$+A$+A$
120 A$=A$+A$+A$
130 REM ABOVE SETS STRING FOR MAX (255)
200 DATA 160,2,177,45,153,137,0,200,192,6
210 DATA 208,246,162,1,32,198,255
220 DATA 32,228,255,201,13,240,11,164,142,145
230 DATA 140,200,132,142,196,139,208,238,76,20
4,255
250 FOR J=896 TO 933:READ X:POKE J,X:T=T+X:NEX
T J
260 IF T<>5535 THEN STOP
400 OPEN 1,8,3,"FILE"
410 REM: NEXT SYS SAME AS 'INPUT#1,A$'
420 SYS 896
425 REM: 1=SIZE OF INPUT (COULD BE 0)
430 L =PEEK(142)
440 PRINT LEFT$(A$,1)
450 IF ST=0 GOTO 420
460 CLOSE 1

```

If you have an Original ROM machine, you

can't handle disk. Even tape files have certain problems. If you plan to write and read files, you will be much better off if you upgrade your machine to Upgrade ROM. This can be done with a chip change. Even so, let's show that String Thing can be made to work here: we'll read a tape on an Original ROM system.

You may write a demonstration file TO tape in exactly the same way as before, except that you must change the OPEN statement TO:

OPEN 1,1,1,"file"

```

70 REM ** STRING THING **
75 REM ** ORIGINAL ROM BASIC **
80 REM ** JIM BUTTERFIELD **
90 REM STRING MUST BE FIRST VARIABLE
100 A$="ABCDEFGHJKLMNOPQ"
110 A$=A$+A$+A$+A$+A$
120 A$=A$+A$+A$
130 REM ABOVE SETS STRING FOR MAXIMUM (255)
200 DATA 160,2,177,124,153,216,0,200,192,6
210 DATA 208,246,162,1,32,198,255
220 DATA 32,228,255,201,13,240,11,164,221,145
230 DATA 219,200,132,221,196,218,208,238,76,20
4,255
250 FOR J=896 TO 933:READ X:POKE J,X:T=T+X:NEX
T J
260 IF T<>6009 THEN STOP
400 OPEN 1,1,0,"FILE"
410 REM: NEXT SYS SAME AS 'INPUT#1,A$'
420 SYS 896
422 REM: ST LOGIC CHANGE
423 IF ST=0 GOTO 460
425 REM: 1=SIZE OF INPUT (COULD BE 0)
430 L=PEEK(221)
440 PRINT LEFT$(A$,1)
450 GOTO 420
460 CLOSE 1

```

Assembly Listing

For those who would like to track the machine language, here's the assembly version of the program. The version is Upgrade/4.0 ROMs (the first BASIC program).

0380	A0	02	LDY	#2	Copy string..	
0382	B1	2A	LOOP1	LDA (VARTAB),Y	info TO work	
0384	99	86	00	STA WORK,Y	area	
0387	C8			INY	..Four bytes	
0388	C0	06		CPY #6		
038A	D0	F6		BNE LOOP1		
038C	A2	01		LDX #1	Connect file #1	
038E	20	C6	FF	JSR CHKIN	..as input.	
0391	20	E4	FF	LOOP2	JSR GETIN	Get character
0394	C9	0D		CMP #\$0D	Return?	
0396	F0	0B		BEQ QUIT	Yes, quit	
0398	A4	8B		LDY COUNT	No, get pointer	
039A	91	89		STA (STRING),Y	..and stash char	
039C	C8			INY	Count it	
039D	84	8B		STA COUNT	Save count	
039F	C4	88		CPY LENGTH	Full string?	
03A1	D0	EE		BNE LOOP2	Nope, do more	
03A3	4C	CC	FF	JMP CLRCHN	Disconnect & quit	

String Thing solves many file input problems: in particular, long data blocks and special characters become very simple. It's as fast as INPUT, but for most purposes it's better.

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VIC Micromon

Bill Yee
Winnipeg, Manitoba

I could not resist F. Arthur Cochrane's suggestion in the January 1982 **COMPUTE!** about modifying the PET Micromon for VIC use and publishing the results. The VIC Micromon presented here is the product of several months of use and revision of an initial modified version completed in April 1982.

The initial modifications involved redefining Micromon's workspace from the PET tape buffer at \$27A to the VIC tape buffer at \$33C. The VIC tape buffer was redefined to \$375, and the Micromon Load and Save commands rewritten to read and write absolute memory images to cassette tape. A Verify command was added as well.

Other modifications included redefining locations used by Micromon in the BASIC and kernal storage areas from the PET to the VIC equivalents. The address of the decimal output routine used by the conversion commands was changed to the VIC routine at \$DDCD. Because the VIC IRQ vector is at \$314, rather than at a zero page location such as \$90 for the PET, the single instruction interrupt time had to be increased to compensate for the absolute store instructions used. Two of these instructions are used in setting the IRQ vector when rolling out of Micromon for the Walk and Quick trace commands. Also, hardware differences required changes to the interrupt timer addresses. Originally at \$E848 and \$E849 for the PET, these were redefined as \$9128 and \$9129 for the VIC.

Micromon uses an IRQ service routine to provide forward and reverse scrolling for the Hex conversion, Memory dump, and Disassembly commands. Because VIC's screen readily relocates and has a unique format of 23 lines by 22 columns, most of the scrolling code in the IRQ service routine had to be rewritten.

Solving Early Problems

I had previously built a 16K memory board for operation in the \$2000 to \$5FFF address space of

the VIC. So, along with the modifications already mentioned, the programming for the initial VIC Micromon included a relocation from \$1000 to \$4000. The code was entered as two separate 2K blocks on my VIC using a BASIC Hex Editor and subsequently programmed onto two 2716 EPROMs with a programmer I had built to operate off the VIC USER I/O port. An extension of the BASIC Hex Editor provided the EPROM programming control.

Once installed on my VIC at \$4000, VIC Micromon was accessed by a SYS16384 from BASIC. Each Micromon command was exercised for proper operation. I had difficulty returning to BASIC with the E and X commands, as well as stack interference in executing test programs with the G, W, and Q commands. I solved these problems by changing the stack area used by VIC Micromon to the bottom half of the \$100 page. This was done by setting the stack pointer to \$7F rather than \$FF in the command input section of VIC Micromon.

The New locater command would work only once in the word mode when the command was invoked several times consecutively. A flag at \$28C for PET Micromon and \$34E for VIC Micromon differentiates between the instruction mode and the word mode in the New locater command. The problem is due to the flag being used also as an offset index to check absolute addresses. The flag was being incremented without being cleared on each consecutive New locater command in word mode. This was fixed by inserting code in the command input section of VIC Micromon to always clear \$34E prior to execution of any command.

The Assembler command would not properly assemble branch instructions which had branch offsets of \$7E and \$7F. This problem resulted from a simple plus/minus range check prior to adjusting the offset value by -2. The fix for VIC Micromon is given here as an inline patch for PET Micromon users. The PET Micromon code from

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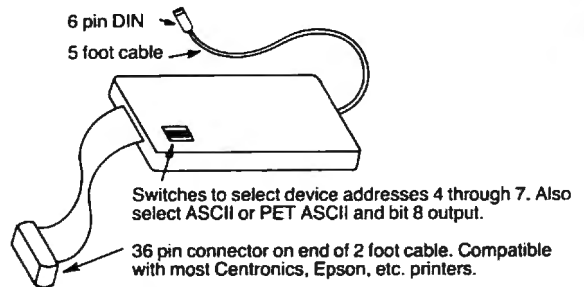
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\$1525 to \$1538 was rewritten to use a value of \$82 for a range check. The resulting code, which is one byte longer, was accommodated by replacing the branch and jump instructions at \$150E to \$1512 with two NOPs and a branch. The code at \$1513 to \$1524 was moved down one location to be at \$1512 to \$1523, and the branch instructions originally at \$1519 and \$1520 had their offsets adjusted up by one.

Table 1: Micromon Locations Redefined for VIC

Location	Old Value	New Value	Location	Old Value	New Value
150E	F0	EA	1523	13	11
150F	03	EA	1524	11	90
1510	4C	D0	1525	90	01
1511	91	7F	1526	0A	88
1512	15	20	1527	98	C8
1513	20	3C	1528	D0	D0
1514	3C	18	1529	6F	6F
1515	18	AC	152A	AE	98
1516	AC	8B	152B	91	2A
1517	8B	02	152C	02	AE
1518	02	F0	152D	30	91
1519	F0	2F	152E	6A	02
151A	2E	AD	152F	10	E0
151B	AD	93	1530	08	82
151C	93	02	1531	C8	A8
151D	02	C9	1532	D0	D0
151E	C9	9D	1533	65	03
151F	9D	D0	1534	AE	B0
1520	D0	20	1535	91	03
1521	1F	20	1536	02	38
1522	20	13	1537	10	B0

F. Arthur Cochrane presented an extra set of commands implemented on about an additional 1K module called Micromon Plus. Of the commands in Micromon Plus, I felt that the Print switcher and PROM programmer commands would be desirable in VIC Micromon. However, instead of creating an extra module above the existing 4K of the initial VIC Micromon, I decided that, with some code crunching, the Print switcher and PROM programmer commands could be contained within an enhanced 4K VIC Micromon. Since there are many printers available with a RS-232 interface, the enhanced VIC Micromon Print switcher command would support the RS-232 interface on the VIC User I/O port rather than the VIC serial port interface. Also, since I already had an EPROM programmer working off the User I/O port, the enhanced VIC Micromon PROM programmer command would support my programmer rather than one on the IEEE bus.

Memory Saving

Code crunching consisted of code optimization and code removal while keeping function and structure. The table of internal Micromon addresses used to set up and check interrupt vectors was removed. While the table helped in any relocation of Micromon, I felt that direct changes of vector address values were relatively easy and well worth the program area saved. VIC Micromon has six locations with interrupt vector values that must be changed when VIC Micromon is relocated. The checks for the different versions of PET BASIC were removed as well. It didn't make sense to have universality in some parts of VIC Micromon when a good part was applicable only to the VIC.

The VIC has two levels of indirection for the input and output to device routines. The first level is the use of PET compatible addresses for the jump vectors at the end of the 8K kernal ROM.

The second level of indirection is the use of an indirect jump table in RAM which allows the user to redefine the vectors. Because of this, I felt that the use of I/O jump vectors at the beginning of Micromon was unnecessary.

Besides the four ROM routines mentioned by F. Arthur Cochrane (input character, output a character, load a program, and save a program), there were other ROM routines, such as get from keyboard (\$FFE4) and close I/P and O/P channels (\$FFCC), used by PET Micromon. For VIC Micromon these were expanded to about 20 ROM routines, since I chose to use VIC kernal routines when possible. For example, the test for STOP key code at location \$18AE of the PET Micromon was replaced with a call to the test STOP key routine at \$FFE1 in the VIC kernal ROM.

Altogether, the code crunching resulted in over 250 bytes freed. This allowed me to add the Print switcher and EPROM commands along with a few handy ones which did not require much code to implement. Following is a detailed description of VIC Micromon commands with a different format or function from similar commands in PET Micromon and of new commands in VIC Micromon.

VIC Micromon Instructions

Initialize Memory And Screen Pointers

```
.1 1000 1E00 1E
```

Define low memory as \$1000 and high memory as \$1E00 regardless of the memory present. The screen is defined to start at the \$1E page of memory. The screen memory should always be on an even

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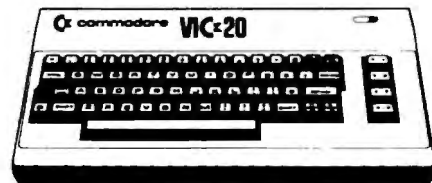
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page within the range of \$1000 to \$1E00. Odd page values result in incorrect setup and operation of the VIC display. Although 3K of RAM can be added at \$400 to \$FFF, this memory is not accessible for use as screen memory.

Memory pages at \$000 and \$200 are accessible, but are not usable since they are used for BASIC and kernal storage, working buffers, and stack area. If the screen page is within the low to high memory range specified, there can be usage conflict of the screen memory pages. If the "I" command is used and exit is made to BASIC, the NEW command must be invoked in the BASIC environment to clean up the memory pointers used by BASIC.

Jump To Micromon Subroutine

J 2000

The subroutine at \$2000 is called while remaining in the VIC Micromon environment. The assembly language subroutine should exit by using a RTS instruction, which causes a return to the command input section of VIC Micromon. The machine image as shown by the Register display command is not used, nor is it disturbed when the subroutine returns to VIC Micromon.

Load

.L 2000 "TEST FILE" 01

Search for and, if found, load into memory the data file on device #1 named TEST FILE. If the name is not specified, the first file found is loaded. The data is loaded into memory starting at location \$2000. The last address loaded is determined by the length of the binary data file. If the device number is not specified, it defaults to device #1, which is the VIC cassette tape. The original memory addresses and name of the last file read can be inspected by doing a Memory display of the tape buffer which is at \$375 for VIC Micromon.

Print Switcher

.P

If the output is to the screen, then switch the output to the RS-232 channel (device #2). If the output is not to the screen, restore the output to the screen with the RS-232 channel left active until the RS-232 output buffer is drained. Note that opening the RS-232 channel grabs 512 bytes for I/O buffering from the top of memory.

.P 0000

Regardless of the output, clear the RS-232 channel and set output to the screen.

.P CCBB

If the output is to the screen, set CC into the RS-232

command register at location \$294 and BB into the RS-232 control register at location \$293. Output is then switched to the RS-232 channel. This command is invalid if output is not currently to the screen.

Command Register Format

Field	Use	Value	Description
7,6,5	Parity Options	--0	Parity disabled
		001	Odd parity
		011	Even parity
		101	Mark transmitted
4	Duplex	111	Space transmitted
		0	Full duplex
3,2,1	Unused	1	Half duplex
		0	Handshake
		0	3 line
		1	x line

Control Register Format

Field	Use	Value	Description
7	Stop Bits	0	1 stop bit
		1	2 stop bits
6,5	Word Length	00	8 bits
		01	7 bits
		10	6 bits
		11	5 bits
4	Unused		
3,2,1,0	Baud Rate	0000	User rate
		0001	50 Baud
		0010	75
		0011	110
		0100	134.5
		0101	150
		0110	300
		0111	600
		1000	1200
		1001	1800
		1010	2400

Save

.S 2000 3000 "TEST FILE" 01

Save memory from \$2000 up to, but not including, \$3000 onto device #1, which is the VIC cassette tape. If the device number is not specified, it defaults to device #1. The name *TEST FILE* is placed in the file header for the file saved.

Verify

.V 2000 "TEST FILE" 01

Search for and verify, if found, the data file on device #1 named "TEST FILE." If the name is not specified, the first file found is verified. The data is verified by reading the file and comparing it to the data in memory starting at location \$2000. If not specified, the device defaults to device #1. If there is a mismatch, the message ERROR is outputted to the screen at the end of the file verification.

Command End Tone

.(

Enable the command end tone. A continuous tone will be generated at the end of execution of the next command. The tone can be turned off but still be enabled by just hitting the carriage return. No tone is generated if there is a syntax error while inputting the next command.

.)

Disable the command end tone.

Program EPROM

.π 2800 2FFF 00

Program the 2716 type EPROM via the EPROM programmer on the VIC User I/O port with data read from memory starting at location \$2800 and ending at location \$2FFF. The last input parameter specifies in hex the starting 256 byte page offset on the EPROM. If the low order byte of the starting memory address is zero and the offset is zero, then the programming starts with the first byte of the EPROM. For example, to program only the last byte of the 2K EPROM with a data byte from location \$2FFF in memory, the command would be:

.π 2FFF 2FFF 07

During programming, a compare of EPROM to memory is done for each data byte just after it is written to the EPROM. Any mismatch due to failure to program the EPROM results in output to the screen of the mismatched memory location. If programming must be terminated early, just hit the STOP key. No other means should be used to abort EPROM programming. *A warm restart or power down while programming can damage the EPROM.*

Read EPROM

.£ 2999 27FF 00

Load memory starting at location \$2000 and ending at location \$27FF with data read from the EPROM via the EPROM programmer on the VIC User I/O port. The last input parameter specifies in hex the starting 256 byte page offset on the EPROM. If the low order byte of the starting memory address is zero and the offset is zero, then the reading starts with the first byte of the EPROM. For example, to read only the last byte of the 2K EPROM and load that byte into memory at location \$10FF, the command would be:

.£ 10FF 10FF 07

During memory load, a compare of EPROM to memory is done for each data byte just after it is written to memory. Any mismatch because of failure to write the memory with data from the

EPROM results in output to the screen of the mismatched memory location. The STOP key can be used to terminate the command early.

Compare EPROM

.= 3000 37FF 00

Compare memory starting at location \$3000 and ending at location \$37FF with data read from the EPROM via the EPROM programmer on the VIC User I/O port. The last input parameter specifies in hex the starting 256 byte page offset on the EPROM. If the low order byte of the starting memory address is zero and the offset is zero, then the reading starts with the first byte of the EPROM. For example, to read only the last byte of the 2K EPROM and compare that with the data byte in memory at location \$37FF, the command would be:

.= 37FF 37FF 07

Any mismatch between the EPROM and corresponding memory data results in output to the screen of the mismatched memory location. The STOP key can be used to terminate the command early.

Table 2: Commands for VIC Micromon

<u>VIC Micromon Instruction</u>	<u>Command</u>
SIMPLE ASSEMBLER	A
BREAK SET	B
COMPARE MEMORY	C
DISASSEMBLER	D
EXIT VIC MICROMON	E
FILL MEMORY	F
GO RUN	G
HUNT MEMORY	H
INITIAL MEMORY & SCREEN PTRS	I
JUMP TO SUBROUTINE	J
LOAD MEMORY FROM DEVICE	L
MEMORY DISPLAY	M
NEW LOCATER	N
OFFSET OR BRANCH CALCULATE	O
PRINT SWITCHER	P
QUICK TRACE	Q
REGISTER DISPLAY	R
SAVE MEMORY TO DEVICE	S
TRANSFER MEMORY	T
VERIFY MEMORY FROM DEVICE	V
WALK CODE	W
EXIT TO BASIC	X
ASCII CONVERSION	@
DECIMAL CONVERSION	#
HEXADECIMAL CONVERSION	\$
BINARY CONVERSION	%
CHECKSUM MEMORY	&
COMMAND END TONE ENABLE	(
COMMAND END TONE DISABLE)
ADDITION	+
SUBTRACTION	-
LOAD MEMORY FROM EPROM	£
PROGRAM EPROM FROM MEMORY	π
COMPARE EPROM TO MEMORY	=

Of the set of commands available on the PET version of Micromon, only two were removed in the conversion to the VIC. These were the K (Kill Micromon) and Z (change character sets) commands. The K command is not necessary since the VIC doesn't have the TIM monitor. The function of the Z command, which is to change character sets, is already provided for on the VIC by pressing the VIC shift and Commodore keys at the same time. The rest of the commands described by F. Arthur Cochrane for the PET Micromon (see **COMPUTE!**, January 1982, p. 160) all apply identically to the commands for VIC Micromon, with the exception of the LOAD and SAVE commands, which have different formats.

VIC Micromon is always entered from VIC BASIC by a SYS16384 when it resides at \$4000 to \$4FFF. Either the E (Exit VIC Micromon) or the X (Exit to BASIC) command would be used to exit VIC Micromon and return to the BASIC environment. The difference between these two commands is that the X command leaves the VIC Micromon vectors in the IRQ and BRK interrupt vector locations while in the BASIC environment. Also, the tape buffer is left defined as beginning at \$375. Thus, certain IRQ interrupt conditions such as the moving of the cursor to the top or bottom of the screen with output from a D, M, or \$ command displayed will cause scrolling and reentry into VIC Micromon. Also, if a BRK instruction is executed, VIC Micromon will be reentered via its BRK interrupt handler.

The E command restores the IRQ and BRK interrupt vectors and resets the tape buffer pointer to a value of \$33C prior to exit to the VIC BASIC environment. Thus all active linkages and vectors to VIC Micromon are removed, and the VIC behaves as if VIC Micromon never existed. In particular, the E command should be used to exit VIC Micromon when the normal VIC cassette tape LOAD, SAVE, and VERIFY commands are to be used in the BASIC environment. Otherwise, invalid results are likely to occur with some tape operations.

Both the E and X commands expect the stack pointer value (as shown for SP by the Register display command) to be the same as when VIC Micromon was first entered via the BASIC SYS command. If the value of SP or the part of the stack pointed to by SP is overwritten, such as by the execution of faulty code, a clean exit to BASIC by the E and X commands is unlikely. However, both the E and X commands do check if BASIC has been initialized, and if not, exit to BASIC is via an indirect jump to the address given at location \$C000. The address given in location \$C000 is \$E378, which is the entry to initialize BASIC. In

this case, the value of SP and the contents of the stack aren't important. Once in BASIC and regardless of how the exit from VIC Micromon was made, any subsequent access to VIC Micromon at \$4000 is always by a SYS16384.

VIC Micromon as given here is located from \$4000 to \$4FFF. It can be relocated to any 256 byte page boundary by making the changes, as shown in the following example, which relocate VIC Micromon from \$4000 to \$6000.

The example begins with VIC Micromon at \$4000 and ends with a relocated VIC Micromon in RAM at \$6000 as well as the original at \$4000.

```
.T 4000 4FFF 6000
.N 6000 6003 2000 4000 4FFF
.N 6012 6E6D 2000 4000 4FFF
.N 6FB5 6FFE 2000 4000 4FFF W
```

<u>Location</u>	<u>Old Value</u>	<u>New Value</u>
6018	45	65
602A	43	63
6392	4C	6C
6650	45	65
66E7	45	65
6897	43	63

In order to access the relocated VIC Micromon at \$6000, exit using the E command and then from BASIC use SYS24576.

Cartridge And Checksum

The VIC-20 treats cartridge programs located at \$A000 in a special way. On power-up, a test is made for the existence of the \$A000 cartridge program, and if one exists, an indirect jump is made to the address specified at location \$A000. This jump is made after the stack pointer is initialized, but before anything else is done. Because kernal initialization has not occurred, any cartridge program using kernal I/O routines must do kernal initialization before using those routines.

VIC Micromon as presented here has the kernal initialization calls built in so that it can easily be relocated and used as a cartridge program at \$A000. Besides making the changes to relocate it to \$A000, the only additional changes are to the first four bytes of VIC Micromon.

<u>Location</u>	<u>Contents</u>
A000	09
A001	A0
A002	C7
A003	FE

Power-up with VIC Micromon installed as a cartridge at \$A000 will result in immediate entry into VIC Micromon. Because BASIC is not initialized

when the E or X command is used after power-up, the exit to BASIC will be via an indirect jump to the address given in location \$C000, which is the entry to initialization of BASIC. Once in BASIC, subsequent access of VIC Micromon at \$A000 must be made to location \$A012, which is done via a SYS40978.

There is one last point, or rather one last byte, in VIC Micromon which is not used for anything other than to make the 4K byte checksum of VIC Micromon come out to a rounded up page value. For example, the VIC Micromon from \$4000 to \$4FFF has a data byte value of \$E6 at location \$4FFF that results in a checksum of \$BF00. This provides an easy way to verify the integrity of VIC Micromon without having to memorize or look up a checksum.

Program 1.

```
1 IFPEEK(20478)=67ANDPEEK(20479)=230THENRUN10
2 PRINT"VIC20 MICROMON LOAD &":PRINT"VERIFIC
  ATION PROGRAM.":PRINT
```

```
3 PRINT"BILL YEE / 27 AUG 82":PRINT:PRINT"AT
  LEAST 4K BYTES OF":PRINT"RAM MUST BE
  INSTALLED"
4 PRINT"AT 16384 ($4000) ELSE":PRINT"LOAD WI
  LL FAIL.":PRINT
5 PRINT"IF LOADED & VERIFIED":PRINT"OK, MICR
  OMON WILL BE":PRINT"ENTERED AUTOMATIC
  ALLY."
6 LOAD",1,1
10 DATA 12915,16867,15061,13732,14507,13829,1
  3801,12813,15027,13920
20 DATA 14355,11977,11877,13583,11338,15173,1
  2337,14852,14051,15723
30 DATA 13442,14047,14746,15059,13134,15848,1
  5858,17856,13327,8655
40 DATA 12171,10231
100 Q=16384
110 FOR BLOCK=1TO32
120 FOR BYTE=0TO127
130 X=PEEK(Q+BYTE):CK=CK+X
140 NEXT BYTE
150 READ SUM
160 IF SUM <> CK THEN PRINT"ERROR IN BLOCK #"
  LOCK:ERR=1:GOTO170
165 PRINT"BLOCK #""BLOCK" OK"
170 CK=0:Q=Q+128
180 NEXT BLOCK
190 IFERR=1THENPRINT"LOAD FAILED":END
200 SYS16384
```

Program 2.

