What To Get Your Computer For Christmas

COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

A Buyer's Guide To Modems

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UXB: A Fast-paced Game For VIC And Atari

Easy File Input For Commodore Computers

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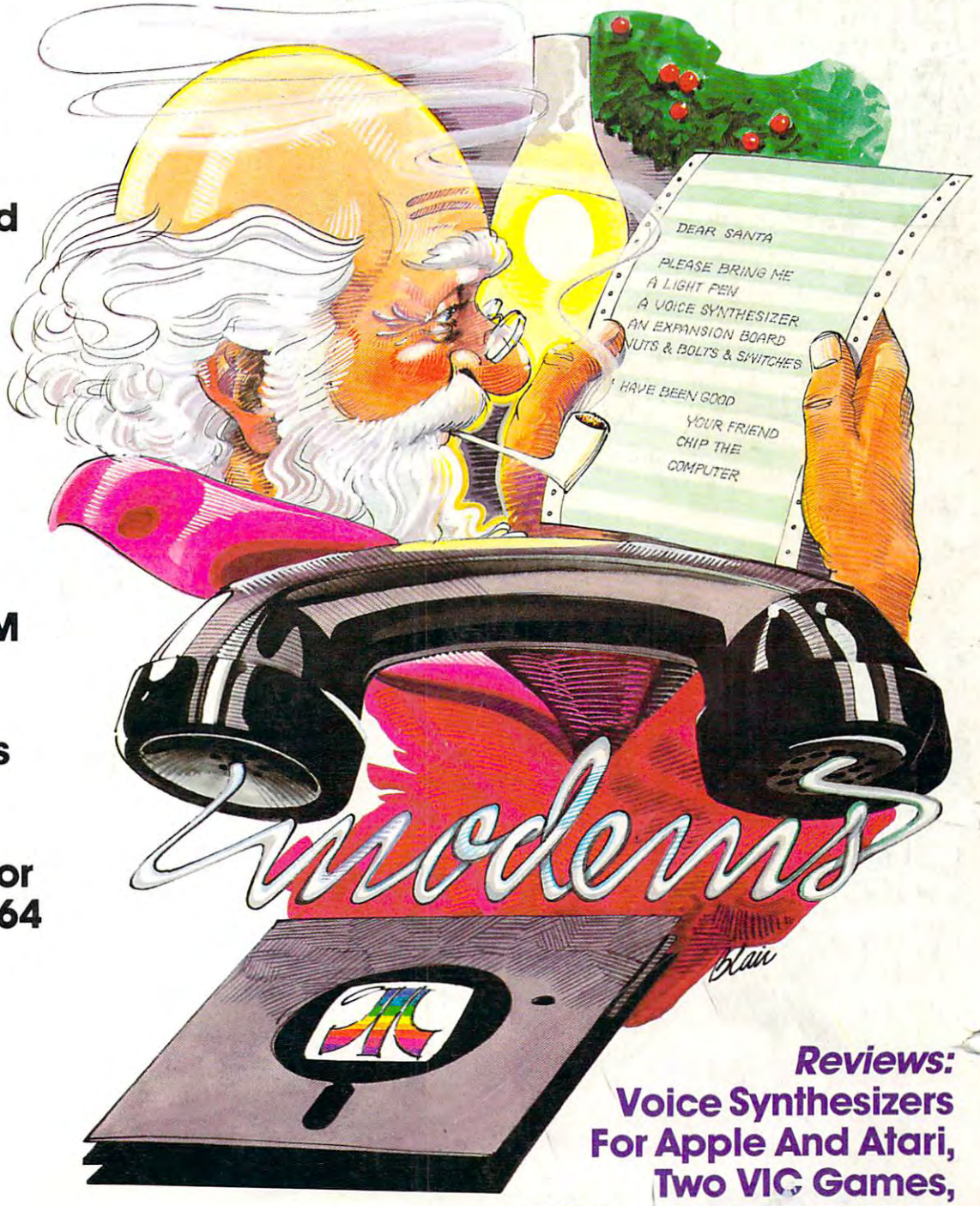

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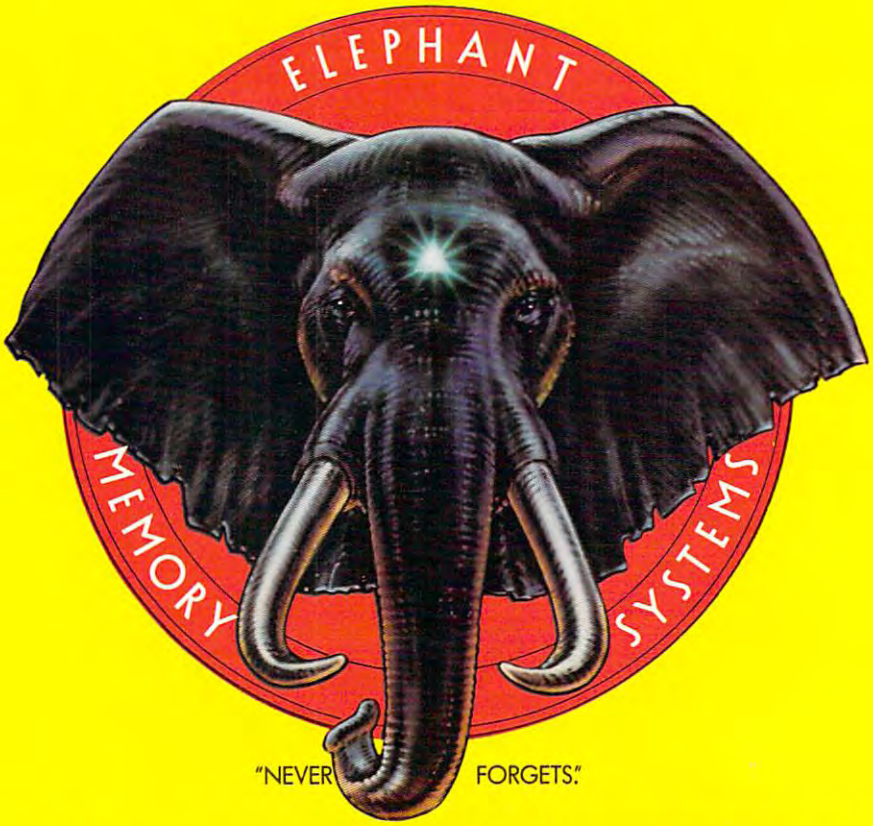

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At Spinnaker Software, we make educational games that are actually fun.

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Our games make the computer screen come to life. With colorful graphics, animation and sound.

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How do we make our games both educational and fun?

We're glad you asked.

Educators and game programmers write our software.

Educators, because they've been in the classroom and know how children learn. And what it takes to keep their interest.

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

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

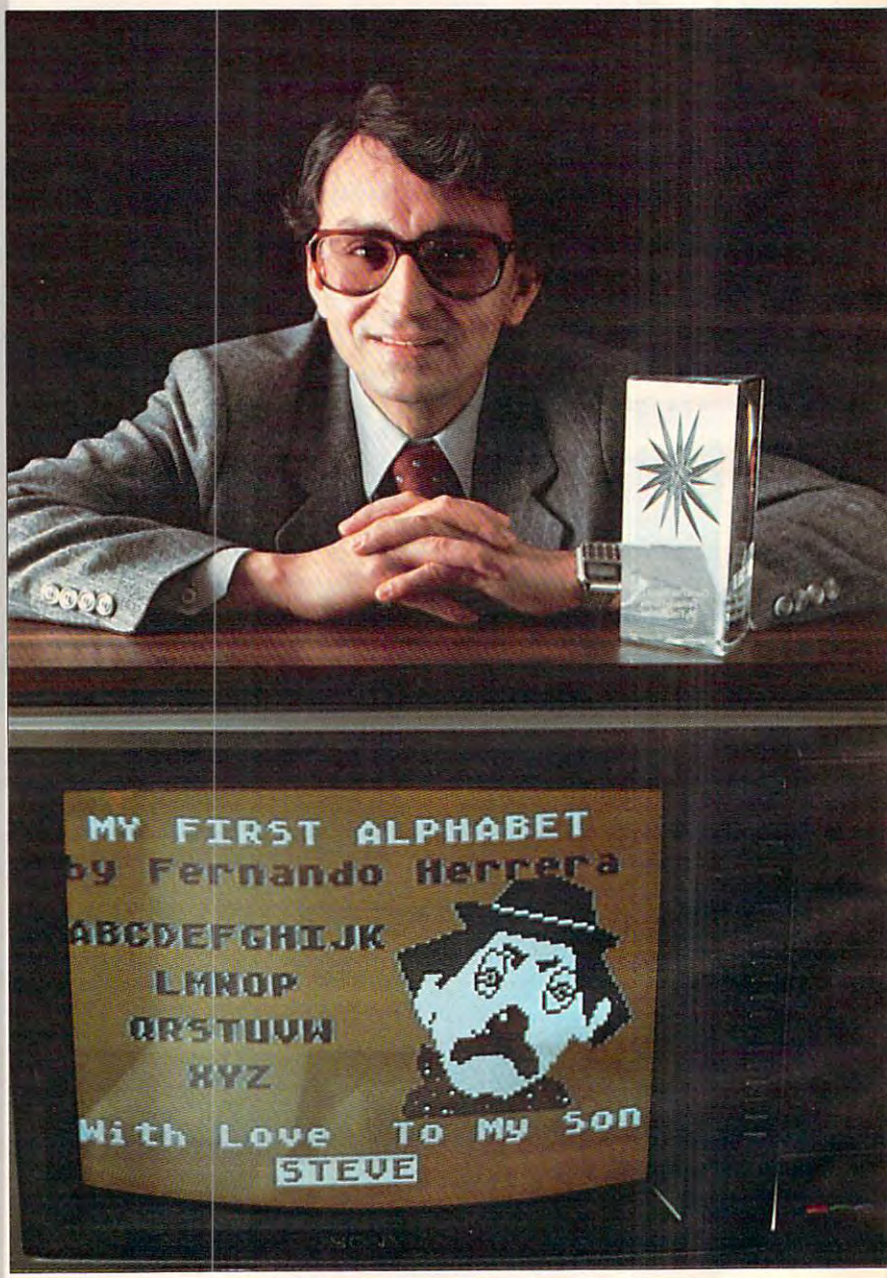
Fernando Herrera became the first grand prize winner of the ATARI Software Acquisition Program (ASAP) competition because he believed in computers, his son and himself.

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 occured 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

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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."

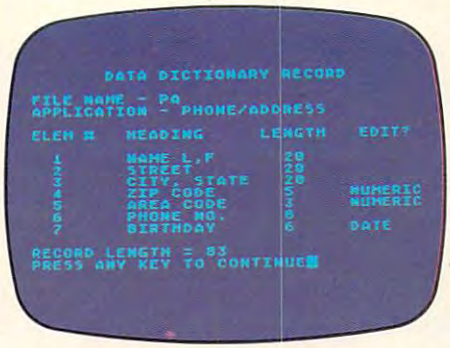
Sheldon Leeman of Oak Park, Michigan, captured an ATARI STAR for his exceptionally well-engineered "INSTEDIT" character set editor.

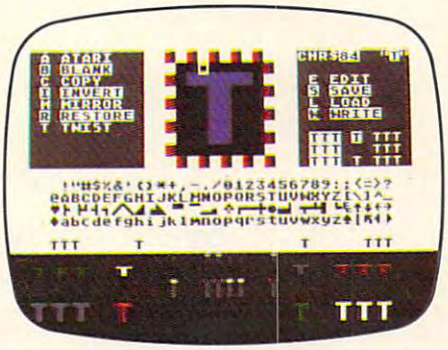
Greg Christensen of Anaheim, California, became our youngest ATARI STAR winner at the age of 17. Christensen designed the clever "Caverns of Mars" game program, which also will be incorporated into the ATARI product line. Greg designed the program in 1½ months after owning his ATARI Home Computer for 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.

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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, TI, 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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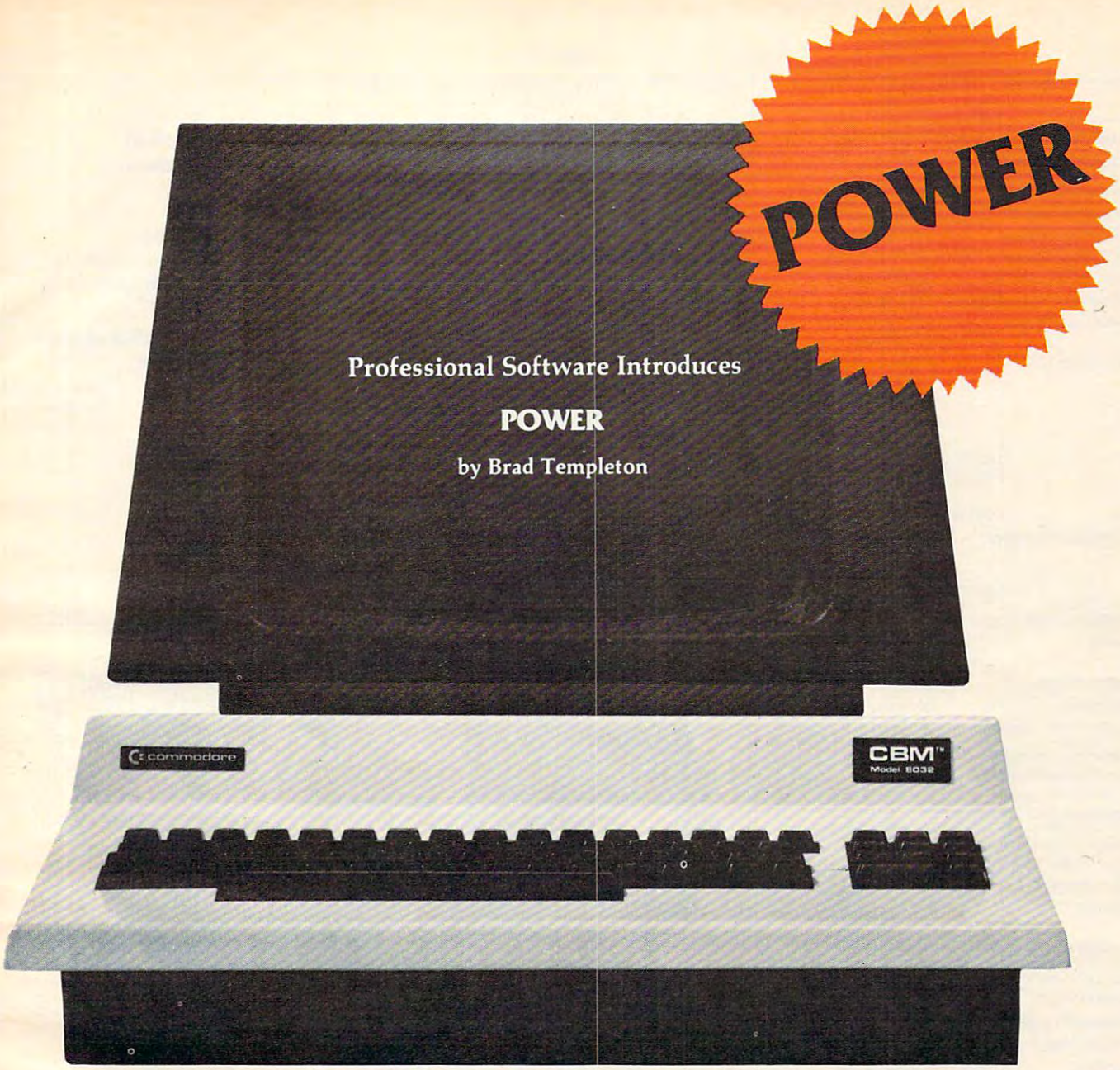

