Applications And Utilities *Estimating TI Memory, Sound On The Sinclair/Timex, Applesoft Printer Control, And Many More*

COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

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An Exciting Game Program For VIC-20, Atari, TI-99/4A, TRS-80 Color Computer, Apple, And PET/CBM

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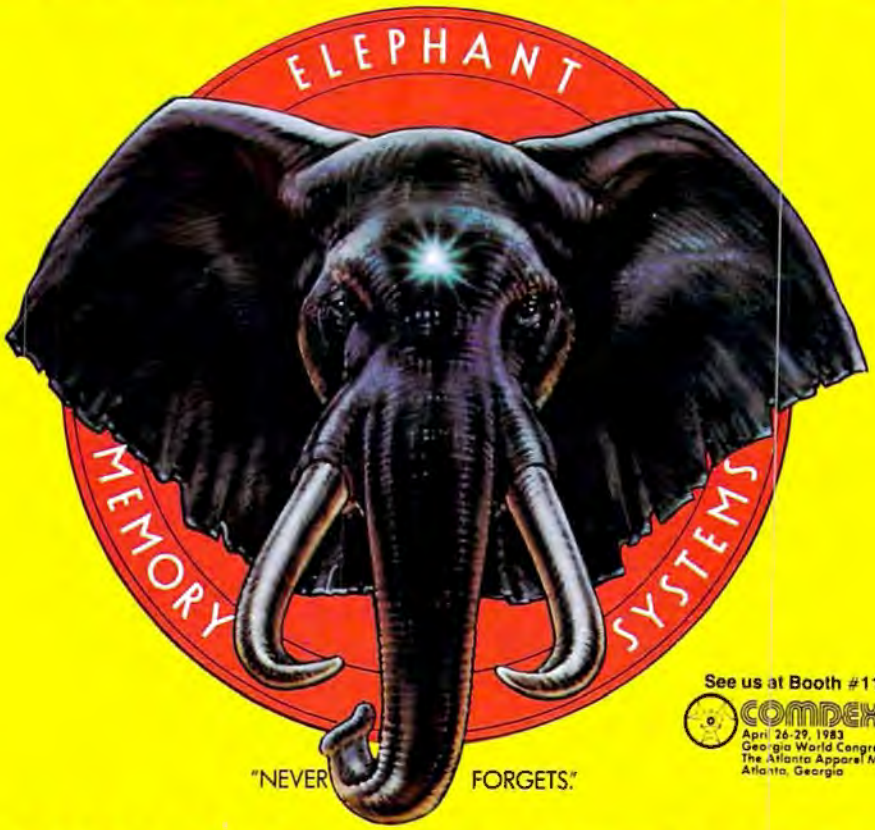

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MORE THAN JUST ANOTHER PRETTY FACE.

Says who? Says ANSI.

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

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

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

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IF YOU'RE WAITING FOR THE PRICE OF WORD PROCESSORS TO FALL WITHIN REASON,

Everyone expected it would happen sooner or later...with WordPro PLUS™ it already has! Now all the marvelous benefits of expensive and advanced word processing systems are available on Commodore computers, America's largest selling computer line. WordPro PLUS, when combined with the new 80 column CBM 8032, creates a word processing system comparable to virtually any other top quality word processor available—but at savings of thousands of dollars!

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

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

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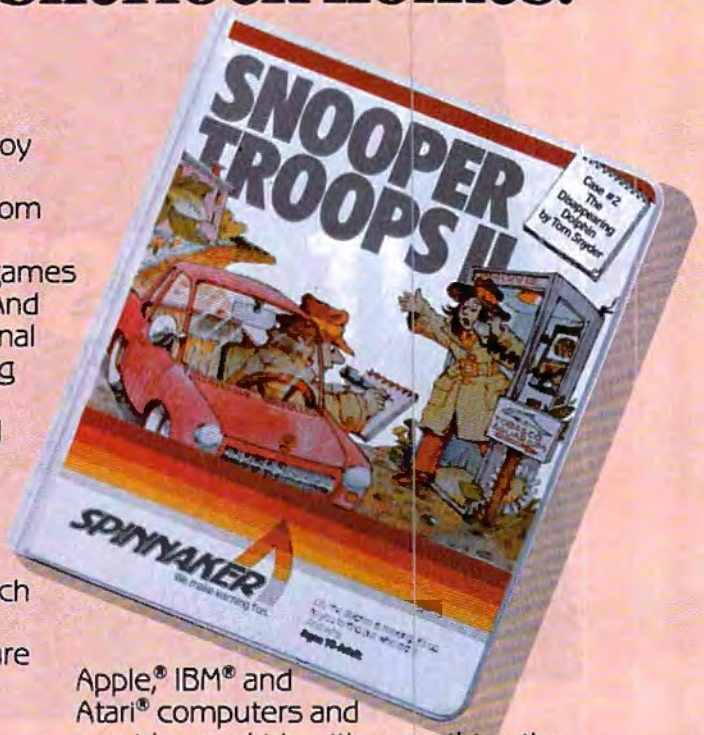
Introducing Snooper Troops™ detective series. Educational games that turn ordinary homes into Sherlock homes.



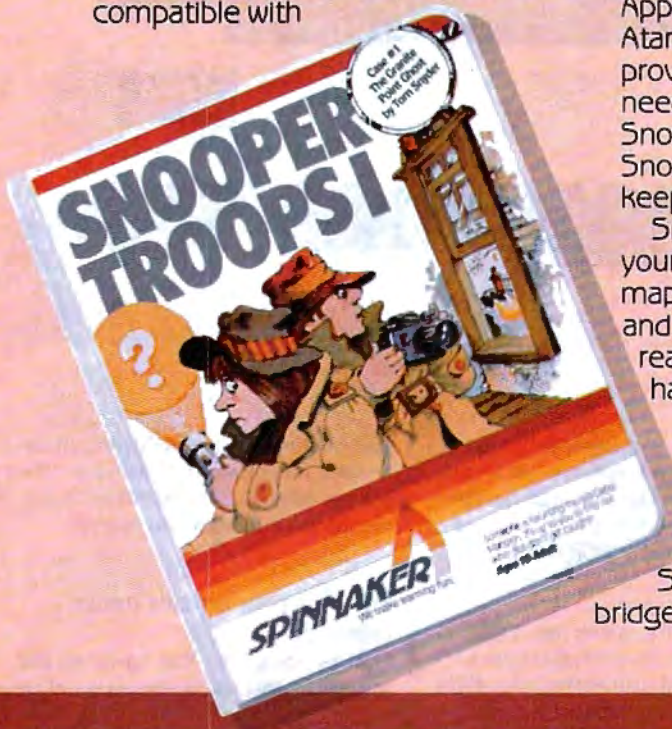
Where can you find educational games that your kids will really enjoy playing?

Elementary, my dear Watson. From Spinnaker.

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

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

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



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

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

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

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

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

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

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

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

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And we're introducing new games all the time.

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

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We make learning fun.

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April 1983 Vol. 5, No. 4

FEATURES

EDUCATION AND RECREATION

REVIEWS

COLUMNS AND DEPARTMENTS

THE JOURNAL

The Color Computer and TI-99/4A data base programs scheduled for this issue will appear next month.

GUIDE TO ARTICLES AND PROGRAMS

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

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EDITOR'S NOTES

The industry price blitz continues with VIC recently advertised at K-Mart for $139, Atari 400 falling below $200, and the Commodore 64 beginning to approach the $400+ price point. Should you wait?

After all, remember when a calculator with *memory* was only $79.95 at Sears? A brokerage house acquaintance recently remarked on the falling prices (he purchased his home computer six months ago for half again as much as it now sells for) by commenting whimsically on the prices, but concluding that he was glad he'd gone ahead and started when he did. He felt as though he was those six months further along in the personal computer revolution.

It will be interesting to see the effect of Atari's recently announced computer/keyboard upgrade for the Atari 2600 game machine. While the price of the unit is expected to be around $90 (we expect the VIC-20 to be less than $100 soon), the Atari unit does, undeniably, have an installed base of millions of potential game machines.

The bottom line, of course, is that all of these new products, price cuts, expansions, and the like simply help make the consumer computer marketplace a mass market reality that much faster. A year or so ago, we did a series on the fine art of raising funds for the purchase of microcomputers for schools. We'd like to update those suggestions and helpful hints with more recent information. After all, a year or two in this industry is a long time, and fund-raising strategies for $1200 machines are vastly different from those for $200 ones. Have you found that school systems are more likely now to provide funding directly? Have you found that parent organizations are more involved? We'd like to present the collective wealth of tactics used by you readers active in educational support. So drop us a one or two page note about your successes and plans, and we'll put them together in an upcoming issue.

In deference to potential problems with confusion of names, we've retitled our newest publication *COMPUTE!'s Commodore Gazette*. This should prevent any confusion with the quarterly magazine produced by Commodore and called *Commodore*. We've also pulled our release issue date for the new monthly to June 1983. I'm pleased to announce that Tom Halfhill of our staff, who many of you have come to appreciate as Features Editor of **COMPUTE!**, will be serving as Acting Editor of *COMPUTE!'s Commodore Gazette*.

Our **COMPUTE! Books** Division is currently undergoing substantial expansion as well. If you're presently working on a title or titles in the consumer computer end of the marketplace, we'd be interested in talking with you. Please contact Scott Card, Senior Editor, Book Division at our home office. Our first titles for the Texas Instruments personal computer and the Radio Shack Color Computer will be released soon. Our thanks to you authors who have started contributing applications articles and materials to **COMPUTE!**.

We're currently investigating the possibilities for delivering portions of our printed software in machine readable form. **COMPUTE!** currently publishes more software in each issue than any magazine in the industry, and we're aware that some mechanism for electronic delivery might be helpful to our readers.

The variety of options range from direct sale of tapes and disks to resource centers such as CompuServe and The Source. We'd like your thoughts and suggestions as well. Short comments can be directed to us on the Editor's Feedback card in the back of the magazine. If you need more room, please feel free to write us a letter. As always, your thoughts and input are invaluable to us.

Robert Lock

PRESENTING THE REMARKABLE SV-318.

THE PERSONAL COMPUTER YOU'LL GROW INTO, NOT OUT OF.

SPECTRAVIDEO SV-318 COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	NEC 8001	RADIO SHACK COLOR COMPUTER
BASE PRICE	**$299**	**$1,540**	**$899**	**$595**	**$399**	**$299**
COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	16K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	32K	16K
BUILT-IN EXTENDED MICROSOFT* BASIC	YES	YES	ADDITIONAL COST	NO	YES	ADDITIONAL COST
BUILT-IN RAM	32K*	48K	16K	64K	16K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	16	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	10
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO IO	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY (LOW PROFILE)	256K YES	143K NO	96K NO	170K NO	N/A NO	170K NO
CP/M* COMPATIBILITY (80 column programs)						
CP/M* 2.2	YES	NO***	NO	NO****	NO	NO
CP/M* 3.0	YES	NO	NO	NO	NO	NO

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

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

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

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

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

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

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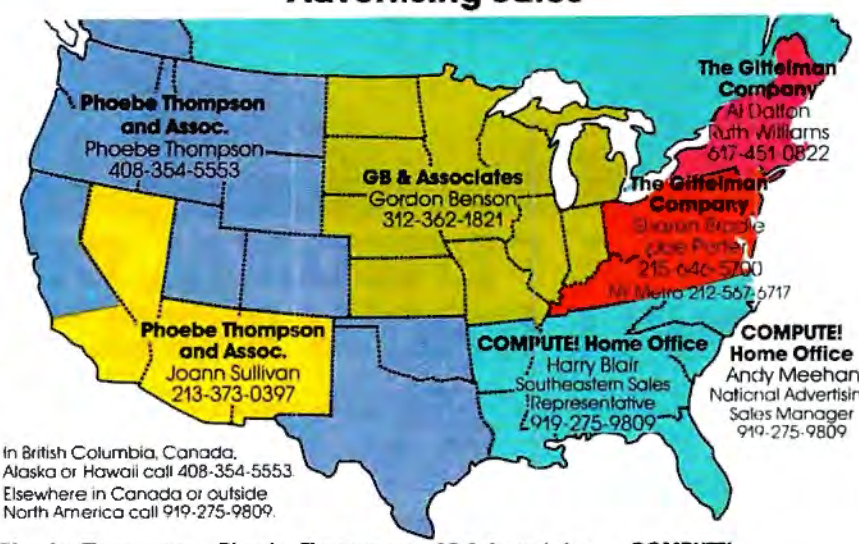

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InfoPro is a menu driven and interactive "information management" system for the Commodore 8032 computer. InfoPro uses "friendly" screen prompts that "guide" you from function to function. This makes InfoPro unusually easy to learn and just as easy to operate.