```
4000 78 4C 12 40 41 30 C3 C2      4138 65 FD 85 FD 98 65 FE 85      4270 4D 03 20 7A 42 85 FB 84
4008 CD 20 8D FD 20 52 FD 20      4140 FE 20 D5 40 20 59 41 20      4278 FC 60 38 A4 FC AA 10 01
4010 18 E5 20 19 43 A9 DF A2      4148 E7 40 B0 51 20 AE 40 20
4018 45 8D 16 03 8E 17 03 AD      4150 B2 40 AC 56 03 D0 46 F0
4020 14 03 AE 15 03 C9 91 D0      4158 EB A2 00 A1 FB AC 57 03
4028 04 E0 43 F0 09 8D 60 03      4160 F0 02 81 FD C1 FD F0 0B
4030 8E 61 03 20 94 48 A9 75      4168 20 F8 47 20 38 49 20 E1
4038 85 B2 A9 80 8D 8A 02 85      4170 FF F0 2A 60 20 E6 47 20
4040 9D A2 D6 20 5D 4E 8E 48      4178 A1 49 F0 1E AE 56 03 D0
4048 03 8E 64 03 58 00 CE 3D
4050 03 D0 03 CE 3C 03 20 AE
4058 45 A2 42 A9 2A 4C 3D 49
4060 A9 3F 20 D2 FF A9 00 2C
4068 A9 0F 8D 0E 90 20 AE 45
4070 A9 2E 20 D2 FF A9 00 8D
4078 4E 03 8D 56 03 8D 64 03

4080 A2 7F 9A 20 8C 48 C9 2E
4088 F0 F9 C9 20 F0 F5 A2 24
4090 DD 90 4F D0 13 8D 49 03
4098 8A 0A AA BD B5 4F 85 FB
40A0 BD B6 4F 85 FC 6C FB 00
40A8 CA 10 E5 4C 60 40 A2 02
40B0 D0 02 A2 00 84 FB D0 09
40B8 B4 FC D0 03 EE 56 03 D6
40C0 FC D6 FB 60 A9 00 8D 4E
40C8 03 20 13 42 A2 09 20 38
40D0 49 CA D0 FA 60 A2 02 B5
40D8 FA 48 BD 53 03 95 FA 68
40E0 9D 53 03 CA D0 F1 60 AD
40E8 54 03 AC 55 03 4C F4 40
40F0 A5 FD A4 FE 38 E5 FB 8D
40F8 53 03 98 E5 FC A8 0D 53

4100 03 60 A9 00 F0 02 A9 01
4108 8D 57 03 20 CB 47 20 AE
4110 45 20 F0 40 20 21 48 90
4118 18 20 E7 40 90 7F 20 59
4120 41 E6 FD D0 02 E6 FE 20
4128 1F 49 AC 56 03 D0 6E F0
4130 EB 20 E7 40 18 AD 53 03

4138 65 FD 85 FD 98 65 FE 85      4270 4D 03 20 7A 42 85 FB 84
4140 FE 20 D5 40 20 59 41 20      4278 FC 60 38 A4 FC AA 10 01
4148 E7 40 B0 51 20 AE 40 20
4150 B2 40 AC 56 03 D0 46 F0
4158 EB A2 00 A1 FB AC 57 03
4160 F0 02 81 FD C1 FD F0 0B
4168 20 F8 47 20 38 49 20 E1
4170 FF F0 2A 60 20 E6 47 20
4178 A1 49 F0 1E AE 56 03 D0

4180 1C 20 F0 40 90 17 60 20
4188 54 48 8D 4B 03 20 7C 41
4190 AD 4B 03 81 FB 20 1F 49
4198 D0 F3 4C 60 40 4C 68 40
41A0 20 74 41 20 8C 48 C9 27
41A8 D0 12 20 8C 48 9D 65 03
41B0 E8 20 A4 49 F0 20 E0 20
41B8 D0 F3 F0 1A 8E 59 03 20
41C0 5F 48 90 D6 9D 65 03 E8
41C8 20 A4 49 F0 09 20 57 48
41D0 90 C8 E0 20 D0 EE 8E 4A
41D8 03 20 AE 45 A2 00 A0 00
41E0 B1 FB DD 65 03 D0 0A C8
41E8 E8 EC 4A 03 D0 F2 20 68
41F0 41 20 1F 49 20 7C 41 B0
41F8 E3 20 2B 44 20 F0 40 90

4200 0D A0 2C 20 C4 40 20 6F
4208 42 20 E1 FF D0 EE 20 B6
4210 45 D0 8A 20 2D 49 20 F8
4218 47 20 38 49 20 C9 4D 48
4220 20 CF 42 68 20 E6 42 A2
4228 06 E0 03 D0 14 AC 4D 03
4230 F0 0F AD 58 03 C9 E8 B1
4238 FB B0 1D 20 65 42 88 D0
4240 F1 0E 58 03 90 0E BD E9
4248 4E 20 99 45 BD EF 4E F0
4250 03 20 99 45 CA D0 D2 60
4258 20 7B 42 AA E8 D0 01 C8
4260 98 20 65 42 8A 8E 4A 03
4268 20 FF 47 AE 4A 03 60 AD

4270 4D 03 20 7A 42 85 FB 84
4278 FC 60 38 A4 FC AA 10 01

4280 88 65 FB 90 01 C8 60 A8
4288 4A 90 0B 4A B0 17 C9 22
4290 F0 13 29 07 09 80 4A AA
4298 BD 98 4E B0 04 4A 4A 4A
42A0 4A 29 0F D0 04 A0 80 A9
42A8 00 AA BD DC 4E 8D 58 03
42B0 29 03 8D 4D 03 98 29 8F
42B8 AA 98 A0 03 E0 8A F0 0B
42C0 4A 90 08 4A 4A 09 20 88
42C8 D0 FA C8 88 D0 F2 60 B1
42D0 FB 20 65 42 A2 01 20 CE
42D8 40 CC 4D 03 C8 90 F0 A2
42E0 03 C0 03 90 F1 60 A8 B9
42E8 F6 4E 8D 54 03 B9 36 4F
42F0 8D 55 03 A9 00 A0 05 0E
42F8 55 03 2E 54 03 2A 88 D0

4300 F6 69 3F 20 D2 FF CA D0
4308 EA 4C 38 49 20 E6 47 A9
4310 03 20 9E 43 A0 2C 4C 3C
4318 45 20 F9 FD A9 3C 8D 13
4320 91 20 3A 43 A9 FF 8D 12
4328 91 A5 FB A0 18 20 34 43
4330 A5 FF A0 14 8D 10 91 8C
4338 11 91 A0 1C 8C 11 91 60
4340 20 54 48 85 FF 20 AE 45
4348 20 6E 41 20 7C 41 20 1C
4350 43 AD 49 03 0A 08 90 17
4358 A1 FB 8D 10 91 78 A9 C4
4360 8D 19 91 A9 3C 8D 11 91
4368 A9 20 2C 1D 91 F0 FB 20
4370 3A 43 58 8E 12 91 A9 0C
4378 8D 11 91 AD 10 91 28 B0

4380 04 10 02 81 FB C1 FB F0
4388 03 20 68 41 20 1F 49 D0
4390 B7 A9 4C 48 A9 77 48 08
```

4398 48 48 48 6C 60 03 8D 4B
 43A0 03 48 20 8C 48 20 00 49
 43A8 D0 F8 68 49 FF 4C 72 42
 43B0 20 2B 44 AE 56 03 D0 0D
 43B8 20 F0 40 90 08 20 C8 43
 43C0 20 E1 FF D0 EE 4C 0E 42
 43C8 20 AE 45 A2 2E A9 3A 20
 43D0 0E 48 20 38 49 20 F8 47
 43D8 A9 08 20 EA 48 A9 08 20
 43E0 AB 43 20 38 49 20 38 49
 43E8 A9 12 20 D2 FF A0 08 A2
 43F0 00 A1 FB 29 7F C9 20 B0
 43F8 02 A9 2E 20 D2 FF C9 22

4400 F0 04 C9 62 D0 06 20 E2
 4408 4A 20 E5 4A 20 1F 49 88
 4410 D0 DF 4C DF 4A 20 E6 47
 4418 A9 08 20 9E 43 20 B6 45
 4420 20 C8 43 A9 3A 8D 77 02
 4428 4C 48 45 20 E6 47 85 FD
 4430 86 FE 20 A4 49 F0 03 20
 4438 EB 47 4C AE 45 20 31 48
 4440 85 FD 86 FE A2 00 8E 66
 4448 03 20 8C 48 C9 20 F0 F4
 4450 9D 4F 03 E8 E0 03 D0 F1
 4458 CA 30 14 BD 4F 03 38 E9
 4460 3F A0 05 4A 6E 66 03 6E
 4468 65 03 88 D0 F6 F0 E9 A2
 4470 02 20 A4 49 F0 22 C9 3A
 4478 F0 1E C9 20 F0 F3 20 90

4480 45 B0 0F 20 6C 48 A4 FB
 4488 84 FC 85 FB A9 30 9D 65
 4490 03 E8 9D 65 03 E8 D0 D9
 4498 8E 54 03 A2 00 8E 56 03
 44A0 A2 00 8E 4B 03 AD 56 03
 44A8 20 87 42 AE 58 03 8E 55
 44B0 03 AA BD 36 4F 20 70 45
 44B8 BD F6 4E 20 70 45 A2 06
 44C0 E0 03 D0 14 AC 4D 03 F0
 44C8 0F AD 58 03 C9 E8 A9 30
 44D0 B0 1E 20 6D 45 88 D0 F1
 44D8 0E 58 03 90 0E BD E9 4E
 44E0 20 70 45 BD EF 4E F0 03
 44E8 20 70 45 CA D0 D2 F0 06
 44F0 20 6D 45 20 6D 45 AD 54
 44F8 03 CD 4B 03 D0 7F 20 21

4500 48 AC 4D 03 F0 2F AD 55
 4508 03 C9 9D D0 20 20 F0 40
 4510 90 01 88 C8 D0 6F 98 2A
 4518 AE 53 03 E0 82 A8 D0 03
 4520 B0 03 38 B0 60 CA CA 8A
 4528 AC 4D 03 D0 03 B9 FC 00
 4530 91 FB 88 D0 F8 AD 56 03
 4538 91 FB A0 41 8C 77 02 20
 4540 B6 45 20 C4 40 20 6F 42
 4548 A9 20 8D 78 02 8D 7D 02
 4550 A5 FC 20 9F 45 8E 79 02
 4558 8D 7A 02 A5 FB 20 9F 45
 4560 8E 7B 02 8D 7C 02 A9 07
 4568 85 C6 4C 68 40 20 70 45
 4570 8E 4A 03 AE 4B 03 DD 65
 4578 03 F0 0D 68 68 EE 56 03

4580 F0 03 4C A0 44 4C 60 40
 4588 E8 8E 4B 03 AE 4A 03 60
 4590 C9 30 90 03 C9 47 60 38
 4598 60 CD 4E 03 D0 1A 60 48
 45A0 4A 4A 4A 4A 20 17 48 AA
 45A8 68 29 0F 4C 17 48 A9 0D

45B0 20 D2 FF A9 0A 2C A9 91
 45B8 4C D2 FF 8D 3F 03 08 68
 45C0 29 EF 8D 3E 03 8E 40 03
 45C8 8C 41 03 68 18 69 01 8D
 45D0 3D 03 68 69 00 8D 3C 03
 45D8 A9 80 8D 48 03 D0 26 A9
 45E0 C0 8D 2E 91 A9 3F 8D 2E
 45E8 91 20 94 48 D8 68 8D 41
 45F0 03 68 8D 40 03 68 8D 3F
 45F8 03 68 8D 3E 03 68 8D 3D

4600 03 68 8D 3C 03 AD 14 03
 4608 8D 44 03 AD 15 03 8D 43
 4610 03 BA 8E 42 03 58 AD 3E
 4618 03 29 10 F0 03 4C 4E 40
 4620 2C 48 03 50 1F AD 3C 03
 4628 CD 5B 03 D0 6B AD 3D 03
 4630 CD 5A 03 D0 63 AD 5E 03
 4638 D0 5B AD 5F 03 D0 53 A9
 4640 80 8D 48 03 30 12 4E 48
 4648 03 90 D2 AE 42 03 9A A9
 4650 45 48 A9 BA 48 4C 06 47
 4658 20 AE 45 20 14 49 8D 4B
 4660 03 A0 00 20 F2 48 AD 3D
 4668 03 AE 3C 03 85 FB 86 FC
 4670 20 38 49 A9 24 8D 4E 03
 4678 20 16 42 20 E4 FF F0 FB

4680 C9 03 D0 03 4C 68 40 C9
 4688 4A D0 4E A9 01 8D 48 03
 4690 D0 47 CE 5F 03 CE 5E 03
 4698 AD 21 91 C9 FE D0 3A A2
 46A0 53 4C 5B 40 A9 00 F0 12
 46A8 AD 5C 03 AE 5D 03 8D 5E
 46B0 03 8E 5F 03 A9 40 D0 02
 46B8 A9 80 8D 48 03 20 A4 49
 46C0 F0 0F C9 20 D0 56 20 45
 46C8 48 20 E3 48 20 A4 49 D0
 46D0 4B 20 AE 45 AD 48 03 F0
 46D8 1F 78 A9 A0 8D 2E 91 A9
 46E0 5F 8D 2E 91 A9 DF A2 45
 46E8 8D 44 03 8E 43 03 A9 49
 46F0 A2 00 8D 28 91 8E 29 91
 46F8 AE 42 03 9A 78 AD 44 03

4700 AE 43 03 20 98 48 AD 3C
 4708 03 48 AD 3D 03 48 AD 3E
 4710 03 48 AD 3F 03 AE 40 03
 4718 AC 41 03 40 4C 60 40 20
 4720 31 48 8D 5A 03 8E 5B 03
 4728 A9 00 8D 5C 03 8D 5D 03
 4730 20 42 48 8D 5C 03 8E 5D
 4738 03 4C 68 40 20 CB 47 8D
 4740 62 03 8E 63 03 20 42 48
 4748 8D 4F 03 8E 50 03 20 42
 4750 48 8D 51 03 8E 52 03 20
 4758 A4 49 F0 0A 20 CF FF C9
 4760 57 D0 03 EE 4E 03 20 21
 4768 48 AE 56 03 D0 18 20 E7
 4770 40 90 13 AC 4E 03 D0 1A
 4778 B1 FB 20 87 42 AA BD F6

4780 4E D0 06 20 C4 40 4C 68
 4788 40 AC 4D 03 C0 02 D0 33
 4790 F0 03 8C 4D 03 88 38 B1
 4798 FB AA ED 4F 03 C8 B1 FB
 47A0 ED 50 03 90 1E 88 AD 51
 47A8 03 F1 FB C8 AD 52 03 F1
 47B0 FB 90 10 88 18 8A 6D 62
 47B8 03 91 FB C8 B1 FB 6D 63
 47C0 03 91 FB 20 1F 49 88 10

47C8 FA 30 9E 20 31 48 85 FD
 47D0 86 FE 20 42 48 8D 54 03
 47D8 8E 55 03 20 8C 48 20 45
 47E0 48 85 FB 86 FC 60 20 31
 47E8 48 B0 F6 20 45 48 B0 03
 47F0 20 42 48 85 FD 86 FE 60
 47F8 A5 FC 20 FF 47 A5 FB 48

4800 4A 4A 4A 4A 20 17 48 AA
 4808 68 29 0F 20 17 48 48 8A
 4810 20 D2 FF 68 4C D2 FF 18
 4818 69 F6 90 02 69 06 69 3A
 4820 60 A2 02 B5 FA 48 B5 FC
 4828 95 FA 68 95 FC CA D0 F3
 4830 60 A9 00 8D 59 03 20 8C
 4838 48 C9 20 F0 F9 20 6C 48
 4840 B0 08 20 8C 48 20 57 48
 4848 90 07 AA 20 57 48 90 01
 4850 60 4C 60 40 20 74 41 A9
 4858 00 8D 59 03 20 8C 48 C9
 4860 20 D0 09 20 8C 48 C9 20
 4868 D0 0F 18 60 20 81 48 0A
 4870 0A 0A 0A 8D 59 03 20 8C
 4878 48 20 81 48 0D 59 03 38

4880 60 C9 3A 08 29 0F 28 90
 4888 02 69 08 60 20 A4 49 D0
 4890 FA 4C 65 40 A9 91 A2 43
 4898 8D 14 03 8E 15 03 60 20
 48A0 A4 49 F0 37 20 E6 47 A5
 48A8 FB 05 FC F0 22 A5 9A C9
 48B0 03 D0 9E A5 FB 8D 93 02
 48B8 A5 FC 8D 94 02 A9 02 AA
 48C0 A8 20 BA FF 20 C0 FF A2
 48C8 02 20 C9 FF 4C 75 40 A9
 48D0 02 20 C3 FF A9 03 85 9A
 48D8 4C 68 40 A5 9A C9 03 F0
 48E0 DC D0 F1 8D 3D 03 8E 3C
 48E8 03 60 8D 4B 03 A0 00 20
 48F0 38 49 B1 FB 20 FF 47 20
 48F8 1F 49 CE 4B 03 D0 F0 60

4900 20 57 48 90 08 A2 00 81
 4908 FB C1 FB D0 69 20 1F 49
 4910 CE 4B 03 60 A9 3E 85 FB
 4918 A9 03 85 FC A9 05 60 E6
 4920 FB D0 09 E6 FF E6 FC D0
 4928 03 EE 56 03 60 98 48 20
 4930 AE 45 68 A2 2E 20 0E 48
 4938 A9 20 4C D2 FF 20 0E 48
 4940 A2 00 BD 76 4F 20 D2 FF
 4948 E8 E0 1C D0 F5 A0 3B 20
 4950 2D 49 AD 3C 03 20 FF 47
 4958 AD 3D 03 20 FF 47 20 38
 4960 49 AD 43 03 20 FF 47 AD
 4968 44 03 20 FF 47 20 14 49
 4970 20 EA 48 4C 68 40 4C 60
 4978 40 20 31 48 20 E3 48 20

4980 42 48 8D 44 03 8E 43 03
 4988 20 14 49 8D 4B 03 20 8C
 4990 48 20 00 49 D0 F8 F0 DB
 4998 20 CF FF C9 20 F0 F9 D0
 49A0 06 20 F0 47 20 CF FF C9
 49A8 0D 60 A0 01 84 BA A9 00
 49B0 A2 65 A0 03 20 BD FF A8
 49B8 20 E6 47 AD 49 03 C9 53
 49C0 D0 08 20 A4 49 F0 AF 20
 49C8 EB 47 20 98 49 F0 2D C9
 49D0 22 D0 A3 20 CF FF C9 22
 49D8 F0 0B 91 BB E6 B7 C8 C0
 49E0 11 90 F0 B0 91 20 A4 49

49E8 F0 12 20 57 48 29 0F F0
49F0 85 C9 03 F0 81 85 BA 20
49F8 98 49 D0 D5 AD 49 03 C9

4A00 53 D0 0C A9 FB A6 FD A4
4A08 FE 20 D8 FF 4C 68 40 49
4A10 4C F0 02 A9 01 A6 FB A4
4A18 FC 20 D5 FF A5 90 29 10
4A20 F0 EA A9 69 A0 C3 20 1E
4A28 CB 4C 60 40 20 E6 47 20
4A30 A5 40 4C 68 40 20 E6 47
4A38 20 1F 49 20 1F 49 20 F0
4A40 47 20 38 49 20 F0 40 90
4A48 0A 98 D0 15 AD 53 03 30
4A50 10 10 08 C8 D0 0B AD 53
4A58 03 10 06 20 FF 47 4C 68
4A60 40 4C 60 40 20 E6 47 20
4A68 7A 4A 4C 68 40 20 AE 45
4A70 A2 2E A9 24 20 0E 48 20
4A78 F8 47 20 EA 4A 20 A0 4A

4A80 20 38 49 20 86 4A 20 89
4A88 4A 20 38 49 A2 04 A9 30
4A90 18 0E 54 03 2E 55 03 69
4A98 00 20 D2 FF CA D0 EF 60
4AA0 A5 FC A6 FB 8D 55 03 8E
4AA8 54 03 20 38 49 A5 FC 20
4AB0 B4 4A A5 FB AA 20 38 49
4AB8 8A 29 7F C9 20 08 B0 0A
4AC0 A9 12 20 D2 FF 8A 18 69
4AC8 40 AA 8A 20 D2 FF C9 22
4AD0 F0 04 C9 62 D0 06 20 E2
4AD8 4A 20 E5 4A 28 B0 C0 A9
4AE0 92 2C A9 14 2C A9 22 4C
4AE8 D2 FF 20 38 49 A6 FB A5
4AF0 FC 4C CD DD 20 05 4B B0
4AF8 41 20 38 49 20 F8 47 20

4B00 7D 4A 4C 68 40 A2 04 A9
4B08 00 85 FC 20 C2 4B 20 2B
4B10 4B 85 FB 20 22 4B 20 3D
4B18 4B CA D0 F7 08 20 38 49
4B20 28 60 20 A4 49 F0 0F C9
4B28 20 F0 0B C9 30 90 0B C9
4B30 3A B0 07 29 0F 60 68 68
4B38 18 60 4C 60 40 85 FE A5
4B40 FC 48 A5 FB 48 06 FB 26
4B48 FC 06 FB 26 FC 68 65 FB
4B50 85 FB 68 65 FC 85 FC 06
4B58 FB 26 FC A5 FE 65 FB 85
4B60 FB A9 00 65 FC 85 FC 60
4B68 20 C2 4B 8D 55 03 48 48
4B70 20 38 49 20 38 49 68 20
4B78 FF 47 20 38 49 68 AA A9

4B80 00 20 F1 4A 20 38 49 20
4B88 86 4A 4C 68 40 20 9F 4B
4B90 20 38 49 20 F8 47 20 EA
4B98 4A 20 A0 4A 4C 68 40 A2
4BA0 0F A9 00 85 FB 85 FC 20
4BA8 C2 4B 20 2B 4B 20 BC 4B
4BB0 20 22 4B 20 BC 4B CA D0
4BB8 F7 4C 38 49 4A 26 FB 26
4BC0 FC 60 20 8C 48 C9 20 F0
4BC8 F9 60 20 54 48 8D 88 02
4BD0 A6 FB A4 FC 20 8A FE A6
4BD8 FD A4 FE 20 7B FE 20 18
4BE0 E5 20 A4 E3 4C 68 40 20
4BE8 F0 47 4C DB 47 20 E7 4B
4BF0 18 A5 FB 65 FD 85 FB A5
4BF8 FC 65 FE 85 FC 4C 0D 4C

4C00 20 E7 4B 20 F0 40 84 FC
4C08 AD 53 03 85 FB 20 38 49
4C10 20 F8 47 4C 68 40 A9 F0
4C18 2C A9 00 8D 0B 90 4C 65
4C20 40 78 20 52 FD 58 A9 3C
4C28 85 B2 AE 42 03 9A A5 73
4C30 C9 E6 F0 95 6C 00 C0 20
4C38 E7 4B 20 21 48 20 38 49
4C40 A0 00 8C 54 03 8C 55 03
4C48 20 F0 40 90 1B AC 56 03
4C50 D0 16 18 B1 FB 6D 54 03
4C58 8D 54 03 98 6D 55 03 8D
4C60 55 03 20 1F 49 4C 48 4C
4C68 AD 55 03 20 FF 47 AD 54
4C70 03 20 FF 47 4C 68 40 AD
4C78 64 03 D0 04 A5 C6 D0 03

4C80 4C 56 FF AD 77 02 C9 11
4C88 D0 7D A5 D6 C9 16 D0 F0
4C90 A5 D1 85 FD A5 D2 85 FE
4C98 A9 17 8D 5E 03 A0 01 20
4CA0 51 4E C9 3A F0 1A C9 2C
4CA8 F0 16 C9 24 F0 12 CE 5E
4CB0 03 F0 CD 38 A5 FD E9 16
4CB8 85 FD B0 E1 C6 FE D0 DD
4CC0 8D 49 03 20 0A 4E B0 B8
4CC8 AD 49 03 C9 3A D0 11 18
4CD0 A5 FB 69 08 85 FB 90 02
4CD8 E6 FC 20 C8 43 4C F4 4C
4CE0 C9 24 F0 1A 20 C9 4D 20
4CE8 6F 42 A9 00 8D 4E 03 A0
4CF0 2C 20 13 42 A9 00 85 C6
4CF8 4C 0E 42 4C 56 FF 20 1F

4D00 49 20 6D 4A 4C F4 4C C9
4D08 91 D0 F0 A5 D6 D0 EC A5
4D10 D1 85 FD A5 D2 85 FE A9
4D18 17 8D 5E 03 A0 01 20 51
4D20 4E C9 3A F0 1A C9 2C F0
4D28 16 C9 24 F0 12 CE 5E 03
4D30 F0 15 18 A5 FB 69 16 85
4D38 FD 90 E1 E6 FE D0 DD 8D
4D40 49 03 20 0A 4E 00 03 4C
4D48 56 FF AD 49 03 C9 3A F0
4D50 06 C9 24 F0 1D D0 27 20
4D58 D0 4D 38 A5 FB E9 08 85
4D60 FB B0 02 C6 FC 20 CB 43
4D68 A9 00 85 C6 20 05 4E 4C
4D70 70 40 20 D0 4D 20 B2 40
4D78 20 70 4A 4C 68 4D 20 D0

4D80 4D A5 FB A6 FC 85 FD 86
4D88 FE A9 10 8D 5E 03 38 A5
4D90 FD ED 5E 03 85 FB A5 FE
4D98 E9 00 85 FC 20 C9 4D 20
4DA0 6F 42 20 F0 40 F0 07 B0
4DA8 F3 CE 5E 03 D0 E0 EE 4D
4DB0 03 AD 4D 03 20 AB 43 A2
4DB8 00 A1 FB 8E 4E 03 A9 2C
4DC0 20 33 49 20 16 42 4C 68
4DC8 4D A2 00 A1 FB 4C 87 42
4DD0 A6 D2 20 D7 4D A6 F4 E8
4DD8 86 AD 86 FE A2 00 86 AC
4DE0 A9 2C 85 FD A0 CE E8 88
4DE8 B1 AC 91 FD 98 D0 F8 C6
4DF0 AD C6 FE CA 10 F1 A9 20
4DF8 A6 D2 86 FE 84 FD A0 2B

4E00 91 FD 88 10 FB A9 13 4C
4E08 D2 FF C0 16 D0 02 38 60
4E10 20 51 4E C9 20 F0 F3 88

4E18 20 3A 4E AA 20 3A 4E 85
4E20 FB 86 FC A9 FF 8D 64 03
4E28 85 CC A5 CF F0 0A A5 CE
4E30 A4 D3 91 D1 A9 00 85 CF
4E38 18 60 20 51 4E 20 81 48
4E40 0A 0A 0A 0A 8D 59 03 20
4E48 51 4E 20 81 48 0D 59 03
4E50 60 B1 FD C8 29 7F C9 20
4E58 B0 02 09 40 60 BD 98 4D
4E60 20 D2 FF E8 D0 F7 60 00
4E68 00 00 00 00 00 00 0D 56
4E70 49 43 32 30 20 4D 49 43
4E78 52 4F 4D 4F 4E 20 56 31

4E80 2E 30 20 20 20 42 49 4C
4E88 4C 20 59 45 45 20 32 32
4E90 20 4A 55 4E 45 20 38 32
4E98 40 02 45 03 D0 08 40 09
4EA0 30 22 45 33 D0 08 40 09
4EA8 40 02 45 33 D0 08 40 09
4EB0 40 02 45 B3 D0 08 40 09
4EB8 00 22 44 33 D0 8C 44 00
4EC0 11 22 44 33 D0 8C 44 9A
4EC8 10 22 44 33 D0 08 40 09
4ED0 10 22 44 33 D0 08 40 09
4ED8 62 13 78 A9 00 21 81 82
4EE0 00 00 59 4D 91 92 86 4A
4EE8 85 9D 2C 29 2C 23 28 24
4EF0 59 00 58 24 24 00 1C 8A
4EF8 1C 23 5D 8B 1B A1 9D 8A

4F00 1D 23 9D 8B 1D A1 00 29
4F08 19 AE 69 A8 19 23 24 53
4F10 1B 23 24 53 19 A1 00 1A
4F18 5B 5B A5 69 24 24 AE AE
4F20 A8 AD 29 00 7C 00 15 9C
4F28 6D 9C A5 69 29 53 84 13
4F30 34 11 A5 69 23 A0 D8 62
4F38 5A 48 26 62 94 88 54 44
4F40 C8 54 68 44 E8 94 00 B4
4F48 08 84 74 B4 28 6E 74 F4
4F50 CC 4A 72 F2 A4 8A 00 AA
4F58 A2 A2 74 74 74 72 44 68
4F60 B2 32 B2 00 22 00 1A 1A
4F68 26 26 72 72 88 C8 C4 CA
4F70 26 48 44 44 A2 C8 D0 20
4F78 20 20 20 50 43 20 20 49

4F80 52 51 20 20 53 52 20 41
4F88 43 20 58 52 20 59 52 20
4F90 53 50 41 42 43 44 46 47
4F98 48 4C 4D 4E 51 52 28 54
4FA0 57 58 2C 3A 3B 24 23 22
4FA8 28 2D 4F 49 4A 25 26 45
4FB0 56 29 3D 5C FF AA 49 9F
4FB8 48 3D 44 1F 47 02 41 F9
4FC0 41 87 41 A4 46 A0 41 AA
4FC8 49 B0 43 3C 47 A8 46 40
4FD0 49 16 4C 06 41 B8 46 2A
4FD8 4C 0C 43 15 44 79 49 64
4FE0 4A F4 4A 68 4B ED 4B 00
4FE8 4C 35 4A CA 4B 2C 4A 8D
4FF0 4B 37 4C 21 4C AA 49 19
4FF8 4C 40 43 40 43 40 43 E6

COMPUTE!
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Three Notes On VIC Micromon

Using the VIC Micromon tape commands L, S, and V on a VIC-20 with 3K of RAM installed at \$400 to \$FFF will result in overwrite of \$400 to \$438 with file header characters (blanks). This is due to the tape buffer being relocated to \$375 while in VIC Micromon from the normal \$33C. The normal VIC cassette commands will work properly and not overwrite this area when you EXIT from VIC Micromon. This is because VIC Micromon restores the tape buffer pointer value to \$33C when an EXIT is done. This problem does not occur if the 3K RAM at \$400 to \$FFF is not installed.

If the I (Initialize memory and screen pointers) command was used in VIC Micromon and you EXIT, then the RUN/STOP plus RESTORE should be used in addition to the NEW command to clean up the BASIC environment.

Any binary image saved on cassette tape with the VIC Micromon "S" command can be loaded in the normal VIC-20 BASIC environment by using the command: LOAD " ", 1, 1 which looks for the next program on tape and LOADs it into the same part of memory that it came from (see page 9 of VIC-20 Programmer's Reference Guide).

Checksum

There's a good amount of typing to do to enter the VIC Micromon program. Use the following BASIC program (after you've SAVED a copy of your efforts) to locate any errors you might have made.

Program 3: VIC Micromon Checksum