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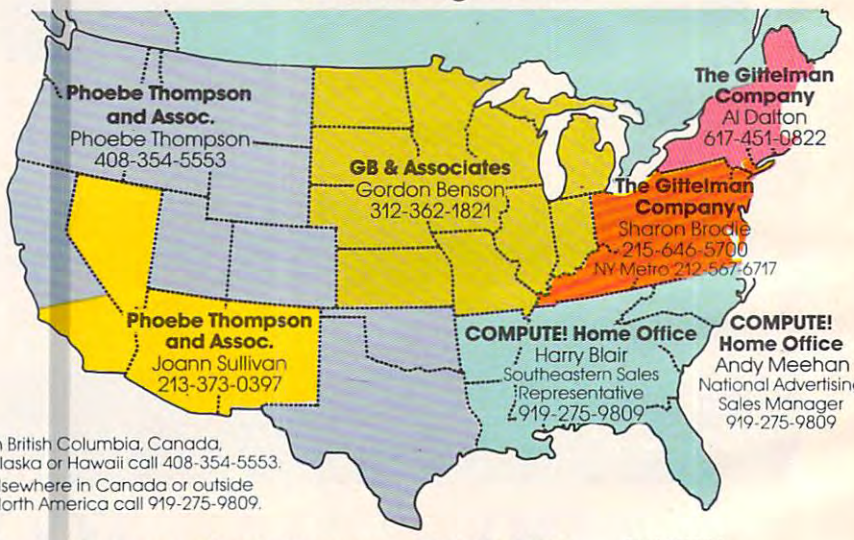

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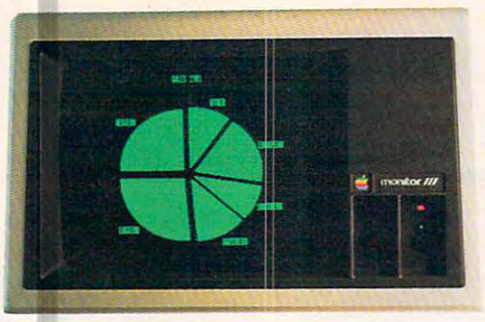
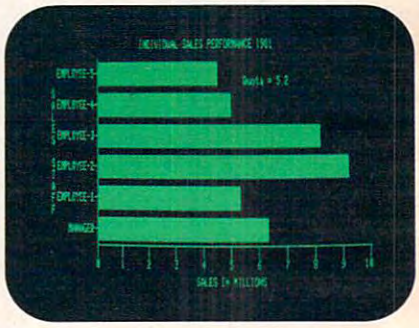
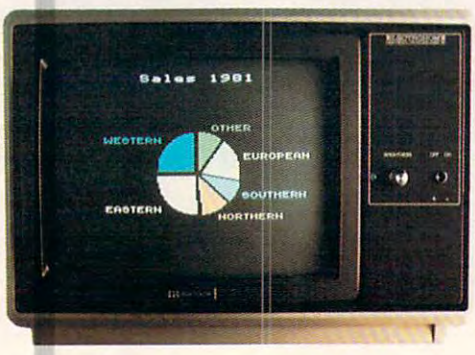
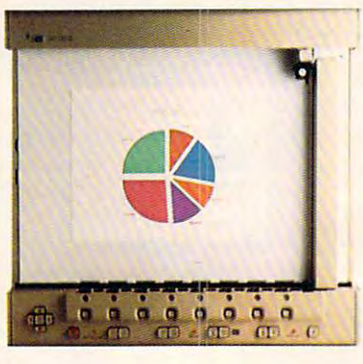


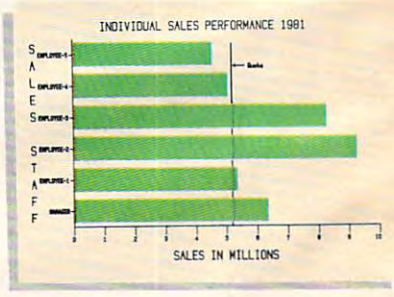


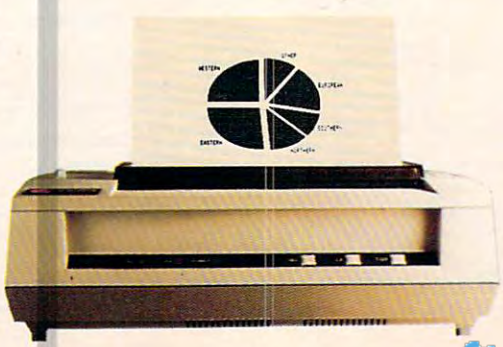


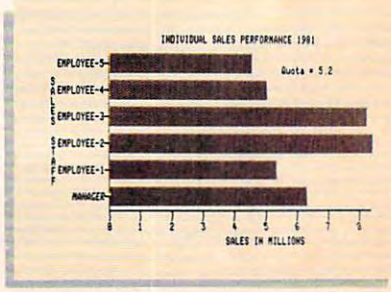
	Apple	VisiTrend/ VisiPlot	pfsGraph
Graph Types			
Line	Yes	Yes	Yes
Vertical Bar	Yes	Yes	Yes
Horizontal Bar	Yes	No	No
Side-by-side Bar	Up to 4	2	4
Pie	Yes	Yes	Yes
Partial Pie	Yes	No	No
Scattergram	Yes	Yes	No
Curve Fitting	5 Kinds	1	None
Data Points (Max.)	3500+	645	36
Plotter Compatible	Virtually Any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

Apple Business Graphics is available for both the Apple II and Apple III.









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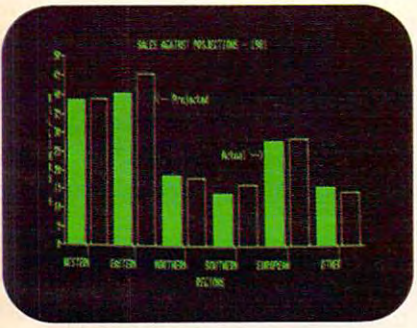

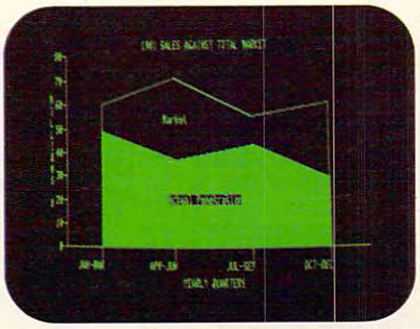

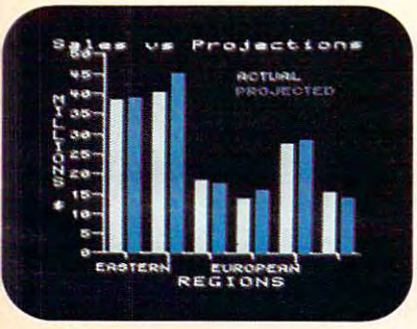

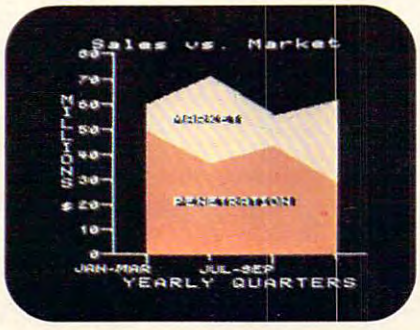

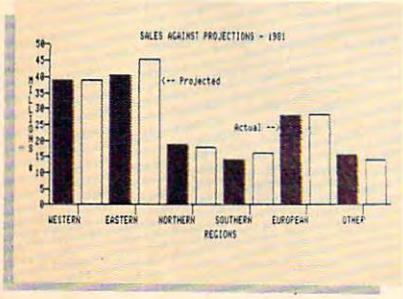

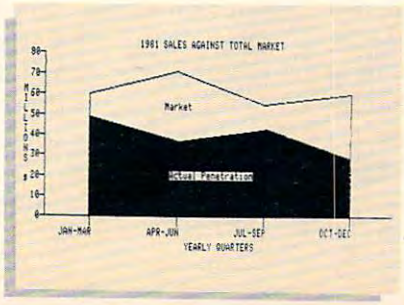

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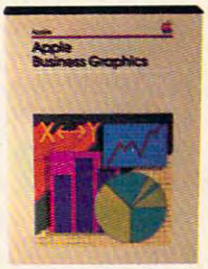

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Ask The Readers

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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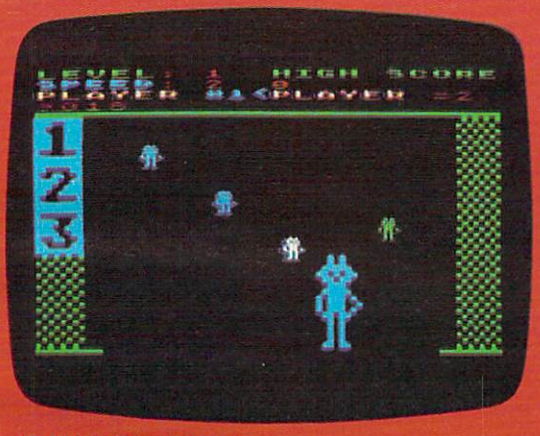
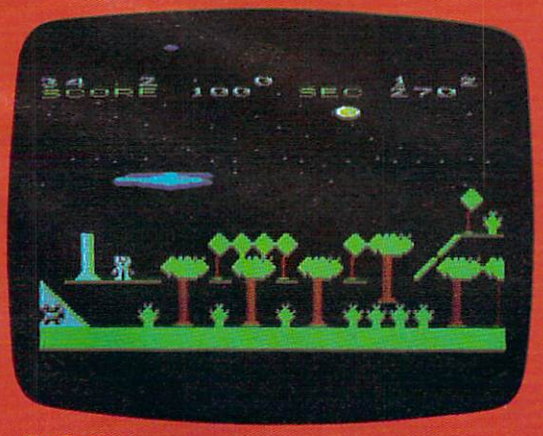
Good News for Kids...

Adventure on a Boat



Robby the Robot Catcher



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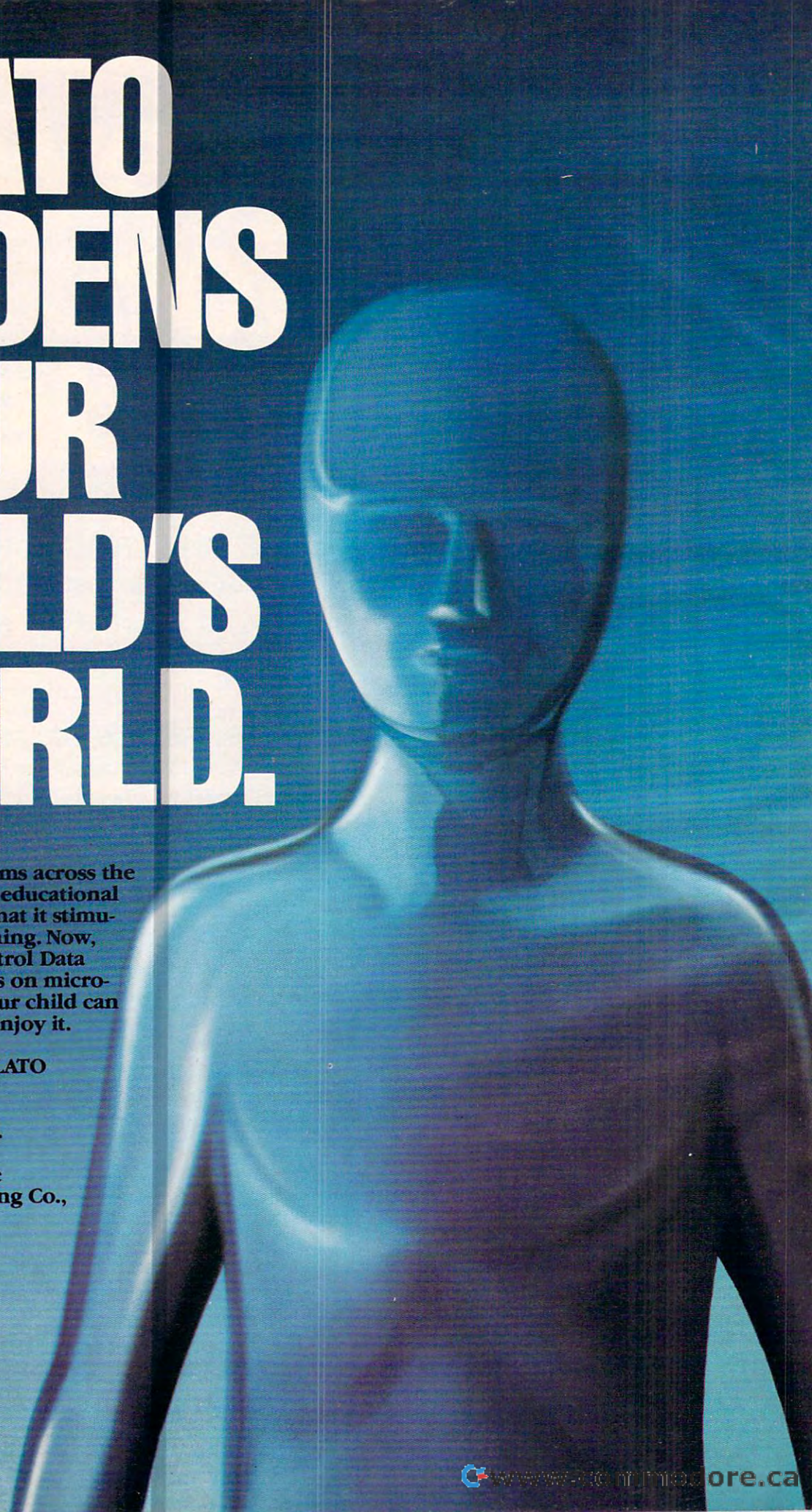