For Mailing List applications InfoPro can print up to 8 labels across and even has a built in "structure" with fields already pre-set. This structure can easily be changed to fit many other types of office jobs.

Another extremely powerful feature of InfoPro is Super Scan. The Super Scan feature acts like an "electronic filing cabinet" and provides the user with almost instantaneous access to the data stored in a file. The powerful Report Generator allows you to "select" information for printing based on up to 5 different parameters or criteria and to perform various math functions.

Another powerful and indispensable feature is InfoPro's ability to interact with the WordPro family of word processing programs. This provides the user with a "link" from the area of data information management to the area of word processing, allowing the user to manipulate, sort, and select data by certain criteria, which can then be inserted into "personalized" letters, documents, overdue notices, etc. InfoPro will also allow you to ADD, DELETE or CHANGE your information "fields" any time you wish. This means that as your business changes, InfoPro has the flexibility to change with it.

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

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Fruitful Connections.

There are more people in more places making more accessories and peripherals for Apples than for any other personal computer in the world.

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But now we're coming out with our very own line of peripherals and accessories for Apple® Personal Computers.

For two very good reasons.

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Second, service and support.

Now the same kindly dealer who keeps your Apple PC in the pink can do the same competent job for your Apple hard-disk and your Apple daisywheel printer.

So if you're looking to expand the capabilities of your Apple II or III, remember:

Now you can add Apples to Apples.

A joy to behold.

The new Apple Joystick II is the ultimate hand control device for the Apple II.

Why is it such a joy to use?

With two firing buttons, it's the first ambidextrous joystick — just as comfortable for lefties as righties.

Of course, it gives you 360° cursor control (not just 8-way like some game-oriented devices) and full X/Y coordinate control.

And the Joystick II contains high-quality components and switches tested to over 1,000,000 life cycles.

Which makes it a thing of beauty. And a joystick forever.

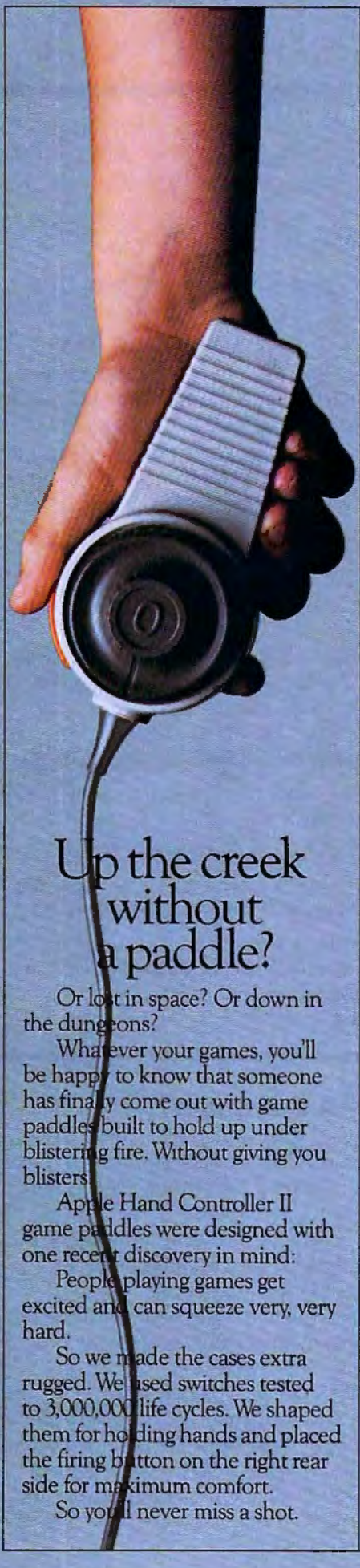
Gutenberg would be proud.

Old Faithful Silentype® has now been joined by New Faithfuls, the Apple Dot Matrix Printer and the Apple Letter Quality Printer.

So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

The 7x9 Apple Dot Matrix Printer is redefining "correspondence quality" with exceptional legibility. With 144x160 dots per square inch, it can also create high resolution graphics.

The Apple Letter Quality Printer, which gets the words out about 33% faster than other daisywheel printers in its price range, also offers graphics capabilities. See your authorized Apple dealer for more information and demonstrations. Because, unfortunately, all the news fit to print simply doesn't fit.



Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

Whatever your games, you'll be happy to know that someone has finally come out with game paddles built to hold up under blistering fire. Without giving you blisters.

Apple Hand Controller II game paddles were designed with one recent discovery in mind:

People playing games get excited and can squeeze very, very hard.

So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

So you'll never miss a shot.

A storehouse of knowledge.

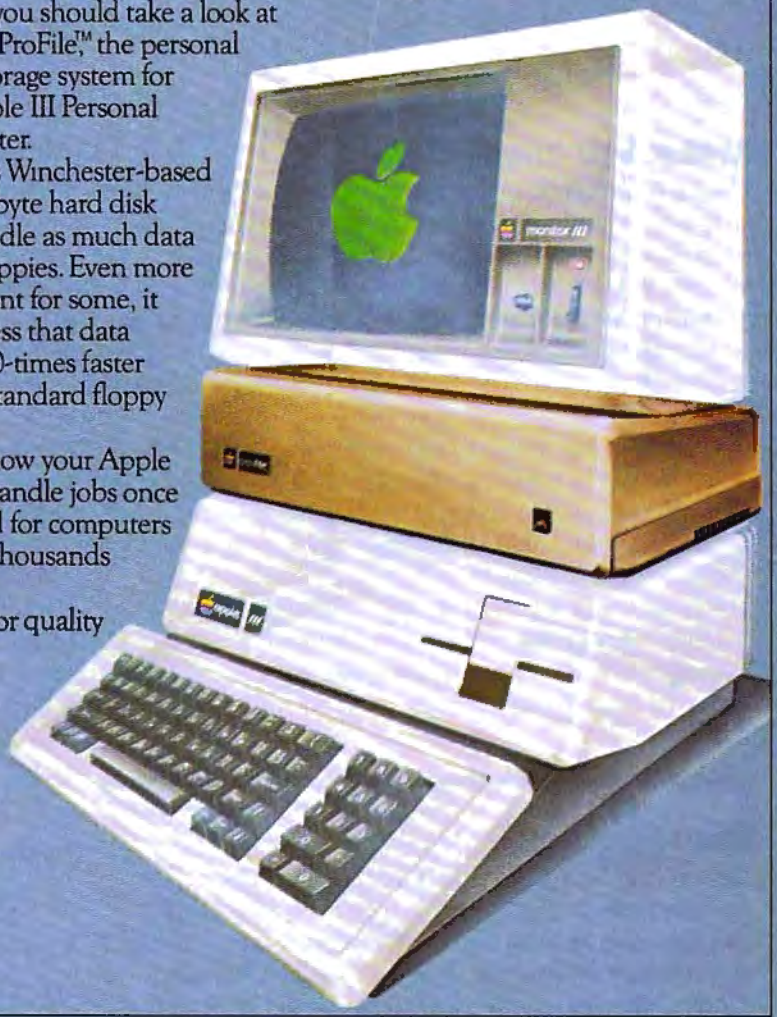
If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile,™ the personal mass storage system for the Apple III Personal Computer.

This Winchester-based 5-megabyte hard disk can handle as much data as 35 floppies. Even more important for some, it can access that data about 10-times faster than a standard floppy drive.

So now your Apple III can handle jobs once reserved for computers costing thousands more.

As for quality and reliability, you need only store one word of wisdom:

Apple.



Launching pad for numeric data.

Good tidings for crunchers of numerous numbers:

Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

The Apple Numeric Keypad II has a standard calculator-style layout. Appropriate, because unlike some other keypads, it can actually function as a calculator.

The four function keys to the left of the numeric pad should be of special interest to people who use VisiCalc.® Because they let you zip around your work sheet more easily than ever, adding and deleting entries.

With one hand tied behind your back.

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READERS' FEEDBACK

The Editors and Readers of COMPUTE!

Make A TV Into A Monitor?

I have heard that it is possible to improve the picture quality of a computer output to a television by rewiring the TV as a monitor in some way. Would you outline the differences between a TV and a monitor for me? Is it possible and practical to convert a TV into a monitor?

Charles Coleman

It's possible, but not practical. You can bypass the receiver section of a television and route input directly to the video stages. However, this is an extremely unsafe practice. Contact with the voltages present inside a TV is likely to cause more than just an unpleasant tingle, and since many sets have a "hot" chassis it is difficult to isolate these voltages from your computer. Why risk ruining your television and computer (and possibly yourself) when a true monitor costs no more than a regular TV?

Atari Revision B

I have had an opportunity recently to upgrade my computer to a "new" version of Atari. Little did I realize at the time that a new version of the operating system was incorporated in the new Atari, rendering a large portion of my available software useless (e.g., *Ghost Hunters* by Arcade Plus).

Can other ways be devised to load the software other than via the operating system? Help?

G. Smyczynski

A few pieces of commercial software will not run on the Revision B Operating System (OS) due to illegal OS calls. Contact the software companies with regard to any updates. If you can acquire an extra 10K ROM board, you can choose either operating system (on the Atari 800 only) merely by changing boards.

Translating Programs For The TI

I own a TI-99/4A home computer. I like your magazine, but I have tried and cannot convert the programs in **COMPUTE!** to run on the TI. Especially hard to figure out are the PEEK and POKE statements.

Could you please explain how to convert the programs to TI? I do appreciate your new TI. column.

John Dobrinski

Texas Instruments appears to have developed their BASIC from a slightly different perspective than many other microcomputer BASICs. The PEEK and POKE commands allow programmers to examine and modify individual memory locations. While this may be a desirable feature on a personal computer, it could be undesirable on a large, multi-user system so no "mainframe" BASICs support these operations. TI BASIC shares this feature of minicomputer BASICs.

Fortunately, TI substitutes an impressive "library" of built-in ROM subroutines which accomplish most of the same things that PEEK and POKE are used for on other computers. For beginners this may even be an advantage, since the subroutine CALLs are usually more easily understood than the equivalent PEEKs and POKEs. For example, to read the TI joysticks you can type:

```
100 CALL JOYST(1,X,Y)
```

Contrast this with the equivalent for the VIC-20:

```
100 POKE 37154,127: X=(NOTPEEK(37151))AND 60 -
    ((PEEK(37152) AND 128)=0) : POKE 37154,255
```

Other impressive features are CALL CHAR, RESEQUENCE, and NUMBER. These provide built-in character definition, renumber, and automatic line numbering utilities.

Should I Buy A Computer?