```

10 DATA 12915,16867,15061,13732,14507,13829,1
  3801,12813,15027,13920
20 DATA 14355,11977,11877,13583,11338,15173,1
  2337,14852,14051,15723
30 DATA 13442,14047,14746,15059,13134,15848,1
  5858,17856,13327,8655
40 DATA 12171,10231
100 Q=16384
110 FORBLOCK=1T032
120 FORBYTE=0T0127
130 X=PEEK(Q+BYTE):CK=CK+X
140 NEXTBYTE
150 READSUM
160 IFSUM<>CKTHENPRINT" ERROR IN BLOCK #"BLOCK
  :GOTO170
165 PRINT"          BLOCK"BLOCK" I
  S CORRECT"
170 CK=0:Q=Q+128
180 NEXT BLOCK
  
```



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For the Atari 800 with 810 disk drive, this is a quicker and simpler method of housecleaning diskettes.

Purge

Al Casper
Saukville, WI

It's summertime; free time for my Atari 800 is now carefully rationed. One of my favorite chores used to be clearing files off my diskettes, making room for new programs and files. Of course I'm kidding; I dreaded purging diskettes. First you had to load DOS and wait. File names had to be carefully entered, and finally the DELETE D:SLOW ? Y or N had to be dealt with. You also had to add one more step if the file was locked, or do it over from the start if you made a mistake. Repeat the above steps for each file you want deleted, and the entire process can easily take twenty minutes per diskette. Purge was written to make this job fast and easy, freeing your valuable time for other things.

Free Directory

When Purge is finished clearing your diskette, a directory is printed on the screen. The directory has two advantages over the DOS directory. First you do not need to load DOS to use it. Second, the files are printed in two columns, allowing twice as many files to be displayed before they start scrolling off the top of the screen.

The program is written in two short sections which makes it easy to save the "DIR" (Section A) as a separate program. The REMarks at the end of section A will explain this in more detail. I keep a copy of "DIR" on each of my diskettes. It requires only three sectors of disk space, well worth the time it can save you. I also have a LISTed version of "DIR" on file named "EDIR." I simply ENTER "D:EDIR" with any program I happen to have in memory. The high line numbers will almost never cause a conflict. Just type GOTO 32100 for a directory listing. "DIR" will now be a part of the program.

To use Purge, simply load the program, insert the diskette to be purged into disk drive one, and type RUN. One at a time the files on that diskette will be displayed on the screen. Pressing RETURN will display the next file. When an un-

wanted file is displayed, press CONTROL "P" to purge it. This process continues until all the files have been displayed. Don't panic if you make an error along the way; just press BREAK and start over. The purging takes place after all the files have been displayed and only if you press "P", as prompted on the screen. You'll hear a lot of action from the disk drive as the purging is taking place. The length of this operation varies with the number and length of files being deleted.

XIO Examples

The following is a line by line description of my program. This will be of most interest to programmers with limited experience working with disk operations. The XIO feature is the key to Purge. Writing this program in BASIC would have been very difficult without XIO. Note that the program listing does not have all the lines in correct order.

Line 32100 This special OPEN will allow inputs from the disk directory. The "*.*" in the file name is the same as a wildcard in DOS.

Line 32102 The TRAP is very useful. In this case it will detect the EOF (end of file), treat it as an error, and end the inputs.

Line 32104-32106 These are the INPUT(s) from the directory. The directory is printed in two columns.

Line 32110-32115 The file is CLOSEd, and the program goes into an endless loop to prevent possible information from scrolling off the screen.

Line 32000 Another TRAP for EOF. The keyboard (K:) is OPENed for input.

Line 32004 The OPEN is again to the directory.

Line 32006 One at a time each directory entry is INPUT and tested for "FREE SECTORS," which would be the last entry. The entry is then printed on the screen.

Line 32008 The program waits for an input from the keyboard. A chime sounds and slows things a bit.

Line 32010 If a purge was requested, the file name is created from the directory information.

Line 32012 The file name is saved in a larger string for later purging.

Line 32016-32017 Blank spaces have to be removed from the file name before they can be unlocked and deleted.

Line 32018 The XIO's perform unlock and delete just as if you were using DOS.

Line 32030 Files are CLOSEd, and the "DIR" routine will follow.

Written for the Apple II and Apple II Plus, this article explains the sounds of the Apple, with special attention to its Music routine.

Apple Sounds

Michael P. Antonovich
Wyomissing, PA

When you are writing software for the Apple II, are you afraid to add sound to your program because you feel that it is too hard or that you have a tin ear? I have tested many Apple programs, and those which incorporate sound, quality graphics, and user-friendly input are often the ones which stand out in my mind. If you haven't been using sound, read on and see how easy Apple sounds really are.

When you bought your Apple II, you received a chip called the Programmer's Aid already plugged into your motherboard. This chip (a ROM - Read Only Memory) contains a group of utilities for the Integer BASIC program. Some of you probably have the Apple II Plus rather than an Apple II. However, don't stop reading if you bought the Language Card.

Maybe you have never looked at what the Programmer's Aid does. If you have, you noticed a utility called the *Music* routine. The Music routine lets you create music with the options of changing the note's pitch, duration, and timbre.

To play a note, you have to POKE three items into memory before you can call the Music routine. The first item is the timbre. Timbre will make the same note sound slightly different, but you have only five possible timbre selections. They are: 2, 8, 16, 32, and 64. The timbre you want must be POKEd into decimal memory location 765 as follows:

POKE 765,32

Timbre 32 will give you the cleanest notes over the Apple's range.

The second item you need to store is the note's duration. A decimal value from 1 to 255 can be POKEd into decimal address 766 to produce short to long notes, respectively. A value of 170 will result in a note of approximately one-second duration. The POKE command is:

POKE 766,170

Third, you must select the note which you want. The note decimal values can range from 1 to 50, with 1 being the low end of the scale. The numbers are based on a chromatic scale. Values of the notes above 50 will result in a random note selection.

Middle C corresponds roughly to the POKE:

POKE 767,32

Finally, you are ready to play the note. To do this, you must call the machine language routine located at decimal address -10473 or 55063, using a CALL statement as in:

CALL -10473

There! How did that sound? Just one note, you say? Well, the following program lists about a dozen sounds made using the above techniques. They are by no means the limits of the Apple's ability. Rather, they are presented to whet your appetite so that you will try to create some sounds on your own.

```

9 REM FALLING SOUND
10 POKE 766,2: POKE 765,32: FOR I=50 TO 1 STEP
  P -1: POKE 767,I: CALL-10473:NEXTI
11 END
19 REM RISING SOUND
20 POKE 766,2: POKE 765,32: FOR I=1 TO 50: PO
  KE 767,I: CALL -10473: NEXT I
21 END
29 REM VARIOUS WHIRLING SOUNDS
30 POKE 766,2: POKE 765,32: FOR I=20 TO 30: P
  OKE 767,I: CALL -10473: NEXT I
31 FOR I=50 TO 10 STEP -1: POKE 767,I: CALL -
  10473: NEXT I: GOTO 30
40 POKE 766,2: POKE 765,32: FOR I=20 TO 30: P
  OKE 767,I: CALL -10473: NEXT I
41 FOR I=30 TO 20 STEP -1: POKE 767,I: CALL -
  10473: NEXT I: GOTO 40
50 POKE 766,2: POKE 765,32: FOR I=10 TO 40: P
  OKE 767,I: CALL -10473: NEXT I
51 FOR I=30 TO 20 STEP -1: POKE 767,I: CALL -
  10473: NEXT I: GOTO 50
59 REM WARNING SIREN
60 POKE 766,2: POKE 765,32: FOR I=1 TO 100: P
  OKE 767,40: CALL -10473: NEXT I
61 POKE 766,4: FOR I=30 TO 20 STEP -1: POKE 7
  67,I: CALL -10473: NEXT I
62 FOR I=10 TO 40: POKE 767,I: CALL -10473 NE
  XT I: GOTO 60
64 REM LIGHT SABER
65 POKE 766,2: POKE 765,32: FOR I=1 TO 100: P
  OKE 767,1: CALL -10473: NEXT I
66 FOR I=10 TO 40: POKE 767,I: CALL -10473: N
  EXT I
67 FOR I=30 TO 20 STEP -1: POKE 767,I: CALL -
  10473: NEXT I: GOTO 65
69 REM PADDLE 0 CONTROLLED MOTOR
70 POKE 766,2: POKE 765,32: POKE 767,140: CALL-1
  0473: FOR I=1 TO PDL(0): NEXT I: GOTO 70
79 REM PADDLE CONTROLLED SOUNDS
80 POKE 766, PDL (1): POKE 765,32: POKE 767, -
  PDL (0): CALL -10473: GOTO 80
89 REM RANDOM NOISE
90 D=64
91 POKE 766,2: POKE 765,D: POKE 767,100: CALL -1
  0473: D=D/2: IF D<1 THEN D=64: GOTO 91
99 REM ALIEN SPACESHIP SOUNDS
100 D=64
101 POKE 766,2: POKE 765,D: POKE 767,150: CALL-10
  473: D=D/2: IF D<1 THEN D=64: GOTO 101
110 D=2
111 POKE 766,2: POKE 765,D: POKE 767,150: CALL-10
  473: D=D*2: IF D>64 THEN D=2: GOTO 111
199 REM MORE SOUNDS
210 POKE 766,2: POKE 765,32: FOR I=50 TO 1 STEP-1: PO
  KE 767,I: CALL -10473: NEXT I: GOTO 210
220 POKE 766,2: POKE 765,32: FOR I=1 TO 50: POKE -
  767,I: CALL -10473: NEXT I: GOTO 220
999 END

```

A quick way to verify cassettes, a survey of languages available for the Atari, and a fix for a bug in Atari's RS-232 handlers.

Insight: Atari

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Optimized Systems Software
Cupertino, CA

Well, I didn't quite make it. I was trying to have a cassette verify program done in time for this month's column, but the pressures of writing a couple of sections for the new *COMPUTE!'s Book of Atari Graphics*, producing three major new OSS products, and answering literally hundreds of phone calls got to me. So, wait for next month. But in the meantime, at least I have a quickie verify method that might keep the frustrations away for a month.

Quick And Dirty

One of the major flaws of the Atari computers has always been the lack of a cassette verify capability. But there is an almost effortless way to simulate this missing capability.

The secret lies in the fact that, because of Atari's superior operating system and because BASIC interfaces properly to it, you can LIST to any file or device. So, when you are ready to save your program to cassette, do *not* use CSAVE. Instead, Use LIST"C:" to produce an ATASCII listing on the cassette. Then you can rewind the tape and, *without deleting or changing the program in memory*, enter the following direct statements:

```
DIM Q$(256) : OPEN #1,4,0,"C:"
FOR Q= TO 10000:INPUT #1,Q$:PRINT Q$
NEXT Q
```

Do you see the reason for the trick? Atari makes no distinction between a listing file and a data file, even on a cassette, so we can simply read the listing as data and print what we read on the screen. If what appears on the screen is correct, the cassette was recorded correctly. Incidentally, the FOR/NEXT loop is only needed so that we can enter the statements in direct mode (without line numbers). The loop will execute more times than there are lines in the file, but the end of file error will stop the process anyway. (And it is a good idea to type "END" after getting the end of file error.)

For the adventuresome, there might be an even easier way. After using the LIST"C:", simply rewind the tape and type ENTER"C:". Remember,

ENTER does *not* erase the program in memory, but instead merges the filed program with the current one. But in this case, since the two programs are the same (if the file was recorded correctly), the ENTER should have no visible effect. If there is an error in the tape, the ENTER will simply halt and no harm will be done. Theoretically. In truth, it is possible that one line could be destroyed (if it were partially ENTERed from one tape block and then blew up in the next block). I have not tested this exhaustively, so use it at your own risk.

Foreign Languages

What is *the* Atari language? What is the best language for doing the most things with an Atari computer? Is there such a thing? There may be no good answers to these questions, but trying to answer them may prove interesting, so let's give it a shot.

The Atari now has a respectable complement of languages available for it. I will list those I know of here and I must apologize in advance for any omissions. The listings within each category are roughly in order of date of introduction of the product. An asterisk indicates a product no longer actively advertised, so check with the publisher for availability.

Assemblers

Cassette-Based Assembler – Quality Software*
Assembler/Editor Cartridge – Atari, Inc.
EASMD (Edit/ASsemble/Debug) – OSS, Inc.*
DATASM/65 – Datasoft*

Macro Assemblers

MAE (Macro Assembler/Editor) – Eastern House
Macro Assembler – ELCOMP
AMAC (Atari MACro assembler) – Atari, Inc.
MAC/65 – OSS, Inc.

Interpreters

Atari BASIC – Atari, Inc.
BASIC A# – OSS, Inc.
LISP – Datasoft
PILOT – Atari, Inc.
tiny c – OSS, Inc.
Microsoft BASIC – Atari, Inc.

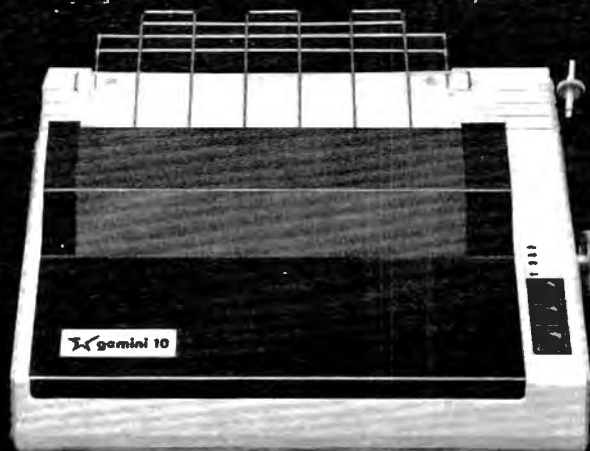
Pseudo-Compilers

QS FORTH – Quality Software
Atari FORTH – Atari Program Exchange
pns FORTH – Pink Noise Studios
PASCAL – Atari Program Exchange
ValForth – Valpar

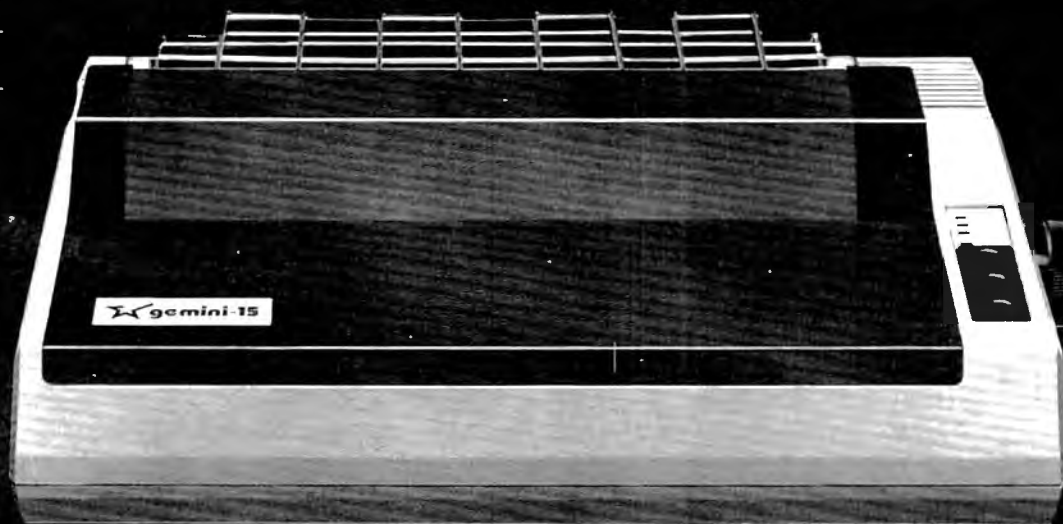
Compilers

PASCAL – Atari Program Exchange
C/65 – OSS, Inc.

I admit I hesitated over classifying FORTH as a pseudo-compiled language, but I was trying to



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group the products by speed and space considerations. Technically, FORTH is a "threaded" language, but that doesn't imply anything about its implementation. Besides, I love to bug the FORTH aficionados. Anyway, to proceed.

The assemblers grow more numerous almost monthly, and it is obvious that most serious graphics work for the Atari is still being done in assembly language, even though the 6502 has one of the strangest assembly languages in existence. (There used to be others far stranger, but they've either died out or been relegated to the dedicated controller market. You know you're an old-timer if you ever used a 4004, PPS-4, PPS-8, 8008, F-8, 2650, COPS, TI1000, etc.)

Of course, Macro Assemblers are a step in the right direction, but I have yet to see any 6502 assembler system done "right," with relocatable and linkable object modules, a symbolic debugger, and more. Yet. For those of you not familiar with macro-assembly techniques, I should point out that old macro hackers usually build up a library of their favorite macros and can easily plug together several variations on a utility program (for example) by simply picking and choosing from their assortment of macros.

I don't really want to explore this subject in depth right now, but I would like to point out that, using some – or at least one – of the currently available macro assemblers for the Atari, you can write assembly language programs that look like this:

```
OPEN 1,8,0,"D:NEWFILE"
LOOP
  INPUT 1,LINE
  IFERROR EXIT
  PRINT 0,LINE
  GOTO Loop
;
EXIT
...
```

It would seem to me that the percentage of Atari owners who will successfully dive into assembly language is too small to make *any* assembler become the dominant Atari language. Currently, though there is no other way to write such marvels as Eastern Front, Frogger, and operating systems. So, at least for many software heavyweights, assembly is *the* language.

Compiling 6502 Code

I'd like to skip the interpreters for now and discuss both kinds of compilers. For starters, what's the difference between a compiler and a pseudo-compiler? Software purists could argue this point for days, but I will use a simple rule here: if it produces output, it's a compiler. If it produces tokens or words which must be interpreted, it's a

pseudo-compiler.

Now, quite honestly, on a 6502 there probably isn't much advantage in one of these over the other. Generally, a pseudo-compiler produces fewer bytes of code, but requires a relatively massive runtime support module (the interpreter, including I/O routines, etc.). As a rule, on most computers, pseudo-compiled code will run slower than compiled code because of the overhead of the interpreter.

Unfortunately, most conventional language compilers for 6502-based machines will of necessity produce large and generally clumsy code. Consider the following statement, legal, with minor variation, in most higher level languages:

```
array(index) = value ;
```

Given that all three variables shown are 16-bit globals, a *really* good compiler for a Z80 could produce as few as 15 bytes of code to execute it (and the one we wrote for Cromemco produces only 16 bytes).

A *superb* compiler for the 6502 could produce as few as 25 bytes, but only if it *knew* that "index" would not contain a value exceeding 127! And, oh yes, most pseudo-code compilers would probably produce 11 or 12 bytes of tokens for this same code.

So, you see, even a multi-pass optimizing compiler can *at best* coax the 6502 into using 1.5 to 2.5 times the amount of code that a Z80 needs. And, in truth, there aren't any "superb," "multi-pass," "optimizing" compilers yet available for the Atari. So the code generated will be even bigger, perhaps as much as three to four times that needed by a Z80. (To be fair, an "average" Z80 compiler would produce 25 or so bytes of code, itself.)

So why did we digress through all of this? Simply to show that it is remarkable that there are any compilers at all for the Atari. Of the two compilers shown, the PASCAL is the more complete language, but it is a little difficult to work with, needs a huge support library, and requires two disk drives. Still, since it is an APX product, it is a remarkable bargain. C/65, on the other hand, is a subset of the full C language; it is a one-pass compiler (no optimizing here, obviously) which produces macro assembly language output. Its primary advantages: the assembly language can produce a listing with the original C code interspersed as comments, it uses a very small support library, and it can run on a single drive. But I think we may not have seen the end of compiler efforts on the 6502.

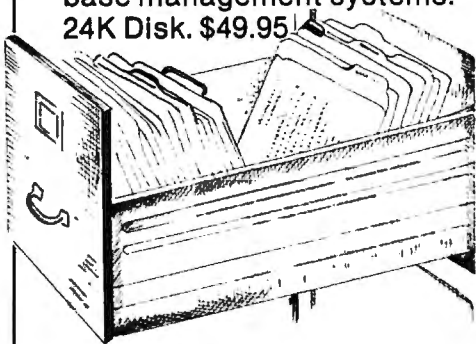
Interpreter Efficiency

But now we come to my favorite topic: interpreters. Despite its shortcomings as a compiled-for machine, the 6502 comports itself nicely when interpreting:

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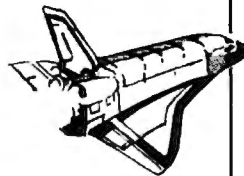


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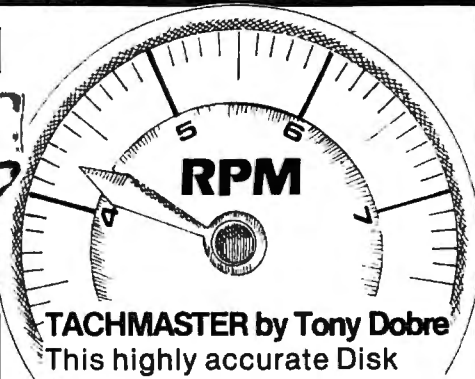
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it is fast and needs only relatively compact code to implement. Why? Simply because interpreters generally work on "lines" of input. But if we limit a line to 256 characters (a very reasonable limitation), we find that there are several modes of operation on the 6502 that just love working with such short character strings. (Especially, of course, the "indirect indexed" or "(zero page),Y" instructions.) The truth of the matter is that the designer of a 6502-based interpreter has a lot of leeway in prescribing how the language will run best.

So look at the wealth of interpreters available already! With more to come, I am sure. We find in these interpreters the most used of all Atari languages, Atari BASIC. Well, that's not surprising, considering that it's essentially a required ingredient in an Atari system. But let's come back to it in a moment.

Naturally, PILOT is here. It's a nice, simple language which can easily be interpreted. It was probably a joy to program; I would have loved being involved.

But there are some real powerhouse languages here, also. LISP has traditionally been an interpreter, the darling of the Artificial Intelligence people. And, finally, there is Microsoft BASIC and BASIC A+. Quite honestly, I feel that these last two languages provide the best and easiest access to the Atari's features. Naturally, I am prejudiced towards BASIC A+, but the Microsoft BASIC has a few nice and unique features even if it isn't quite as easy to use.

What's *The Atari Language*?

So, after all that, just what is *the Atari language*? Well, I'm going to cop out and say that it's Atari BASIC. Despite all the nasty things said about the poor thing, look at all the things written in BASIC. And they work.

Atari BASIC is an excellent starting point. The easiest-next step is BASIC A+, but most people won't have too much trouble learning other algebraic languages, such as PASCAL or C (the only real problem with these languages is that debugging is so much harder than with an interpreter). I consider PILOT and LISP useful languages in their own right, but much of what you learn in them is non-transportable to other languages.

The same is true of FORTH. FORTH enthusiasts would have you believe that FORTH is the only language you will ever need. Nonsense. Each language has its uses, its strong points, and its failings. (In my opinion, the major failings of FORTH are (1) that it operates independent of the host system's DOS and (2) techniques learned in FORTH are often non-transportable to other languages, because of FORTH's reverse-Polish

notation. However, I respect the language for what it is: a hacker's dream come true. And I'm a hacker.)

Personally, I like to collect languages the way other people collect games. Seldom will I find one that won't teach me something new about how computers can be made to work. So try some "foreign" languages yourself soon and see how much fun they can be. (And pain and trouble and frustrating and educational and uplifting.)

System Reset And The 850

A couple of times in the past, I have presented in this column the "rules" for adding device drivers to Atari OS. Well, would you believe it, Atari itself broke the rules when they implemented the 850 (RS-232) handlers. The violation was a minor one, yet the consequences *can* be severe. To start with, let's recap my rules:

1. Locate the current value of system LOMEM (contents of \$02E7).
2. Load your driver into memory and relocate it to LOMEM.
3. Adjust the contents of LOMEM to reflect the memory being used by your driver.
4. Add your device's name and handler address to the handler table (HATABS, at \$031A).
5. Get the current value of DOSINI (location \$000C) and save it somewhere in your handler. Put your own initialization address into DOSINI.
6. Whenever your initialization routine is called (i.e., when System Reset is pushed by a user), first call the initializer whose address was in DOSINI before you changed it. Then perform steps 3 and 4 again, since Reset will have changed LOMEM and reloaded the HATABS.

Now step 2 is the most difficult of these to accomplish, in practice, because it is hard to produce a relocatable module on the Atari. Many programs I have seen (and written) are actually assembled absolute at a "known" good location. This is okay, if you are writing for your own private system: you know what will be loaded when and where. But if you are producing a driver for sale, you really should follow the rule faithfully.

Atari's 850 drivers do, indeed, relocate themselves beautifully. They add their name to the handler table. They adjust the system LOMEM pointer. So what do they do wrong? One minor thing: they do steps 3 and 4 *before* they call the old initialization routine (see step 6) instead of *after*!

The result: the 850 handler changes LOMEM to just above itself and then calls the DOS initialization, which resets LOMEM to just above DOS!

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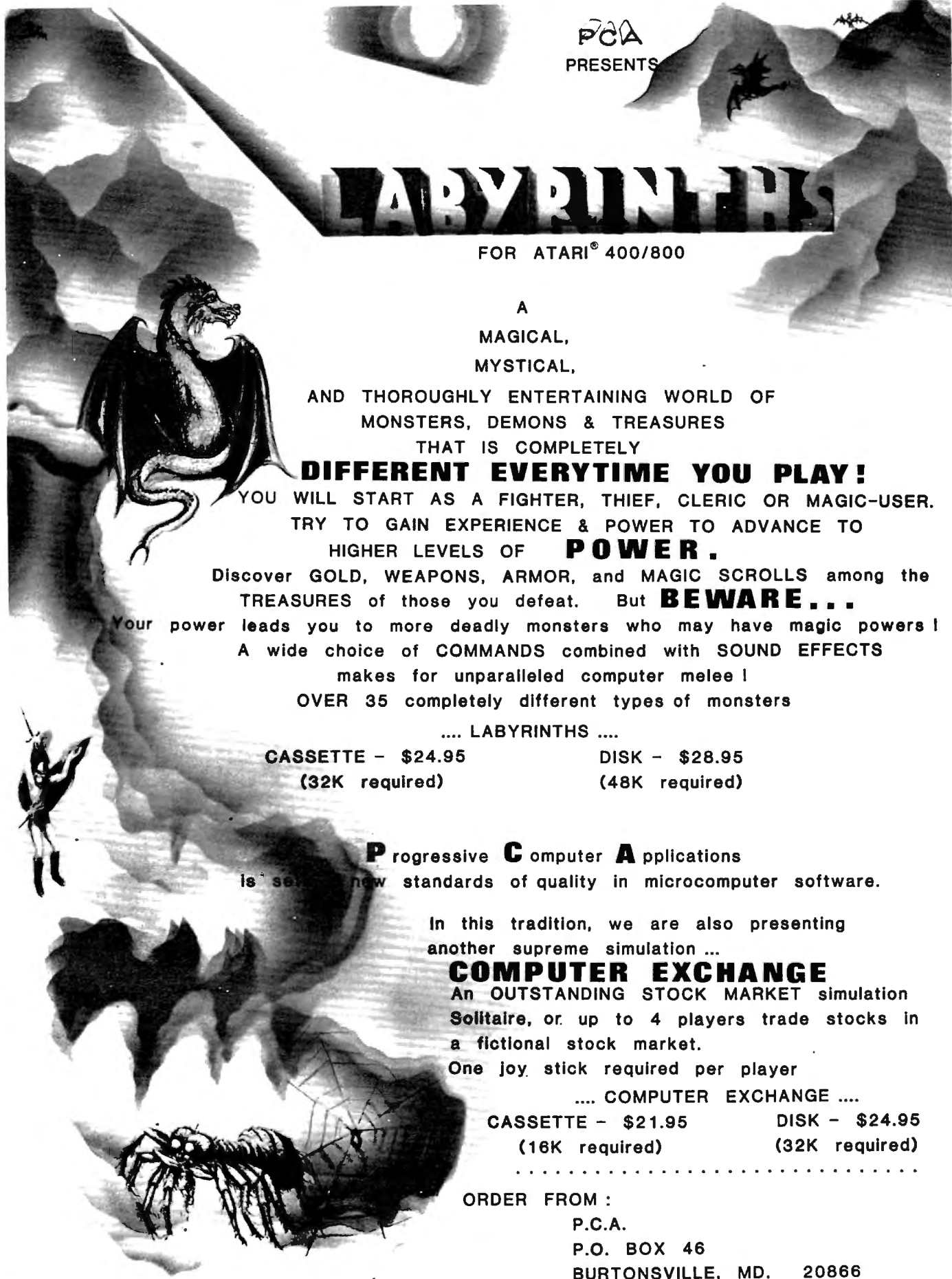
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Thus, the RS-232 handlers are not protected from programs which come in and *quite properly* use RAM starting at LOMEM. Generally, if you are running with Atari BASIC, this won't affect you, since BASIC maintains its own pointer to LOMEM once it is initialized at power on. But if you return to DOS without MEM.SAV, or run some assembly language utility... well, there are just too many cases where this little *faux pas* can wipe you out.

I am currently working on a patch (ready by next month, I hope) to the handler (to be made via the handler loader) which will fix this problem. In the meantime, it might be a good idea to have your programs check for the existence of the "R" name in HATABS and avoid the appropriate amount of memory if it is found.

In December we'll have some heavy assembly language stuff, what with the patch to the 850 handler and the cassette verify routine. I hope to return to some more BASIC stuff to start off the new year. ©

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Modifications Or Corrections To Previous Articles

TI 99/4A Charades

Our thanks to Steve Davis, author of "Charades" for the TI 99-4A (September 1982, p. 64), for pointing out the following typos in the program listing:

```
831 DATA SHARP AS A TACK
1220 CALL CLEAR
1330 IF STATUS=0 THEN 1340 ELSE 1350
1370 RETURN
1580 CALL SOUND
```

PET Machine Language Compactor

Author David Evans has provided some readers with a faster version of his "Compactor" (July 1982, p. 159). To make all versions work correctly, he suggests that the following line be typed in and then the corrected version be saved via the monitor (the start and end addresses are \$0363, \$0B78):

```
IF PEEK (2461) = 12 THEN POKE 2461,13 ©
```

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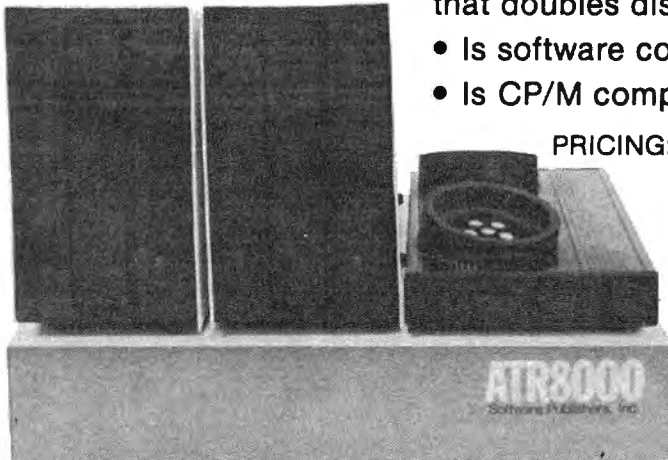
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Here's an expert's explanation of how to telecommunicate with the help of machine language.

A Monthly Column

Machine Language: Serial Communications

Jim Butterfield
Associate Editor

So you want to communicate? If you want to reach another device or computer over a distance of 20 feet or so, you can string eight wires or more and spit out all eight bits of a byte at one time. But to go across town or around the world, you'll have to send one bit at a time, one behind the other. That's serial transmission.

We'll take a small part of the communications interface – the part that changes the computer's bytes into serial and back – and discuss the machine language approach.

What Is It?

Most small computers run their communications at a modest speed, say 300 bits per second. (Don't say "baud": it has a special meaning in telecommunications and will just get things muddled.) At this low speed, we use a type of transmission called "asynchronous" (a-SINK-ron-uss). In non-technical terms, this means send a character when you feel like it, and send nothing if you choose. This makes it easy for the sender: if there's nothing to send, don't worry about it. It's a little tougher for the receiver, which must keep an eye on the line and decide if there's a character coming in or not.

The usual code used for communications characters is ASCII. Some books tell you that it's a seven-bit code. Don't believe it. For communications purposes, we send eight bits of data. Wait, there's more. We have to send a little extra because of this asynchronous thing.

Before we send the eight bits, one behind the other, we must send a "start bit." This tells the other end, "Look out, there's a character coming!" After we have sent the start bit plus the eight data bits, we enforce a quiet time of one-bit length. This

helps the receiving end catch up in case we're getting a bit ahead. This quiet time is called the "stop bit," and it's a minimum wait time only. If we don't have another character to send, the quiet time continues far beyond a single-bit time.

The receive end must spot the start bit, and then start clocking in the eight bits of data that follow it. It can ignore the stop bit pause at the end, but might choose to check that it's there so as to spot possible errors.

Setting The Quiet Line

The outgoing line is often one of the output ports. We'll need to separate it from the other ports. To set the line to the quiet state (called "marking"), we'll probably want to set the port to a binary one. Let's assume that we're using bit six of an I/O register at E84F. We'd code: LDA \$E84F:ORA #\$40:STA \$E84F and the line would now be set to the idle, marking state.

Starting The Character

Suddenly, we have a character to send. We'll store it into location CHAR, and set a value of 8 into location COUNT to count the bits as they go out. Now our job is to send the start bit. That's a zero, or spacing, signal. But wait! We must decide about the timing.

Three hundred bits per second works out to a timing of 3,333 microseconds per bit. That's the value we must place in our timer if it counts in microseconds: 3333 or hexadecimal 0D05. The value might need to be slightly adjusted, but it's close. We might code a subroutine:

```
SPACE LAD $E84F
      AND #$BF      (clear out bit)
      STA $E34F
TIMER LDA #$05
      STA $E848      (timer low)
      LDA #$0D
      STA $E849      (timer high)
WAIT  BIT $E849      (watch timer)
      BPL WAIT
      RTS
```

This routine will hang in a stall loop until the time is up. It seems inefficient – interrupts could do the job more efficiently – but maybe we have nothing better to do anyway until the time has gone by.

Sending The Bits

Our start bit has gone. Now for the eight bits of our byte. Let's count down with DEC COUNT, and, if all the bits have gone, we can exit with BEQ EXIT. Otherwise, we get the bit (low order first) with LSR CHAR. The bit we want pops into the Carry flag. If the bit is zero (carry clear), we want to call subroutine SPACE again. If the bit is one (carry set), we must call a new subroutine, MARK:

MARK LDA \$E84F
 AND # \$40
 STA \$E84F
 BNE TIMER

The last branch is unconditional; the AND guarantees that the Z flag is clear. This way, both MARK and SPACE will time out by one-bit time.

The calling sequence, then, looks like:

BITZ DEC COUNT
 BEQ EXIT
 LSR CHAR
 BCS DOMARK
 JSR SPACE
 JMP BITZ
 DOMARK JSR MARK
 JMP BITZ

What do we do when we have sent all eight bits and go to EXIT? We call JSR MARK one last time. That clocks out the enforced pause and sets the line back to idle for us. After this we can look for another character to send, or do other jobs if we want.

One odd protocol note: many programs choose to send the enforced pause – the stop bit – as the first part of a character. This is OK. So long as the pause is definitely sandwiched in between characters, it doesn't matter how you arrange it.

Receiving: An Outline

To receive, we have a slightly more complex task to do. When the line is idle, we must watch it constantly, since a character might begin at any time. Interrupts are sometimes used to good effect here.

When the start bit is spotted, we have a special job to do. At the moment that we detect the start, we're on the edge of the timing. If we delayed one-bit time, we might be at the beginning of the first data bit, or we might be a shade early and be at the end of the stop bit. This isn't satisfactory: we could read the wrong signal.

So instead of waiting one bit time, 3333 microseconds, we wait for one and one-half times: 5000 microseconds. That should place us right in the middle of the first bit timing, allowing us to take a solid reading. For the remaining bits, we'll return to a time delay of 3333, allowing us to check each bit smack in the middle of its time.

We'll pack the bits together by placing each bit into the Carry flag and then doing a ROR to the memory byte. And we'll remember to count, of course. When we receive the last bit, we will time out one more bit time; that should place us in the middle of the stop bit. We can now put our assembled character away and start watching the line for a new character.

It's educational and economical to do your own communications interface. We've looked at only one facet of the job: changing the computer's

parallel data to a serial signal.

Of course, you could buy a UART (Universal Asynchronous Receive Transmit) chip to do the whole job for you, but that's the easy way out. Or is it? Last time I put a board together, my sports jacket became a smoking jacket. ©

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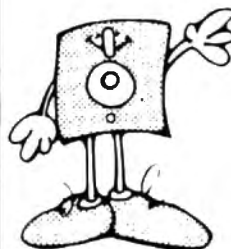
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It would be nice if you could just touch one key and then a BASIC program would immediately begin execution. Or if, when debugging a program, you could press the first function key and get a LISTing. Here's how to do it.

Although the program that allows the function keys to be programmable is in machine language, no knowledge of machine language is needed to use it.

Programming VIC's Function Keys

Jim Wilcox
Vienna, WV

Once this program is typed in, double check the DATA statements, since one error can result in a catastrophe. RUN the program after SAVEing it, and wait for about five seconds. The following should then appear: "F1=?". Type in the BASIC command or statement you would like the function one key to equal. For every carriage return you would like, type in the back arrow located on the upper left-hand corner of the VIC. Once you are sure the function key has been defined properly, press the RETURN key. The program will then ask for the rest of the function keys' definitions. After you have defined the eighth function key, the computer will print READY. The function keys are now ready to be used. Just press the appropriate function key, and the characters for which it was programmed will be printed.

What If It Doesn't Work?

If the VIC just locks up or if you don't get the READY message, turn the VIC off and reLOAD the program. Recheck the program with the listing provided, from the beginning to line 65, especially the DATA statements.

When the READY message occurs after all eight keys have been defined and the VIC doesn't print the characters corresponding to the function key, check the program from lines 70 to 95.

If it still doesn't work, check the subroutine in lines 100 through 115.

How The Program Works

The BASIC program will POKE two machine language programs into your VIC. One goes into the cassette buffer, the other in the uppermost memory position. The program in the cassette buffer asks for the definition of each function key.

Once the RETURN key is pressed, the program will store the ASCII value of the characters pressed in the uppermost portion of memory. After all eight keys have been programmed, the program will tell the computer to go to the other program in the top of memory every sixtieth of a second. The original program is not needed once the above operations have been performed and will be erased after any command for the cassette recorder is given. This is done to save 147 bytes of VIC's memory.

The second program will constantly check for a function key pressed. If one is pressed, the program will print the characters for which the function key was defined.

How To Save Memory

The longer each command for a function key, the more memory will be used up. If the commands are short, only about 200 bytes will be used up. The maximum amount of memory that can be used by this routine is about 800 bytes. To use the least amount of bytes, the commands can be typed in the shorthand method shown on pages 133-134 in the *VIC Owners Manual*.

Having programmable keys can be a great aid to a computer operator. The VIC is equipped with eight keys which you can use for whatever purpose you want. Time can be saved in writing and debugging programs. Here's an example:

```
RUN
F1=? LIST ←
F2=? POKE
F3=? RUN ←
F4=? PEEK(
F5=? GOTO
F6=? GOSUB
F7=? PRINT PEEK(7680) ←
F8=? LOAD ← LIST ←
```

```
5 F=0:C=PEEK(55)-120:IFC<0THENC=C
+256:F=-1
10 D=PEEK(56)+F:POKE55,C:POKE56,D:
CLR
15 S=828:I=146:GOSUB100
20 DATA32,198,3,165,55,133,251,133
,253,165,56,133,252,133,25
4,169,49,133,0,169
25 DATA133,133,1,169,13,32,210,255
,169,70,32,210,255,165,0,3
2,210,255,169,61
30 DATA32,210,255,169,63,32,210,25
5,169,32,32,210,255,32,207
,255,72,160,0,165
35 DATA1,145,55,104,32,198,3,201,1
3,240,14,201,95,208,2,169,
13,145,55,32
40 DATA207,255,76,124,3,230,0,165,
```

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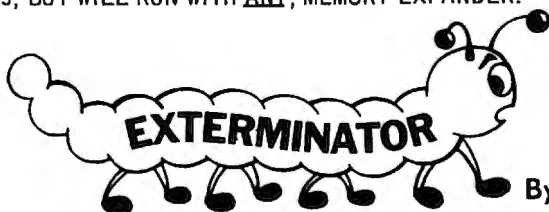


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```

0,41,1,208,10,24,165,1,105
,4,133,1
45 DATA76,170,3,56,165,1,233,3,133
,1,165,0,201,57,144,163,12
0,169,L0,141
50 DATA20,3,169,H0,141,21,3,88,169
,0,133,0,32,68,198,76,116,
196,166,55
55 DATA208,2,198,56,198,55,96
60 S=PEEK(55)+256*PEEK(56):I=119:G
OSUB100
65 SYS(828)
70 DATA165,0,240,59,160,0,177,251,
32,L99,H0,176,12,165,55,19
7,251,208,21,165
75 DATA56,197,252,208,15,169,0,133
,0,165,253,133,251,165,254
,133,252,76,191,234
80 DATA166,198,177,251,157,119,2,2
30,198,32,L111,H0,165,198,
201,11,144,204,230,0
85 DATA76,191,234,165,215,32,L99,H
0,176,3,76,191,234,165,8,4
1,1,208,247,160
90 DATA0,177,251,197,215,208,6,32,
L111,H0,76,L6,H0,32,L111,H
0,76,L81,H0,201

```

```

95 DATA133,144,6,201,141,176,2,56,
96,24,96,166,251,208,2,198
,252,198,251,96
100 F=0:FORD=STOS+I:READA$:IFASC(A$
)<58THENA=VAL(A$):GOTO115
105 IFASC(A$)=76THENA=VAL(RIGHT$(A$
,LEN(A$)-1))+PEEK(55):IFA>
255THENA=A-256:F=1
110 IFASC(A$)=72THENA=VAL(RIGHT$(A$
,LEN(A$)-1))+PEEK(56)+F:F=0
115 POKED,A:NEXT:RETURN

```

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Copy Atari Boot Tapes To Disk

C. Scott Davis
Broomfield, CO

If you're an Atari owner who purchased a disk drive after you bought your initial system, probably one of the first things you did was transfer your program library from cassette to diskette. I know I did. Everything was going along fine until I got to a boot tape. They're the ones you load by powering-up the system while depressing the START key. The game "SHOOT" appearing in the September 1981 issue of **COMPUTE!** is an example.

Not being satisfied with leaving several programs on cassette, I had to find a way to put them on disk. After a little research I developed a program that did the job. Considerable credit goes to Bob Nalbome, who had already developed his own program to read and display data from cassette tapes.

To use the program, simply boot up your system with the BASIC cartridge in place, the disk drive turned on with a DOS disk inserted, and a blank formatted disk handy. Run the program from this article. When finished, you should have a boot disk containing the program from your boot tape. A boot disk is loaded by powering up your disk drive, inserting the disk, and then powering up your computer while depressing the START key.

Here's an explanation of the program:

Lines 180 - 210 read the first four bytes of information from the tape. The number of records and starting address for loading are contained in bytes two, three, and four.

Lines 220 - 370 display system parameters as well as information just obtained from the boot tape. This could be useful if the tape can't be copied because of lack of memory space.

Line 380 calculates the starting address for a work area to be used in transferring data from tape to disk. 500 bytes above the area used by BASIC was selected.

Line 390 calculates the address of the last location required for the work space.

Lines 400 - 480 check to make sure your system has sufficient space to make the transfer. Note

that a boot tape may contain as many as 256 records (128 bytes each) requiring a total of 32K of free space. Most tapes should be much smaller.

Lines 490 - 570 place the code for a short machine language routine into reserved memory starting at location 1536 decimal. This routine will read the tape and store the data in the work area previously defined. Machine language is required because BASIC isn't fast enough for more than the first record on the tape. Table 1 shows the assembly language version of this code.

Line 620 opens the cassette for input. The parameter 128 specifies data with short inter-record gaps.

Line 630 calls the routine to read the tape. The work area starting address and the tape length in bytes are passed via the USR function.

Lines 650 - 670 check for an error in the tape reading attempt.

Lines 720 - 740 set up parameters for writing data onto disk. The locations and values used were derived from the *Atari Technical Users Notes*.

Lines 750 - 800 provide a routine to write a single sector of data to disk. See Table 2.

Lines 810 - 870 provide a loop to manipulate several parameters and call the machine routine. The variable START contains the starting address of the next 128 bytes of data to be written.

Line 820 POKEs the low byte of the STARTing address into memory.

Line 830 POKEs the high byte of START into memory.

Line 840 takes care of the disk sector number to be written.

Line 850 calls the USR routine to do the write to disk.

Line 860 increments the starting address for the next write operation.

Table 1.

Decimal Data	Assembly Code	
104	PLA	Pull the number of USR parameters from the stack
162,16	LDX #\$10	Place \$10 into the x register for an offset into IOCB #1
169,7	LDA #\$07	\$07 is control code for character read operation
157,66,3	STA \$0342,X	Place that \$07 into ICCOM of IOCB #1
104	PLA	Pull the high byte of variable START from the stack
157,69,3	STA \$0345,X	Place it into ICBAH of IOCB #1
104	PLA	Pull the low byte of START from the stack
157,68,3	STA \$0344,X	Place it into ICBAL of IOCB #1
104	PLA	Pull the high byte of variable FLEN from the stack
157,73,3	STA \$0349,X	Place it into ICBLH of IOCB #1
104	PLA	Pull the low byte of FLEN from the stack
157,72,3	STA \$0348,X	Place it into ICBL of IOCB #1
32,86,228	JSR \$E453	Jump to CIOV
16,4	BPL \$04	Conditional branch forward by 4 if no error
169,1	LDA \$01	Put a \$01 in A
133,212	STA \$D4	Place the 1 in the USR return location
96	RTS	Done

Table 2.

Decimal Data	Assembly Code	
104	PLA	Pull the number of USR parameters from the stack
32,83,228	JSR \$E453	Jump to DSKINV to write a sector
96	RTS	Done

```

220 PRINT "SYSTEM PARAMETERS:"
230 PRINT
240 BTOP=PEEK(144)+256*PEEK(145)
250 PRINT "BASIC MEMTOP = ";BTOP
260 OTOP=PEEK(741)+256*PEEK(742)
270 PRINT "OS MEMTOP = ";OTOP
280 PRINT "FREE RAM = ";OTOP-BTOP
290 PRINT
300 START=ADL+256*ADH
310 PRINT "YOUR BOOT TAPE NORMALLY"
320 PRINT "LOADS STARTING AT ";START
330 IF NREC=0 THEN NREC=256
340 PRINT "CONTAINS ";NREC;" RECORDS"
;
350 FLEN=128*NREC
360 PRINT " = ";FLEN;" BYTES"
370 PRINT
380 START=BTOP+500
390 LAST=START+FLEN
400 IF LAST<OTOP THEN 490
410 PRINT "WORK AREA REQUIRED"
420 PRINT
430 PRINT START," TO ";LAST
440 PRINT
450 PRINT "INSUFFICIENT FREE RAM"
460 PRINT
470 PRINT "SORRY"
480 STOP
490 FOR A=1536 TO 1569
500 READ D
510 POKE A,D
520 NEXT A
530 DATA 104,162,16,169,7,157,66,3
540 DATA 104,157,69,3,104,157,68,3
550 DATA 104,157,73,3,104,157,72,3
560 DATA 32,86,228,16,4,169,1,133,212
570 DATA 96
580 PRINT "REWIND THE TAPE AGAIN"
590 PRINT "DEPRESS PLAY BUTTON"
600 PRINT "PRESS RETURN"
610 PRINT
620 OPEN #1,4,128,"C:"
630 X=USR(1536,START,FLEN)
640 CLOSE #1
650 IF X<>1 THEN 680
660 PRINT "TAPE READ ERROR"
670 STOP
680 PRINT "PUT A FORMATTED DISK IN"
690 PRINT "DRIVE #1 - PRESS RETURN"
700 INPUT A$
710 PRINT
720 POKE 769,1:REM DUNIT=1
730 POKE 770,87:REM WRITE=87
740 POKE 779,0:REM DAUX1=0
750 FOR A=1536 TO 1540
760 READ D
770 POKE A,D
780 NEXT A
790 DATA 104,32,83,228
800 DATA 96
810 FOR SECTOR=1 TO NREC
820 POKE 772,START-256*INT(START/256)
830 POKE 773,INT(START/256)
840 POKE 778,SECTOR
850 X=USR(1536)
860 START=START+128
870 NEXT SECTOR
880 PRINT
890 PRINT "DONE"
900 END

```

```

100 GRAPHICS 0
110 DIM A$(1)
120 PRINT
130 PRINT "PLACE BOOT TAPE IN PLAYER"
140 PRINT "REWIND TAPE - ";
150 PRINT "DEPRESS PLAY BUTTON"
160 PRINT "PRESS RETURN KEY"
170 PRINT
180 OPEN #1,4,0,"C:"
190 GET #1,A:GET #1,NREC
200 GET #1,ADL:GET #1,ADH
210 CLOSE #1

```

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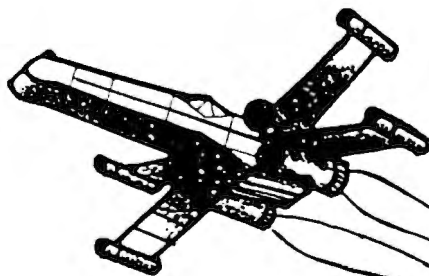
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A routine for Upgrade and 4.0 BASIC (except 4.0, 40-column model) PETs that saves screen images on disk and has other applications.

PET: Picture Files

Elizabeth Deal
Malvern, PA

PET knows four types of disk files. It's time we add another, except that it really isn't new — just a program file under a new name. The set of subroutines in the listing shows a way to use a disk as a storage device for screen images. The routine is for Upgrade PET. Conversions to BASIC 4 (80 column) are coded in.