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- **Spanish Vocabulary Builder.**
- **German Vocabulary Builder:** students are presented with a basic vocabulary of 500 words, including useful verbs, number words or common words for traveling or in the home. Groups of related words give learners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

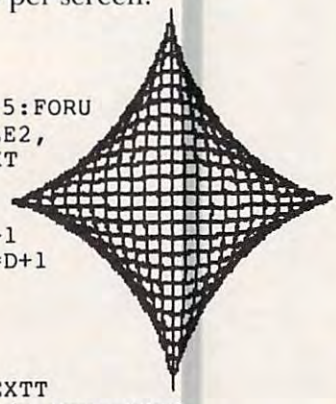
K. Gottlieb

```
10 OPEN #4,9,0,"E:":DIM LL$(40):GRAPH
   ICS 5
31000 OPEN #1,8,0,"P:"
31010 FOR Y=0 TO 39
31020 FOR X=0 TO 79
31030 LOCATE X,Y,Z
31040 IF Z=0 THEN PUT #1,32:GOTO 3108
      0
31050 IF Z=1 THEN PUT #1,42:GOTO 3108
      0
31060 IF Z=2 THEN PUT #1,43:GOTO 3108
      0
31070 PUT #1,111
31080 IF X=79 THEN ? #1
31090 NEXT X
31100 NEXT Y
31110 POKE 656,0:POKE 657,0
31120 FOR Y=0 TO 3:INPUT #4,LL$:? #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$(19)
30 Y=4096:OPEN1,4
40 FORE=0TO154STEP7:D=-1
50 FORZ=0TO190STEP10:D=D+1
60 W=Y+(Z*16)+E
70 FORF=0TO6
80 A%(F)=PEEK(W+F)
90 NEXTF
95 FORT=0TO9:B%(T)=0:NEXTT
100 S=256:FORL=0TO7:S=S/2:FORI=0TO6
110 IF(A%(I)ANDS)=STHENB%(L)=B%(L)+(2↑I)
120 NEXTI:NEXTL
130 FORF=0TO7:IFB%(F)<128THENB%(F)=B%(F)+128
140 A$(D)=A$(D)+CHR$(B%(F)):NEXTF
150 IFD<19THENNEXTZ
160 FORF=0TO18
170 PRINT#1,CHR$(8)A$(F);
180 A$(F)="":NEXTF
190 PRINT#1,CHR$(8)A$(19)
200 A$(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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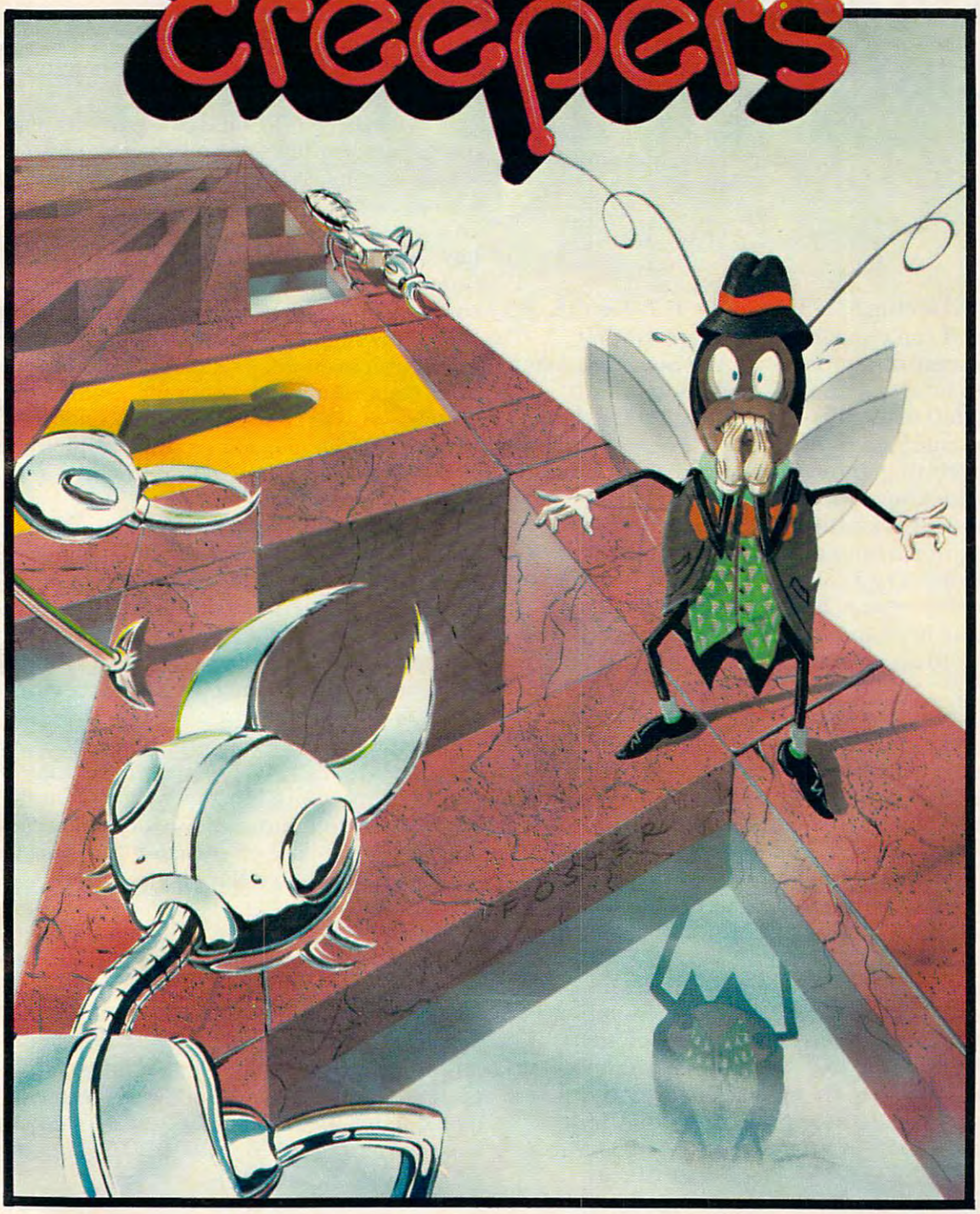
FOR THE
ATARI
400/800

by James Albanese

jeepers creepers



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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.

A typical acoustic-coupled modem for linking computers over telephone lines.

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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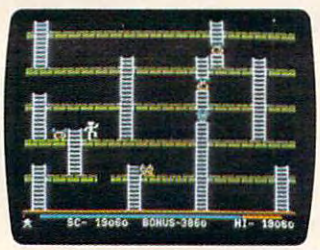

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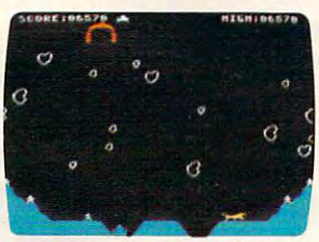

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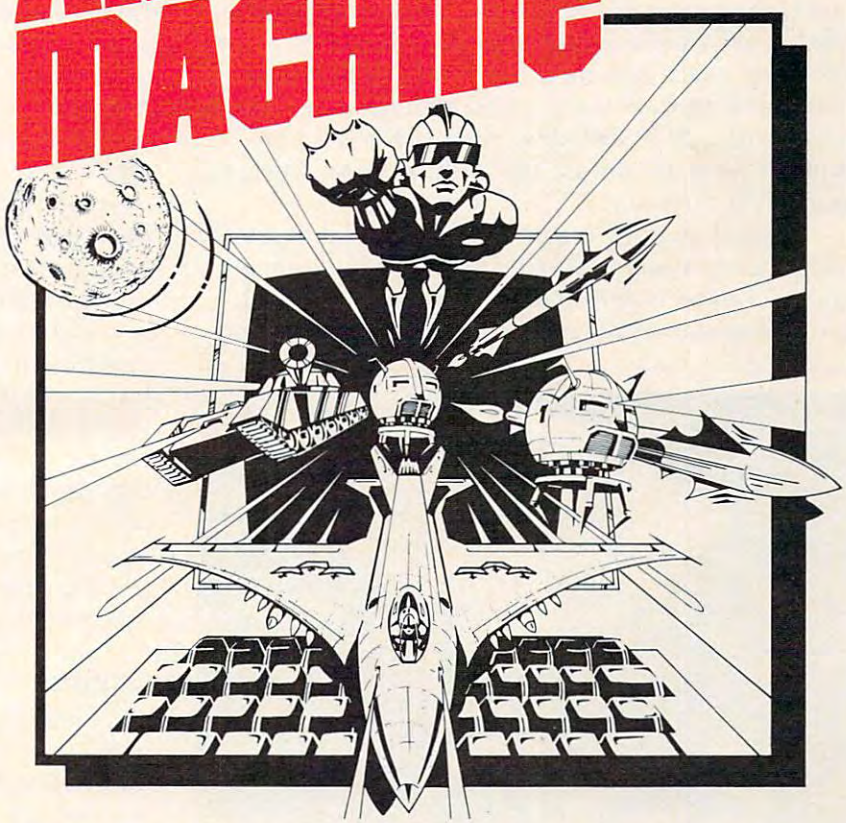

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The main problem with cassettes, of course, is that they're slow. It can easily require five or ten minutes to load or save a program that could be handled by a disk drive in seconds. How valuable is your time to you? A little waiting may be worth 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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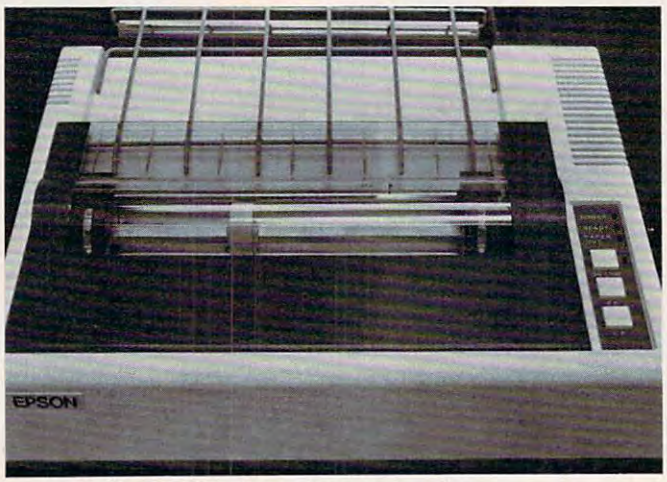
printhead backs up a fraction of an inch and prints it again, filling in the gaps between the dots. This can produce highly legible type (the Atari program listings in **COMPUTE!** are examples of emphasized printing).

An 80-column dot matrix printer.



An example of a 40-column dot matrix printer.

Another thing to check for when looking at dot matrjx 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 low 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 lose. 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 *mo*dulator-*demo*dulator, 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

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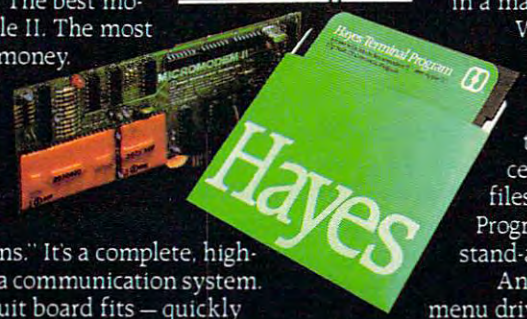

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with the data transmission, a persistent problem with some acoustic modems. An advantage of acoustic modems is that they don't require any special connections to phone lines, but a disadvantage is that a standard telephone handset is mandatory. Phones 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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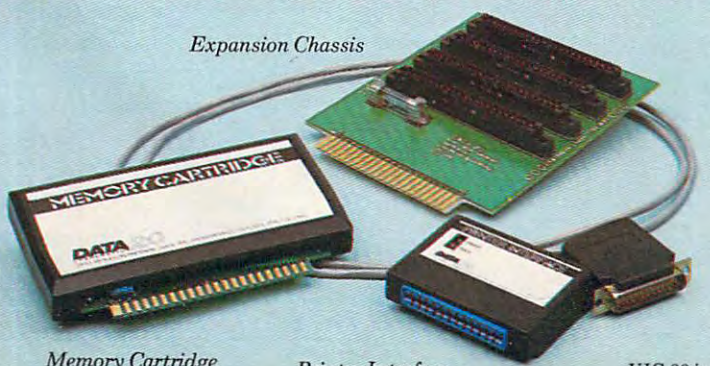

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What's (On) My Line

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 documentation 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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Now you can prevent this from happening to you with an AC Surge Protector from Electronic Protection Devices. Each Protector is a solid state clamping device with 6 outlets utilizing modern high speed semiconductor technology. Using our Protectors is as simple as plugging it into any standard three wire duplex outlet then plugging what needs protection into it. Each Protector exceeds the IEEE 587-1980 Guide for Surge Voltages in Low Voltage AC Power Circuits.

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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.
5835 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.
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San Diego, CA 92110

Universal Data Systems
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U.S. Robotics, Inc.
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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 / D-Cat	Auto-Cat / 212 Auto-Cat	Apple-Cat II / 212 Apple-Cat II	TRS-80 Lynx / Apple Lynx	Microconnection 01 / R1	Microconnection T1	PConnection Modem Card	Microconnection A1A / A2A	Microconnection TC1 / AP1	Microconnection A1 / R1A	Microconnection T1A / A2	Hayes Micromodem 100R / II	Stack Smartmodem 300 / Smartmodem 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 / Apple	Osborne / RS-232	TRS-80 Model I	IBM PC	Atari w/850 / Atari	TRS-80 Color / Apple	Atari w/850 / RS-232	TRS-80 II, III, 16 / Atari	S-100 Bus / Apple	RS-232
Communication Standard	Bell 103	Bell 103 / Bell 103 & 212A	Bell 103 & 202 / Bell 103 & 212A	Bell 103	Bell 103	Bell 103	Bell 103/113	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103	Bell 103 / Bell 103 & 212A
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	Direct-Connect
Baud Rate	0-300	0-300 / 0-300 & 1200	0-300 & 1200	300	300	300	300	300	300	300	300	45-300 / 110 or 300	0-300 / 0-300 & 1200
Duplexing	Both-Switchable	Both-Switchable	Both / Both-Switchable	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	Switchable Or Auto	Switchable	Switchable	Auto	Auto	Switchable / Auto	Switchable / None	Auto / Switchable	None	None
Auto-Answer	No	Yes	Yes	Yes	No	No	Yes	No	No / Yes	No / Yes	Yes / No	Yes	Yes
Auto-Originate	No	Yes	Yes	Yes	No	No	Yes	Yes	No / Yes	No / Yes	Yes / No	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 On Board	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	Yes	No
Terminal Software Included?	No	No	Yes	Yes	No	Yes	Yes	Yes	No / Yes	Yes / No	Yes	No / $30 Option	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 / $199	$249 / $695	$389 / $725	$299.95	$159	$209	$350	$239 / $279	$199.50 / $299	$199	$259 / $249	$399 / $379	$289 / $699

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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
Manufacturer/ Distributor	Microbits	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/CBM 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-Switchable / 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	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."

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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$;:GOTO16
28 REM********LASER FIRE***********
29 POKE,16:POKEF,15:REM*****SOUND
30 X=X+1:Y=3:GOSUB10:FOR I=1TO185STEP5:PRINT"
    @";:POKEG,I:NEXT:POKEE,0:GOSUB10
31 FORI=1TO37:PRINT" ";:NEXT:X=X-1:Y=0
32 REM********CHECK FOR HIT*********
33 IFX+1=AGOTO60
34 IFX+1=A+1GOTO60
35 IFX+1=A+2GOTO60
36 GOTO16
37 REM******LOCATE INVADER SHIP*****
38 A=1+INT(RND(1)*20):IFA<3THENA=3
39 IFA>18THENA=18
40 REM*****PRINT INVADER SHIP********
41 GOSUB11:PRINTIN$: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}_ N{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}){OFF}{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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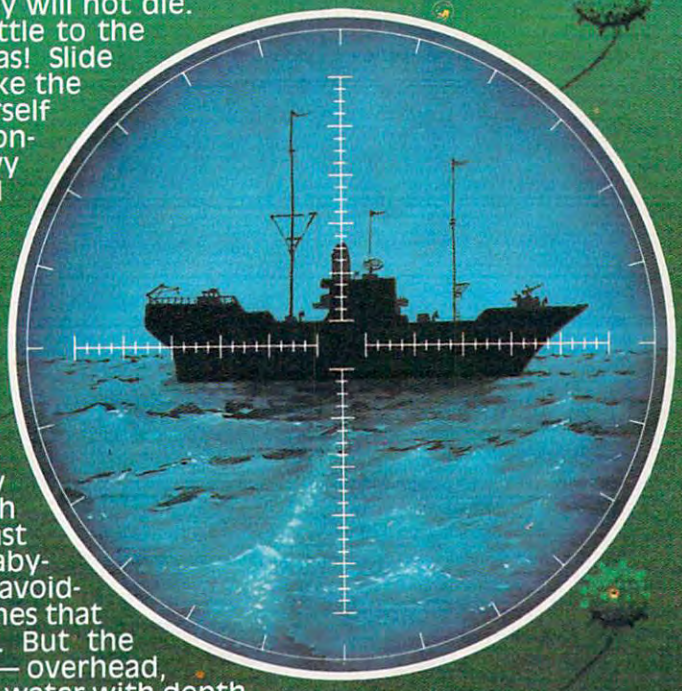

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Notes On The Atari Version:

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 "RAMTOP 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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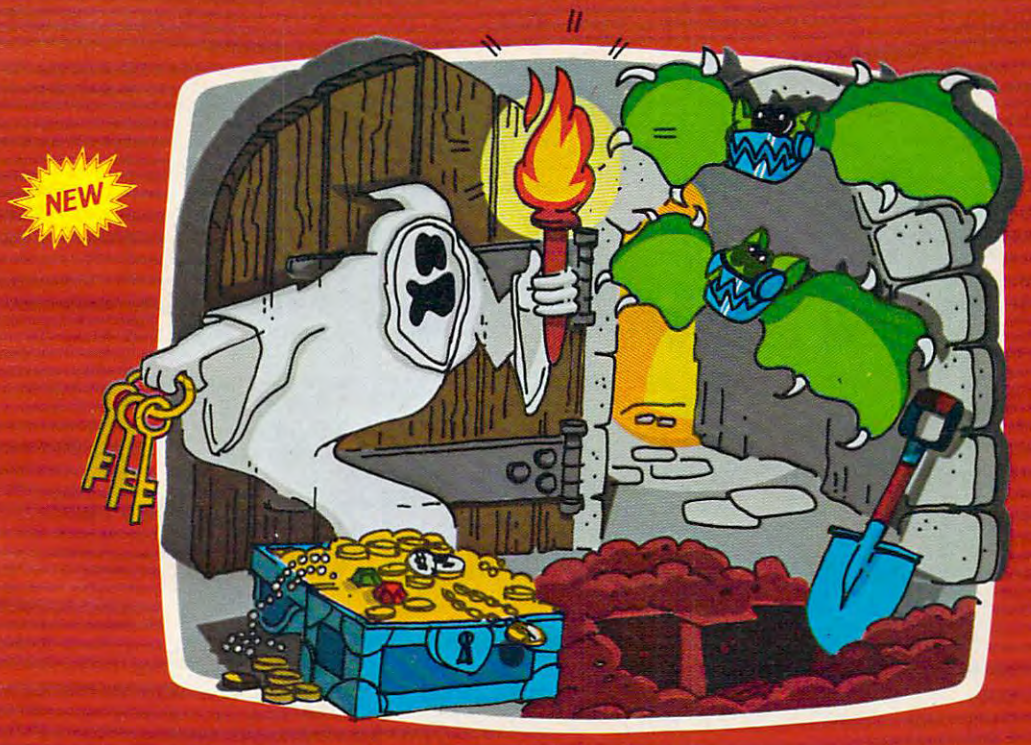

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```
    E UP,HIT 8
146 PRINT"{DOWN}            TO MOVE DOWN,HIT 2
147 PRINT"{Ø2 DOWN}           {REV} PRESS SPACE ~
    TO CONT {OFF}"
148 GETC$:IFC$=""GOTO148
149 GOTO123
```