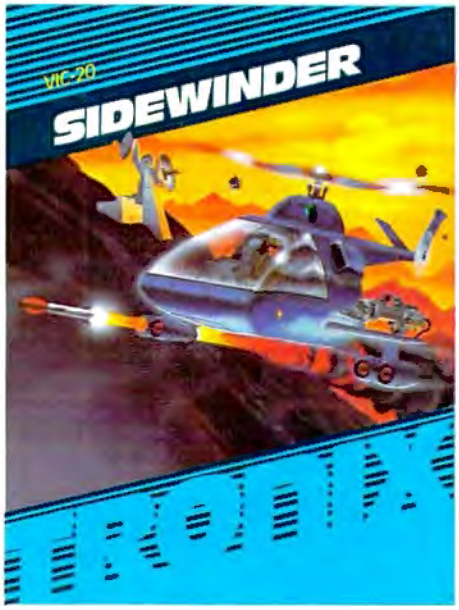
Recently, my interest has turned toward finding out about home computers. As a start, I purchased **COMPUTE!**, and visited a few stores with home computers and software.

So far, my observations show that the home computer market is directed mostly toward games, especially space and war games.

Since there is an eleven year old in the family, my interest is also in the educational aspect of home computers.

I have two basic concerns before I spend hundreds of dollars and find that a home computer is not a waste of money, a flash in the pan, or a pie-in-the-sky promise. Please advise me where local sales personnel and even some teachers are not able to answer me:

THE ULTIMATE IN FAST ACTION FOR YOUR VIC-20.



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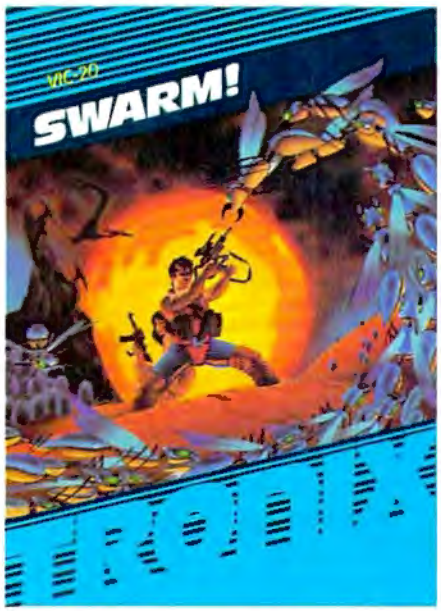

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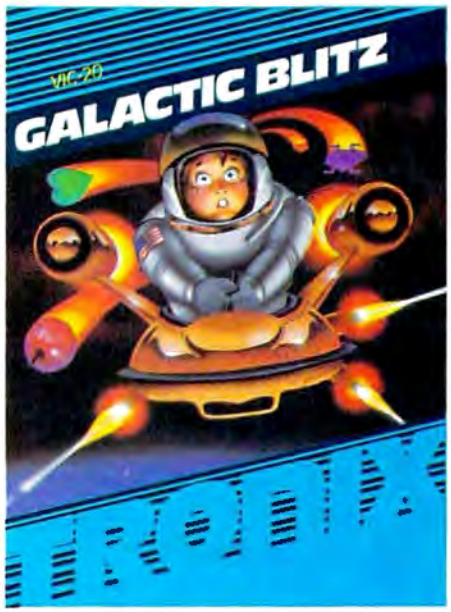

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TRONIX

a) guidance for a home computer, especially in education.

b) how can I put the home computer to work to pay for itself?

I can see the use of the computer as a tool in industry and small business; however, visions of incessant space invaders and missile command games and their sound effects will create a home arcade that's bound to become boring and shelved after a short period of time.

Please help, and offer me your guidance.

Cas Piotrowski

This issue of **COMPUTE!** *is representative of the mix of articles, applications, and programs we publish each month. There are two "arcade" style games, two educational games, and several dozen other programs. The majority of articles reflect the extraordinarily varied interests of* **COMPUTE!***'s readers and testify to the variety of uses to which home computers can be put.*

There are programs here which: teach touch typing, help you plan for retirement, create art on the computer screen, quickly search through records, alphabetize, draw charts and graphs, make music, assist in writing anything from a letter to a novel – and this is only one issue.

Few people buy a computer and then end up putting it in a closet with their abandoned hobbies. Personal computing can be a hobby, but is often much more. Many people find that they use personal computers as much as (even in preference to) TV. As to making your computer pay for itself, it will add speed and accuracy to virtually any mental activity. It can save you a significant amount of time organizing any of your leisure activities or assist you in your vocation. It can put you in touch with information on hundreds of subjects through the phone lines, when connected to an information service *such as CompuServe or The Source. It can help you make decisions which could save considerable amounts of money. (See the "Retirement Planner" program in this issue.)*

It's not the computer games – educational, challenging, and just plain fun though they can be – which drive business and government toward ever-increasing computerization.

BASIC Assembling

I am programming in machine language on my Commodore 64, but I do not have an assembler and therefore I must POKE the values directly into memory. My question is this: After loading the accumulator with an ASCII character code, how would I store it in screen memory, if screen memory starts at decimal 1024, and I cannot POKE in values greater than 255? (I already know about the subroutine at $FFD2.) Also, how would I execute a JMP or JSR using POKE commands?

Chris Coon

You seem to have addresses mixed up with values. It's true that any byte can only hold numbers up to 255. When machine language programmers send a character to the screen memory of the computer, they use two bytes to hold the target address. However, you can POKE from BASIC in the following way: POKE 1024,65. This will put the graphics symbol for a spade in your 64's screen. The POKE command will let you use any number less than 65536 as the address, followed by the value you want to send: POKE address, value.

Underlying your questions is an attempt to combine BASIC (POKE) with machine language (JSR, etc.). In the early days of computing, machine language programmers "hand assembled," constructing their programs with methods similar to POKEs. That was because computer memory was valuable and in short supply. Computers now have enough memory to hold an assembler *and at the same time create machine language programs elsewhere in memory. An assembler is to machine language programming what BASIC is to BASIC programming – a program to make it easy to write programs.*

You might want to get a book on machine language programming. Machine Language For Beginners *is now available from* **COMPUTE! Books**. *It contains an assembler which works on Apple, Atari, and any Commodore machine.*

Even More Perfect Commodore INPUT

Blaine Standage's article "Perfect Commodore Inputs" is interesting, but even his simple method has a simplification. I, too, have read many articles and seen many programs that use elaborate methods to eliminate the return to READY difficulty that plagues novice users of PET programs. I found a very simple method of avoiding this which also allows you to make your prompts without the added "?" when I was fooling around with OPENing files to the screen and keyboard devices. This is it:

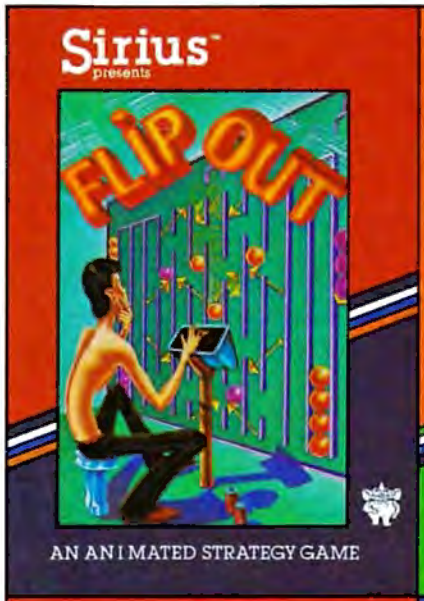
```
10 OPEN 1,3:CMD 1
20 INPUT"PROMPT? ";A$:PRINT
```

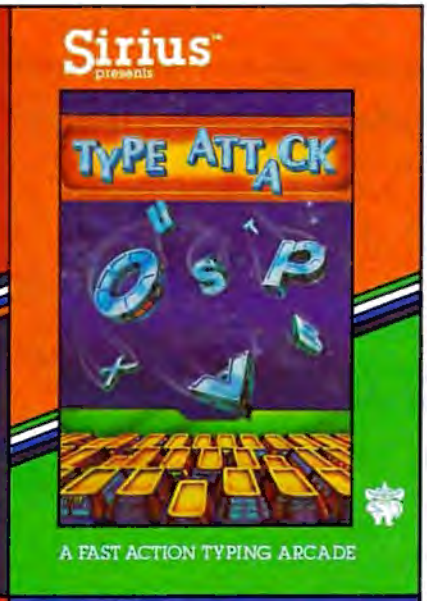
This program will perform the exact same thing as the INPUT# in Standage's article. It has the added advantage of being shorter and allowing you to use regular INPUT statements rather than INPUT#. In fact, you could easily convert entire programs by just adding the OPEN and CMD statements at the beginning and inserting a PRINT statement after each INPUT statement. I particularly like it when I want users to input at a colon prompt, and so on.

Here's how to exit the unRETURN mode. (If you BREAK the program at this point, it will con-

Have A Great Playday!

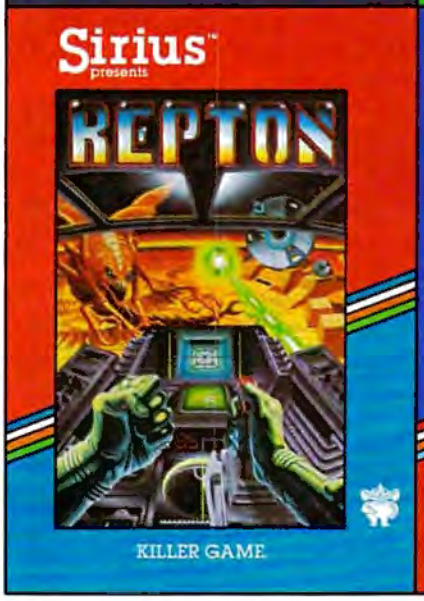
Take your marble to the top. Pick your spot and let it drop. Hope for a flip instead of a flop. Once you get it, the fun never stops! It's FLIP OUT — a crazy new strategy game for one or two players. Each marble you drop causes a chain reaction, so take your time and plan carefully. Plan right and you'll flip, if you didn't you Flip Out!

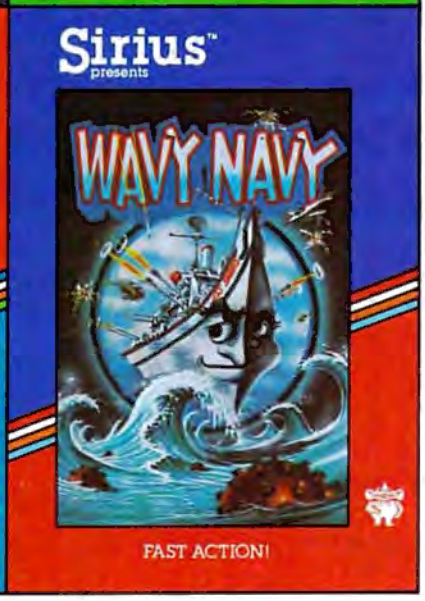




Turn your keyboard into a typing arcade! You can blast attacking letters and words right out of the sky. Type Attack was designed by a professional educator and the fast action game experts at Sirius. It features 39 pre-programmed lessons and 60 user defined lessons. Great sound, graphics and a real-time words per minute bar make improving your typing skills fun!

It is up to you to stop the invasion of the evil Quarriors and save Repton. You are armed with devastating Nuke Bombs, a Radar Screen, a Laser Gun and an Energy Shield. You'll need them all! You'll be attacked by Nova Cruisers and Single Saucers. You must avoid Spye Satellites and deadly Dyne-Beam Shooters and you must stop the Draynes from depleting the Reptonian power supply. Repton is a battle so thrilling you'll be relieved to find out you're still on earth when it's over!