The save/load method described here need not be limited to the screen; it can handle any area of memory. This opens up some interesting possibilities for BASIC, without touching machine code directly.

At present, if you or your children have ever wanted to save a picture from the screen onto a disk file, and bring it back by pressing one shifted key, then this routine is just for you. We use it as an instant subroutine with *Power* (Professional Software), but it can be used without *Power*. The code shows bare-bones essentials. You can customize it for your hardware setup or for different applications.

The Mechanics

The lines that actually do the work are 330-500. The code is a translation into BASIC from the machine language monitor save and load routines, which here function as such. The save command is particularly powerful, in that from within BASIC we can easily save any area of memory.

The subroutine in lines 330-500 needs only this information:

- (1) device number (DV)
- (2) file name FL\$
- (3) address of file name; pointer in 68/69 gives address for 218/219
- (4) length of file name.
- (5) start (S1-S2) and end (S3/S4) addresses for writing.

The picture files are program files, quick and compact. Code conversion is not needed. Characters in reverse, quotes, commas, colons, and other

such nasties cause us no problem whatsoever. Loading does not cause a change in BASIC pointers, and, since it does not cause the automatic execution from the first line of text, you don't have to code around that issue.

Disk errors do not cause any problems. The curious necessity of pressing a STOP key in the event of FILE NOT FOUND condition has been eliminated (line 460). The message prints by itself if file does not exist, hence this code is more feasible for use within a program than the semi-direct Power-mode, a necessity for users without *Power*.

I have hard coded device 8 and drive 1. Most of you have interrogation routines on the demo disk; they can make the setup more flexible. The program does ask for a file name and permits you to gracefully get out (type X) before any disk activity takes place. Limit your input to 12 characters, and be careful not to push cursor-down and clear-screen during input. Once again, existing get/input routines are a neater solution.

Cautions

Do not change the business part of the program without first understanding it.

Screen images, if loaded via an ordinary LOAD command by mistake, cause a crash. For that reason, files saved by my routine have a clearly visible "P." (for picture) prefix. This overcomes the only (I think) dangerous feature of the program. If you have a habit of saying "LOAD"P*",8" then this is a good time to plan to stretch the habit to three letters. Of course, one experience guarantees fast learning. This program does not check the end-load address. It is unlikely you have a "P." file starting at the screen and going all the way into the interface chips.

The load command is tricky, in that it normally loads into the same place as where the code came from. This means that, unless you're careful, you may mess up a program in memory if you inadvertently ask for a display of a wrong file. The coding

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in lines 460-500 prevents this from happening. Your variations on this theme may exclude the starting address test in line 490, but be careful what you're doing.

The message end of line 490 is never executed by my program, as the failure to find a program file with a "P." prefix is actually detected in line 460. I keep line 490 for safety, in the event of skipping "P." in line 210 or in versions of the routine or in the event of an existing "P." file that is not a screen file.

For loading via this program you may, of course, use "*" for a file name, as "P.*" will result, bringing in the first picture file.

Do not add the "P." prefix when you are asking to write or read; the routine does it for you and prints it as an input prompt, but you can't change it. The only time "P." in "P.ELEPHANT*" is mandatory is when you want to load the elephant while in the monitor mode (and don't use Power!). Needless to say, "P." must be used when you save screen via the monitor if you plan to read by this code.

Consider the bottom line useless. It is saved, but is used by my routine for asking file name and for floppy error messages. Bottom line seldom is used anyway, so it shouldn't be too painful to forget it. You may change the end address to skip saving that line.

Go easy on the RETURN key after a picture has been displayed, if that picture happens to be a program text or if numbers exist on the left edge. You may or may not want to enter the lines into your program.

Power Mode

The code in lines 110-120 is my hookup to *Power*. Many of you are familiar with Charles Brannon's Keyprint routine, which dumps the screen to printer when a key is pressed. This *Power* hookup works in a similar fashion: pressing a user-designated shifted key dumps the screen image onto a floppy or brings an old image back. The shifted key does not print and, miracle of useful miracles, the cursor stays in place.

Program Mode Suggestions

Don't worry if you don't have *Power*. You can use the routine just about as listed. But it has to be done in a program. You have to arrange for starting and ending the procedure without scrolling the screen. The reason is that, in contrast to *Power*'s instant subroutines, PET's direct "execute" type commands must be typed on the screen, and the cursor hops down. Both events usually mangle the picture.

The simplest thing is to transfer your picture to another area of the PET before saving. Changing top of the PET pointer will protect the picture.

You can then save the entire alternate screen area (change the addresses). After loading it by the quick load method, you can transfer the image back, for further work, or whatever.

Swapping the screen prior to input activity into an alternate area is a good idea anyway in very serious uses. You will then not need fancy user-proof input routines, your picture being safe elsewhere.

Some Applications For Picture Files

Many uses are obvious. Your child's masterpiece can be preserved (several times, while working). Graphs and other displays can be saved. Tiny sections of programs can be saved and brought back without disturbing a program in memory. You can save an annotated history of your floppy on the floppy. You can debug programs which are heavily screen oriented, by being able to quickly overlay and compare various outputs you've previously saved as picture files. Fixing the pointer chain can be a building block for a BASIC disk append routine. And more.

Non-Upgrade PETs

The table shows the system addresses used in the code so that if anything goes wrong you can track it down. Most addresses are identical in Upgrade and 4.0 BASIC. Addresses of two ROM routines differ. Provided that they function in the same way (the Micromon code seems to tell me they do), 4.0 users should experience no difficulty.

Upgrade	BASIC #4	Meaning
SC = 32768	same	screen
68/69	same	last used variable (FL\$)
212	same	device
209	same	length of file name
218/219	same	address of file name
136/137	same	temp. storage/rnd #
157	same	load flag = 0
251/252	same	save start address
201/202	same	save end address
LR = 62242	62294	load routine \$F356
SR = 63140	63203	save routine \$F6E3

Additionally, 80-column PETs have a 2000-byte screen. This is reflected in the screen end address correction in line 300, as well as in longer strings of blanks. Be careful of three-way concatenation if memory is getting short.

References

1. *CBM User Manual* (Upgrade) Monitor listing.
2. Butterfield, BASIC4 Memory map and ROM routines, **COMPUTE!**, November/December 1980, #7.
3. Butterfield, Upgrade Memory map, **COMPUTE!**, November/December 1979, #1.
4. Micromon code where one gets load subroutine address.

5. Butterfield disk utilities where one gets instructions about disk.

6. Collins, "Host Equipment Test," *The Microcomputer Magazine* (Commodore-PA), also in the *Transactor* (Commodore-Canada).

```

110 REM"W 170:WRITE PIC TO FLOPPY
120 REM"R 180:READ TO SCREEN
130 STOP
170 LF=0:GOTO190:REM W (ON DEVICE 8
180 LF=1 :REM R DRIVE 1)
190 DV=8:DR$="1":FL$=""
200 IFLF=0THENFL$="@
210 FL$=FL$+DR$+"P."
220 GOSUB270:GOSUB550
230 E1=1:GOSUB630:IFE1GOTO250
240 FL$=FL$+I$:GOSUB330
250 PRINTH$;:RETURN
260 REM---SOME SYS CONSTANTS-----
270 GOSUB520:IFTP=0THENSTOP
280 SC=32768:LR=62242:SR=63140
290 S1=0:S2=128:S3=232:S4=131
295 IFTP=2THENLR=62294:SR=63203
300 IFTP=3THENLR=62294:SR=63203:S3=208:S4=135
310 FF=20:RETURN
320 REM---READ/WRITE FILE-----
330 CLOSE15:OPEN15,DV,15
340 IFLFTHENGOSUB460:IFE1THENRETURN
350 POKE212,DV:POKE209,LEN(FL$)
360 POKE136,PEEK(68):POKE137,PEEK(69)
370 AD=PEEK(136)+256*PEEK(137)+1
380 AD=PEEK(AD)+256*PEEK(AD+1)
390 POKE218,AD-256*INT(AD/256):POKE219,AD/256
400 IFLFTHENPOKE157,0:SYS(LR):GOSUB430:CLOSE15
:RETURN
410 POKE251,S1:POKE252,S2:POKE201,S3:POKE202,S
4:SYS(SR)
420 REM---FLOPPY STATUS-----
430 INPUT#15,E1,E$,E2,E3:IFE1=0THENPRINTH$M1$;
:RETURN
440 PRINTH$BL$H$ " *E1,E$,E2,E3;:CLOSE15:RETUR
N
450 REM---LEGAL TO LOAD?-----
460 CLOSEFF:OPENFF,DV,3,FL$+"P":GOSUB430:IFE1
THENRETURN
470 GET#FF,I$:LA=ASC(I$+CHR$(0))
480 GET#FF,I$:CLOSEFF:LA=LA+256*ASC(I$)
490 IFLA<>SCTHENPRINTH$M2$;:E1=1
500 RETURN
510 REM---J.COLLINS TYPE TEST-----
520 A=PEEK(57345):TP=0:IFATHENTP=1:IFAAND1THEN
TP=3:IFAAND4THENTP=2
530 RETURN:ORIG=0,UPGR=1,4/40=2,4/80=3
540 REM---MESSAGES-----
550 H$="{HOME}{24 DOWN}":REM[HOME,24DOWN]
560 BL$="
":REM[39BLANKS]
570 IFTP=3THENBL$=BL$+BL$+CHR$(32)
580 BL$=BL$+CHR$(20)+" ":MI$=" OK"
590 M2$=" * ??"
600 PRINTH$BL$;:REM CLEAR BOTTOM LINE
610 RETURN
620 REM---CONFIRM,ASK FILE NAME---
630 LL$="WRITE ":IFLFTHENLL$="READ "
640 PRINTH$"{REV} X/FILE NAME{OFF} "LL$FL$;
:GOSUB680
650 IFASC(I$)=88THENPRINTH$M1$;:RETURN
660 E1=0:RETURN
670 REM---INPUT-----
680 CLOSEFF:OPENFF,0:INPUT#FF,I$:CLOSEFF:RETUR
N
690 REM-----

```

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Building on an intriguing video display technique ("Marquee," February 1982, p. 135), this program makes it easy to add horizontal scrolling which is independent of BASIC. Line 20 can accept a string either from the keyboard or a DATA statement READ. The rest is automatic and, because this routine uses interrupts, it is "transparent" to other things BASIC is doing at the time. It works as printed for Upgrade and 4.0 BASIC PET/IBM's. If you have an 80-column screen, change the 40 in line 864 to an 80. Change the speed by changing the five in line 864.

Calling Routine For Marquee

Kenneth Finn
Bedford, NY

"Marquee." by Mark Bernstein (**COMPUTE!**, February 1982, #21), is an exciting program that gives the capability to make the top line of the screen into a billboard with strings moving from right to left across it.

Since the program is in machine language, it requires a special set-up to use from BASIC. The way the program was originally written, you load the Accumulator and X register of the 6502 with the address of the string you want printed before calling the routine. In his article he coded such a string for demonstration. However, when you are writing a BASIC program, setting up such a string is not so easy.

The following routine can be used in any BASIC program to make Marquee work simply and easily for you. The trick is that locations 68 and 69 contain an address for the location of the last referenced string in the BASIC program. Thus, we must make our BASIC program reference the correct string, then tack on a chr\$(0) to it as an end marker, and then indirectly get its address. The following program does this for you in the form of a subroutine.

```

10 INPUT /ENTER STRING;/A$
20 LET A$=A$+CHR$(0):GOSUB100
30 REM
40 GOTO 10
50 END
60 REM
70 REM
100 REM MARQUEE CALLING SUBROUTINE
103 REM
105 IF PEEK(145)<>46 THEN 105
110 POKE1009,PEEK((PEEK(68)+2+PEEK(69)*256):
    REM HI BYTE
120 POKE1011,PEEK((PEEK(68)+1+PEEK(69)*256):
    REM LO BYTE
130 SYS1008:RETURN
140 REM
150 REM

```

The above routine makes using Marquee from

BASIC simple and makes the routine even more valuable.

```

10 GOSUB800
20 INPUT A$:A$=A$+CHR$(0):REM OR READ A
    $ (FROM A DATA STATEMENT IN PROGRAM)
30 POKE1009,PEEK(PEEK(68)+PEEK(69)*256+2
    ):REM HIGH BYTE
40 POKE1011,PEEK(PEEK(68)+PEEK(69)*256+1
    ):REM LOW BYTE
50 SYS1008
60 END
800 REM MARQUEE MACHINE LANGUAGE
810 FOR ADRES=864TO1015:READ DATTA:POKE
    ADRES,DATTA:NEXT ADRES
820 RETURN
864 DATA 40,0,5,85,228,7
870 DATA 5,40,160,1,185,0
876 DATA128,153,255,127,200,204
882 DATA96,3,208,244,32,161
888 DATA3,205,97,3,240,15
894 DATA192,255,240,11,200,140
900 DATA101,3,172,96,3,153
906 DATA255,127,96,172,96,3
912 DATA169,32,153,255,127,238
918 DATA103,3,173,103,3,205
924 DATA96,3,176,48,96,172
930 DATA101,3,177,0,41,191
936 DATA96,141,0,0,142,1
942 DATA0,169,0,141,103,3
948 DATA141,101,3,173,144,0
954 DATA141,99,3,173,145,0
960 DATA141,100,3,120,169,223
966 DATA141,144,0,169,3,141
972 DATA145,0,88,96,120,173
978 DATA99,3,141,144,0,173
984 DATA100,3,141,145,0,88
990 DATA96,206,102,3,16,9
996 DATA32,104,3,173,98,3
1002 DATA141,102,3,108,99,3
1008 DATA162,3,169,248,32,169
1014 DATA3,96

```


A gentle introduction to PET interfacing with a simple example to let your computer control external devices.

PET Interfacing

Mike Baskerville
Compton, CA

Technological advances in the field of microprocessor interfacing permit the computer to control large amounts of current and voltage. Silicon devices such as the diode, transistors, and thyristors allow the computer to function as a very flexible control mechanism.

The intent of this article is to open the door for users who would like to do something with their PET/CBM other than send electronic mail and dazzle their friends with the PET's computing abilities.

The user port on the PET/CBM is one of the few things that has not changed from the first 4K PET to the current 32K CBM. It is driven by POKEs and read with PEEKs. Machine language programming allows very quick responses, making the port priceless. Those of you not familiar with the user port, pay close attention: you may be in for a pleasant surprise.

The 6522 VIA (Versatile Interface Adaptor) is the IC (integrated circuit) which gives us the user port. It provides a parallel eight-bit bidirectional data port as well as serial in and out for those great sound effects. Bidirectional means that data can be read or written and is an important feature because many hardware applications require monitoring as well as control. The eight-bit parallel port can control eight devices, or a combination of monitoring and control can be obtained without additional decoding or multiplexing.

Data seen on the port in the output mode is a one or a zero in binary. The corresponding measured quantities are +2.4 volts (binary one) or something less than +0.5 volts, which corresponds to the binary zero. Knowing this, and having a little knowledge of semiconductors and digital logic, you can easily control lights, TVs, radios, security systems, tape recorders, or just about anything that can be turned on and off.

Obviously, I can't (in one article) show how to interface to any device, but I will introduce a simple interface and trust that, with a little creativity, many users will adopt their own style and applications.

Like money in the bank, a buffer is a good

idea. A buffer adds a margin of safety between you and the computer (we don't want to lose that 6522 VIA). For the purpose of buffering I have used AND gates, NAND gates, and/or hex inverters. In order to maintain compatibility, TTL (Transistor-Transistor Logic) IC's should be utilized. This compatibility assures proper voltage, current, and switching levels for the buffer. At this point, I recommend that anyone seriously interested in interfacing acquire a TTL data book. Many are on the market. *The TTL Data Book* (Texas Instruments) is fine. The 6522 VIA is manufactured by MOS Technology / Commodore Semiconductor Group. Their address is Valley Forge Corp. Center, 950 Rittenhouse Rd., Norristown, PA, (215)666-7950.

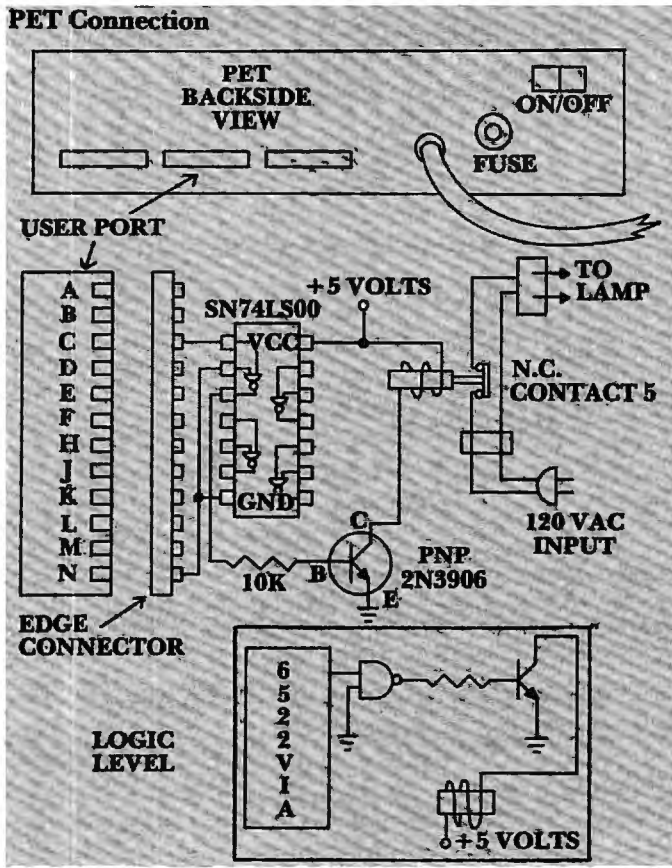
Our simple demonstration interface could control a lamp to provide home security or just to show off the versatility of your PET. You will need a NAND gate (SN74LS00), a 5 volt DC power supply, a NPN transistor, a SPST relay, a 10K resistor, and some means of bringing it all together.

The circuit shown in Figure 1 operates as follows: one of the inputs to the NAND gate is grounded, and the other is connected to the output of the user port. When the port goes low (POKE 59471,0), the NAND gate output goes high (which will forward bias the transistor and energize the relay coil). The contacts open and the lamp goes out. The 10K resistor between the base of the transistor and the NAND gate insures that only a small current will forward bias the transistor — insuring long life and saturation of the transistor. To turn the light on (POKE 59471,1), the port goes high, causing the NAND gate to go low; thus the transistor loses its bias and the coil voltage drops to zero. The lamp comes on. With this circuit configuration, and a relay with a one-amp contact rating, you can easily control a 100 watt light bulb.

It is a good idea to test your circuit before making the final connection to the computer. An additional advantage of the buffer (the NAND gate) is that the circuit can be tested by grounding both inputs of the NAND gate. This will simulate a low output from the user port. By removing one of the grounds, the NAND gate output will go low, simulating a high output on the port. A nice feature of TTL is that an open input is interpreted the same as a logic level one.

Driving the circuit can be as simple as pressing a button on the computer. If a triac is used, instead of the relay, the light could be dimmed and brightened as well as turned off and on. The sample program allows a time delay for the circuit.

This particular application of the user port is only one of the unlimited possibilities for your PET/CBM. I hope you have as much fun developing your interfaces as I do mine.



```

100 REM      SAMPLE PROGRAM FOR USER PORT I/O
110 PRINT "{CLEAR}":POKE59468,12
120 POKE59459,1:REM      SETS PA-0 FOR OUTPUT

130 P$="{HOME}{12 DOWN}{17 RIGHT}"
140 T$="{HOME}{03 DOWN}{09 RIGHT}"
150 T1$="{HOME}{21 DOWN}{09 RIGHT}"
160 T3$="COMPUTERIZED LAMP CONTROL"
170 T4$="{10 RIGHT}PRESS"
180 T5$="{02 DOWN}{04 RIGHT}{REV} L {OFF}IGHT -
      {REV} D {OFF}ARK "
190 L$=" LAMP ON "
200 L1$="{REV} LAMP ON {OFF}"
210 O$=" LAMP OFF "
220 O1$="{REV} LAMP OFF {OFF}"
230 PRINTT$;T3$;T1$;T4$;T1$;T5$
240 A$="L":GOTO270
250 REM      THIS ROUTINE SETS PA-0 HIGH OR LOW

260 GET A$
270 IF A$="L" THEN POKE 59471,1:PRINTP$;L$:B$="
      L"
280 IF A$="D" THEN POKE 59471,0:PRINTP$;O$:B$="
      O"
290 A=A+1:IFA>30 THEN GOSUB 320
300 GOTO 260
310 REM      FLASHING INDICATOR ROUTINE
320 IF B$="L" AND B1$="S" THEN PRINTP$;L$:A=0:
      B1$="":RETURN
330 IF B$="L" THEN PRINTP$;L1$:A=0:B1$="S":RET
      URN
340 IF B1$="S" THEN PRINTP$;O$:A=0:B1$="":RETU
      RN
350 PRINTP$;O1$:A=0:B1$="S"
360 RETURN
    
```

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You can customize your Atari BASIC by adding new commands to the language itself. To demonstrate how to do it, the program below adds five DOS commands to BASIC — including a directory command. There are two versions of the same program. Program 1 is a BASIC loader. You type it in normally and it will create a machine language program for you from the information in the DATA statements. Program 2 is a disassembly of the same routine. It shows how the machine language works and is useful to programmers who know machine language or want to learn more about it. It's not necessary, however, to understand Program 2 in order to make good use of Program 1.

The Atari Wedge: Adding Commands To Atari BASIC

Charles Brannon
Editorial Assistant

A letter was published recently in **COMPUTE!**'s "Ask The Readers" column, regretting the need for "this POKE or that POKE" to accomplish various tasks. The required solution is an "expanded command set." An enticing prospect, adding commands to a language, and a seemingly impossible one, too.

Atari BASIC, like most microcomputer BASICs, is "burned" into nonvolatile ROM memory. The machine language routines to list, save, edit, and run your program cannot be altered or "patched" in any way. (However, on a 48K Atari, you can copy the BASIC cartridge to disk as a binary file, modify it with a "machine language monitor," and load it into the top of memory where it will act almost as a ROM cartridge.)

The most common (and easiest to implement) extension of a language is the addition of "immediate mode" commands. These direct commands, which are not usually executed in a program, but from the keyboard, include RUN, SAVE, LIST, NEW, DOS, etc. Thanks to Atari's modular Operating System (OS), we can easily add this type of command.

An Overview Of Atari's Operating System

To understand how the Atari Wedge works, we'll have to delve into the mysterious 10K ROM. If you just want to use the program and aren't concerned about the technical details, feel free to skip ahead. The Operating System (OS) of a computer is responsible for all input and output to and from disk, cassette, printer, and keyboard. It can also perform such chores as memory management and screen display. On many microcomputers, the OS does not exist as a separate entity, but is incorpo-

rated into the BASIC interpreter.

The Atari, on the other hand, is the first microcomputer with a general-purpose "plug-in" operating system. This goes hand in hand with the use of program and game cartridges. All programs running on an Atari use a common set of routines, from floating point arithmetic to high-resolution graphics routines such as PLOT, DRAWTO, and FILL.

A Mini-language

So, instead of BASIC providing a marginal operating system (which on many machines is a maze of machine language calls, requiring incompatible register setup and initialization), we have a BASIC cartridge which uses "universal" OS routines. A good OS simulates a mini-language. It provides documented, unchanging (between various revisions), unified subroutines with full parameter passing and error-checking.

Furthermore, a good OS is *extensible*. All the major routines and subroutines are accessed *indirectly*, through pointers. That is why the Atari is so flexible. If you want to change the personality of your computer, just change one of the *vectors* of a given routine to point to your machine language routine. Your program can then pass on control to the default program.

A Flexible Computer

This indirection is visible throughout the Atari. At the low end is color indirection, where you can change the color of anything drawn to another color merely by changing one *color register*. The default character set pointer can be changed to point to a user-designed character set. The system

interrupt routines and display list interrupts are all fully accessible via a table of pointers. The BREAK key can be masked; the keyboard scan routine can be modified or bypassed; exotic peripherals can be serviced. And *all* input/output devices are user-definable, from the keyboard to the disk drive.

A notable peculiarity of the Atari is that not just the disk drive or printer, but also the TV screen and keyboard, are considered "peripherals." You don't print a character to the screen on the Atari; you send a character or buffer to the Editor device.

Chain Of Command

Through the hierarchy of a subset of the OS, the CIO (Central Input/Output), BASIC politely requests a line of input from screen and keyboard. After BASIC makes this request, control is passed to CIO, which calls the Editor. The Editor lets the user enter a "line" of text (which can be up to three screen lines long). The user can use cursor controls to edit the line or to move the cursor anywhere on the screen to edit another line.

When RETURN is pressed, the line the cursor is on is placed into a buffer (block of memory). Next, CIO gives this information to the calling routine via another buffer. The CIO is designed to be easy to use from machine language. If you think it sounds complicated, imagine performing all these tasks *without* an operating system!

Driving A Wedge

We don't have to modify BASIC at all. We just "wedge" our way into the Editor device, "E:". As intimated, even the "system" devices such as "E:" or "D:", the disk "driver," can be replaced. Usually, however, you don't want to replace a vectored

routine; you just want to insert an additional task. In this case, you point the vector to your routine, which performs the little extra task and then calls the main routine. This "bypass" explains the term *wedge*.

The Handler table contains the names of all the devices. If you wanted to, you could change the name of the cassette device (C:) to another character, such as T: (for Tape), by finding the "C" in the table and changing it to a "T". Along with each name, the Handler table includes an address that points to another table of addresses that point to all the functions of that particular device. This is multi-level indirection. There is even a vector that points to a list of vectors!

We want to modify the Editor, so we change the first vector to point to *our* list of vectors. All we really need to do is change one of the vectors in the Editor's list of vectors, the "Get Character" address. Since this list is in ROM, at \$E400, we need to copy this 16-byte table to RAM, modify it, and re-point the Handler table to our RAM version of the Editor Handler table.

A Monitor Monarchy

Now that we've got the Operating System calling our routine instead of the Editor in ROM, we've got total control of almost all console input/output. The Get Character routine, instead of calling E:, asks us for an ASCII character, presumably from the screen and keyboard. We comply by calling the default routine in ROM.

This seems rather roundabout, doesn't it? But we reserve the right to monitor all characters returned to the Operating system, and hence, BASIC. We get to examine every line of input before that line is returned to BASIC, where any strange new commands would be scorned with an error message.