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$=CHR$(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
    ,0,0,64,0,4,0,0,0,0,0,0,0,128,0
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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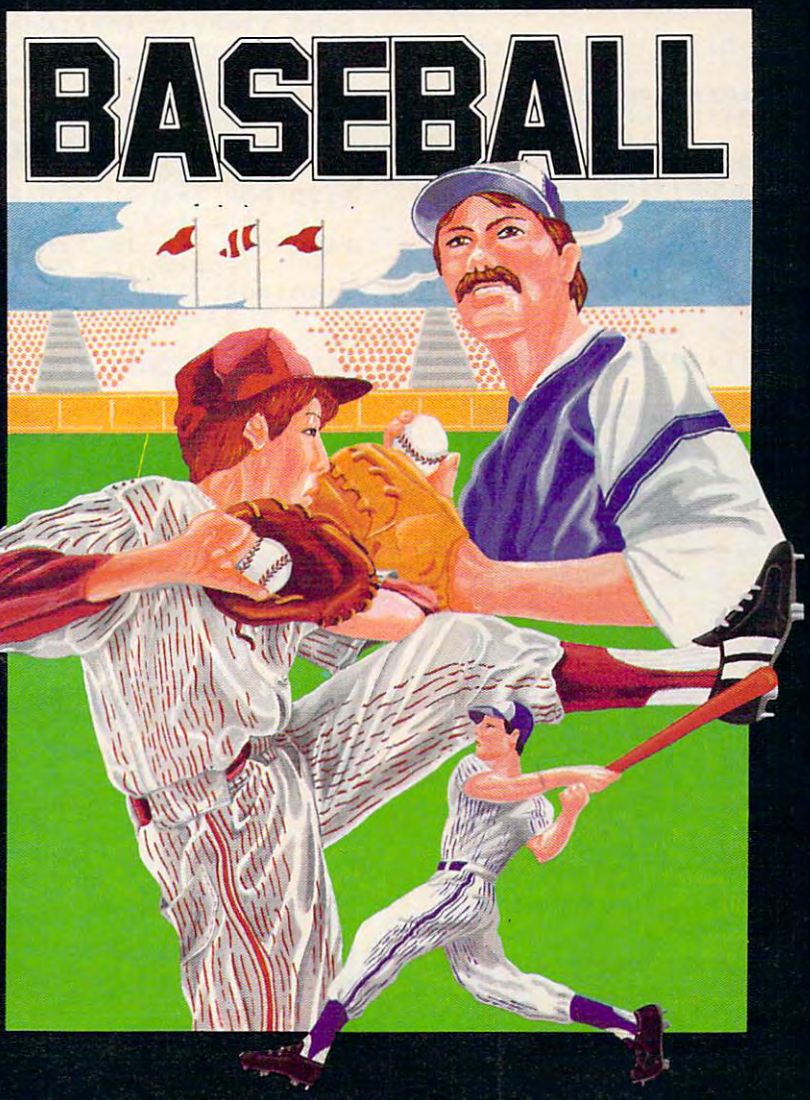

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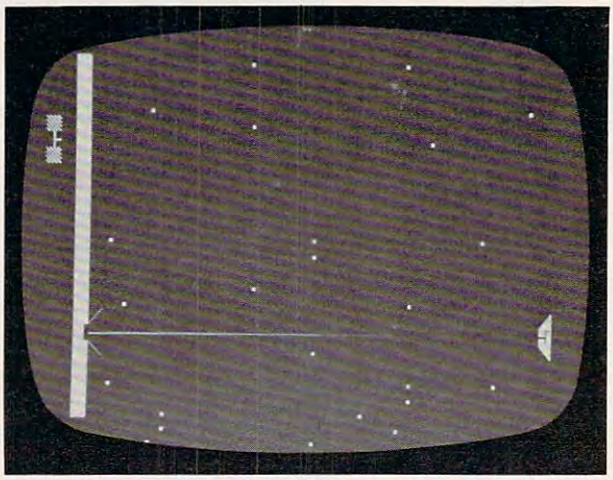
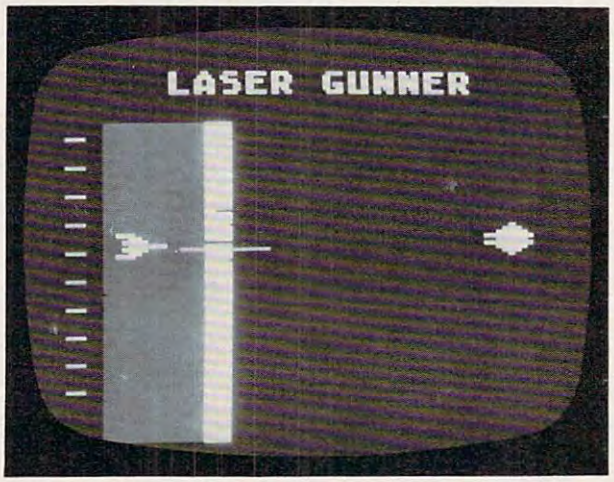
```
800 IF TARGET=0 THEN GOSUB 950:TARGET
    =TARGET(INDEX):REM SELECT A TARGET
810 IF AY<>TARGET THEN 840
820 CNT=CNT-1:IF CNT THEN 630
830 CNT=LEVEL:GOTO 870
840 AY=AY+SGN(TARGET-AY):REM MOVE TOW
    ARDS TARGET
850 PM$(P1+AY,P1+AY+11)=ALIEN$
860 GOTO 630
870 IF ABS(AY-PY)<10 THEN GOSUB 970
880 PM$(MS+AY+5,MS+AY+5)=CHR$(12):REM
     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$(0)
1030 IF Z1<126 OR Z2>30 THEN NEXT I
1040 FOR I=30 TO 1 STEP -1:FOR J=0 TO
      20 STEP 3:SOUND 0,J+I,10,8:POKE
      707,PEEK(53770):NEXT J:NEXT I
1050 SOUND 0,0,0,0:SOUND 1,0,0,0:POKE
      707,14:FOR W=1 TO 50:NEXT W:POK
     E 707,0
1060 FOR I=0 TO 15 STEP 0.2:SOUND 0,I
     ,8,I:POKE 704,16+I:NEXT I
1070 SOUND 0,0,0,0
1080 Z1=PY:Z2=PY:INCR=0
1090 Z1=Z1+INCR*(Z1<128):Z2=Z2-INCR*(
     Z2>=0):POKE 704,PEEK(53770)
1100 PM$(P0+Z1,P0+Z1)=CHR$(255):PM$(P
     0+Z2,P0+Z2)=CHR$(255):POKE 53279,0
1110 INCR=INCR+0.5:IF Z1<127 OR Z2>0
     THEN 1090
1120 FOR I=1 TO 100:POKE 704,PEEK(537
     70):NEXT I:REM FLASH PLAYER
1130 FOR I=0 TO 7:POKE 53248+I,0:NEXT
      I:GRAPHICS 2+16
1140 POSITION 4,0:? #6;"laser gunner"
     :POSITION 3,5:? #6;"your score w
     as:";
1150 POSITION 10-LEN(STR$(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
```



"Laser Gunner," PET/CBM version: the alien craft begins blasting a hole in the protective shield.