Talk about adventure on the high seas! You're blasting away at a squadron of enemy bombers and Kamikaze fighters from the deck of your P.T. boat. Suddenly you notice the sea is loaded with mines and an Exocet missile is screaming toward you on the horizon. Instinctively you jerk the joystick to the starboard, keeping your thumb on the fire button. Phew! That was close! Sometimes it's hard to believe Wavy Navy's just a video game.

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tinue to avoid sending CRLFs to the screen. That is, when you press RETURN, the information will get sent to the computer, but the cursor won't move to the next line.) So you need to: PRINT#1:CLOSE 1. Typing anything that gives you a SYNTAX ERROR also does the trick, but it isn't a particularly elegant way of exiting a program. So, at the end of the program, just put:

```
30 PRINT#1:CLOSE 1:END
```

Mits Hadeishi

A Disk Drive For The Atari 400

I was in a computer store the other day and overheard a salesman say that you could not use a disk drive with the Atari 400. Is this because of the 16K memory or because of some hardware problem?

Tom Bigelow

There is just barely enough memory in a 16K Atari 400 to load the Disk Operating System (DOS). DOS is a program which the computer then uses to manage the various functions of the disk drive (much the way that the computer's Operating System (OS) handles housekeeping for the computer itself).

However, the 400 can be expanded up to 48K, or even up to 90K, using available commercial memory expansion boards. See the ads in **COMPUTE!**.

What's Machine Language?

I recently received a program that works, but I cannot make any sense of it. Here it is:

```
100 DATA 169,64,24,105,1,32
110 DATA 210,255,201,90,208
120 DATA 246,169,13,76,210,255
130 FOR J=828 TO 844:READ X
140 POKE J,X:NEXT J
200 FOR J=1 TO 10
210 SYS 828
220 NEXT J
```

I have a number of questions....

C. P.

The questions, and Jim Butterfield's answers to them, are given below:

1. What do the numbers which follow the SYS statement reference?

This number – in this case 828 – is the address of the machine language subroutine to be called. It's a little like GOSUB 838 ... except that with SYS, the 828 is not a line number; it's the actual address where the machine code lies in the computer's memory.

2. When data numbers are POKEd into memory to accomplish machine language programming, what do those numbers mean?

In the case of your sample program, they are machine language instructions; you'll need a machine language reference manual to sort them out – and even then, you'll probably need to translate the decimal numbers into hexadecimal.

169, for example, is LDA or Load A – it brings the following value (64) into an internal chip register called A (or sometimes the Accumulator). 24 is the CLC or Clear Carry instruction – it turns off an internal flag called Carry within the chip. 105 is the ADC, or Add with Carry instruction; it asked the processor to add the following value (1) into the Accumulator. And so on... there are a lot of niggling details here, but the individual instructions are not hard. Obviously, you'll need a guide; any 6502 reference book will do the trick.

3. As a separate matter: what is meant by "setting the pointers" which indicate where BASIC programming begins?

The BASIC program that you load or type in, together with any variables it might create, must fit into a block of memory called "BASIC RAM". This block is usually set up so that you get all the spare RAM memory that's available.

If you need to set RAM aside – sometimes for special screen activities, and sometimes for machine language – you must change either where BASIC RAM starts (in VIC and Commodore 64, this is recorded in addresses 43 and 44), or where BASIC RAM ends (in VIC/64, addresses 55 and 56). To make extra room, you must move the start location upward, to leave empty space below; or the end location downward, to leave empty space above.

The addresses for start and end are stored in two bytes. To read such an address, take the contents of the first byte and add it to 256 times the contents of the second byte. On a VIC or 64, you would type:

```
PRINT PEEK(43)+256*PEEK(44)
```

to get the address where BASIC starts.

To move either pointer, you'll need to calculate the new values to be stored there, and there's extra work called for:

– When you move end-of-BASIC, follow this with a CLR command.

– When you move start-of-BASIC, store a zero just before the start location; move the pointer, and then say NEW.

To move the end-of-BASIC to 6144, we would POKE 55,0:POKE 56,24:CLR. To move the start-of-BASIC to 5121, we would POKE 5120,0:POKE 43,1:POKE 44,20:NEW. In either case, we'd cut down our available BASIC working space.

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

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THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

In the early days of electronic computing, there was only one type of computer program: governmental, especially military. The first electronic computer, the ENIAC, was built in Pennsylvania during World War II. Only governments could afford to build computers, and the major justification for spending money on these extraordinarily costly machines was that they could break secret codes, calculate missile trajectories, and assist in solving other war-related problems.

Four decades later, computers are becoming as common and as necessary as cars. Paralleling this is a constantly increasing array of software. *Software* means a *program*, a list of actions for the computer to take which, when followed, achieves whatever the *programmer* wants to achieve. PRINT 1+1 is a program, a piece of software, which would result in the computer displaying a "2" on a TV screen or printing it on a piece of paper. *Hardware* is the TV or printer or the computer itself. In cooking, hardware would be pans, spoons, and the stove. Software would be a recipe for stew or cupcakes.

Fifteen Categories

To get a general idea of the kinds of jobs personal computers currently tackle, we can separate programs into fifteen broad types: 1. Graphics, 2. Music, 3. Word Processing, 4. Education, 5. Home Applications, 6. Games, 7. Accounting, 8. Financial Simulation, 9. Data Base Management, 10. Languages, 11. Operating Systems, 12. Disk Operating Systems, 13. Utilities, 14. Telecommunications, 15. Artificial Intelligence.

In the next couple of columns, let's go through these classifications one by one and describe, in general terms, the characteristics of each category.

Graphics

For personal computers, graphics is most often found in game programs as an important part of the overall pleasure of the game itself. People do sometimes write "graphic demos," dazzling displays which are solely designed to be demonstrations of their computer's special color or high resolution abilities. But most graphics are written to improve a game.

Usually, the goal of graphics is to reproduce a visual concept as accurately as possible. In practice, this can require the use of *high resolution* graphics techniques. The more points of light on the TV screen (called *pixels*) that the programmer can control, the higher the resolution. Extremely high resolution can quickly use up the computer's free memory. The color and shade of each pixel has to be "remembered" in the computer's memory. A typical 21 inch color TV display would require control over roughly 500,000 pixels to achieve the resolution of broadcast TV. To animate this, you would need to change the picture 30 times per second!

There are a variety of techniques, however, which reduce the memory requirements and the programming necessary to create high resolution video. Home computer memory becomes larger and less expensive each year. The creators of the movie *TRON* demonstrated what computers can do visually. It is possible that personal computer programmers may, in the future, have that degree of control over the images on their home screens. Imagine the kinds of games we'll be playing then.

Music

A Moog synthesizer is to computer music what *TRON* is to home computer art: a hint of what's coming. Computers lend themselves very well to composition and *synthesis* (creating sounds by changing waveforms, timing, and various other elements of noise). Once a computer has memorized the kind of sound you want (violin? piano? an instrument no one has ever heard before?), it can go on to remember the melodies and the chords of a song. Then, by changing a few numbers, you can move the whole piece up or down the scale, make a symphony exclusively for tubas, add echo, whatever. In other words, your computer can be a *music processor*, a synthesizer.

This technology is available now. The new Commodore 64 computer contains an advanced music synthesis capability, a "synthesizer on a chip." What's more, Commodore has announced that it will be marketing a keyboard with three additional synthesizer chips inside that can attach to the 64 to form a complete computer musical instrument. After you've heard the sounds that can come out of this computer, you will agree that the future of music software is going to be astounding.

Next month we'll continue this overview of the types of software now available for home computers. ©

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Computers And Society

David D Thornburg, Associate Editor

Jewels And Stones

Many years ago I talked to a scientist from the Far East who had just finished evaluating a series of grant proposals. I asked him about their quality. He thought for a minute and said, "They are a mixture of jewels and stones."

This January I attended the Winter Consumer Electronics Show in Las Vegas (our first impressions of this show appeared in **COMPUTE!** last month). In addition to all manner and form of new computer hardware, there were many software vendors in attendance as well. Because of my strong position in defense of certain video games, I want to devote some time to covering what I saw – it was clearly a collection of "jewels and stones."

Stones

I can't say I'm surprised, but the introduction of X-rated video games has so passed the boundaries of good taste that I can't resist commenting on them. While most of the quality software vendors exhibited their wares in the main conference hall, several vendors had to place their booths in a special room that was otherwise devoted to the promotion of X-rated video tapes.

Several companies had games to show for the Atari Video Computer System. These games all had such similar characteristics that vendor differentiation was hard to detect. I won't glorify these offerings by mentioning the names of the vendors, but I will describe the products in the hope that interested readers will learn enough here without having to enhance the profits of companies who are producing pure trash.

I have several criticisms common to all the games I saw. The strongest criticism I have is that these games degrade women. I suppose that I should be pleased that one of the games was withdrawn before the show. Since this game allowed the player to participate symbolically in racism and rape, I might even stand and applaud its departure from the marketplace – but the games that were left were hardly much better.

In addition to the degrading manner in which the game figures are treated, the game play consists of nothing more novel than a simple variant of games like *Breakout*, *Kaboom*, or a cat and mouse maze game.

If a civilization from another planet saw these cartridges, I'm sure they would wonder what motivation we have to procreate our species. I can only hope that an educated public will provide a clear message of disinterest in the current crop of X-rated "stones." Silicon is too valuable to waste on such trash.

Jewels

I've said it before, and I'll say it again – video games can be powerful educational tools. Rising from the gutter level of the X-rated offerings, I was pleased to see several games that were not only educational, but which also reinforced the idea that people should help each other.

At first glance, *Choplifter* from Brøderbund (for the Apple and Atari computer systems) looks like another shoot-em-up rescue game. You pilot a helicopter that picks up stranded people who are under attack. You must dodge or fight tanks and airplanes on your rescue missions, but your goal is to pick up the people and carry them to safety. My first positive response to this game came when I saw the rescued people leave the helicopter – and one of them stopped to wave goodbye.

I then noticed something even more impressive. The player *doesn't* get points for shooting planes or tanks. The player gets points only for rescuing people. What a pleasant idea!

Another Atari home computer game with nice goals is *Astro Chase* by Fernando Herrera (the author of the popular *My First Alphabet*). In this game, an astronaut has to protect Earth from migrating mine fields. Time wasted shooting other spaceships tends to spell an early death to Earth, so one learns quickly to focus on the task at hand. In addition to spectacular graphics, this game has some cute features. The first time the astronaut returns to Earth, he looks around and scratches his head because there is no welcoming committee. He then takes off to save Earth again. *This* time when he returns – wait – I don't want to spoil it for you. This is a very nice game.