So, we just catch the carriage return code and leisurely examine the input buffer, located at \$0580. All we have to do is compare it against a table of commands, and, if we find a match, execute the command. If not, we just return the line to CIO (and CIO gives it back to BASIC) on the assumption that it's either a blank line, a BASIC command, or a syntax error. Sounds simple, but such a "parsing" routine is quite a headache to code and understand.

A REMarkable Solution

After we've intercepted and executed the line, how do we prevent a syntax error when we return the line to BASIC? (And since we've "cut in," we have to follow protocol and return *something*.) One solution would be to erase the buffer by filling it with spaces. An easier trick would be to change the first character of the line to a period, e.g., "SCRATCH D:TEMP" would become ".CRATCH D:TEMP". Since BASIC interprets a leading period as an

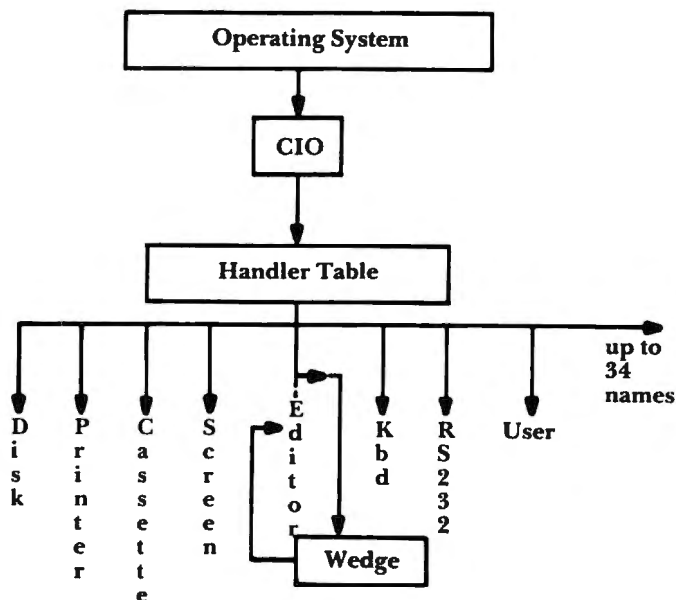


Figure 1. Wedging Into a Vector

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abbreviation for "REM" (don't ask me why, it's just a lucky fluke), BASIC conveniently ignores the command *and* returns READY (which it wouldn't if we merely blanked out the line).

The parser routine makes it easy for you to add commands. Just place the name of each command, followed by a zero, and the address where you want control to be transferred after the command is recognized, in COMTBL (COMmand TABLE, see Program 2). The length of the line is found in LENGTH, and the second character after the command is returned in PARMS (since this is where any parameters would be).

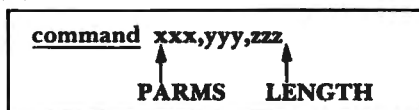


Figure 2.

Note that the length is one character past the end of the string, assuming you number from zero. Your command processor can find the command string in LBUFF (\$0580).

Theoretically, this technique can be used to add commands to *any* language environment. You only have to find a way to make the language processor ignore commands when you return the line (such as blanking it out). Of course, the commands themselves are usually language-specific.

Copious Commands

Now the way is open to add a plethora of BASIC utility commands. Of course, these will have to be written in machine language and interfaced with the Wedge. I've included the resident DOS commands LOCK, UNLOCK, RENAME, and SCRATCH, as well as DIR to print the directory.

You can study the assembly listing (Program 2). If you have an assembler, try typing it in and modifying it. It contains a wealth of techniques and information, such as pattern matching, indirect subroutine calls, making a routine "RESET-proof," using CIO for input/output from machine language, long branching, modular programming, calling BASIC's ERROR routine, even "pressing" SYSTEM RESET from within a program.

Using Wedge 1.0

A machine language program can be hard to even enter into the Atari without an assembler. Program 1 will write the machine language to disk in the form of an "AUTORUN.SYS" file. Save this program so you can write copies to any disk. When you boot this disk, the AUTORUN file will automatically load and initialize the Wedge. You can use the Wedge's "console DOS" directly, without waiting for the disk utility package (DUP.SYS) to load in, and without losing any programs in memory.

Commands provided are DIR (lists the directory of drive one), LOCK, UNLOCK, SCRATCH (delete), and RENAME. Remember to include the D: (or D2: for drive two, if you have one) in the filename with all the commands except DIR. With RENAME, use the convention RENAME D:-oldname,newname".

The Wedge is "persistent"; in other words, it re-initializes itself when you press SYSTEM RESET, so it's kind of hard to get rid of it. An additional command, KILL, removes the Wedge. You can bring back the Wedge with: PRINT USR(7936).

These commands are just a start. Many others are possible: RENUMBER, FIND, AUTO line number, UPDATE (removes unused variables from the variable name table), and more. If you come up with a useful BASIC utility in machine language, send it to **COMPUTE!** to be incorporated into a future version of the Wedge.

Talking Back

We've managed to intercept BASIC at the command level. In future issues, we'll go into how you can tell BASIC what to do from machine language. We'll even try to pursue that elusive aim – actually adding commands to a running program.

Program 1: BASIC Loader

```

100 REM WEDGE BASIC LOADER
110 GRAPHICS 0: ? "Insert a DOS 2.0S d
iskette"
120 ? "with DOS.SYS in drive 1."
130 ? : ? "Press RETURN when you have
done this."
140 IF PEEK(764)<>12 THEN 140
150 POKE 764,255
160 ? : ? "Now writing the Wedge AUTOR
UN.SYS file"
170 TRAP 190
180 OPEN #1,8,0,"D:AUTORUN.SYS":TRAP
4000:GOTO 200
190 CLOSE #1: ? : ? "Can't open AUTORUN
.SYS for write.":END
200 PUT #1,255:PUT #1,255:REM $FFFF H
EADER
210 PUT #1,0:PUT #1,31:REM $1FOO STAR
T
220 PUT #1,74:PUT #1,33:REM $214A END
230 FOR I=7936 TO 8522+6:REM INCLUDE
6-BYTE AUTORUN
240 READ A:TRAP 310:PUT #1,A:TRAP 400
00
250 CKSUM=CKSUM+A
260 NEXT I
270 IF CKSUM<>60435 THEN ? "{BELL}Bad
number in DATA statements.":ERR=
1
280 CLOSE #1
290 IF NOT ERR THEN ? : ? "DATA ok, w
rite successful."
300 END
310 ? : ? "Error-";PEEK(195);" when at
tempting disk write.":CLOSE #1:EN
D
320 REM
330 REM Following is the decimal

```



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340 REM equivalent of Wedge 1.0
 350 REM Must be typed in perfectly
 360 REM in order to function.

370 REM

```

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 31,169,75,141,231,2
7966 DATA 169,33,141,232,2,96
7972 DATA 32,64,21,32,11,31
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 55,33,65,116,97,114
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 133,203,96,251,243,51
8104 DATA 246,184,31,163,246,51
8110 DATA 246,60,246,76,228,243
8116 DATA 56,1,1,125,32,32
8122 DATA 62,246,8,201,155,240
8128 DATA 4,230,203,40,96,140
8134 DATA 181,31,142,182,31,165
8140 DATA 203,240,86,169,51,133
8146 DATA 205,169,32,133,206,160
8152 DATA 0,177,205,217,128,5
8158 DATA 208,12,200,177,205,240
8164 DATA 40,196,203,208,240,76
8170 DATA 37,32,201,255,240,53
8176 DATA 160,0,177,205,240,9
8182 DATA 230,205,144,2,230,206
8188 DATA 76,242,31,24,165,205
8194 DATA 105,3,133,205,144,2
8200 DATA 230,206,76,215,31,200
8206 DATA 132,204,177,205,141,183
8212 DATA 31,200,177,205,141,184
8218 DATA 31,108,183,31,160,0
8224 DATA 169,46,153,128,5,169
8230 DATA 0,133,203,169,155,172
8236 DATA 181,31,174,182,31,40
8242 DATA 96,68,73,82,0,125
8248 DATA 32,83,67,82,65,84
8254 DATA 67,72,0,22,33,76
8260 DATA 79,67,75,0,27,33
8266 DATA 85,78,76,79,67,75
8272 DATA 0,32,33,82,69,78
8278 DATA 65,77,69,0,37,33
8284 DATA 75,73,76,76,0,42
8290 DATA 33,255,155,50,54,32
8296 DATA 70,82,69,69,32,83
8302 DATA 69,67,84,79,82,83
8308 DATA 155,155,0,0,68,58
8314 DATA 42,46,42,162,80,169
8320 DATA 12,157,66,3,32,86
8326 DATA 228,162,80,169,3,157
8332 DATA 66,3,169,6,157,74
8338 DATA 3,169,120,157,68,3
8344 DATA 169,32,157,69,3,32
8350 DATA 86,228,152,16,3,76
8356 DATA 55,33,162,80,169,5

```

```

8362 DATA 157,66,3,169,100,157
8368 DATA 68,3,141,68,3,169
8374 DATA 32,157,69,3,141,69
8380 DATA 3,169,20,157,72,3
8386 DATA 141,72,3,32,86,228
8392 DATA 152,48,13,169,9,141
8398 DATA 66,3,162,0,32,86
8404 DATA 228,76,166,32,162,80
8410 DATA 169,12,157,66,3,32
8416 DATA 86,228,76,30,32,162
8422 DATA 80,157,66,3,169,0
8428 DATA 157,73,3,164,203,153
8434 DATA 128,5,56,152,229,204
8440 DATA 157,72,3,24,169,128
8446 DATA 101,204,157,68,3,169
8452 DATA 5,105,0,157,69,3
8458 DATA 32,86,228,152,16,3
8464 DATA 76,55,33,76,30,32
8470 DATA 169,33,76,229,32,169
8476 DATA 35,76,229,32,169,36
8482 DATA 76,229,32,169,32,76
8488 DATA 229,32,173,37,31,133
8494 DATA 12,173,38,31,133,13
8500 DATA 76,116,228,72,162,80
8506 DATA 169,12,157,66,3,32
8512 DATA 86,228,104,162,255,154
8518 DATA 133,185,76,64,185
9000 REM DATA FOR AUTORUN ADDRESS
9010 DATA 224,2,225,2,1,31
9020 REM END OF DATA STATEMENTS

```

Program 2: Wedge Disassembly

```

0100 ; The Atari Wedge
0110 ;
0120          *=$1F00
0130 ICCOM   =*$0342
0140 ICBADR  =*$0344
0150 ICBLN   =*$0348
0160 ICAUX1  =*$034A
0170 COPN   =*$03
0180 CPTXTR  =*$09
0190 CGTXTR  =*$05
0200 CPBINR  =*$0B
0210 CCLOSE  =*$0C
0220 CID     =*$E456
0230 OPDIR   =*$06
0240 HATABS  =*$031A
0250 LBUFF   =*$0580
0260 LENGTH  =*$CB
0270 MEMLO   =*$02E7
0280 PARMS   =*$CC
0290 COM     =*$CD
0300 DOSINIT =*$0C
0310 ENTRY   PLA          ;For BA
          SIC initialization
0320 ; Make wedge "RESET-proof"
0330 INIT
0340          LDA DOSINIT          ;Save D
          OS
0350          STA REINIT+1        ;initia
          lization
0360          LDA DOSINIT+1        ;inside
          the REINIT
0370          STA REINIT+2        ;JSR ca
          ll
0380 ;
0390 INIT2   LDA #REINIT&255 ;Replac
          e DOS init
0400          STA DOSINIT          ;with W
          edge
0410          LDA #REINIT/256 ;init
0420          STA DOSINIT+1
0430          JSR MSG ;Print message
0440          JSR ECHANGE          ; hooku

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```

p new E:
0450 LDA #ENDWEDGE&255 ;Bump
up
0460 STA MEMLO
0470 LDA #ENDWEDGE/256 ;low
memory pointer
0480 STA MEMLO+1
0490 RTS
0500 ;
0510 REINIT JSR XXXX ;XXXX is
filled in with DOSINIT
0520 JSR INIT2
0530 XXXX RTS
0540 ;
0550 ; Print "welcome" message
0560 ;
0570 MSG LDA #WMSG&255 ;Store a
address of
0580 STA ICBADR ;message
0590 LDA #WMSG/256
0600 STA ICBADR+1
0610 LDA #0 ;Set len
gth
0620 STA ICBLEN+1
0630 LDA #12
0640 STA ICBLEN
0650 LDA #CPBINR ;Ignore
carriage-returns
0660 STA ICCOM
0670 LDX #0 ;File 0,
the editor
0680 JSR CIO ;Call CI
O to print it
0690 TYA
0700 BMI ERR ;If no e
rror, return
0710 RTS
0720 ERR JMP ERROR
0730 ;
0740 WMSG .BYTE "Atari Wedge",155
0760 ;
0770 ; Following replaces the old E:
0780 ;
0790 ECHANGE LDY #0 ;Search
for E:
0800 ELOOP LDA HATABS,Y ;in hand
ler table
0810 CMP #'E
0820 BEQ EFOUND ;Found e
nd?
0830 INY ;no, nex
t entry
0840 INY
0850 CPY #34 ;end of
table?
0860 BNE ELOOP
0870 RTS ;return
0880 ;
0890 ; Store new handler table address
s
0900 ;
0910 EFOUND INY
0920 LDA #WEDGETAB&255
0930 STA HATABS,Y
0940 INY
0950 LDA #WEDGETAB/256
0960 STA HATABS,Y
0970 ; Transfer Editor table to Wedge
table
0980 LDX #0
0990 XFER LDA #E400,X
1000 STA WEDGETAB,X
1010 INX
1020 CPX #16
1030 BNE XFER
1040 ; Patch in MYINPUT routine
1050 LDA #MYINPUT-1&255
1060 STA WEDGETAB+4
1070 LDA #MYINPUT-1/256
1080 STA WEDGETAB+5
1090 CLC
1100 LDA #E404 ; Get ch
aracter address
1110 ADC #1 ; Actual
address is +1
1120 STA MYINPUT+1 ; Egads!
1130 LDA #E405 ; Self-m
odifying code!
1140 ADC #0 ; (Accept
any carry)
1150 STA MYINPUT+2
1160 LDA #0
1170 STA LENGTH ;Clear l
ength initially
1180 RTS
1190 ;
1200 ; Wedge handler address table
1210 WEDGETAB *:=*+16
1220 YSAVE *:=*+1 ;Used to
save Y register
1230 XSAVE *:=*+1 ;Ditto f
or X
1240 JUMPADR *:=*+2 ;used fo
r indirect JMP
1250 MYINPUT
1260 ; The $F63E address is actually
placed here by above code
1270 ; to permit this routine to run
on the Revision B OS
1280 ; (where it wouldn't be $F63E)
1290 JSR $F63E ;Get a c
haracter from E:
1300 PHP
1310 CMP #155 ;End of
line? (CR)
1320 BEQ ENDLINE ;Yes, co
mplete line ready
1330 INC LENGTH
1340 PLP
1350 RTS ;No, let
CIO have the character
1360 ENDLINE
1370 STY YSAVE ;Save Y
for CIO
1380 STX XSAVE
1390 LDA LENGTH
1400 BEQ RETURN.LINE
1410 LOOKUP
1420 LDA #COMTBL&255 ;Set up
indirect pointer for
1430 STA COM
1440 LDA #COMTBL/256 ;comman
d table
1450 STA COM+1
1460 NEXTCOM LDY #0
1470 COMLOOP
1480 LDA (COM),Y ;Compare
command against line buffer
1490 CMP LBUFF,Y ;Okay so
far?
1500 BNE NOTSAME ;no matc
h
1510 INY
1520 LDA (COM),Y ;is next
character null?
1530 BEQ COMFOUND ;yes, co
mmand found
1540 CPY LENGTH ;exceede
d limits?
1550 BNE COMLOOP ;if not,

```

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```

        continue comparison
1560      JMP RETURN.LINE ;give 1
        ine to language
1570 NOTSAME CMP #255      ;End of
        table?
1580      BEQ RETURN.LINE
1590      LDY #0           ;No, ski
        p over command
1600 FINDEND LDA (COM),Y
1610      BEQ ENDCOM      ;Hit the
        zero yet?
1620      INC COM         ;No, nex
        t character
1630      BCC NOINC1
1640      INC COM+1
1650 NOINC1  JMP FINDEND  ;continue
        until null byte found
1660 ENDCOM  CLC         ;Add 3 to
        skip over null byte
1670      LDA COM         ;and JMP
        address
1680      ADC #3
1690      STA COM
1700      BCC NOINC2     ;Check fo
        r carry
1710      INC COM+1
1720 NOINC2  JMP NEXTCOM
1730 COMFOUND
1740      INY
1750      STY PARMS      ;Y is ind
        ex into parameters
1760      LDA (COM),Y    ;Load JU
        MPADR with command address
1770      STA JUMPADR
1780      INY
1790      LDA (COM),Y
1800      STA JUMPADR+1
1810      JMP (JUMPADR) ;Execute
        !
1820 EXIT   LDY #0       ;Command
        s return here
1830      LDA #'         ;Change
        first character to
1840      STA LBUFF,Y   ;".", or
        REM
1850      ;              Allows B
        ASIC to ignore line
1860 RETURN.LINE
1870      LDA #0
1880      STA LENGTH
1890      LDA #155      ;Return
        EOL to CIO
1900      LDY YSAVE     ;Restore
        Y
1910      LDX XSAVE     ;and X
1920      PLP           ;and pro
        cessor status
1930      RTS          ;That's
        it
1940 COMTBL
1950      ; Wedge commands and command tab
        le
1960      ; Format is:
1970      ; .BYTE "COMMAND",0
1980      ; .WORD COMMAND.ADDRESS
1990      ; End of table is
2000      ; .BYTE 255
2010      .BYTE "DIR",0
2020      .WORD DIR
2030      .BYTE "SCRATCH",0
2040      .WORD SCRATCH
2050      .BYTE "LOCK",0
2060      .WORD LOCK
2070      .BYTE "UNLOCK",0
2080      .WORD UNLOCK
2090      .BYTE "RENAME",0
2100      .WORD RENAME
2110      .BYTE "KILL",0
2120      .WORD KILL
2130      .BYTE 255
2140      ;
2150 DIRBUF  *=*+20
2160 DIRNAME .BYTE "D:*. *"
2170      ;
2180      ; Start of commands:
2190      ;
2200 DIR
2210      LDX ##50      ; IOCB#5
2220      LDA #CCLOSE
2230      STA ICCOM,X
2240      JSR CIO ;CLOSE#5
2250      ; OPEN#5,6,0,"D:*. *"
2260      LDX ##50      ;channel
        #5
2270      LDA #COPN    ;open co
        mmand
2280      STA ICCOM,X
2290      LDA #OPDIR    ;special
        "directory" command
2300      STA ICAUX1,X
2310      LDA #DIRNAME&255 ;filen
        ame (wildcard)
2320      STA ICBADR,X
2330      LDA #DIRNAME/256
2340      STA ICBADR+1,X
2350      JSR CIO      ;set it
        up!
2360      TYA
2370      BPL NOERR1
2380      JMP ERROR
2390      ; Print a line to the Editor
2400 NOERR1
2410 NEXT   LDX ##50      ;#5
2420      LDA #CGTXTR   ;Get a l
        ine
2430      STA ICCOM,X
2440      LDA #DIRBUF&255 ;Put it
        into the buffer
2450      STA ICBADR,X
2460      STA ICBADR
2470      LDA #DIRBUF/256
2480      STA ICBADR+1,X
2490      STA ICBADR+1
2500      LDA #20      ;Maxim
        um length is 20
2510      STA ICBLEN,X ;(actua
        lly 17)
2520      STA ICBLEN
2530      JSR CIO
2540      TYA          ;Check
        for end of file
2550      BMI ENDIR    ;On err
        or, finished directory
2560 NOERR2  LDA #CPTXTR ;Put te
        xt record (print a line)
2570      STA ICCOM
2580      LDX #0      ;Channe
        l 0 is open to the Editor
2590      JSR CIO
2600      JMP NEXT     ;Read n
        ext line
2610      ;
2620 ENDIR   LDX ##50      ;CLOSE#
        5
2630      LDA #CCLOSE
2640      STA ICCOM,X
2650      JSR CIO
2660      JMP EXIT
2670      ;End of directory routine
2680      ;

```

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```

2690 ;Following routine is used by lo
ck
2700 ;unlock, scratch, and rename
2710 ;Filename buffer is in LBUFF
2720 ;e.g. LOCK D:TEMP
2730 ; this ^ portion is used
2740 ; to tell CIO the filename.
2750 CALLC10
2760 LDX #50 ;Use file
5 (XIO n,#5,etc.)
2770 STA ICCOM,X ;Store co
mmand
2780 LDA #0 ;Clear MS
B
2790 STA ICBLN+1,X ;of lengt
h
2800 LDY LENGTH
2810 STA LBUFF,Y
2820 SEC ;Get leng
th
2830 TYA ;of filen
ame
2840 SBC PARMS ;(skip ov
er command name)
2850 STA ICBLN,X
2860 CLC
2870 LDA #LBUFF&255 ;PARMS is
start of parameters,
2880 ADC PARMS ;the spac
e in LBUFF
2890 STA ICBADR,X ;after th
e command
2900 LDA #LBUFF/256
2910 ADC #0 ;Catch an
y carry
2920 STA ICBADR+1,X
2930 JSR CIO ; Do the job
2940 TYA
2950 BPL NOERR3
2960 JMP ERROR
2970 NOERR3 JMP EXIT
2980 ;
2990 SCRATCH LDA #33
3000 JMP CALLC10
3010 LOCK LDA #35
3020 JMP CALLC10
3030 UNLOCK LDA #36
3040 JMP CALLC10
3050 RENAME LDA #32
3060 JMP CALLC10
3070 ;
3080 ;Remove Wedge
3090 ;
3100 KILL LDA REINIT+1 ;Restore ol
d DOS
3110 STA DOSINIT ;vector
3120 LDA REINIT+2
3130 STA DOBINIT+1
3140 JMP #E474 ;"Press" SY
STEM RESET
3150 ;
3160 ;
3170 ; End of current wedge
3180 ; (Although more commands can be
added.)
3190 ; See future issues of COMPUTE!
3200 ;
3210 ERROR PHA ;Save error
code
3220 LDX #50 ;close file 5
3230 LDA #CCLOSE
3240 STA ICCOM,X
3250 JSR CIO
3260 PLA ;retrieve er
ror code

```

```

3270 LDX #FF ;reset stack
3280 TXS
3290 STA $B9 ;tell BASIC
the error code
3300 JMP $B940 ;call the ER
ROR routine
3310 ; in the BASI
C cartridge
3320 ;
3330 ENDWEDGE
3340 ; Autorun
3350 ;
3360 *=$02E0
3370 .WORD INIT
3380 ;
3390 .END

```

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This tutorial article presents several interesting extensions for the XIO(FILL) program on page 54 of the Atari BASIC Reference Manual.

A Fill-In On XIO(FILL)

Gretchen Schabtach
Alexandria, VA

Your Atari readily fills line drawings of figures with color using a special application of the XIO statement. However, the example in the *BASIC Reference Manual* (see page 54) can be expanded upon to demonstrate the strengths and limitations of this application. A critical point about XIO filling is that filling stops when a pixel which has been previously filled with color is encountered. Thus, interesting effects occur when the Atari is commanded to fill overlapping figures with color.

To get the most from the following short programs, begin by running the demonstration program on page 54 of the *BASIC Reference Manual*. Then run Program 1. Program 1 generates three rectangles, randomly positioned, with random proportions, and fills them from top to bottom and left to right with three different colors. Observe what happens when the figures overlap.

Moving line by line, from top to bottom and left to right, the fill stops when a colored pixel is encountered. Thus, when the program generates two overlapping rectangles, filling of the second rectangle stops whenever the first filled rectangle is encountered – and does not resume even if the second rectangle extends to the right beyond the first rectangle.

With a few modifications, Program 1 is not only illuminating with regard to the XIO(FILL) function, but also much more interesting. First, randomly change the colors to be used in filling. Second, generate rectangles continuously. To do this, make the following changes:

```
20 N=INT(RND(0)*3+1)
160 (i.e., delete)
170 GOTO 20
```

After you've modified the program as specified above, run it and admire the changes. Now, add a little music to your life. This is easily accomplished by adding the following statements:

```
81 I=INT(RND(0)*256)
82 SOUND 1,I,10,4
84 SOUND 2,255-I,10,4
```

Try this, and then delete line 150. This will speed things up a little and make them even more interesting.

Finally, black backgrounds can become tiresome. To randomly change the background color, type in the following:

```
11 REM : CHANGE BACKGROUND
12 B=INT(RND(0)*16)
13 SETCOLOR 4,B,2
166 REM : CHANGE BACKGRD SO GOTO 12
170 GOTO 12
```

Your final program listing should look like that shown in Program 2.

There are further simple and interesting modifications. For example, vary the constants in statements which include random number generators – those containing (RND(0)); or delete + 16 in line 10 and provide yourself with a text window in which you can write commentary on what the viewer sees; or change the characteristics of the shapes generated to be filled with color (lines 40 through 80). Your imagination will suggest other possibilities.