"Laser Gunner," Atari version: the protective shield is breached.

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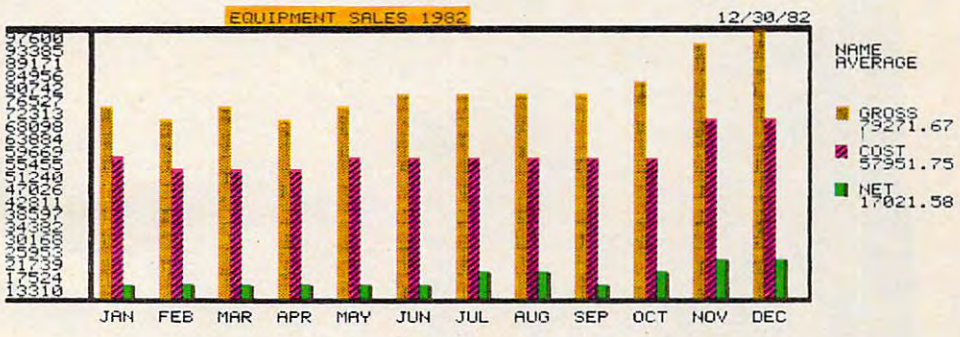

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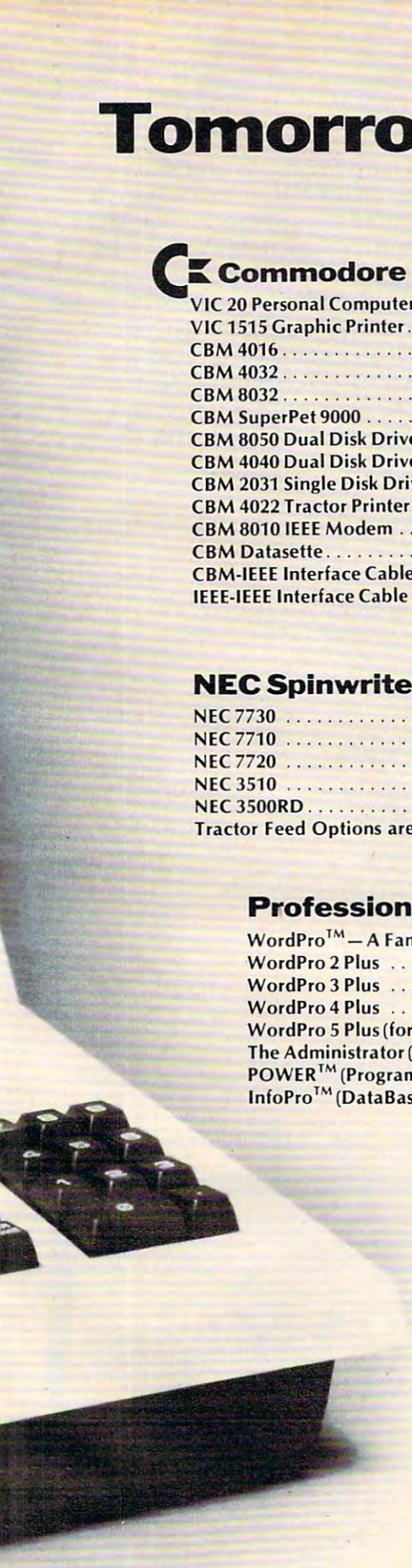

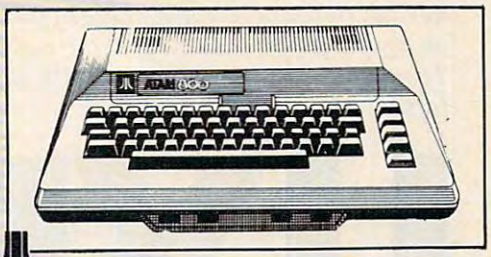

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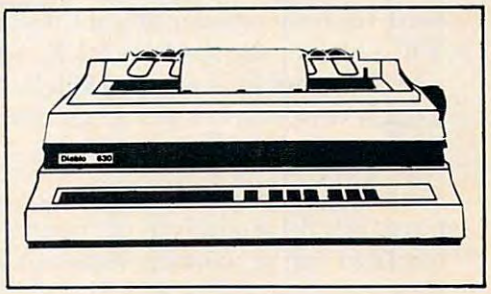

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For Atari and VIC, a game which tests both dexterity and nerve. Unexploded bombs litter a minefield. Your job is to quickly defuse the bombs without tripping a mine. The VIC version saves memory space by putting the instructions on a separate program. Type in Program 1 and SAVE it. Then type in Program 2 and SAVE it on the same tape (after Program 1).

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.

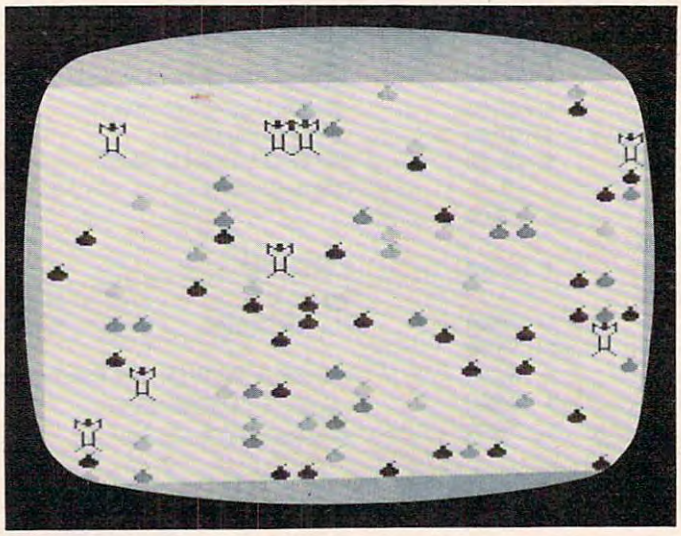
A Few Complications

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.

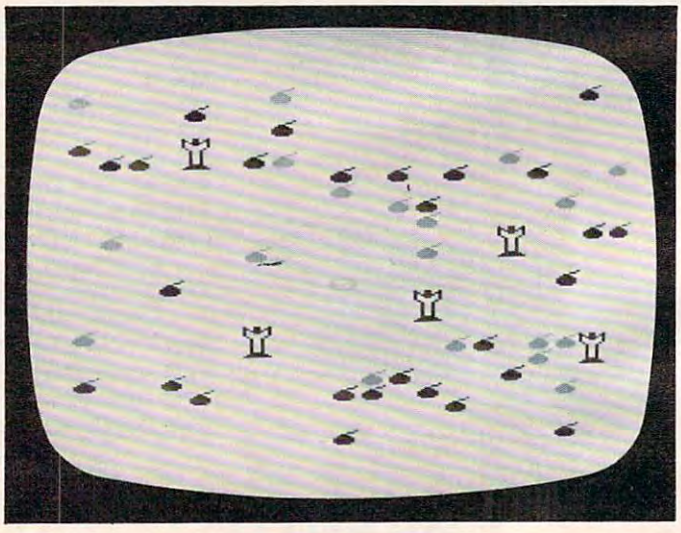
Using the keyboard for movement makes the game quite challenging for VIC owners, since it takes a while to get used to such movement. Hold a key down to continue movement in the selected direction, but let go before you hit a mine! A joystick makes movement much easier so an extra incentive was added 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 TRANSPO
    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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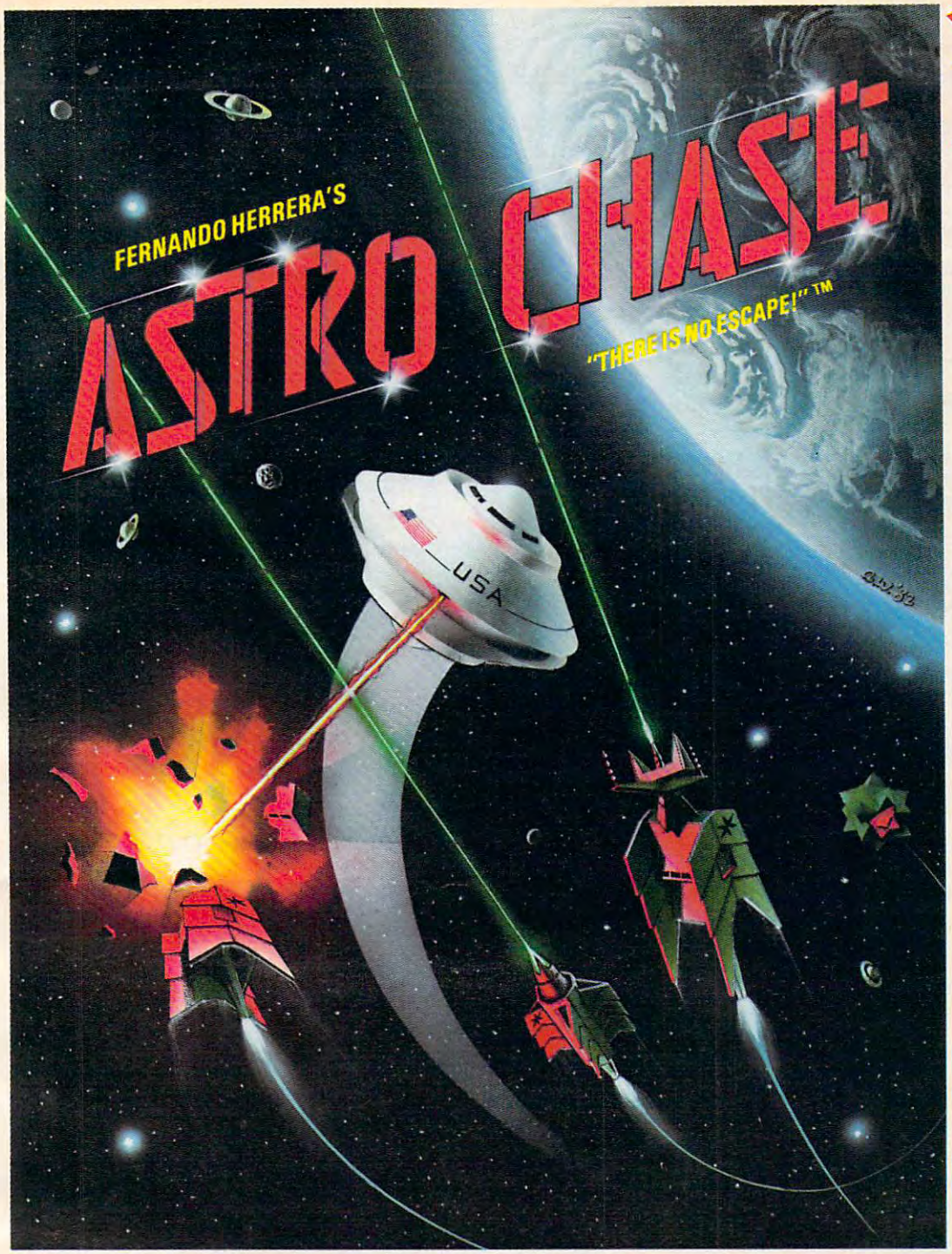

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```
    D  WWII UXB'S(UNEXPLODED GERMAN ROCKE
    T";
470 PRINT" BOMBS). YOU MUST DE-FUSE THE  UXB'S
     BY SIMPLY RUN-  NING INTO THEIR TAIL
    S.";
480 PRINT"IF YOU HIT AN OLD BOMBYOU WILL BE BL
    ASTED!! IF YOU GET ALL THE "
490 PRINT"UXB'S YOU WILL GET TWOMORE ON THE NE
    XT ROUND-IF YOU DON'T MAKE IT";
500 PRINT" YOU GET TWO LESS (DOWNTO 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*RN
    D(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{P}":GOTO 490
480 ? #6:? #6;"{3 SPACES}high score
    {Z}";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;"  {R}{2 P} point bonus
    {P}"
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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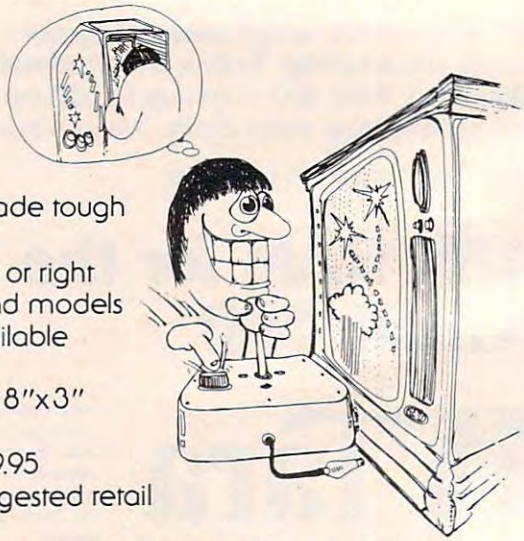