You may recall that last year I spoke highly of software developed by CTW. At last, through their new division, Children's Computer Workshop (CCW), many fine educational games are appearing for machines as diverse as the Atari VCS and the Apple II. Atari was displaying an

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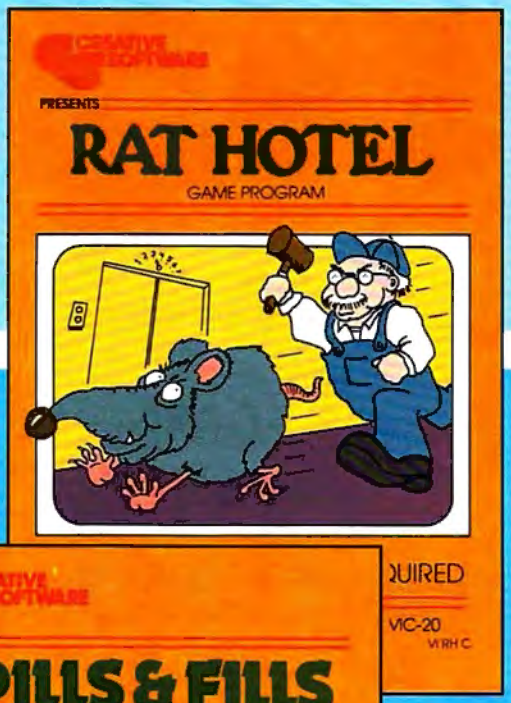

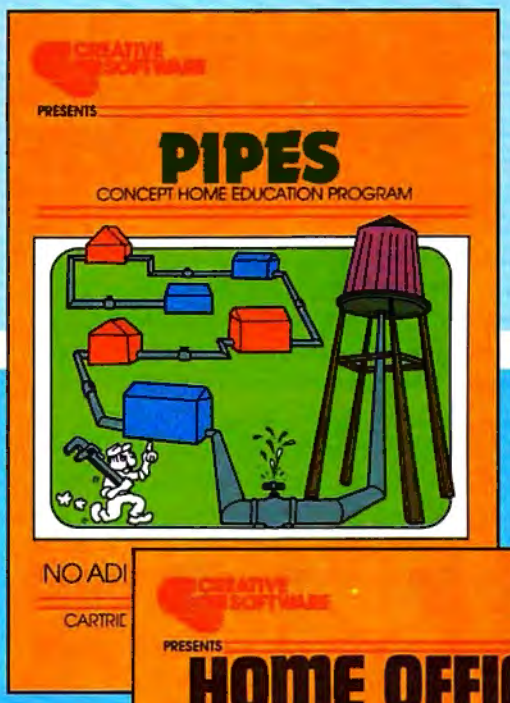

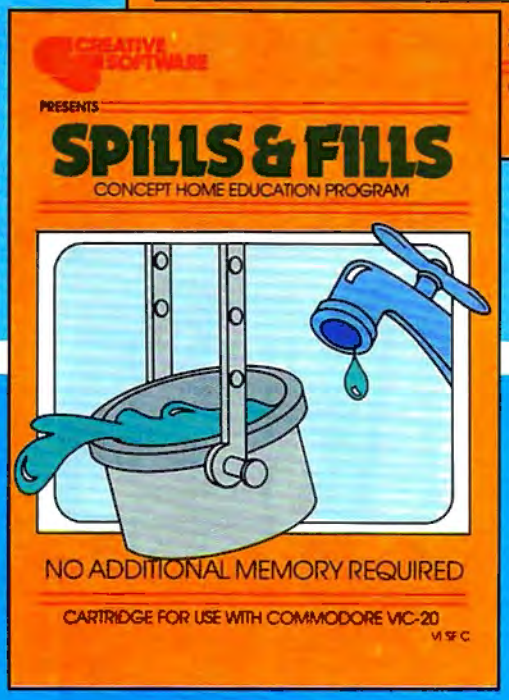

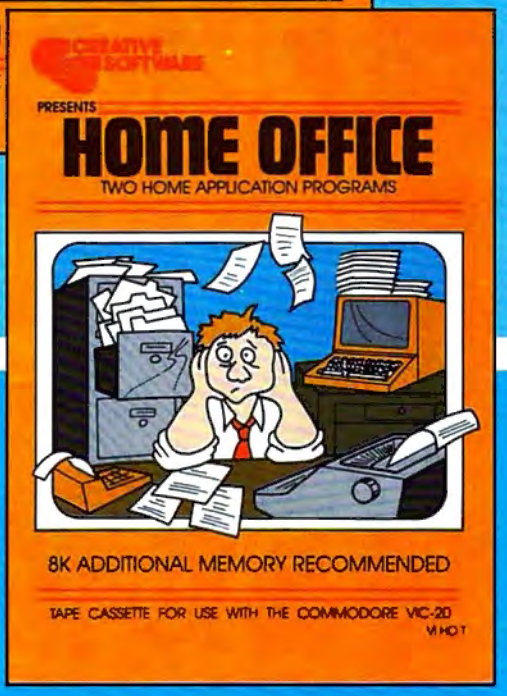

HOW CAN YOU BE **CREATIVE** IF YOUR **SOFTWARE** ISN'T?

CREATIVE SOFTWARE
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excellent maze game in which you pick up cookies along the maze and put them in a cookie jar before the Cookie Monster gets to them. This entertaining game not only has high play value, but it also reinforces certain direction identification skills that help children learn to read. Tremendous effort has gone into these CCW designs, and the result is a line of software of great entertainment and educational value for young children.

You may also recall my interest in the EPYX games *Jabbertalky* and *Ricochet*. Added to my collection of EPYX favorites is *Alien Garden*, a game that requires a combination of mechanical skill and careful thought. In this game you control a bee-like Cosmic Critter that can bite, "wing," or sting a crystal flower. Each flower can grow, explode, change, or be eaten. Since each flower species responds differently to the same stimulus, it takes a lot of concentration to remember which type of flower should be handled in which way. Since this game provides constant motion, the player has to be good at thinking quickly.

I'm sure I missed seeing many other fine games, and I apologize to any vendor who feels left out. My point this month is that there is garbage on the shelves, and some terrific offerings as well. Anyone who dismisses *all* video games as a useless waste of time would benefit from playing any of the "jewels" listed above. ©

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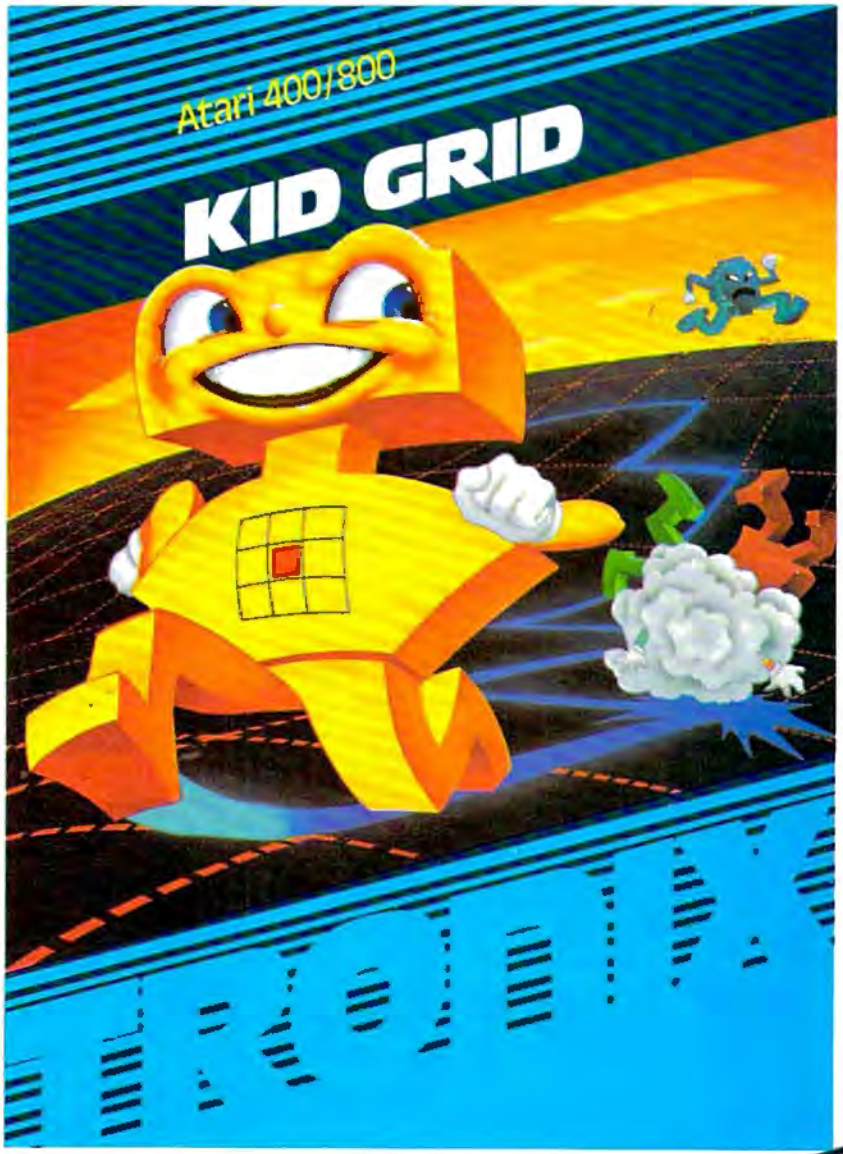

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Selecting The Right Word Processor

Tom R Halfhill, Features Editor

One of the most useful and powerful applications for a personal computer is word processing. But the bewildering variety of word processing programs sometimes makes selecting the right one a difficult task. Here are some things to consider when making your choice.

Until the first day I used a word processor, my idea of the ultimate writing tool was an IBM Selectric typewriter.

As good as electric typewriters are, I realized that word processors are as far beyond typewriters as typewriters were beyond red crayons.

And as much as I like computers, as a writer I have to confess that if computers could do nothing else but word processing, it would justify their existence to me.

Obviously, this is one writer who is sold on word processing. Why?

Creative freedom, for one thing. With a word processor, you don't have to picture in your mind how the words will "read" on paper. You can just type them on the screen, and if they're awkward, zap them into oblivion with the delete key. No more piles of crumpled-up paper shuffling around your ankles. Less creative constraint while staring glumly at a blank page, reluctant to type for fear of another false start.

More flexibility, for another thing. With a word processor you can start at the end, or begin in the middle, and when you're done merge all the parts together into a uniform document.

With a word processor, you can tinker with text. Shape it. Mold it. It's like the difference between sculpting in clay or sculpting in marble.

Sure, you might be thinking, that's a writer's point of view. But what can word processing offer to the average person?

Plenty: you don't have to be a novelist or a journalist. Letters to Aunt Maude are enough. People are always asking what home computers are good for besides playing games, and word processing is one of the answers. If you can type, you can type better with a word processor. And if you can't type, you need a word processor even more.

For a minimum extra investment, that home computer beneath your fingertips can be turned into a word processor that only a few years ago would have cost $5000, $10,000, or even $20,000. The first word processor I used cost my newspaper several thousand dollars, lacked any disk or tape storage of its own, had rather crude editing functions, and contained only 2K of memory for text. The home computer I now use for word processing cost less, does more, and holds almost 16 times as much text.

Word processing is one of the most powerful applications you can implement on a microcomputer. That's one reason why there are scores of programs to choose from. Which is best for you? Here are some things to think about.

Fundamental Features

Word processors are descended from *text editors*. Sometimes the terms are used interchangeably, but the phrase "text editor," when applied to a writing tool, is becoming less common.

Basically, text editors started out as utilities for editing programs. Programmers created text editors to help them modify their code before cursor keys and full screen editing became standard. Eventually, someone got the idea that writers could use the text-manipulation features to edit their prose. Since English has little in common with FORTRAN, more features were added to text editors to make them easier to use, especially since most writers at the time knew nothing (and probably cared less) about computers.

At first, writers did not have much say about what features a word processor should have. That's why some writers and typists were turned off by their contact with the early word processors. The short history of word processing has often been a struggle between what writers would like to have and what programmers think writers would like to have (few people are accomplished in both fields).

Since today's word processors owe their

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parentage to text editors, there is still some family resemblance. For example, some word processors are *line-oriented*. Generally, the editing is done on lines of text, rather than on words. Often the editing in a line-oriented word processor is done in a different mode, apart from the writing. This is a holdover from the days of text editors, since programs are written in distinct lines of code. Many writers find word-oriented word processors more natural, because individual words – not lines – are the building blocks of English.

The ability to translate thoughts into words without irretrievably committing them to paper is a great psychological advantage for a writer.

The most basic feature of all word processors is that they let you type on a TV screen or monitor rather than on paper. If you make a mistake, you don't have to back up and strike it out with xxxxx's, or try to hide it with messy chalk correction sheets or white fluid. Usually you just backspace the cursor, erasing what you mistyped, and then type it again.