Program 1.

```
3 REM : DEMO OF XIO FILLING
5 REM : BY GRETCHEN SCHABTACH
6 REM : AND MERLIN(ATARI 800)
8 REM : SUPPRESS WINDOW IN GR.7
10 GRAPHICS 7+16
15 REM : ESTABLISH 3 FILL COLORS
20 FOR N=1 TO 3 STEP 1
30 COLOR N
35 REM : GENERATE FIGURE TO FILL
40 X1=INT(RND(0)*80)
50 Y1=INT(RND(0)*48)
60 X2=X1+INT(RND(0)*80)
70 Y2=Y1+INT(RND(0)*48)
80 IF X1=X2 OR Y1=Y2 THEN 40
90 PLOT X2,Y2
100 DRAWTO X2,Y1
110 DRAWTO X1,Y1
115 REM : FILL FIGURE
120 POSITION X1,Y2
130 POKE 765,N
140 XIO 18,#6,0,0,"S:"
150 FOR W=1 TO 400:NEXT W
155 REM : CHANGE COLOR FOR NEXT
    FIGURE
160 NEXT N
165 REM : GENERATE NEW FIGURE
170 GOTO 10
```

Program 2.

```
3 REM : DEMO OF XIO FILLING #2
5 REM : BY GRETCHEN SCHABTACH
```

```

6 REM : AND MERLIN (ATARI 800)
8 REM : SUPPRESS WINDOW IN GR.7
10 GRAPHICS 7+16
11 REM :CHANGE BACKGROUND
12 B=INT(RND(O)*16)
13 SETCOLOR 4,B,2
15 REM : ESTABLISH 3 FILL COLORS
20 N=INT(RND(O)*3+1)
30 COLOR N
35 REM : GENERATE FIGURE TO FILL
40 X1=INT(RND(O)*80)
50 Y1=INT(RND(O)*48)
60 X2=X1+INT(RND(O)*80)
70 Y2=Y1+INT(RND(O)*48)
80 IF X1=X2 OR Y1=Y2 THEN 40
81 I=INT(RND(O)*256)
82 SOUND 1,1,10,4
84 SOUND 2,255-I,10,4
90 PLOT X2,Y2
100 DRAWTO X2,Y1
110 DRAWTO X1,Y1
115 REM : FILL FIGURE
120 POSITION X1,Y2
130 POKE 765,N
140 XIO 18,#6,0,0,"S:"
155 REM : CHANGE COLOR FOR NEXT
    FIGURE
165 REM :GENERATE NEW FIGURE
166 REM :CHANGE BACKGRD SO GOTO 12
170 GOTO 12

```

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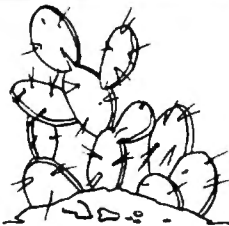
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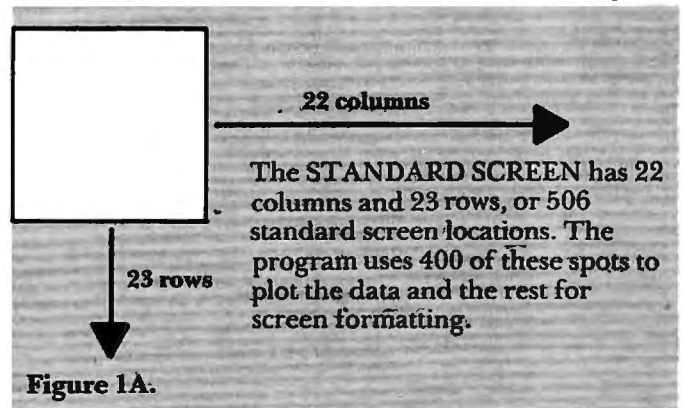
Matt Urnezis
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line which best fits the data. Also listed is the coefficient of determination which tells how well the Y values are explained by the X values. This last item is the "standard error" of the estimate. This represents how far away the data points tend to be from the linear regression line. More thorough explanations of the meaning of each analysis can be found in most statistics books.

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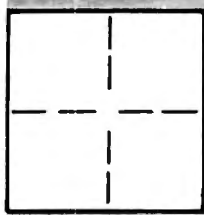


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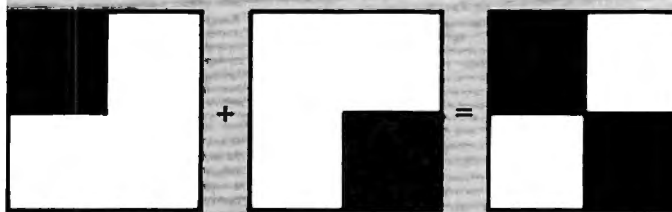
515 B=INT(B*1000+.5)/1000
516 C=INT(C*1000+.5)/1000
525 R2=INT(R2*1000+.5)/1000
535 SD=INT(SD*1000+.5)/1000

```



To plot the data, each standard screen location is divided into four subsquares.

Figure 1B.



NEW DATA OLD DATA RESULT

The program takes each data point and determines which screen location and subsquare should be used. It then PEEKs the screen location to see what data is already present. The program combines this PEEK with the new data and POKEs the result on the screen.

Figure 1C.

```

10 X=4*(PEEK(36866)AND128):S=X+64*
   (PEEK(36869)AND120)+463:C=
   38351+X:POKE36879,8
20 PRINT"{CLEAR}"SPC(197)"{PUR}
   MEDIUM RESOLUTION","{DOWN}
   DATA ANALYSIS"
30 PRINT"{GRN}{DOWN}          BY MATT
   ":FORX=1TO2000:NEXT
40 DIMD%(15,4):FORX=0TO15:FORY=0TO
   4:READD%(X,Y):NEXT Y,X
50 DATA32,108,124,123,126,123,98,2
   55,123,97,124,225,124,255,
   226
60 DATA126,127,226,97,126,108,108,
   225,98,127,225,225,225,254
   ,251
70 DATA255,254,255,255,236,127,127
   ,251,252,127,226,251,226,2
   36,226
80 DATA97,252,236,97,97,98,98,254,
   98,252,251,251,251,160,251
90 DATA236,160,236,236,236,254,254
   ,254,254,160,252,252,160,2
   52,252
100 DATA160,160,160,160,160:PRINT"{
   CLEAR}"SPC(176)
110 INPUT"{BLU}THE X AXIS NAME";X$:
   INPUT"{CYN}{DOWN}THE Y AXI

```

```

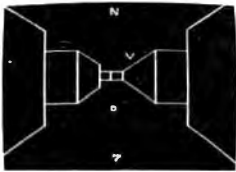
S NAME";Y$
120 INPUT"{GRN}{DOWN}HOW MANY X VAL
   UES";A:DIMP(1,A):PRINT"{CL
   CLEAR}"
130 FORX=1TOA:PRINT"{GRN}{02 DOWN}D
   ATA PAIR";X
140 INPUT"{BLU}{DOWN}THE X VALUE";P
   (0,X):INPUT"{CYN}THE Y VAL
   UE";P(1,X):NEXT
150 FORX=0TO1:H(X)=P(X,1):L(X)=P(X,
   1):FORY=1TOA
160 IFH(X)<P(X,Y)THENH(X)=P(X,Y)
170 IFL(X)>P(X,Y)THENL(X)=P(X,Y)
180 NEXTY:IFH(X)=L(X)THENH(X)=L(X)+
   2
190 NEXT:FORX=1TO800:NEXT:PRINT"{CL
   CLEAR}"SPC(181)"{PUR}TYPE ~
   1 WHEN"
200 PRINTSPC(29)"FINISHED",SPC(25)"
   WITH THE GRAPH."
210 FORX=1TO3000:NEXT:PRINT"{CLEAR}
   "SPC(6)"{GRN}DATA POINTS"
220 FORZ=0TO21:POKEC-1-22*Z,4:POKEC
   +22+Z,4:POKEC-22*Z,6:POKEC
   +Z,6:NEXT
230 POKES,109:FORZ=0TO9:POKES-22-44
   *Z,107:POKES+1+2*Z,113:POK
   ES-44-44*Z,93
240 POKES+2*Z+2,64:NEXT:Y=LEN(Y$):X
   =LEN(X$):IFY>20THENY=20:Y$
   =MID$(Y$,1,20)
250 IFX>20THENX=20:X$=MID$(X$,1,20)
260 FORZ=1TOY:R=ASC(MID$(Y$,Z,1))-6
   4:IF R<0THENR=R+64
270 POKES-463+22*Z+22*INT((20-Y)/2)
   ,R:NEXT:FORZ=1TOX:R=ASC(MI
   D$(X$,Z,1))-64
280 IFR<0THENR=R+64
290 POKES+22+Z+INT((20-X)/2),R:NEXT
300 FORB=1TOA:S(0)=0:S(1)=2:FORC=0T
   O1
310 N(C)=(P(C,B)-L(C))*19.99/(H(C)-
   L(C))
320 DN(C)=N(C)-INT(N(C)):IFDN(C)<.5
   THENS(C)=2-C
330 NEXTC:P=S-21+INT(N(0))-22*INT(N
   (1)):V=PEEK(P):FORZ=0TO15
340 IFV=D%(Z,0)THENRL=D%(Z,S(0))+S(1
   )):Z=15
350 NEXTZ:POKEP,RL:POKE36876,225:PO
   KE36878,15:FORX=1TO5
360 NEXTX:POKE36878,0:NEXTB
370 GETA$:IFA$<"1"GOTO370
380 PRINT"{CLEAR}"SPC(135)"CALCULAT
   ING DATA"
390 IFA>2GOTO410
400 PRINT"{CLEAR}"SPC(111)"THE DAT
   A WILL NOT","{DOWN} GIVE ~
   MEANINGFUL","{DOWN}
   RESULTS":GOTO550

```

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410 FORZ=0TO1:FORW=1TOA:P1(Z)=P1(Z)
+P(Z,W):W(Z)=W(Z)+P(Z,W)↑2
:NEXTW,Z
420 FORW=1TOA:N=P(0,W)*P(1,W)+N:NEX
TW
430 IFW(0)-P1(0)↑2=0GOTO400
440 B=(N-P1(0)*P1(1)/A)/(W(0)-P1(0)
↑2/A)
450 C=P1(1)/A-B*P1(0)/A
460 SD=(W(1)-C*P1(1)-B*N)/(A-2):IFS
D<=0THENS D=0:GOTO480
470 SD=SD↑.5
480 IFW(1)-P1(1)↑2/A=0THENR2=0:GOTO
500
490 R2=(C*P1(1)+B*N-P1(1)↑2/A)/(W(1)
)-P1(1)↑2/A)
500 PRINT" {CLEAR} "SPC(7)" {PUR}Y=X*A
+B"
510 PRINT" {DOWN} {RED} Y= {CYN}";Y$
:PRINT" {RED} X= {BLU}";X$
520 PRINT" {RED} A={GRN}";B:PRINT" {
RED} B={GRN}";C
530 PRINT" {BLU} {03 DOWN} COEF OF DE
TERMINATION {GRN}";SPC(4)R2
540 PRINT" {BLU} {03 DOWN} STD ERROR
OF ESTIMATE {GRN}";SPC(4)SD
550 PRINT:END
    
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Telephone, message systems, teletext, newspapers, banks — many areas of modern life are being transformed by telecommunicating computers.

Telecommunications

What Is It?

Michael E. Day
Chief Engineer, Edge Technology
West Linn, OR

Tel-e-com-mu-ni-ca-tion: communication by radio, telephone, telegraph, television, etc.

Telecommunication within the computer industry generally refers to communicating with a computer via a modem. Such communication has been around for awhile, but until the advent of the personal computer there was little need for the average person to use it. With the personal computer becoming ever more popular, this is changing; and knowing about telecommunications is becoming more necessary.

Necessary Uses

Currently, personal computerists use telecommunications mainly for communicating with public access message systems around the country. This has been the "CB radio craze" of the computer industry. The novelty of it is wearing off and other uses for the modem are being considered.

At first consideration, a very simple use of the modem, conversing with a friend, would seem pointless, since talking to your friend over the telephone would be simpler. This is true if the friend is located locally. But if the friend lives far away, there might be large phone bills or else little contact with the friend. You could communicate with the friend by mail, but mail delays the message.

The computer can help by providing a means of communication that keeps down both the communication time and the costs. Not only does the computer send information more quickly than you can talk, but it also gets rid of the casual talk that extends the time.

Businesses have for some time used computers as a means of reducing communications costs. Also, the computer is a vital link which allows the deaf to communicate when they would otherwise not have that ability. In fact, most telephone companies provide the equipment to the deaf free of charge.

Public Uses

Of course, telecommunication is not limited to

personal communications; information of many sorts, including almost any form of printed matter, can be transferred via the modem. Such things as letters, contracts, news, and special interest subjects can all be transmitted through the modem. The API and UPI news services have been doing this for many years. The weather services provide information this way as well.

Most of the information provided by the vari-

...what about the computer? It needs its own type of information flow.

ous information dispensers is in fact provided to them through a telecommunications network. Since the information is already in a form that computers can work with, it requires little work or reorganization to provide the information in a form that the average person can use.

Some information services have sought to reorganize information to make it more readily recoverable. For example, the newspaper industry, spurred by increasing costs and decreasing income, is searching for ways to increase profits by reducing costs while extending and diversifying the types of services they perform.

The news industry is not alone. Telephone companies are exploring this area also, most noticeably by the electronic directory service. They hope to eliminate expensive telephone directories by providing a means to obtain information over the telephone itself. (The biggest problem to date: the terminal needed to access the information costs far more than the directory, even taking into account the cost of directory assistance currently provided by the operator.)

New Systems

The need for a well-defined and up-to-date method of communicating information, both nationally and internationally, has caused European countries to develop a replacement for the TELEX system. This new system, called "teletex," goes beyond TELEX by allowing almost any form of data to be transmitted. (The TELEX system allowed only uppercase letters, numbers, and a few special characters.)

Other telecommunications systems being implemented are the "videotex" and "teletext" (note the additional "t"). Rather than limiting

themselves to text type data, these systems transmit graphic information in the form of pictures and use existing video transmission systems (TVs). Previously, the major method of graphics transfer was by a special modem and a facsimile machine (FAX for short) which provides a picture copy of the transmitted data. While a FAX machine is much slower in transmitting a page of text, its advantage is that it can send pictures.

All of this information flow is nice for people. But what about the computer? It needs its own type of information flow. The computer runs on programs, which can also be transferred with a modem. However, there are no standards in the business world for such transfers, primarily because there has been no need for them.

In the personal computer world, however, there is such a need. This is due to the large number of individuals owning machines, the variety of these machines, the numerous programs written to run on the machines, and the greater interest in being able to transfer programs. Public computer systems have been set up specifically to provide a centralized base for these programs. The most popular of these are the CPM based systems, referred to as RCPM (Remote CPM).

These systems maintain various programs for computers which run with the CPM operating system. The programs provided are "Public Domain" programs; this means that they are provided to the general public free of charge, for anyone's use. Some retain copyrights on the programs, but this is generally to prevent resale of the "free" program. Others simply do it for the advertisement. (You can use my program, but my name has to stay in it.) Others don't care; they just want to see their program out there.

Some programs by their very nature are "public domain" programs. For example, any program created on government time or equipment is in the public domain, unless it has security restrictions. This is also true of many programs from educational institutions. Finally, some programs have been around for so long that no one knows who the original author was.

Business Uses

Financial institutions are also heavily into telecommunication. They use telecommunication to keep in constant touch with their various branches. This way, there is an instant update in the main computer whenever a transaction occurs. They also use telecommunication to transfer money back and forth, since this reduces transit time, in turn reducing the "float" time in which the money is unusable.

Telecommunication is also what makes automatic teller machines possible. The automatic teller

is in constant communication with the bank's central computer, so that your account is immediately updated when you perform a transaction at the machine.

Although the credit card industry also depends upon telecommunication to transfer funds, it has been somewhat lacking at the customer end. Despite efforts to improve the situation, it is still the general rule that if a card needs to be checked, the checking is done manually. Electronic checking of cards would mean less hassle to the customer: checking could be done more quickly, and stolen cards could be identified more readily.

An offshoot of the credit card is the debit card. With a credit card, you are not only paying for the credit card system's operation, but you are also paying for the use of someone else's money. With a debit card, however, you are using your own money, not borrowing it.

Telecommunication could allow you to call a store, browse through its catalog, place your order, and pay for it – all without leaving your living room. Even if you are only comparison shopping, the video catalog could help you narrow your selection by showing who is selling what and for how much. You would save time by not having to wander from store to store.

Other types of purchase not readily possible now could also become available. Deferred payment could become a snap; you could purchase an item with a delayed payment, and if you like it, you could then release the payment. The seller would have greater protection as well, since if you didn't release the funds within a certain time, they could be automatically released.

Telecommunication has many possibilities – not only for increasing the amount of data and knowledge, but also for reducing (or eliminating) the number of tiresome chores now undertaken by people. ©

Using *your* computer
in an interesting
application?
Write it up for
other **COMPUTE!**
readers to use.

COMPUTE!'s Listing Conventions

Many of the programs which are listed in **COMPUTE!** use special keys (cursor control keys, color keys, etc.). To make it easy to tell *exactly* what should be typed in when copying a program into the computer, we have established the following listing conventions.

For The Atari

In order to make special characters, inverse video, and cursor characters easy to type in, **COMPUTE!** magazine's Atari listing conventions are used in all the program listings in this magazine.

Please refer to the following tables and explanations if you come across an unusual symbol in a program listing.

Atari Conventions

Characters in inverse video will appear like: **ERASE**. Enter these characters with the Atari logo key, (A).

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, {A} means to enter a reverse-field heart with CTRL-comma, {5 A} means to enter five inverse-video CTRL-U's.

For 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.

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*.

For The Apple

Programs listed as "Microsoft" are written for the PET/CBM,

Apple, OSI, etc. Although the programs are general in nature, you may need to make a few changes for them to run correctly on your Apple. Microsoft BASIC programs written for the PET/CBM sometimes contain special cursor control characters. The following table shows equivalent Apple words. Notice that these Apple commands are *outside* quotations (and even separate from a PRINT statement). PRINT"[RVS]YOU WON" becomes INVERSE: PRINT"YOU WON":NORMAL

{CLEAR} (Clear Screen) HOME
 {DOWN} (Cursor down)
 Apple II +: Call -922
 POKE 37,PEEK(37)+(PEEK(37)<23)
 {UP} (Cursor up)
 POKE 37,PEEK(37)-(PEEK(37)>0)
 {LEFT} (Cursor left) PRINT CHR\$(8);
 {RIGHT} (Cursor right)
 PRINT CHR\$(21)

{RVS} (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the PRINT statement ends with a semicolon.)

INVERSE

{OFF} (Inverse video off) NORMAL

Shifted characters can represent either graphics characters or uppercase letters. If within text, just use the non-shifted character, otherwise substitute a space. Some "generalized" programs contain a POKE such as POKE 59468,14. Omit these from the program when typing it in. One final note: you will probably want to insert a question mark or colon within an INPUT prompt. PET/CBM and many other BASICs automatically print a question mark:

```
INPUT "WHAT IS YOUR NAME?";N$
becomes
INPUT "WHAT IS YOUR NAME?";N$
```

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 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 One {F1}	Function {NIM}

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}	

COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

February 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever-expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, The Voracious Butterfly on OSI.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

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.

December 1981: Saving Fuel \$\$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, Vic Color Tips, VIC Memory Map, ZAP: A VIC Game.

February 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Atari P/M Graphics Made Easy, Atari PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April 1982: Track Down Those Memory

Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple's Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

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 Artifacts, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

Home and Educational COMPUTING! (Fall 1981 and Summer 1981 – count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters, Alternate Screens, Automatic Line Numbers, Using The Joystick (Spacewar Game), Fast Tape Locator, Window, VIC Memory Map.

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The FORTH Page

The words *SERT* and *TRADE* allow you to move and mass-move screens around on a disk without fear of accidentally erasing something of value. No matter how you use these commands, no screens are ever overwritten. They simply end up somewhere else.

Disk Management

Michael Riley
Philadelphia

SERT (N1 N2 N3 —)

Deletes the group of screens numbered N1 through N2 and reinserts them between the screens numbered N3 and N3 + 1.

TRADE (N1 N2 N3 —)

Swaps a group of screens numbered N1 through N2 with a group of screens starting at N3. The two groups are assumed to be the same size.

The algorithm for *SERT* is a bit tricky, but it is an effective solution to a common problem. The problem with most block-move algorithms is that they need a large buffer area to store the block while moving the text that lies between the block and the destination point. Other algorithms move the block one small piece at a time, and the entire text in between must be repositioned once for each move.

The algorithm in *SERT* does a little more calculating in order to save space and time. *SERT* picks up the first screen that needs to be moved and calculates its destination position. Next, it picks up a second screen at that position before setting down the first screen. The destination of the second screen is then calculated, and so on.

The following words were used to implement *SERT* and *TRADE* and would not normally be used for editing:

(SERT) (N1 N2 N3 —)

Swaps two adjacent groups of screens. The two groups need not be the same size. Screens N1 through N2-1 are swapped with N2 through N3-1.

FX (N1 N2 — N1 N2 or N2 N1)

Two numbers are swapped if N1 is larger. "fix"

PAD-SWAP (N1 —)

Swaps the contents of block # N1 with 1024 bytes at pad.

B-DIST (variable)

The total number of screens to be moved. "big distance"

LIM (variable)

The highest screen to be moved plus one.

CNT (variable)

The number of screens moved. "count"

S-DIST (variable)

The number of screens in the highest numbered group. "small distance"

STRT (variable)

The first screen to be moved. "start"

Program 1.

```
SCR # 122
0 ( PAD-SWAP B-DST CNT S-DEST STRT )
1 : PAD-SWAP ( N1 --- / SWAP SCR W/ PAD )
2   DUP BLOCK PAD 1024 + 1024 CMOVE
3   PAD SWAP BLOCK 1024 CMOVE UPDATE
4   PAD 1024 + PAD 1024 CMOVE ;
5 0 VARIABLE B-DST 0 VARIABLE LIM 0 VARIABLE CNT
6 0 VARIABLE S-DIST 0 VARIABLE STRT
7 : (SERT) ( N1 N2 N3 --- )
8   DUP LIM ! SWAP - S-DIST ! STRT !
9   LIM @ STRT @ - B-DST ! 0 CNT ! STRT @
10  BEGIN DUP PAD-SWAP
11   BEGIN S-DIST @ + DUP LIM @ < 0 =
12   IF B-DST @ - THEN
13   DUP PAD-SWAP 1 CNT + ! DUP STRT @ =
14   UNTIL CNT @ B-DIST @ <
15   WHILE 1 STRT + ! 1+ REPEAT DROP ; -->
```

Program 2.