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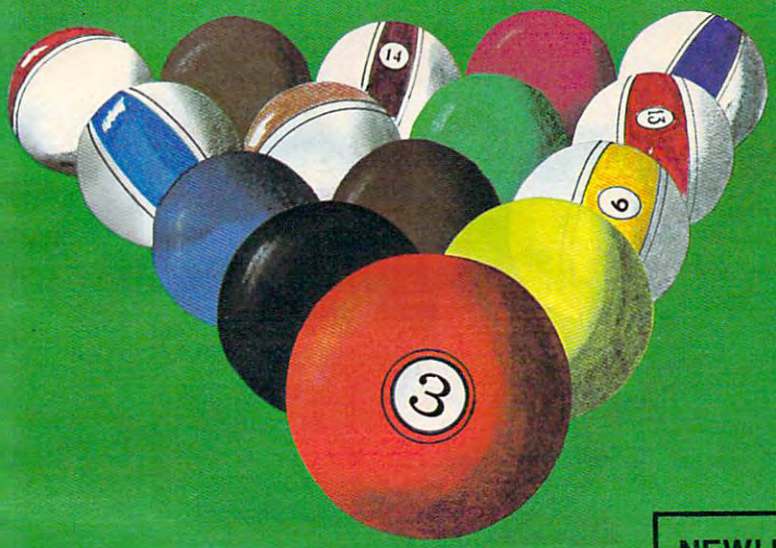

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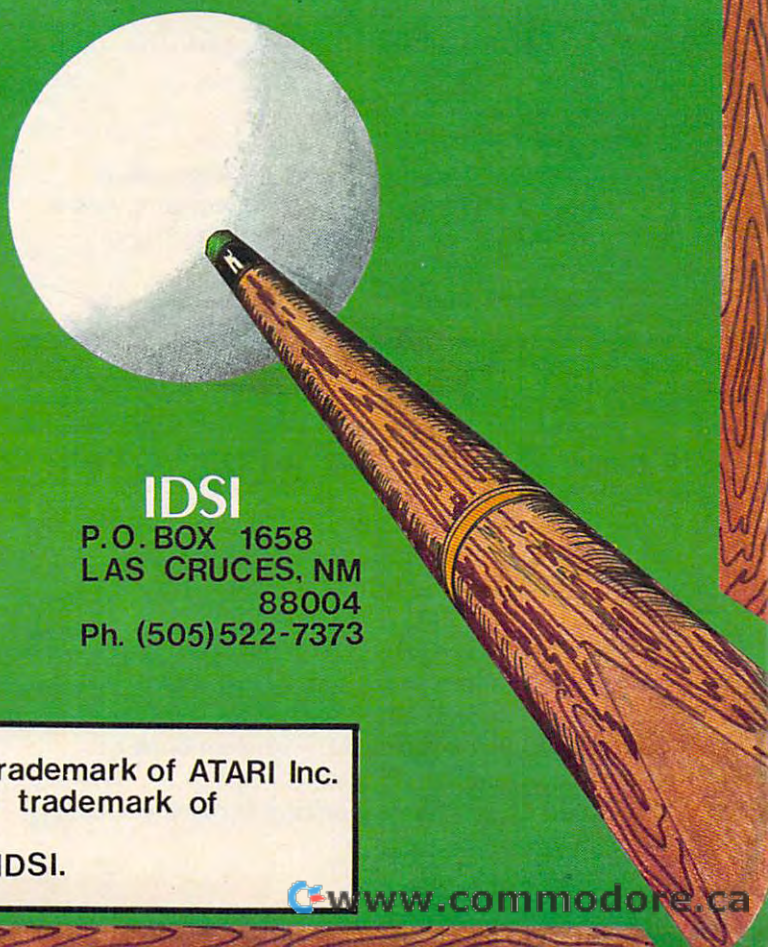

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Part I

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 espression 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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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.
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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

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

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.
16K Tape, $19.95

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.
48K 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.
16K Tape or Disk, $29.95

FINANCIAL WIZARD
From Computari
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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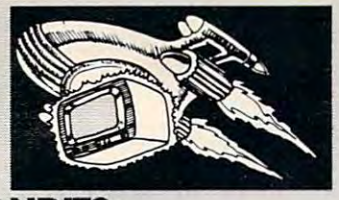

BANDITS

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.

48K Disk, ~~$29.95~~ *Save 20%!*

Now Thru Dec. 1 You Pay Only $23.96

MOONBASE Io

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: Io, 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.

16K Tape or 32K Disk, ~~$29.95~~ *Save 20%!*

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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!

32K Disk, ~~$29.95~~ *Save 20%!*

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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 stationery; 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

VAULTS OF ZURICH

By Felix & Greg Herlihy 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**

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!

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

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

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.

16K Tape or Disk, $29.95

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.

16K Tape or Disk, $34.95

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.

16K Tape, $15.00

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FAR PROTECTOR

From Epyx

YOU are the final defense against the enemy's nuclear attack! Six cameras are your eyes on the sky; you're armed with a Repulser Beam and laser system. Your charge: Destroy the enemy's satellites and missiles. Requires joystick.

ROM Cartridge, $59.95 16K Required

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 IDSI

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 Bonks, Anti-Particle Lasers, Gorfian fighters and torpedos, etc. Four levels, from an Astrobattle to a full-fledged Space War. Requires joystick.

ROM Cartridge, $44.95 16K Required
Disk, $39.95 24K Required

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

Hoards 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.

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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.

ROM Cartridge, $49.95
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.

ROM Cartridge, $39.95 4K Required

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

Watch out—those Beanies are back, buzzing the city, and that means ***trouble!*** Shooting them makes them meaner; poison doesn't work—what can we do? It's BEANY BOPPER to the rescue, with his pivotal laser and rapid-fire stunt gun. Fast action, exciting sound and color; 6 play options. Requires joystick. **Also available for VCS.**

ROM Cartridge

ALIEN GARDEN

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.

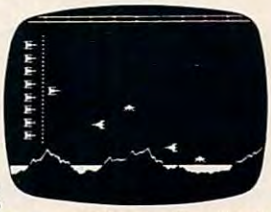
ROM Cartridge, $39.95 16K Required

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 Worriors, and do battle with the monsters you encounter, like the Burwors, Garwors, Worluk and enemy Worriors. Only then can you turn your attention to the Wizard, who can teleport magically around the screen, hurtling 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 PPLOT 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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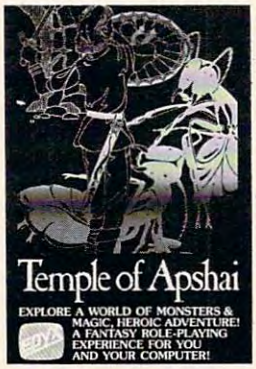
Slaying Monsters Should Be Mostly Fun and Games



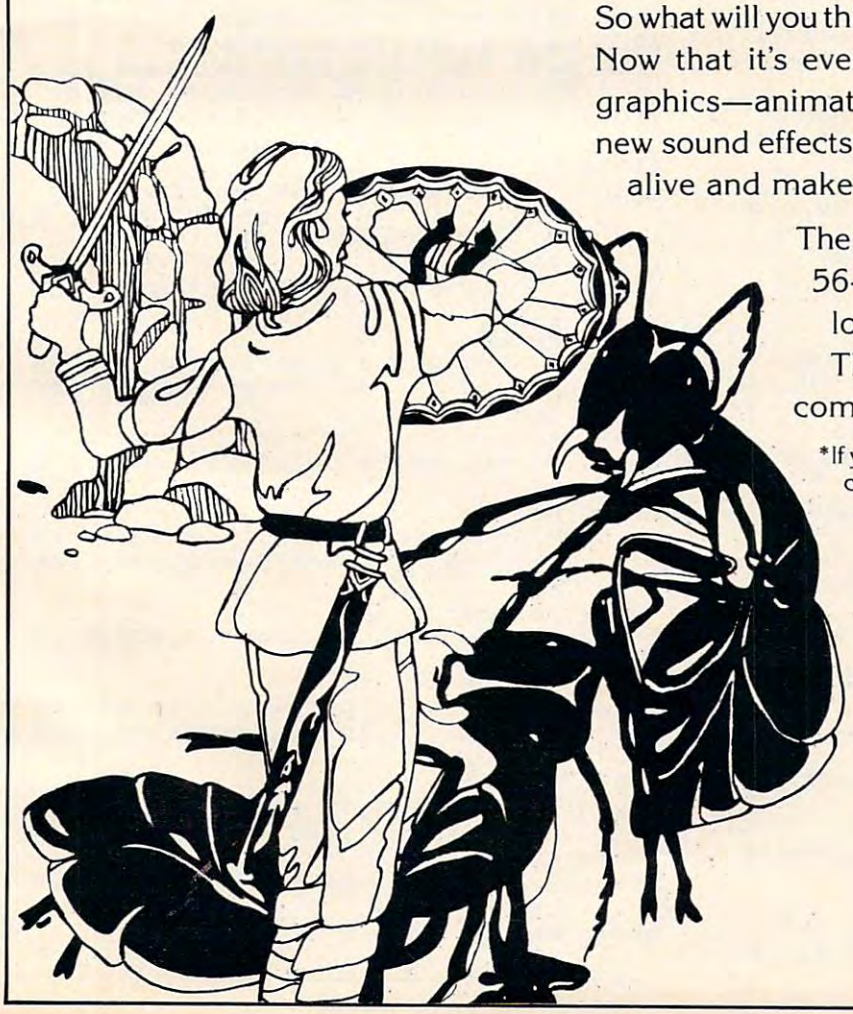
Be one of more than 16 million alter-egos that your computer can generate. Walk into a labyrinth filled with traps, treasures and monsters. There you'll test your strength, constitution, dexterity, intelligence . . . against thousands of monsters in over 200 caverns and chambers—growing in wealth, power and experience as you progress through the four levels of the dungeon.

Your character will do whatever you want him to do. Do battle—in real time—with the likes of giant ants, ghouls, zombies...Explore the various levels of the maze and discover the great treasures within.

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.

So what will you think of The Temple of Apshai now? Now that it's even better than ever. With better graphics—animated movement—and completely new sound effects that make your computer come alive and make The Temple even more fun.*

An EPYX game from Automated Simulations



The Temple has a superbly illustrated 56-page Book of Lore, and your local dealer has it for the ATARI,** TRS-80,** APPLE,** and IBM** computers.

*If you already have The Temple of Apshai, you can enjoy these great improvements. Just send us your original cassette or disk together with your check for $5.00 and we'll send you the brand new version—with better-than-ever graphics and sound.

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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:VPLOT=150:PPLOT=200:HP
     LOTT=250:HPLOTTRF=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 PPLOT
2080 RESTORE 2300:COLOR 1:GOSUB PPLOT
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$:RESTORE
     2960:GOSUB CHECKI
2910 IF INDEX=0 THEN ? "ANY ANSWER IS
      A GOOD SIGN":GOTO 2950
2920 IF INDEX=1 THEN ? "I'M GLAD":GOT
     O 2950
2930 ? "YOU MUST HAVE GOTTEN OUT OF T
     HE WRONG SIDE OF BED THIS MORNIN
     G"
2940 ? "ANYWAY, ";:GOTO 2950
2950 ? "MY NAME IS ATARI":GOTO 3000
2960 DATA YES,1,Y,1,YEAH,1,NO,2,N,2,E
     ND,0
3000 ? "WHAT IS YOUR NAME";:INPUT INP
     UT$
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,GRANDADDY,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 wherever 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:

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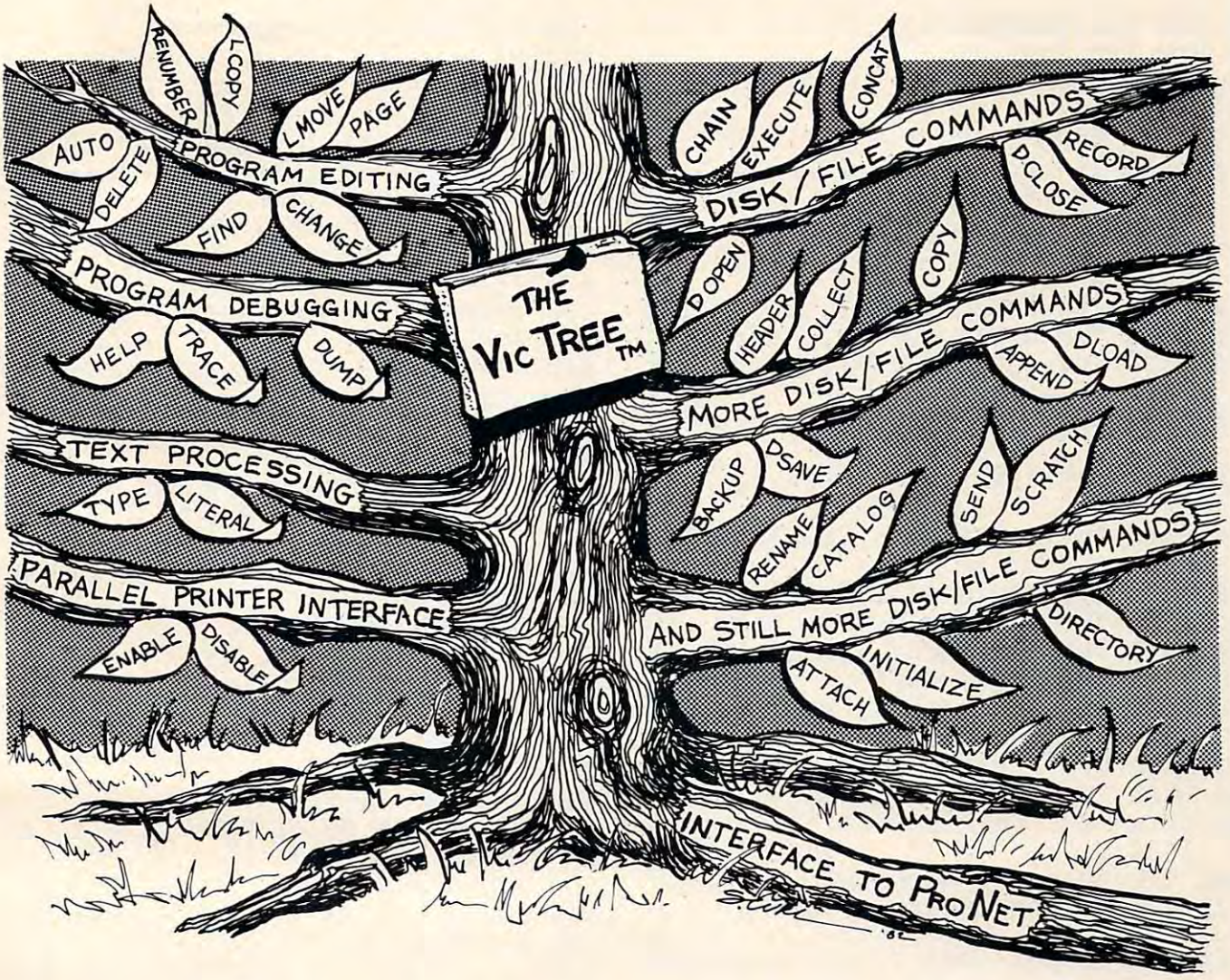