But this is more than merely a way to banish errors. The ability to translate thoughts into words without irretrievably committing them to paper is a great psychological advantage for a writer. A sentence can be experimentally worded several different ways, and the awkward versions discarded.

There is a minus side to this feature. Since the words on the screen are not permanent, a sudden power failure (or even a split-second "wink") can wipe out everything you've written. The solution is to occasionally save your text to disk or tape, especially if it's important or hard to reconstruct.

Another universal feature of word processors is the ability to go back in your text and insert words, and even whole sentences or paragraphs, if you have second thoughts. Transitions can be smoothed, ambiguities clarified, rough edges polished. You can also go back and delete words, sentences, and paragraphs. To do these things on a typewriter, or when composing text longhand, you'd have to resort to striking over, crossing out, jotting in margins, and recopying the whole page to get a neat finished product. With a word processor, you do all your tinkering on the screen, and simply print out a neat copy when you're done.

Advanced Features

You can, of course, do very crude word processing without buying a word processing program at all. Using the built-in screen-editing functions found on nearly all home computers, you can write your text in a series of PRINT statements in BASIC, get everything just right, and then print it out.

You could also try programming a simple word processor in BASIC, perhaps storing the input in strings which are then PRINTed out. Program listings for BASIC word processors also have appeared in magazines, including **COMPUTE!**.

But for lots of writing, there are definite advantages to commercial word processors (when we say "word processors," we're speaking here of word processing programs for home/personal computers, not the *dedicated*, or single-purpose, word processing machines found in many offices). The best commercial software is in fast, efficient machine language and offers many advanced features. Some features to look for:

- *Block Move*. What if a sentence, paragraph, or even group of paragraphs somewhere in your document would work better somewhere else? Such as at the top, or maybe the end? A block move function replaces old-fashioned cutting and pasting. You can define a "block" of text and move it anywhere you want. Usually there is a limit on how much you can move, but you can move large sections in smaller chunks. Journalists like this feature because it lets them juggle the elements of their articles.

- *Headers/Footers*. A header is a short line of text which is automatically printed at the top of each page, and a footer is automatically printed at the bottom. For example, articles submitted to **COMPUTE!** for publication require a header atop each page that includes the author's last name, a one- or two-word article title, and the page number, such as "Smith/Memory Map/4." Most word processors allow you to define such a header (or a footer) once at the beginning of the document, and then automatically print it on each page.

- *Page-Numbering*. Sometimes this is called *pagination*, a term which more properly means something else (see below). Page-numbering means simply that pages will be automatically numbered if you wish. Often you can place the page number in a header or footer, or start from a number other than one (handy when adding something to an existing document).

- *Pagination*. Some people need to know exactly how the text will appear on paper. Perhaps

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the document contains columnar charts, or subheadings, or footnotes, or figures, which cannot be broken across two pages. Usually only expensive, dedicated word processing machines have screens which exactly simulate a sheet of typing paper. On other systems, especially home computers with less than 80-column wide screens, some advanced word processors allow the document to be "printed" to the screen, just as if the TV were a printer. This gives a preview of how the paper will appear. A word processor with pagination shows exactly where each page "breaks." If the break is undesirable, you can reformat the document, perhaps by changing the margins, and try again. If the format of documents is important to you, these features will save lots of paper.

- *Text Buffer.* This is a section of memory in which you can temporarily store a block of text. When you need it, you can recall the block and insert it anywhere in the document. Often this is separate from the buffer which handles block moves, but some word processors use one buffer for both functions. Sometimes buffers are used to rapidly delete large sections of text; the text is stored in the buffer and erased with a "block delete" or "erase buffer" command.

- *Chained Files.* Sometimes a document will be too large to fit into the computer at once. The solution is to write the document in several parts, saving each one to disk or tape separately. A word processor with file-chaining allows you to print the entire document as if it were one piece. Some programs do this automatically; when the end of one part is reached, they load the next part and continue printing. Others require you to supervise the operation and issue commands yourself.

- *Merged Files.* This powerful feature lets you assemble a document on the screen from several parts stored separately on disks or tapes. You could write something in bits and pieces, as the mood strikes you, and fit it together later. Or you could create form letters, storing frequently used paragraphs and merging them as needed with whatever's on the screen. This is a real labor-saver for lawyers and businesses. On some word processors, it's as easy as positioning the cursor at the bottom of the screen text and loading the next file as usual.

- *Justification.* Although your printer automatically lines up the left margin, the right margin is generally left "ragged," or staggered. Most word processors allow you to automatically "justify," or line up, the right margin also. This can present a neater appearance. However, some people find unjustified text easier to read (the typesetting in **COMPUTE!** is unjustified, or "ragged right").

- *Global Search.* With this powerful feature, you can give the word processor a word or phrase, and it will search through all the text and find every occurrence. What is this good for? Authors love it for indexing their books. Or, if you want to locate a particular sentence or section in a very long document, you can use the search function to find a word which you know appears there. In combination with the *Replace* function described below, you can make quick, repetitive changes to long documents.

- *Search And Replace.* Let's say you've written a long document in which you refer dozens of times to someone named "Smith." Then you discover that Smith spells his name "Smythe." You could spend an hour trying to track down every Smith yourself, and you'd probably miss a few. But with Search And Replace, the word processor does it for you, in seconds. It automatically changes every "Smith" to "Smythe." Some word processors pause each time they find the target word and ask if you're sure you want it replaced. That way, somebody else referred to in your document who really does spell his name "Smith" won't have his name misspelled, either.

- *Horizontal Scrolling.* Because the typical TV cannot clearly display more than 40 characters across a screen, virtually all home computers designed to work with TVs are limited to 40 columns or less. (There are 80-column adapters available for some computers, but they require a special computer monitor.) Since a standard sheet of typing paper accommodates up to 80 characters per line, what you see on the screen is not what you get on paper. To get around this, some word processors offer *horizontal scrolling*. The entire screen moves horizontally, right to left, as the cursor bumps against the right screen margin. In effect, the screen is a moving "window" looking onto a wider document. Some word processors scroll up to 140 columns horizontally, which is useful for business charts. The *Atari Word Processor* uses horizontal scrolling, and Commodore plans to market something similar for the Commodore 64.

- *Parsing.* Also known as *word wrapping*. On word processors, unlike typewriters, you can't hit a carriage return key at the end of each line. Instead, you just type continuously, pressing RETURN only at the end of paragraphs. When you reach the end of a screen line, some word processors break the last word wherever it happens to bump against the right screen margin. This leaves random word fragments at the beginning and end of each screen line. (The printer, of course, ignores this and prints the word whole.)

However, they instantly "jump" the word down to the next line as you type. The text appears on the screen "ragged-right." This is a highly personal feature. Some people say that parsing is distracting and wastes screen space; others believe that parsed, unbroken words are easier to proof-

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read on the screen. Try both methods before deciding which you prefer.

● *Superscripts, Subscripts.* These are the tiny numbers printed slightly above or below the normal line of copy. For instance, the exponent in 10^2 is a superscript; H_2O has a subscript. Not all word processors can handle these.

Superscripts and subscripts are examples of special printing functions. Others may include *boldfacing* (printing in darker type), *elongating* (printing in larger, stretched-out type), *condensing* (printing in smaller type), underlining, *proportional spacing* (the printer uses less space to print an I than a W), and *italics*. Word processors vary in the number of special printing functions they support.

The important thing to remember is that the word processor must be matched to the printer you're using. Special printing functions are activated by sending *control codes* to the printer – usually by embedding special characters in your text – and not all printers use the same control codes. So it's quite possible that your word processor allows underlining, but your printer does not. Likewise, your printer might allow italics, but your word processor might not.

This means you should carefully consider not only the word processor's features, but also how it works with your particular printer. If you're planning to buy a printer and a word processor at about the same time, decide which purchase will influence the other. Buying a certain printer will limit you to certain word processors; buying a certain word processor will limit you to certain printers. Some word processors get around this problem by being extremely flexible. They can be *configured* (modified) to match almost any printer on the market.

Enhancements

Since word processors are becoming extremely popular in business, a number of enhancements, or add-on programs, are being designed to work with them. Word processing is only one part of today's "automated office." Microcomputers also are used to maintain data bases, files, and mailing lists. Some word processors for home/personal computers also are made to work with companion programs.

For instance, if you must regularly send out form letters to addresses on a mailing list, why bother to retype the addresses each time? Some mailing list programs are designed to work with compatible word processors. With only a few keystrokes, you can recall addresses from the mailing list and merge them with your form letters.

The same thing is possible with some data base managers. The files can be transferred to a word processor and merged with letters or other documents.

If you think you might need these features, consider them carefully when choosing a word processor. Almost always, the various programs must be specially designed to work together.

Another interesting enhancement is a spelling-checker program. This program links up with your word processor, compares your spelling to its own dictionary, and corrects any errors. Some programs even allow you to add your own words to the dictionary – those that you find especially troublesome, or technical words unique to your field. Only a few spelling checkers are available for home/personal computers, but more are becoming available.

And as if that weren't enough, Bell Laboratories – the research arm of American Telephone & Telegraph – is perfecting a program called *Writer's Workbench*. This program detects and corrects all kinds of writing errors – grammatical as well as spelling. A companion program, diplomatically dubbed *Suggest*, recommends changes.

Even more amazing, *Writer's Workbench* can actually rewrite text to remove gobbledygook. Conceivably, it could be applied to everything from business letters to legal documents to federal regulations.

Will this super-sophisticated copy editor-on-

a-disk forever solve everybody's writing problems? Probably not. As an experiment, Bell scientists fed Abraham Lincoln's Gettysburg Address through *Writer's Workbench*. First, here's part of the familiar original:

> *Fourscore and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation or any nation so conceived and so dedicated can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.*

And now the computer's version:

> *Eighty-seven years ago, our grandfathers created a free nation here. They based it on the idea that everybody is created equal. We are now fighting a civil war to see if this or any similar nation can survive. On this battlefield we are dedicating a cemetery to those who died for their country. It is only right.*

That's pretty fancy work for a computer program. But most would agree that something was lost in the translation. It will probably be a long while before writers are laid off by their word processors. ©

Air Defense

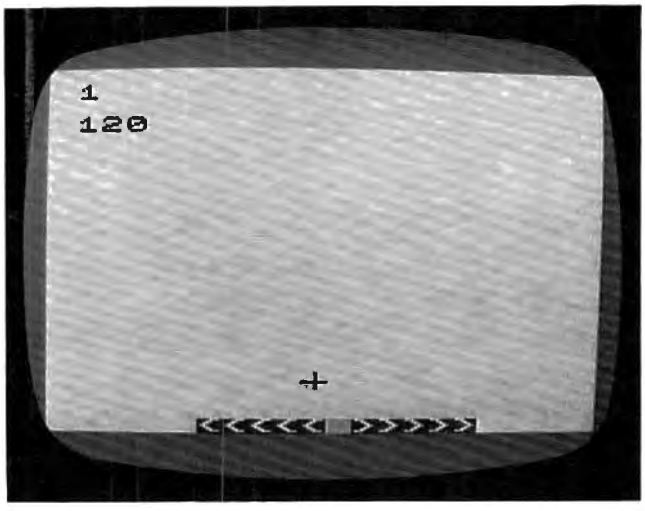
T. L. Wahl

"Air Defense" is a challenging game for the 5K VIC-20, 16K Atari 400/800, unexpanded TRS-80 Color Computer, Apple II, TI-99/4A, and PET/CBM. Look in the article for special notes on your particular machine.