```
SCR # 123
0 ( FX SERT TRADE RANGE? ROOM? )
1 : ROOM? ( / IF ERROR, PRINT 'NO ROOM IN DICT' )
2   PAD 2048 + FIRST > 14 ?ERROR ;
3 ( ' FIRST > ' IS INSTALATION DEPENDENT )
4 : RANGE? ( N1 --- N1 / LEGAL SCREEN NUMBER? )
5   1 OVER > OVER 300 ( 4040 PET ) > OR 6 ?ERROR ;
6 : FX ( N1 N2 --- N2 N1 [OR] N1 N2 )
7   OVER OVER > IF SWAP THEN ;
8 : SERT ( 1ST LAST DEST --- / REINSERT SCRS AT DEST )
9   ROOM? 1+ RANGE? SWAP 1+ RANGE? ROT RANGE?
10  FX >R FX >R FX (SERT) ;
11 : TRADE ( 1ST LAST DEST --- / TRADE WITH SCRS AT DEST )
12  ROOM? ROT >R R SWAP - B-DST ! ( LAST )
13  1+ R> ( LAST+1 1ST )
14  DO I RANGE? I B-DIST @ - RANGE? ( I I+DST )
15  OVER PAD-SWAP PAD-SWAP PAD-SWAP LOOP DROP ;
```

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New Products



Spinnaker Software Corp. Markets Home Learning And Strategy Games For Atari And Apple

Two software design companies, DesignWare and Computer Learning Connection, are finalizing the initial Spinnaker product line, aimed at providing both education and entertainment for children in a home setting.

Working closely with Spinnaker, DesignWare and Computer Learning Connection have prepared four game products which will be published by the new company via retail micro-computer stores throughout the country.

The two Spinnaker learning games authored by DesignWare, a San Francisco-based courseware development company, are designed for children ages four to nine and will foster understanding and enjoyment of the uses of a personal computer. The games attempt to balance amusement and learning and require a minimal amount of text material.

The Spinnaker learning games developed by DesignWare include *Face Maker* and *The Story Machine*. *Face Maker*, intended for children four to eight years of age, provides an animated format to familiarize a child with the graphics capabilities of a computer. By choosing from a varied menu of eyes, ears, noses, mouths, etc., the child composes a face which he can then animate with a series of expressions, including smiling, winking, and

wiggling of ears.

The Story Machine provides an opportunity for children ages five to nine to develop and strengthen their sentence and paragraph skills.

Sentences and paragraphs, composed by the child from a substantial list of nouns, verbs, prepositions, and other parts of speech, are animated with full color graphics and sound. *The Story Machine* will also provide keyboard practice and introduce the child to the editing capabilities of the computer.

Computer Learning Con-

nection, located in Cambridge, Massachusetts, is producing the first two entries of a strategy game series for Spinnaker. The Snooper Troops Series will be composed of mystery games in which the player (ages ten to adult) becomes a private detective. In trying to determine which of eight suspects committed the crime, the player strengthens his skills in reasoning and developing hypotheses as he drives around town, questions witnesses, searches houses for clues, and accumulates information via the Snoopnet computer.



Spinnaker's holiday software

The Spinnaker games will be marketed nationally on a major scale by the publishing company. Its marketing efforts will include the design and production of a distinctive array of packaging for the new games, which will provide maximum protection for the discs over a long time period.

The company has also introduced a holiday package. A Christmas Sampler brings to the entire family a variety of holiday classics with full-color graphics and sound. Interspersed with animation, the graphic depictions of *A Christmas Story*, *The Night Before Christmas*, and a selection of Christmas carols are accompanied by screen texts for easy follow-along by younger family members. Christmas music adds a third dimension for holiday gatherings.

This software is available for the Apple II and Atari 800 (48K) or IBM PC (48K) with disk drive. A color monitor is recommended.

Spinnaker Software
26 Brighton St.
Belmont, MA 02178
(617)484-8444

Interfaces For Commodore 64 And VIC

XITEL announces two interfaces, both for the new Commodore 64 and VIC-20.

Its Model CX-6401 interface allows the new Commodore 64 or VIC-20 to use *any* type of standard, commercially available parallel interface printer. The interface connects to the Serial Port/Bus on the computer, *not* the user port, allowing the user port to remain open for use by a modem or RS-232C peripheral device.

Some key features of the CX-6401 are:

- Eliminates handshaking problem of RS-232C cartridge.
- Mode switch to correct ASCII problem.
- No RS-232C cable necessary.
- Allows use of lower cost parallel type printers.
- No external power required.
- Allows use of multiple printers.
- Leaves user port lines available for other use.

The CX-6401 comes with a

six foot serial bus cable and connector for direct connection to the Commodore 64 or VIC-20. In addition, the CX-6401 has a one foot parallel cable for connection to the printer. Installation is simple. \$89.95.

The new CX-6402 full RS-232C interface, for the new Commodore 64 and VIC-20, allows the use of any type of RS-232C peripherals, such as modems, printers, etc. The interface connects to the computer's user port. The CX-6402 is a complete RS-232C Interface, for *all* RS-232C devices.

Some key features of the CX-6402 are:

- Allows full use of all eight active "handshaking" RS-232C signal lines on the VIC-20 and Commodore 64.
- Full RS-232C logic levels.
- Requires no external RS-232C cable.
- Operates at all VIC-20/Commodore 64 baud rates.
- Requires no external power.

The CX-6402 comes ready to install. In addition, the CX-6402 comes with a six foot parallel cable for connection to the printer. \$59.95.

continued on p. 238

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Owners of Atari 810 disk drives purchased prior to Atari's fast formatting engineering change can now increase the formatting speed of their machines by more than 30%.

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of soldering, a person can complete the task in about 15 minutes. The tools required are a screw driver and a low wattage solder iron.

Fast-Chip is available from Atari dealers worldwide for \$39.95 and carries a one year guarantee. Installation is available from most local dealers for a slight extra fee, or users can send their drive postpaid with payment of \$39.95 plus \$15 for shipping, handling, and installation to:

Binary Corporation
3237 Woodward Avenue
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SOFT 8 For Apple II

Legend Industries' new SOFT 8 for the Apple II computer ends the restriction of the Apple to

eight slots.

SOFT 8 provides an extra slot on the Apple motherboard. The SOFT 8 card plugs into slot 7 and provides slots 7 and 8. Switching between the slots is software driven (unlike its sister SLOT 8, which is hardware driven) and allows you to switch between one card and another with simple software commands. With SOFT 8 you can PR#8, IN#8 and catalog slot 8 like you would any other slot in the Apple II. You can now put nine cards in your Apple and have them all software accessible.

The disk supplied with the SOFT 8 allows you to modify standard Apple DOS so that it will recognize the added slot.

An example of SOFT 8's use would be to access between a Z-80 card and a 6809 card. However, there are other possibilities.

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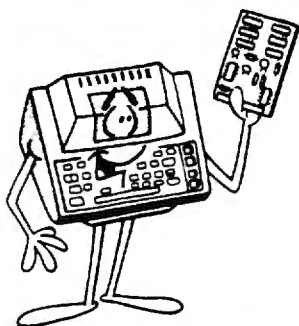
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ComputerTown Test Site: A Call For Proposals

ComputerTown, USA!, a micro-computer literacy project funded by the National Science Foundation, is accepting proposals from individuals and organizations interested in becoming an official test site for the project's Implementation Package.

Proposals will be accepted until December 1, 1982. The new site will be announced January 15, 1983.

Project coordinators are looking for a test site within the United States, east of the Mississippi River. The chosen site will assist the project in testing and evaluating the prototype ComputerTown Implementation Package, which provides resource information and materials for starting a community-based microcomputer literacy project.

ComputerTown representatives will make site visits and assist test site personnel with planning and organizing its activities. There are no provisions for the direct funding of the test

site's activities, since that is one of the parameters being tested — how local resources can be used to create a community computer literacy project.

Everyone who submits a proposal will receive a draft copy of the Implementation Package, regardless of which location is chosen as the official test site.

ComputerTown offers teaching, consulting, and information services to a network of over 80 affiliates throughout the United States and overseas. These affiliates exist in public libraries, boys' clubs, children's museums, senior citizens' centers, and other community facilities. The selection of a test site in no way precludes regular support and information services provided by ComputerTown to anyone interested in computer literacy.

For proposal guidelines or further information about ComputerTown services and activities, contact:

ComputerTown
P.O. Box E
Menlo Park, CA 94025

Job Costing And General Accounting Program

The Management Accountability Group has just released *The*

Contractor, a job costing system and a general accounting program. It is fully integrated and interactive, requiring only one data disk and one program disk. The program will handle up to 200 jobs at one time as well as handling general ledger, accounts receivable, payroll, and inventory transactions. The system is designed to run on Commodore Business Machines' 8032 CPU and 8050 disk drive.

The Management Accountability Group, Inc.
493 East Clayton Street
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(404)353-8090

Six New Products For The Atari

MMG Micro Software has introduced six new programs for the Atari:

Asteroid Miner, a 32K BASIC game tutorial that uses over 25 players, player-missile graphics, machine language subroutines, a redefined character set, multi-processing with the vertical blank interrupt interval, and more. The program comes with a book that explains each part and a fully documented source code for both the BASIC and assembly language parts of the program. \$34.95.

Chomper, an arcade game

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RAM Test is an all machine language memory test. It is capable of testing 48K in four minutes, and it does test the cartridge area of memory. Also, it makes repair easier by pinpointing bad memory locations. \$24.95.

BASIC Commander is an all machine language program which occupies 4K of RAM and is co-resident with your BASIC program. The program allows single keys to access DOS functions, BASIC file manipulation commands, and more. Also, the program allows you to renumber all BASIC lines and all references automatically and to delete any range of lines. Extensive error trapping is included. Available on disk only. \$34.95.

Mail List, a BASIC and

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Computer Learning Center

Queue, Inc., of Fairfield, Connecticut, opened (September) its first Computer Learning Center at 161 Kings Highway, Fairfield, Connecticut.

The Learning Center offers computer-assisted tutoring in a variety of academic subjects, including mathematics, English, reading, spelling, vocabulary, grammar, social studies, science, biology, chemistry, physics, astronomy, psychology, sociology, history, government, philosophy, French, German, Spanish, Russian, and Italian, for students from kindergarten through college and adult. The computers used are Apple II and III, VIC-20, and TRS-80 Model III; PET and Atari are to be added soon.

The Learning Center also offers specialized courses in SAT and GRE preparation, computer literacy, computer programming, speed reading, typing, word processing, and computer applications in business.

The Queue Computer Learning Center offers teachers free orientation courses on microcomputers in education, a large selection of free literature, and an opportunity to review an order from a large library of educational software.

For computer owners, the Learning Center will have a large selection of game, educational, and business software for review and purchase.

Queue is planning to open

additional learning centers and is seeking people, particularly teachers, interested in owning or operating a Computer Learning Center.

For more information, call or write:

Queue Computer Learning Center
161 Kings Highway
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Queue has also announced two new, free catalogs of educational software for Apple, PET, TRS-80, and Atari computers. The catalogs are K-9 and high school/college. Each contains several hundred programs from a wide variety of publishers.

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VIC Software From Western New England

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Concentration is the classic game of memory retention. Two players are pitted against each other in a battle to see who can remember more. It features sound and a colorful playing board. Price is \$7.95.

Code Cracker is another challenge to the mind. The player must deduce the secret three- to six-digit number in 20 turns or less. The computer evaluates the player's guess by displaying a series of dots that tell the player how close he was to the actual number. Price is \$7.95.

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Atari Bank Select Memory

Mosaic Electronics, Inc., has announced its new memory board, the Mosaic 64K RAM Select for Atari 400.

The board consists of 48K RAM with four banks of 4K RAM addressed above the 48K limit. This insures that the 48K recognized by the OS is continuous, that 52K RAM is always available, and that a ROM cartridge does not affect the availability of the bank select RAM. The 4K RAM banks allow for a

larger hard-wired RAM size, and all Atari software and peripherals are compatible.

Suggested retail price is \$249.95.

Customer Service
Mosaic Electronics
P.O. Box 708
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Retirement Financing Plan For The Atari

Advanced Financial Planning has just released for sale a software program for the Atari 400/800 computers entitled *Retirement Planning*. A unique financial planning program, it allows users to establish a retirement financing plan which takes into account their personal situation relative to inflation, investment returns, retirement income needs, etc. To

do this, the program performs the following functions:

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The program is priced at \$29.95 and requires 32K memory, disk drive and the Atari BASIC cartridge.

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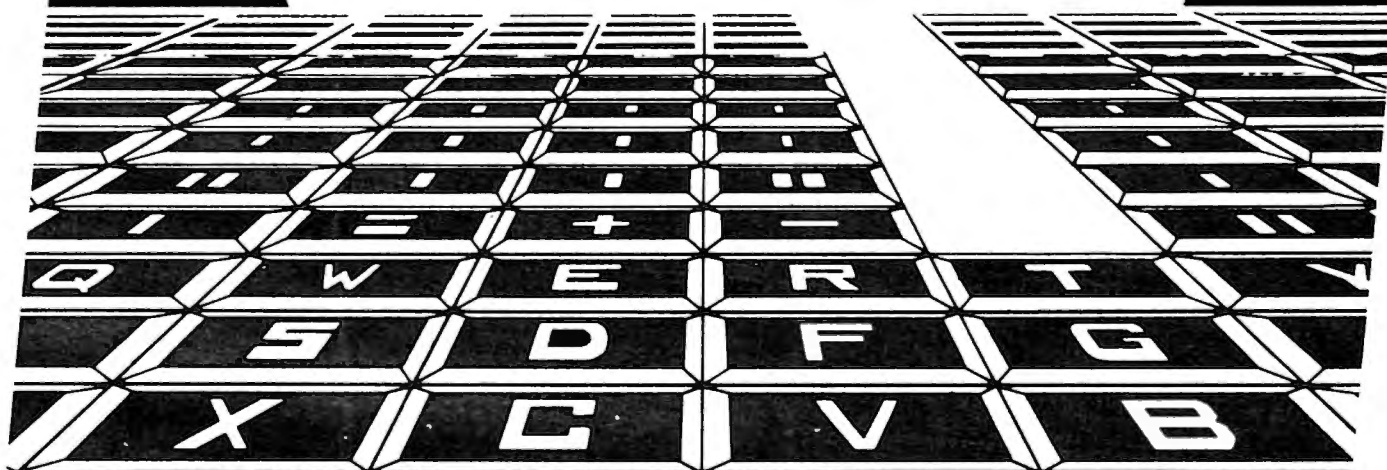
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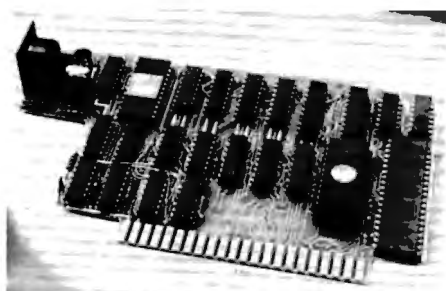
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A 40/80 Character Expansion For The VIC-20

An often discussed disadvantage of the VIC-20 was the number of columns of the screen. The length of a screenline was just 22 characters. This could not prevent the VIC computer from being a success in the hobby world, but it made (semi)professional applications impossible.

Computer World has de-



Computer World video cartridge

signed an expansion to make the VIC suitable for professional applications, e.g., accounting and word processing, especially when using the Brother 8300 daisy wheel printer/typewriter, adapted to operate with the VIC-20.

When using our video cartridge, you may choose between a 25 x 40 and a 25 x 80 character mode (25 lines of 80 characters each). This enables you to use the programs written for the 2000, 3000, 4000 and 8000 CBM computers without major alterations.

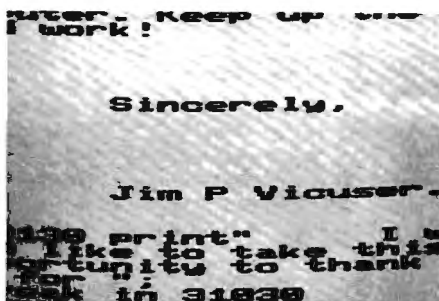
The Computer World video cartridge for the VIC-20 has the following features:

- 40 or 80 column display (switchable with BASIC, without losing any program in memory).
- VIC and PET/CBM graphics.
- 32K RAM expansion (instead of 27.5K). Note: All you need is the expansion box with the 3, 8 and 16K RAM cartridges.
- Upper- and lowercase with true

descenders.

- Full cursor control.
- Program editing in 40 or 80 column mode.
- No alterations needed in VIC.
- No external power supply needed.
- Fits in the Arfon or Commodore expansion box.
- Operates with all ROM cartridges, except those located in the area from A000 hex to C000 hex.

The price is \$249 US.



Screen display using the Computer World video cartridge

Central Point Software, Inc.
P.O. Box 19730-#203
Portland, OR 97219
(503)244-5782

Terminal Emulation Package For The SuperPET

Watsoft has introduced a software package that provides enhanced terminal emulation support for the SuperPET. The package includes interrupt-driver buffered input from the host line. This prevents loss of received characters during certain screen operations, such as scrolling, when using data rates of up to 9600 baud.

Additional keys have been defined to enable transmission of the "BREAK" condition and the ASCII control characters. A local/remote echo setting allows optional display of characters transmitted to the host computer. Special character sequences

THE MONKEY WRENCH™ FOR ATARI

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A BASIC and machine language programmers aid for 800 users. Plugs into right slot and works with ATARI BASIC. Adds 9 new direct mode commands including auto line numbering, delete lines, change margins, memory test, renumber BASIC, hex/dec conversion, cursor exchange, and machine language monitor.

The monitor contains 15 commands used to interact with the 6502. Some are display memory/registers, disassemble, hunt, compare, hex/dec convert, transfer memory, and printer set/clear. Uses screen editing.

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The BRANDING IRON is an EPROM programmer especially designed for PET and ATARI computers. Programs 2716 and 2532 type EPROMs. The PET version plugs into the cassette and I/O port and comes with software which adds the programmer commands to the PET monitor. The ATARI version plugs into controller jacks and comes with a full fledged machine language monitor which provides 30 commands for interacting with the computer and the BRANDING IRON.

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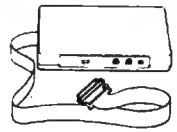
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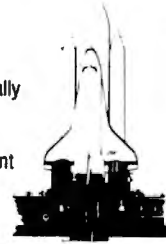
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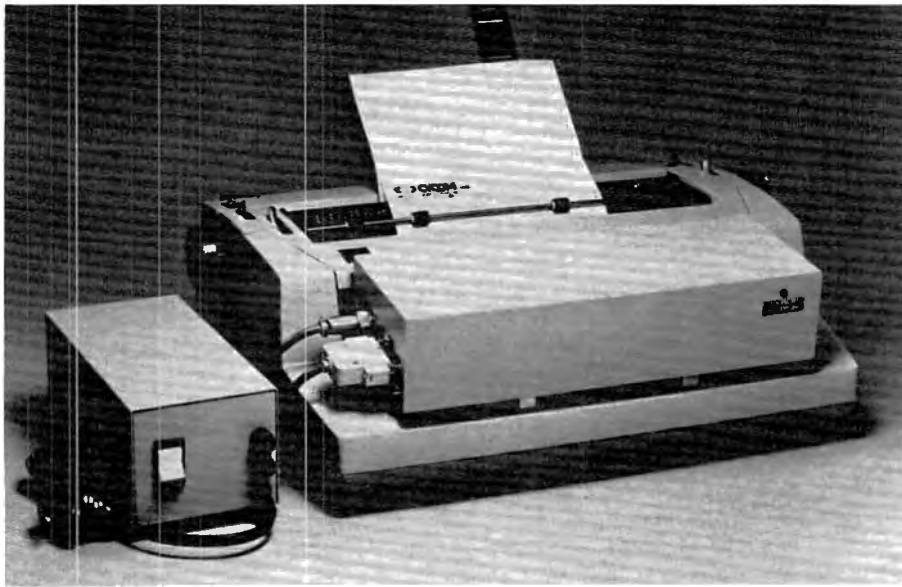
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transmitted from the host computer can be used for terminal control operations such as x-y cursor positioning, screen-clear, etc. Optional XON/XOFF support for both transmission and reception of data avoids data overruns without requiring large buffers. In addition to supporting the ASCII character set, an alternate mode provides APL characters with standard overstrikes.

The software is supplied on

a 5 1/4" diskette and includes implementation and user documentation. The package is distributed on an "as-basis" without maintenance. Available for a one-time fee of \$100 (U.S. funds); Ontario residents add 7% provincial sales tax.

*Watsoft Products Inc.
158 University Ave. W.
Waterloo, Ontario
Canada N2L 3E9
(519)886-3700*



Tyrop II shown installed on top of typewriter's keyboard

Adapter For Electric Typewriters

Hollander Office Products has announced hardware enhancements and a price reduction to the Tyrop, an adapter designed to turn an electric typewriter into a low-cost word processing printer when interfaced with a microcomputer.

Trade-named the Tyrop II, the new adapter has been modified with an external DIP switch to allow easy conversion from serial to parallel interfaces. Also, a new PROM includes a back-spacing key for underscoring text. The Tyrop II retails for \$695.

The adapter is compatible

with IBM Selectric I, II and III, or with other equivalent electric typewriters. The printing speed for typewriters using the Tyrop II is 600 characters per minute.

The Tyrop II is installed on top of the typewriter's keyboard and connects by cable to the microcomputer. A side panel switch at the off-line mode provides self-diagnostic monitoring of all printing and adapter functions.

Hollander Office Products is the exclusive U.S. distributor for the Tyrop II, manufactured by Cycom Corporation, Japan.

*Hollander Office Products
41 Dusenber Drive
Thousand Oaks, CA 91362
(800)235-3524*

Stock Market Simulation

Blue Chip Software has announced the release of a program for Apple and IBM computers — *Millionaire*.

Available on a 5 1/4" and 8" disk, *Millionaire* brings the user into the world of Wall Street. Players can manipulate as many as 15 different stocks (such as IBM, Exxon, Bendix, etc.) with a dazzling array of transaction formats. They can buy and sell stocks, put options, call options, buy on margin, borrow against their net worth, etc.

Users familiar with the stock market will quickly recognize the accuracy that author Jim Zuber maintains throughout the game. In fact, players can summon each of the 15 stocks' corporate histories as well as week-by-week industry trends and graphs.

For the player who knows little or nothing about the stock market, playing *Millionaire* will provide a friendly, easily understood atmosphere in which to learn.

Millionaire is available to run on Apple II Plus and III (\$79.95); IBM PC, Osborne and other CP/M systems (\$99.95).

*Blue Chip Software
18653 Ventura Blvd., Suite 215
Tarzana, CA 91356
(213)881-8288*

Space Ace For Atari

London Software has announced a new arcade quality action game, *Space Ace*. Using the full hires graphic potential of the Atari 400/800, *Space Ace* incorporates attention to detail while providing dynamic action.

A player's ship travels over the entire screen, while constantly scrolling, randomly generated, multicolored asteroids provide continuous challenge. Space bombs pursuing you across the

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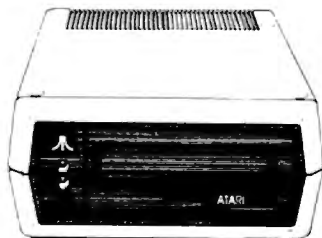
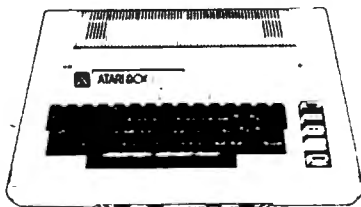
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galaxy and space mines eluding visibility keep players on their toes. The space death vortex, a rotating three-dimensional orb, randomly pursues your ship. If you escape all these dangers, you may still be destroyed by the pulsating atomic core of the Silurian warship, unless, of course, you are a true Space Ace.

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Space Ace provides constant action with three levels of play, each automatically increasing through nine sub-levels of difficulty. In addition, a user-selectable time limit option adds a new dimension of strategy to the game. As the clock counts down before him, the player must decide whether to take extra risks to maximize his score or to play it safe and survive.

Space Ace requires 16K, joystick, and is offered on both disk and cassette at \$29.95. VISA/MC: include all names and numbers on card. Please add \$1.50 postage and handling per order; California residents add an additional \$1.95 tax or see your dealer/distributor. For more information or to order, call or write:

London Software
374 Wildwood Avenue
Piedmont, CA 94611
(415)893-1090

Fractions Programs For PET, TRS-80, And Apple

Quality Educational Designs has introduced new versions of *Fractions* for the PET and for the TRS-80 Model III as well as a newly revised version for the Apple.

Fractions, a carefully designed sequence of 24 interactive programs, guides students (fifth grade and up) through the con-

cepts and operations of fractions. For each of 11 topics, a concept development and skill building program is followed by an enrichment exploration program. *Fractions* also includes a concept overview program and a placement or review test program.

The new versions take full advantage of graphics capabilities, and they keep the pedagogical soundness of earlier versions of *Fractions*.

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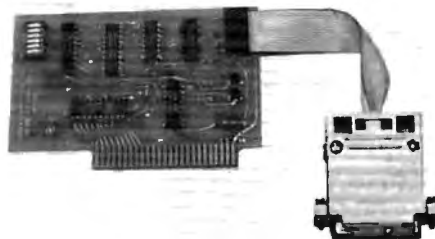
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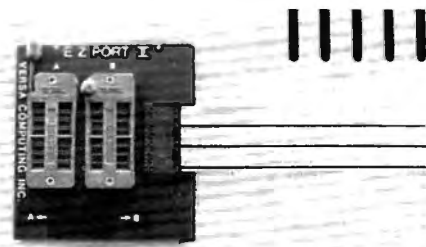


Versa's Serial Interface for Apple

hassle of converting from one I/O device to another (i.e., paddles to joystick to VersaWriter) by extending the I/O games port outside the computer. Changes are convenient, quick, and safe.

Also now available from Versa is a low cost, serial interface for Apple II computers. The Versa serial interface is designed to function only with those features necessary to operate a serial printer. The serial interface operates with the RS 232-C protocol, and other configurations can also be accommodated at installation times. The unit sells for \$79.95

The interface operates at switchable baud rates of 300, 600, 1200, 1800, 2400, 4800, 9600 and 19,200. In addition to baud rate, the printer is equipped with switches for automatic line feed, screen display, and line length. The interface package contains a 4.5x2.7" printed circuit board, and a ribbon cable with eight female pins crimped on one end and a 16 pin dip header



Versa's EZ Port II for Apple

Port Extension And Serial Interface For Apple

Versa Computing has introduced EZ Port-II, a twin-switched zero insertion force (ZIF) socketed extension and cable designed to extend the Apple computer game I/O port. EZ Port-II is a two-socket version of the earlier EZ Port-I. EZ Port-II sells for \$34.95.

EZ Port-II eliminates the

on the other.

Versa Computing Inc.
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Atari's New Research Laboratory

Atari has established in New York City a new research laboratory dedicated to the exploration of microprocessor-based products in electronic publishing and transactional services for home computers.

Headed by Steven T. Mayer, vice president of research and product development, the new lab will be responsible for development of advanced products for Atari, a leading manufacturer of coin-operated and home video games and home computers. The lab will also function as a focus for joint research projects with

other subsidiaries of Warner Communications Inc., Atari's parent company. The lab staff includes computer programmers and scientists who will build on Atari's expertise in electronic entertainment and computation.

Atari Incorporated
1265 Borregas Avenue
P.O. Box 427
Sunnyvale, CA 94086

The black, low profile, all-aluminum cabinet measures 4 x 1½ x 9½ inches. It is simple to install and operate and is compatible with nearly any standard data terminal or personal computer. It is made in the USA.

An Apple version (MFJ-1231) that plugs into the game port comes complete with software. No serial interface board is



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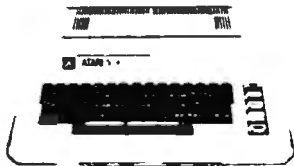
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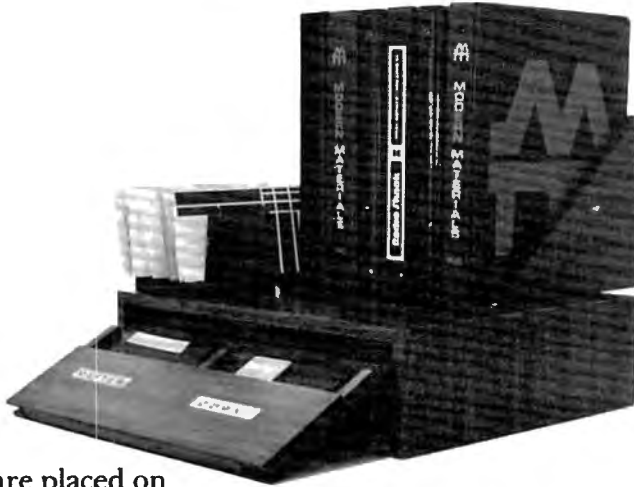
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administrators, and program planners will include: evaluation of hardware and software, administrative uses, data management, computer-assisted instruction, computer languages, programming, and the use of microcomputers to assist the handicapped.

Program Chairperson is Kathleen M. Hurley, Vice President of Research and Development, Developmental Learning Materials, Inc., of Allen, Texas. A past president of the Association for Special Education Technology, Ms. Hurley has served on the Government Relations Committee of the Association of Media Producers and on the advisory boards of LINC Services, Inc. and the Southern Association for Children Under Six.

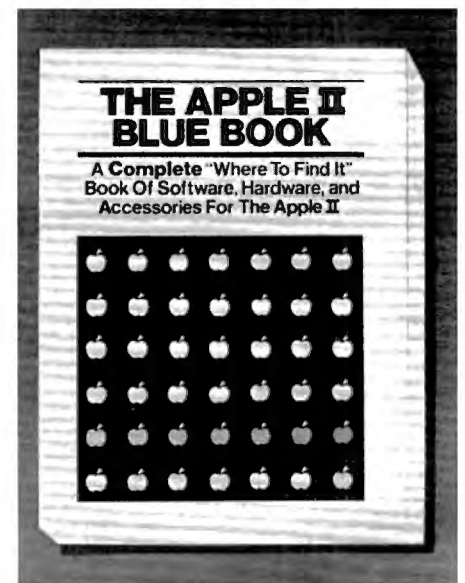
Program information and preregistration and housing forms may be obtained from:

John Grossi, Conference Manager
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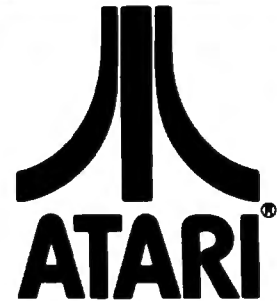
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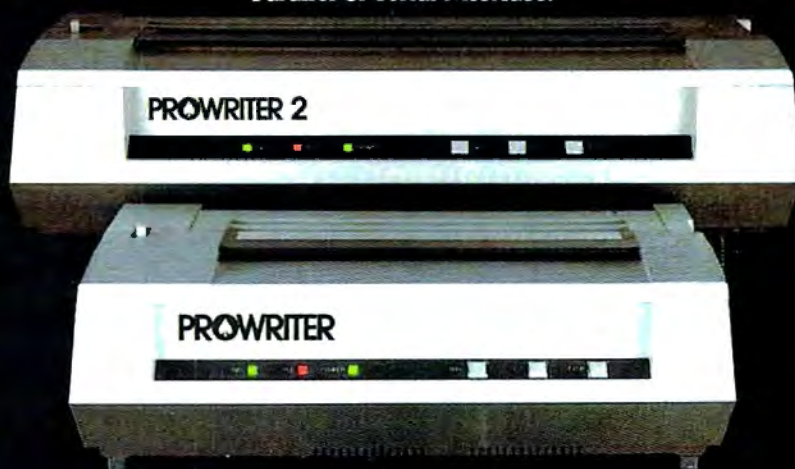
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