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```
1 REM THE HARMONIZER
2 REM THE TUNE IS
3 REM "SILENT NIGHT"
4 REM
10 DATA "VS G3A1G2E6,  G3A1G2E6"
12 DATA "VS D3R1D2B6,  C3R1C2G6"
14 DATA "VS A3R1A2C3B1A2, G3A1G2E4
    R2"
16 DATA "VS A3R1A2C3B1A2, G3A1G2E5
    R1"
18 DATA "VS D3R1D2F3D1B2, 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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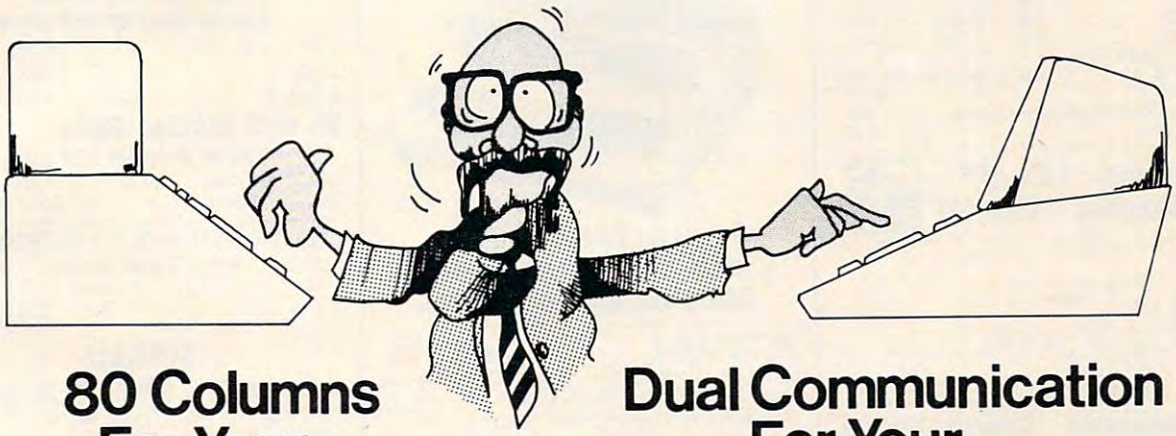
IT'S ENOUGH TO MAKE YOUR HEAD SPIN



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NEW Version with TURTLE GRAPHICS

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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.

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RANDOM ACCESS DATA BASE

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

MAILING LABELS

Typical mail records may be packed 3000 per disk on 8050 (1400 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

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COMPLETE DISK RECOVERY SYSTEM FOR CBM DRIVES
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- duplicate disks, skipping over bad blocks
- complete diagnostic facilities
- un-scratch scratched files
- check and correct scrambled files
- recover improperly closed files
- extensive treatment of relative files
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- comprehensive user manual (an excellent tutorial on disk operation and theory).

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Two ports with full bipolar RS232 buffering. Baud rates from 300 to 4800. For PET/CBM, AIM, SYM.

CBM Software

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CMAR Record Handler	110
UCSD Pascal (without board)	135
Wordcraft 80	300
BPI Accounting Modules	300
Professional Tax Prep Sys.	600
Intelligent Terminal Emulator	25
ASERT Data Base	375
Personal Tax Calc	55
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.

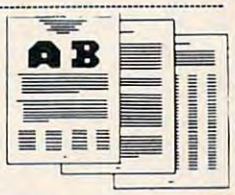
Runs on any 16K or 32K PET/CBM (including 8032) with ROM 3 or 4, and CBM disk drive. Please specify configuration when ordering.

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**

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

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

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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 A$: IF A$ = "N" THEN ~
    Q = 1: VTAB 9: GOTO 1420
1260 IF A$ = "Y" THEN 1280
1270 IF A$ < > "Y" THEN 1250
1280 PRINT : VTAB 10: PRINT "ARE THERE MORE THA
    N 100 ENTRIES ? (Y/N)";
1290 GET A$: IF A$ < > "Y" AND A$ < > "N" THEN ~
    1290
1300 IF A$ = "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 A$
1340 IF A$ = "S" THEN Q = 1: GOTO 1370
1350 IF A$ = "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 A$
1390 IF A$ = "P" THEN 1420
1400 IF A$ = "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 "   ";A$
1480 IF A$ = "" THEN 1590
1490 I = VAL (A$)
1500 IF I > LX THEN LX = I
1510 IF I < SX THEN SX = I
1520 IF G THEN INPUT "FREQ: ";Q : PRINT
1530 X(E,0) = I
1540 X(E,1) = Q
1550 N = N + Q
1560 T = T + Q * I
1570 TS = TS + Q * I  2
1580 GOTO 1450
1590 PRINT
1600 REM *** CALCULATIONS & DISPLAY
1605 ONERR GOTO 1640
1610 E = E - 1
1620 MN = T / N
1630 V = (TS - N * MN  2) / (N - S)
1640 HOME : PRINT " #ENTRIES: "E
1650 PRINT " # DATA: "N
1660 PRINT "   RANGE: "SX" TO "LX
1670 PRINT "   TOTAL= "T
1680 PRINT "    MEAN= "MN
1690 PRINT "VARIANCE= "V
1700 PRINT " STD DEV= " SQR (V)
1710 PRINT "  MEDIAN= ";: INVERSE : PRINT "SORT
    ING": NORMAL
1715 IF MD = 0 THEN GOSUB 1030
1720 J = 0:M = INT (N / 2): L = N - 2 * M
1730 FOR I = 1 TO E
1740 IF X(I,0) = X(I + 1,0) THEN X(I + 1,1) = X
    (I,1) + X(I + 1,1):X(I,1) = 0
1750 IF X(I,1) THEN J = J + X(I,1)
1760 IF J = M AND L = 1 THEN MD = X(I + 1,0):M ~
    = 1E10
1770 IF J = M AND L = 0 THEN MD = (X(I,0) + X(I
     + 1,0)) / 2:M = 1E10
1780 IF J > M THEN MD = X(I,0):M = 1E10 : L = 1
1790 NEXT
1800 VTAB 8: HTAB 11: PRINT "       "
1810 VTAB 8: HTAB 11: PRINT MD;: IF L = 0 THEN ~
    PRINT " (NOT A DATA POINT)";
1820 PRINT
1830 PRINT : INVERSE : PRINT "DATUM    FREQUENC
    Y CUM.FREQ." : NORMAL : PRINT
1840 J = 0:K = 0:CU = 0
1850 FOR I = 1 TO E
1860 IF X(I,1) THEN CU = CU + X(I,1): PRINT X(I
    ,0); TAB ( 16);X(I,1); TAB( 23);CU
1865 J = J + 1: K = K + 1
1870 IF J < 10 THEN 1920
1880 IF I > = N THEN 1920
1890 PRINT : INVERSE : PRINT " MORE...PRESS A K
    EY ";: NORMAL
1900 GET A$
1910 GOSUB 2020
1920 NEXT I
1930 IF.K < 11 THEN 1970
1940 VTAB 22: PRINT : PRINT "REVIEW THE DATA? (
    Y/N)";
1950 GET A$
1960 IF A$ < > "N" THEN GOSUB 2020: GOTO 1840
1970 VTAB 22: PRINT : INVERSE : PRINT " ENTER N
    EW DATA? (Y/N)";: NORMAL
1980 GET A$
1990 IF A$ = "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
```

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 " ";
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
     UENCY{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
```

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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"THENG=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"FREQ";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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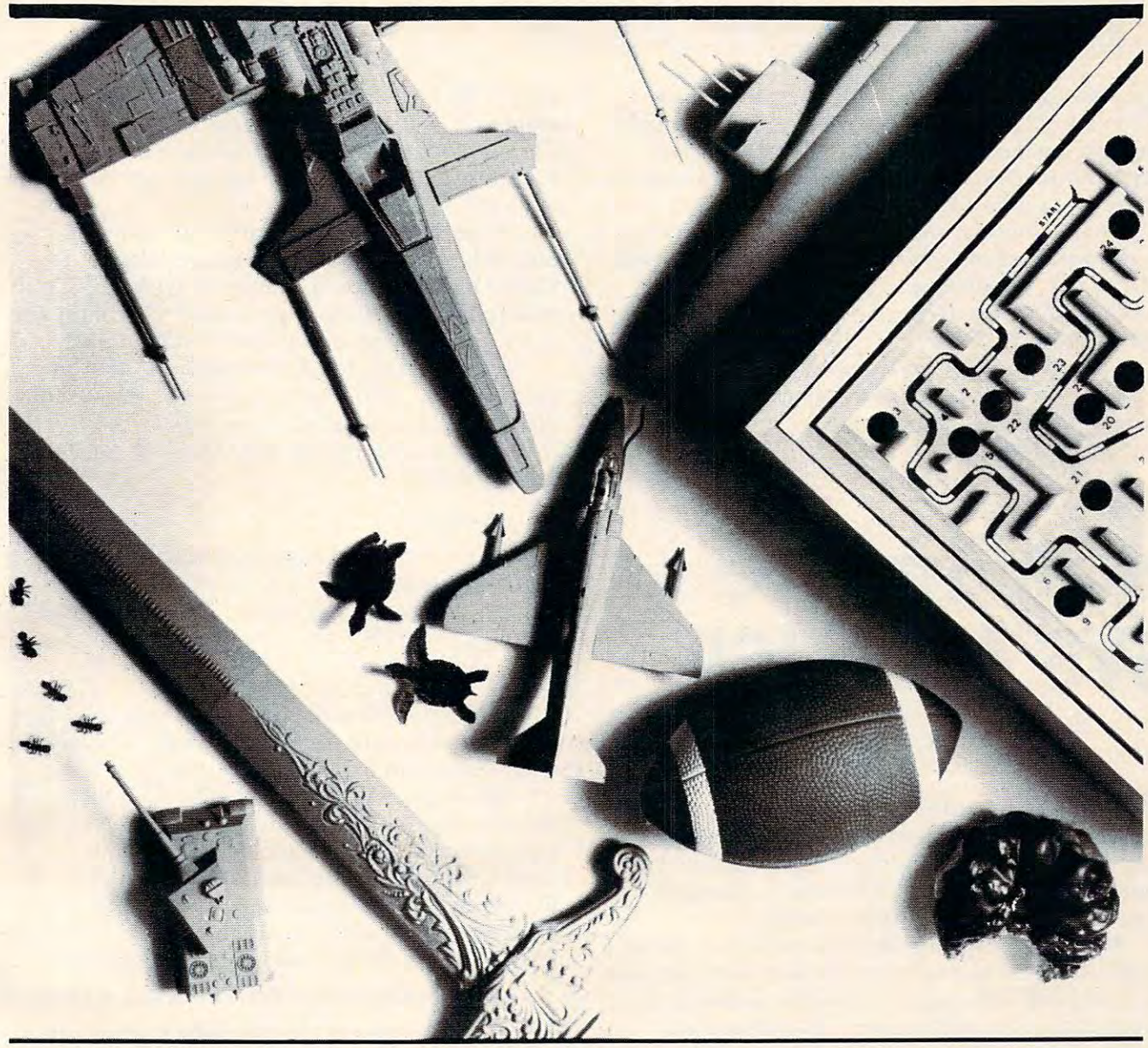

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In addition to providing an introduction to the use of SYS which allows you to take advantage of the machine language routines in your BASIC's ROM chips, this article also demonstrates a way to pass information between BASIC and machine language.

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 1.

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

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top titles in programming

#5534 **The BASIC Conversions Handbook for Apple™, TRS-80™, and PET™ Users** (Brain Bank) A complete guide to converting Apple II and PET programs to TRS-80, TRS-80 and PET programs to Apple II, and TRS-80 and Apple II programs to PET. Equivalent commands are listed for TRS-80 BASIC (Model I, Level II), Applesoft BASIC, and PET BASIC, as well as variations for TRS-80 Model III and Apple Integer BASIC. Also describes variations in graphics capabilities. **$8.95**

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#5855 **Advanced BASIC: Applications and Problems** (Coan) "... a useful textbook to the student in a follow-up course, or the programmer acquiring BASIC as his second or third language... well above average..." *Data Processing Digest.* Advanced techniques and applications, including coordinate geometry, area under a curve, sequences and series, polynomials, simulations, and games. **$12.75**

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CARD GAMES

NEW

BRIDGE MASTER (Available for all computers) Price: $21.95 Diskette
If you liked DYNACOMP'S BRIDGE 2.0, you will absolutely love BRIDGE MASTER. BRIDGE MASTER is a comprehensive bridge program designed to provide hours of challenging competition. Bidding features include the Blackwood convention, Stayman convention, pre-emptive openings, and recognition of demand bids and jump-shift responses. After playing a specific hand, you may replay the same hand, with the option of switching cards with your computer opponents. This feature allows you to compare your bidding and playing skills to BRIDGE MASTER. Bonuses for game contracts and slams are awarded as in duplicate bridge. Doubled contracts are scored based upon a computer assigned vulnerability. A score card is displayed at the conclusion of each hand. The score card displays a summary of total hands played, total points scored, number of contracts made and set, and % bids made. BRIDGE MASTER is clearly the best computer bridge program available.
DYNACOMP'S previous BRIDGE 2.0 customers may upgrade to BRIDGEMASTER for a nominal charge of $5.00 plus postage and handling (see ordering information box). Original cassette/diskette must be returned.