The object of the game of "Air Defense" is to defend your land (at the bottom of the screen) from falling bombs. The bombs appear at various places at the top of the screen. As they fall, the player must line up the crosshair of his gunsight and fire when the bomb and crosshair are aligned. On the VIC version press S to move up, X to move down, ‹cursor down› to move left, and ‹cursor up› to move right. Press SPACE to fire.

The player gets only one shot, and timing is critical. After 20 bombs have appeared, the game ends, and the player is given a score showing hits and misses and a point score.

One of the unique features of the game is the increasing difficulty factor: as the player improves his skill, the crosshair is gradually moved toward the top of the screen, and quicker reflexes and improved technique are required to destroy the falling bombs. As a reward for increasing skill, the player earns higher point values for successive hits. In addition, the player receives a higher score the sooner the falling bomb is destroyed.



A bomb explodes in the VIC-20 version of "Air Defense" (PET/CBM and Apple versions are similar).

Program 1: VIC Version

```
100 X=RND(0)
110 A=8152:B=38872:P=0:M=0:T=0:Q=0
120 PRINT"{CLEAR}{07 DOWN}      AIR DEFENSE
    "
130 PRINT"{02 DOWN}      DO YOU NEED"
140 PRINT"{DOWN}     INSTRUCTIONS?"
150 PRINT"{DOWN}    TYPE 'Y' OR 'N'"
160 FOR H=1TO1000:GETD$
170 IF D$="N" THEN 380
180 IF D$="Y" THEN 220
190 NEXT
200 PRINT"{CLEAR}{DOWN}YOU DID NOT PRESS '
    Y' OR 'N'."
210 FOR K=1TO5000:NEXT:GOTO120
220 PRINT"{CLEAR}  YOU MUST STOP THE"
230 PRINT"   FALLING BOMB BY"
240 PRINT"    EXPLODING IT IN"
250 PRINT"      MID-AIR."
260 PRINT"{DOWN} MOVE THE CROSSHAIR"
270 PRINT"{DOWN}*{REV}LEFT{OFF}:CURSOR U/D
     KEY"
280 PRINT"{DOWN}*{REV}RIGHT{OFF}:CURSOR L/
    R KEY"
290 PRINT"{DOWN}*{REV}UP{OFF}:WITH THE 'S'
     KEY"
300 PRINT"{DOWN}*{REV}DOWN{OFF}:WITH THE '
    X' KEY"
310 PRINT"WHEN THE BOMB AND THE"
320 PRINT"CROSSHAIR ARE LINED UP, FIRE BY ~
    PRESSING THESPACE";
330 PRINT" BAR."
340 PRINT"{DOWN}PRESS ANY KEY TO START"
350 GET D$:IF D$="" THEN 350
360 PRINT"{CLEAR}{10 DOWN}      GOOD LUCK!
    "
370 FOR I=1TO2500 :NEXT
380 IFT=20 THEN 860
390 PRINT"{CLEAR}":D=INT(RND(1)*10)
400 T=T+1
410 E=D+7685
420 F=D+38405
430 PRINTP*Q*10
440 FOR I=1 TO 200:NEXTI
450 POKE A,91:POKE B,0
460 GET A$
470 IFA$="S"THENA=A-22:B=B-22
480 IF A$="X"THEN B=B+22:A=A+22
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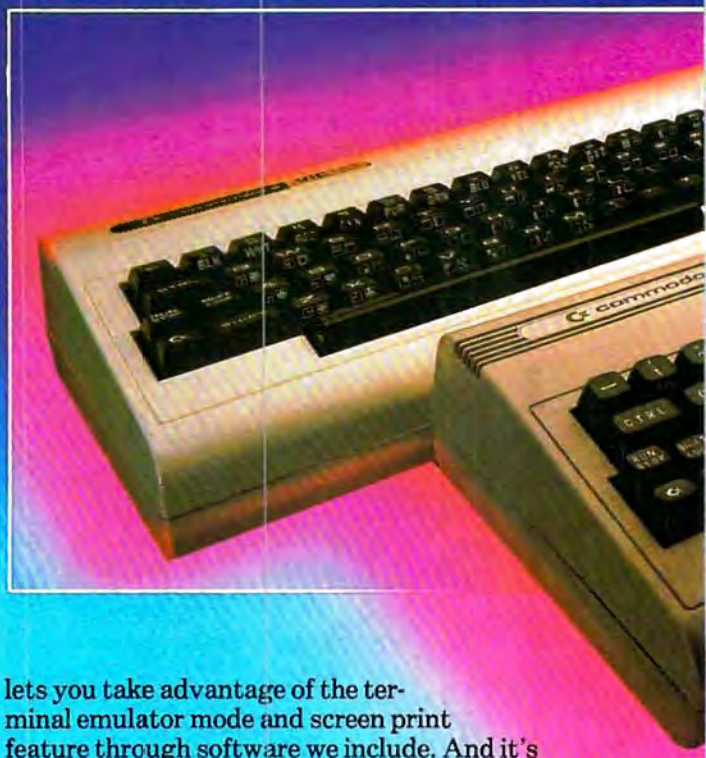

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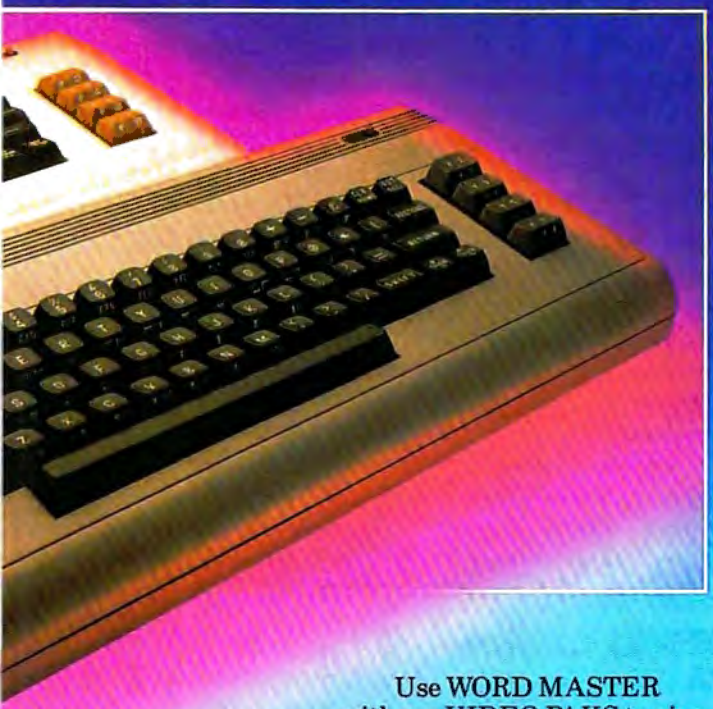

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```
490 IF A$="{RIGHT}"THEN A=A+1:B=B+1
500 IF A$="{DOWN}"THEN A=A-1:B=B-1
510 IF A<7680 THEN A=A+22:B=B+22
520 IF A>8163 THEN A=A-22:B=B-22
530 POKE E,42:POKE F,0
540 FOR I=1 TO 50:NEXT
550 IF E>8163 THEN GOTO 760
560 IF A=ETHEN 580
570 E=E+22:F=F+22:PRINT"{CLEAR}":GOTO450
580 GET B$
590 IFB$=" "THEN 620
600 GOTO 570
610 REM BOMB IS DESTROYED
620 X=100:FORI=1TO10:POKEE,X
630 POKE F,0
640 POKEE+21,X
650 POKEF+21,0
660 POKEE+24,X
670 POKEF+24,0
680 X=X+1
690 NEXT
700 NO=210:S1=-3:DU=60:GOSUB 960
710 P=P+1
720 Q=Q+22-INT((A-7680)/22)
730 A=A-22:B=B-22
740 GOTO380
750 REM BOMB GETS YOU!
760 POKE E,32:FOR I=1TO5
770 POKEE-I,188
780 POKEF-I,0
790 POKEE+I,190
800 POKEF+I,0
810 FOR S=1 TO 50:NEXT
820 NEXT
830 M=M+1
840 NO=135:S1=-2:DU=100:GOSUB 960
850 GOTO380
860 PRINT"{CLEAR}{DOWN}       GAME OVER"
870 PRINT"{03 DOWN}DESTROYED"P
880 PRINT"{02 DOWN}MISSED"M
890 PRINT"{02 DOWN}TOTAL POINTS"P*Q*10
900 FOR I=1 TO 30:GET D$:NEXT I
910 PRINT"{04 DOWN}PRESS {REV}P{OFF} TO PL
    AY AGAIN"
920 GET D$:IF D$="" THEN 920
930 IF D$="P" THEN 110
940 END
950 REM EXPLOSIONS
960 POKE 36877,NO
970 FOR I=15 TO 1 STEP S1
980 POKE 36878,I
990 FOR DELAY=1TODU:NEXTDELAY:NEXTI
1000 POKE 36877,0:POKE 36878,0
1010 RETURN
```

Atari Notes

Program 2 will run on any 16K Atari 400/800. Protect your multicolored city (designed by Harry Blair, **COMPUTE!**'s illustrator) from falling bombs. Move the crosshair with your joystick to intercept the bomb before it lands. You receive more points the higher up on the screen you intercept the bomb. The game ends when the city is finally pulverized.

A Velocity Stick

You'll probably notice that joystick response is a little odd. When you move it just a bit, your crosshair moves finely. But when you continue pressing it in a certain direction, the crosshair really takes off. This type of joystick response is called a *velocity stick*, or more accurately, an *acceleration stick*.

A velocity stick lets the player have fine control over his marker, but automatically speeds up response when the stick is pushed long enough. It's like the gas pedal in a car. A true acceleration stick would also coast a while when you let go, but not in Air Defense.

This game was an experiment of sorts. Among the novelties are realistic multicolored characters in IRG mode 5 (see the Atari Notes for "Thunderbird," **COMPUTE!**, January 1983, #32), and a multicolor player (the airplane) formed by overlaying two players to get three colors.

Of course, some machine language is necessary to move player/missile graphics (unless you use strings). A small routine moves players zero and one (the airplane) in tandem. BASIC is too slow to use two POKEs without some flicker. The other routines are more interesting. QUIKMOVE moves a series of bytes from one position to another. It is used here to move the shapes for the explosion (stored in the character set) into player four. It can only move up to 255 bytes.

PMG ML Routine

PMOVE is responsible for moving a player any number of spaces up or down. It does this by "scrolling" the player memory strip the number of specified times. It can move the player down the screen as many as 127 times, and move it up by adding 128 to the number of moves you want to go up (it makes more sense in machine language). It will only move the player vertically; and, if you move too much, the player will disappear (a good way to clear out a player is to move it 0 bytes, which is really 128 bytes). It's used in Air Defense to move the crosshair.

The syntax for SPOKE (Simultaneous POKE) is:

XX=USR(1719,N)

N is the new horizontal position of players zero and one.

The syntax for QUIKMOVE is:

XX=USR(1729,FROM,TO,LENGTH)
FROM=source address,
TO=destination address, and
LENGTH=number of bytes to move.

The syntax for PMOVE is:

XX=USR(1664,ADR,N)

N is either 1-127 to move the player down, or 129-255 ((1 - 127)+128) to move the player up. ADR is the address of the player's first byte (player zero would be PMBASE+512 in double-resolution).