BACCARAT (Atari only) Price: $18.95 Cassette/$22.95 Diskette
This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.

GIN RUMMY (Apple diskette only) Price: $22.95 Diskette
This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

POKER PARTY (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32K (or larger) Apple II.

GO FISH (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GO FISH is a classic children's card game. The opponent is a friendly computer with user inputs that are simple enough for small children to easily master. The Apple and Atari versions employ high resolution graphics for the display of hands. A must for children! Runs in 16K.

NEW

BLACKJACK COACH (32K TRS-80 only) Price: $29.95 Cassette/$33.95 Diskette
BLACKJACK COACH teaches and evaluates professional playing methods. This program will coach you using the Basic and the Complete Card Counting Methods. The BLACKJACK COACH can be used in automatic, unattended play to test the playing and betting strategies you select. Extensive summary reports pinpoint the strengths and weaknesses of various methods of play. All the standard player choices are included: Insurance, splitting pairs, double downs and surrender (optional). A line printer may be used to collect data. If you risk money at the tables, increase your skills with the BLACKJACK COACH!

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Available for all computers) Price: $25.95 Cassette/$29.95 Diskette
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

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 airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) Price: $17.95 Cassette/$21.95 Diskette
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 255 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled 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 reviews 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 play.

NEW

FROG MASTER (Atari only) Price: $17.95 Cassette/$21.95 Diskette
The Atari APEX first prize winner, FROG MASTER contains exciting arcade features in addition to being a highly educational program. It is a fast-moving high-concentration game for 1-4 players. You score by making touchdowns on the opponents' goal line – if his goalie doesn't get there first. But your players (tadpoles and frogs) must be trained. This is accomplished by giving them a reward at just the right moment when they do something right. This takes precise timing and judgement. Your critters must penetrate barriers and avoid evil line backs if they are to score. Many will fall by the wayside, but some will get through. As they learn you can look inside their heads to see how they think. As you reward them, they reward you (the "thought processes" simulated demonstrate the basic type of animal learning - operant conditioning - widely studied in high school and college courses). As you teach them they teach you how learning takes place! Great graphics! Runs in 16K. Requires two joysticks.

FOREST FIRE! (Atari only) Price: $14.95 Cassette/$18.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalities. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

CRANSTON MANOR ADVENTURE (North Star, SuperBrain and CP/M only) Price: $19.95 Diskette
At last! A comprehensive Adventure game 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 associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play 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 an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace 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 in 16K Atari.

NEW

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 algorithimic logic, and is a "natural" for computer calculation. The RUBIK'S CUBE SOLVER permits you to input the starting state of the 24 facing elements of the cube. It then solves the problem one step at a time, with each step shown as a unfolded view of the cube. Can you solve the cube in fewer steps. In any case, it sure beats disassembling the cube or peeling off 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 within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II), NEC and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density, double density, compatible format) 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820, Heath/Zenith and many others). 5¼" CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

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**Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.

***For most North Star disk-based systems.

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This is the classic space simulation, but with several new features. For example, the Croylins now shoot at the Invincible without warning while also attacking starbases in other quadrants. The Croylins also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Invincible is besieged by three heavy cruisers and a starbase S.O.S. is received! The Croylins get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

LIL' 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 several enemy cities. You are attempting to bomb these cities while at the same time trying to avoid their defensive fire (MISSILE COMMAND in reverse?). Also, your radar has been damaged so that you can only see downwards. This would normally not be much of a problem except 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 for a bombing run while the enemy craft is out of range, and quickly retreat to the skies. A fun game. Requires 16K.

ESCAPE FROM VOLANTIUM (Atari only) Price: $15.95 Cassette/$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! 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 lopped 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 chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 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; let five UFO's get by and 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 "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the 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 in 16K.

NEW

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 a color TV so that you can see the green of the fairway, the blue of the water hazards, and the white sand of the traps. You tee off with a wood, use your wedge in the sand trap, and putt on the green just as would be done on the course. Show off the Atari to 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, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection 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 CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.
Why pay $9.95 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 "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 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
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

TWO PLAYER GAMES

NEW

TWO PLAYER GAMES (Available for all computers: 32K disk/diskette only)
DYNACOMP has acquired the distribution rights to the best eight of Xitron's war games. These two-player games were originally written for the North Star computer, but have since been converted to play on all of the computers currently supported by DYNACOMP. Because our licensing and development costs were so low, DYNACOMP offers these programs two to a disk(ette) for only $19.95/diskette, $23.95/disk. If you like war games, then this is a bargain you can not pass up.

Set #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: Spring 1940 Place: Northern France. The German blitzkrieg in the east was complete. Germany had turned its attention to the west: France. The German forces has penetrated the Ardennes and Meuse. The heroism of Dunkirk, the defense of the Aisne-Somme position, and the final collapse of the French armies in the south has all passed. And, now, the drive on Paris . . .

Set #2: STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE
STARSHIP TROOPERS
Date: Fortieth Century Place: Arachnid planet of Sheol. The first all-out battle on the planet Sheol which will match equal forces of Terran and alien units. The outcome will set the course of the conflict, for the planet of Sheol is a key position in the solar war.
INVASION OF THE MUD PEOPLE
A Peruvian 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. Eye-witnesses have reported strange creatures appearing from scores of slimy mud holes which have oddly begun forming across the terrain.

Set #3: FALL OF THE THIRD REICH and ARMORCAR
FALL OF THE THIRD REICH
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 several allied divisions to cross before it finally collapsed on March 17 ... and so, the allies began their drive on Berlin.
ARMORCAR
Date: 2 Feb. 1944 Place: Minsk, Russia. A German front-line unit is hard pressed for radio equipment and medical supplies. A relief convoy of armored cars must reach them through partisan-infested territory.

Set #4: MOUNT SURIBACHI and MIDDLE EARTH
MOUNT SURIBACHI
Date: 16 Feb. 1945 Place: Iwo Jima. The Japanese opened fire from Mount Suribachi as the marines landed on the porkchop-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 air field. Mount Suribachi proved to be one of the most strongly defended positions in the Japanese theatre 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 South America, a team of United Nations' researchers have undertaken a mission to an uncharted frontier; the center of the Earth. After a perilous journey spanning a period of several months, the mission has arrived at the Earth's core, a land of flames, steam, oceans, and unforeseen vegetation. And then the creatures of MIDDLE EARTH appeared . . . unmatched by the most frightening horror stories created by man . . .

MISCELLANEOUS

CRYSTALS (Atari only) Price: $14.95 Cassette/$18.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two 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 in 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 (4 or more)
The complete collection may be purchased for $159.95.

NEW

5¼" DISKETTES (soft sectored/ten sectored) 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!

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BUSINESS and UTILITIES

NEW

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/her own investment catagories. PORTFOLIO MANAGEMENT is a top quality, professional tool which will not only provide you with new conveniences 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.

NEW

PERSONAL FINANCE SYSTEM (Available for all computers) — Price: $39.95 Diskette

PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. 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 store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record 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 sort. PFS has been demonstrated on network (CBS) TV!

NEW

FAMILY BUDGET (Apple and Atari only) — Price: $34.95 Diskette

FAMILY BUDGET is a very convenient financial 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 to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

NEW

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 textural 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 your Apple. The minimum 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 x or more in price. The commands available in TEXT MASTER are: COLLECT, USE, EXECUTE, NONUM, INSERT, MERGE, STOP, RENUM, 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 modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) 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 communications 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 uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, 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.

NEW

PAYFIVE (Apple II plus diskette, two drives required) — Price: $149.95

This is an enormously flexible employee payroll system with extraordinarily good human engineering features. PAYFIVE prints checks and compiles 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 they also can be used in any combination. PAYFIVE includes many other features and comes extremely well documented with a 200 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 16K.

NEW

TAX OPTIMIZER (Available for all computers) — Price: $59.95 Diskette

The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is 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 CPA offices and comes complete with the current tax tables in its data files. 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 (DJ, S & P, NASDAQ) and MORE! You may plot (HIRES) the price history of any stock against any other, time, or the indexes. 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 autoboot/autorun 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 oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days x 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

NEW

NYINDEX (Atari only) — Price: $29.95 Diskette

NYINDEX is a comprehensive software package for storing, retrieving 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 above plus the index oscillator, 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 7. No longer will you have to read the locations of those tiny blocks on your graph paper and calculate PLOTs and DRAWTOs. With PMG you will be able to easily design colorful graphic displays with your joystick and save them on diskette for later recall.

LIFE CYCLE ANALYSIS AND DEPRECIATION (Apple diskette only) — Price: $39.95 Diskette

This software package creates a data file of business expenses for equipment which can later be used to calculate and display a variety of reports. You may project annual costs, find the present worth, create depreciation schedules and justify tax deductions. The evaluation techniques conform 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.

NEW

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 to create 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 all 16 available colors. When you are done with a picture, it can be saved on disk with a single key command. Up to 24 images can be saved as "frames" of a movie, and then played back at high speed to creat short animated sequences. The effects are truly stunning.

This package comes complete with demonstration programs so that even novice 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.

SHAPE MAGICIAN (Apple II, 48K, diskette only) — Price: $29.95

At last! An 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 enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card. Purchase orders accepted.

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Within North America: Add $2.00
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All orders (excluding books) are sent First Class.

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Deduct 10% when ordering 3 or more programs; 20% when ordering 5 or more. Dealer discount schedules available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star, Osborne, Superbrain and NEC format.

Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

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New York State residents please add 7% NYS 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 chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 7. HODGE PODGE is a non-intimidating 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 multiplication problems in which the student may be tested both on the final answer and/or on the subtotal answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems; one particularly nice 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 or choose from a menu of filter forms. 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 Hanning 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 business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling 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 hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific 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; retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted 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 unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data, curve and residual plotting; a statistical analysis (e.g.: standard deviation, correlation, coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone 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 a imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data, results and residuals may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

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 size 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: $39.95 Cassette/$43.95 Diskette

In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2**P factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1
Collection #1: Chapters 2 and 3 - Data and function plotting; complex variables and functions.
Collection #2: Chapter 4 - Extended matrix and vector operations.
Collection #3: Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.
Price per collection: $16.95 Cassette/$20.95 Diskette
All three collections are available for $44.95 (three cassettes) and $53.95 (three diskettes).

Volume 2
Collection #1: Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2: Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.)
Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6: Chapter 6 - Methods for finding the real roots of functions.
Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
Collection #8: Chapter 8 - Optimization by steepest descent.
Price per collection: $14.95 Cassette $18.95 Diskette
All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).

Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP:

BASIC SCIENTIFIC SUBROUTINES, Vol. 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol. 2 (790 pages): $23.95 + $1.50 postage

See reviews in KILOBAUD, Dr. Dobbs, and ACCESS.

NEW

SOFTNET (Apple II and TRS-80 48K diskette only) — Price: $129.95

SOFTNET may be used to create models of liquid pipeline systems to evaluate their flow performance. Up to 150 nodes with up to 150 connecting elements may be simulated, and models may be combined to form yet larger models. If you are involved in water distribution systems, chemical fluid flow problems, building plumbing, or similar situations, this is an ideal analysis tool.

NEW

FILTER ANALYSIS (Apple only) — Price: $19.95 Cassette/$23.95 Diskette

FILTER ANALYSIS is the ideal program for determining the frequency response of passive filters. Any number of RLC components may be included, and any number of poles treated. FILTER ANALYSIS features its own mini-language which makes circuit description simple. Results may be printed in tabular form or plotted in HIRES graphics (decibels versus log-frequency).

ACTIVE CIRCUIT ANALYSIS (Available for all computers) — Price: $35.95 Cassette/$39.95 Diskette

With ACAP you may analyze the response of an active or passive component circuit. The circuit may be probed at equal steps in frequency, and the resulting complex voltages at each component juncture examined; the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library. Requires 48K.

LOGIC SIMULATOR (Available for all computers) — Price: $35.95 Cassette/$39.95 Diskette

Test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip-flops, and one-shots. Inputs may be clocked in with varying clock cycle lengths, displacements and delays may be introduced to probe for glitches and race conditions. A timing diagram for any given set of nodes may be plotted. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR. Requires 48K.

NEW

BEAM DEFLECTION (Available for all computers) (disk/diskette only) — Price: $29.95 Diskette/$32.45 Disk

BEAM DEFLECTION is the first in DYNACOMP's new series of structural analysis software packages. It consists of two programs. The first program permits the development of data files which describe the problem. For example, the ends of the beam may be pinned, clamped or free. The beam may be uniformly supported by an elastic bed, or held up by springs variously placed and having differing spring constants. The elasticity and cross section of the beam may vary along its length. The load may be uniformly distributed or it may include discrete forces. The beam may be pinned at various points along its length. And so on. All this information may be easily entered and edited using the data input program.

Following this the analysis program is called. The calculated results are the stress and deflections of the beam, both in numerical and graphical form, since the input data is saved, cases may be easily re-run with modification, thereby permitting iterative design.

The documentation which comes with BEAM DEFLECTION clearly shows how to use the software. In addition, three text problems are described and demonstrated to ensure that you understand how to use the program. Also, helpful theoretical information is supplied in the appendix.

STATTEST (Not available on Atari cassette or for PET/CBM) — Price: $19.95 Cassette $23.95 Diskette

This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 50 countries). During the past three years we have greatly enlarged the DYNACOMP product line, but have maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such publications as COMPUTRONICS, 80 Software Critique, A.N.A.L.O.G., Softalk, Creative Computing and Kilobaud. DYNACOMP software has also been chosen for demonstration on network television. Our customer support is as close as your phone. Feel free to call us toll free to discuss products or give advice.

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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

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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 CHRGOT 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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