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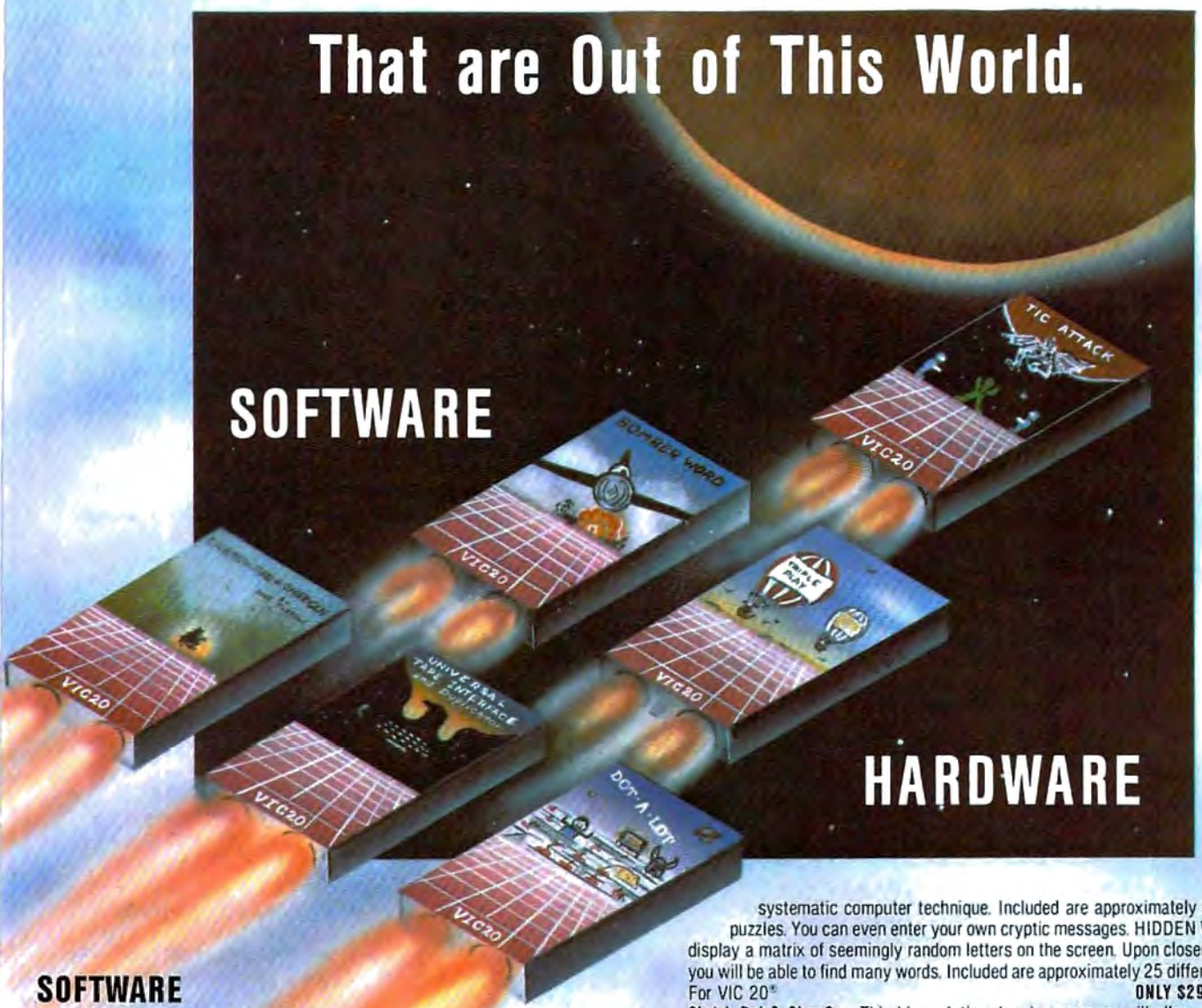

SOFTWARE

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

ZAP!–Climbing the corporate ladder could be fun except for all that falling paperwork. This Hires arcade type game allows up to 4 players to advance through each floor and change levels to scale the corporate ranks. Be careful, it's easy to be ZAPPED! CARTRIDGE for VIC 20.® **$29.95**

Bomber Word–A unique graphic word game on cartridge that provides the full thrill of arcade action. Complete with six modes of play options for added enjoyment. Play against the computer or another player. 6 to adult. For VIC 20®. **$29.95.**

Tic Attack–A fast action arcade game on Cartridge that challenges all of your dexterity. Written in machine language for special audio & visual effects. Over 100 levels of play. High score indication. For VIC 20®. **$29.95**

Dot-A-Lot–As you wander through the maze of life collecting Berries, you happen upon some magical fruit. Pick one and the treasures appear, but the Meanies are out today looking to spoil your fun. Defeat them and continue on to a higher level. An ever changing maze plus arcade type animation and sound will provide a real winning CARTRIDGE for the VIC 20®. **$29.95**

Triple Play–Three word games that are both fun and educational. The games that are included are CROSSWORDS (requires at least 8K expansion). Five complete puzzles are included and each puzzle has up to 100 different words. CRYPTO-SOLVE will help you solve those cryptic messages found in newspapers, books, and magazines with a systematic computer technique. Included are approximately 50 different puzzles. You can even enter your own cryptic messages. HIDDEN WORDS will display a matrix of seemingly random letters on the screen. Upon closer inspection, you will be able to find many words. Included are approximately 25 different puzzles. For VIC 20® **ONLY $29.95 for all 3**

Sketch Pad & Char-Gen–This hi-resolution drawing program will allow you to draw pictures in detail. Use either the keyboard or optional joystick. A fill command will allow you to fill a block and other commands allow you to easily clear the screen. You can also save and load pictures. Char-Gen is a simple to use custom character generator that will allow you to design different characters for each printable key on the computer. This program is an excellent device to design game creatures, foreign alphabets, secret symbols, or other special characters. One set is included and you can make and store others quite easily. Both for VIC 20® **ONLY $24.95**

HARDWARE

Expand-O-Ram–16K Expansion Board for the VIC 20® with reset, memory write protect, full memory allocation, plus TWO expansion slots. Like having 2 products in 1. Can even be used as a cartridge development system. **$119.00**

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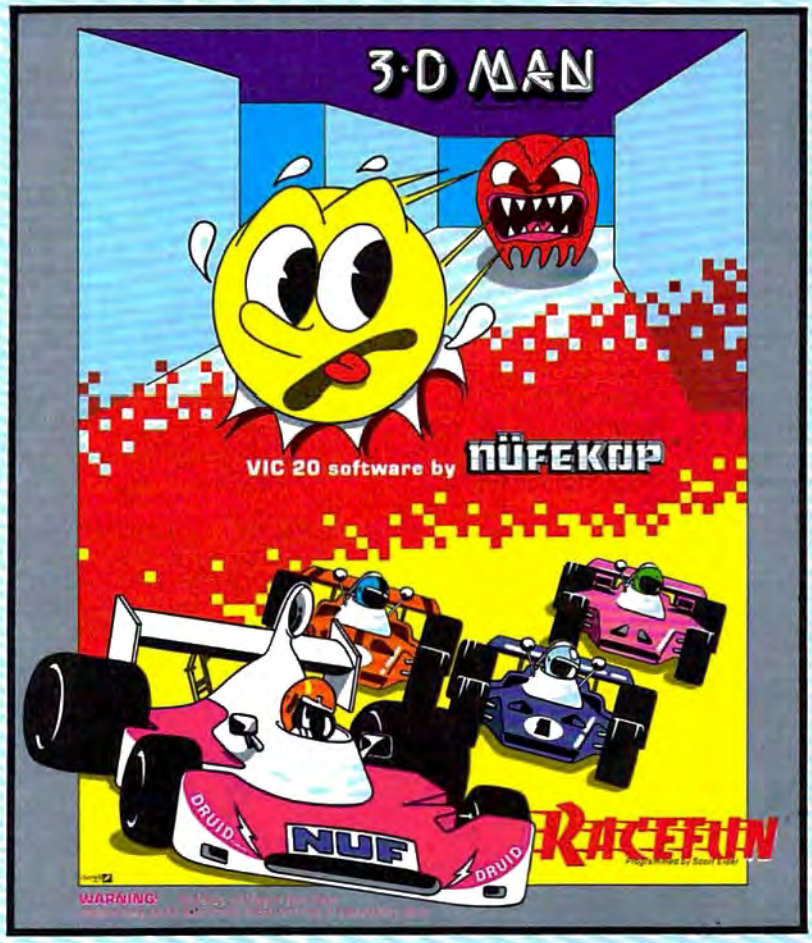
Program 2: Atari Version

```
100 REM AIR DEFENSE - ATARI VERSION
110 REM Charles Brannon 1983
120 REM
130 GOSUB 590:REM Initialize game
140 PLANEPOS=30:BOMBFALLING=0
150 POSITION 28,0:IF DIFF=1 THEN ? "
    EASY":GOTO 170
160 ? "hard"
170 K=PEEK(53279):IF K=5 THEN DIFF=3
    -DIFF
180 IF K=PEEK(53279) THEN 180
190 IF K<>6 THEN 150
200 POSITION 28,0:? "{4 SPACES}":POK
    E 53278,0
210 IF PEEK(53279)=6 THEN RUN
220 IF SELECTED>=0 THEN 240
230 SELECTED=INT(39*RND(0)):IF CITY$
    (SELECTED+1,SELECTED+1)=CHR$(0)
    THEN 230
240 IF PLANEPOS>210 THEN PLANEPOS=30
250 A=USR(SPOKE,PLANEPOS):PLANEPOS=P
    LANEPOS+3
260 IF INT((PLANEPOS-48)/4)=SELECTED
     THEN YPOS=3:BOMBFALLING=1
270 IF  NOT BOMBFALLING THEN 300
280 COLOR 32:PLOT SELECTED,YPOS-DIFF
    :COLOR 64:PLOT SELECTED,YPOS
290 YPOS=YPOS+DIFF:SOUND 0,YPOS,2,4:
    SOUND 1,YPOS,10,YPOS/1.4:IF YPOS
    >21 THEN 450
300 ST=STICK(0):GOSUB 400:IF ST=15 T
    HEN VEL=0
310 VEL=VEL+1:XD=(PTRIG(0)-PTRIG(1))
    *VEL
320 PX=PX+XD:IF PX<46 OR PX>200 THEN
     PX=PX-XD
330 POKE 53250,PX
340 YD=VEL*(-((ST=14)+(ST=10)+(ST=6)
    )+((ST=9)+(ST=5)+(ST=13)))
350 IF YD=0 THEN 210
360 POKE 77,0:PY=PY+YD:IF PY<32 OR P
    Y>96 THEN PY=PY-YD:GOTO 210
370 D=YD:IF D<0 THEN D=128-D
380 A=USR(PMOVE,P2,D)
390 GOTO 210
400 IF PEEK(53254)=0 THEN RETURN
410 EX=PX:EY=PY:GOSUB 490:COLOR 32:P
    LOT SELECTED,YPOS-DIFF:BOMBFALLI
    NG=0:SELECTED=-1
420 SCORE=SCORE+(22-YPOS)*10:POSITIO
    N 28,0:? SCORE;
430 PX=140*RND(0)+48:POKE 53250,PX
440 POKE 53278,0:POP :GOTO 210
450 EY=104:EX=SELECTED*4+44:POKE 532
    59,1:COLOR 32:PLOT SELECTED,YPOS
    -DIFF:GOSUB 490:POKE 53259,0:POK
    E 53278,0
460 BOMBFALLING=0:CITY$(SELECTED+1,S
    ELECTED+1)=CHR$(0):SELECTED=-1
470 HIT=HIT+1:IF HIT=39 THEN 1020:RE
    M TOTAL DESTRUCTION
480 PX=140*RND(0)+48:POKE 53250,PX:G
    OTO 210
490 REM DO EXPLOSION IN PLAYER 4
500 REM AT POSITION EX,EY
510 POKE 53251,EX:EP=P3+EY:POKE 5325
    0,0
520 FOR I=1 TO LEN(EXPL$)
530 POKE 707,PEEK(53770):IF FINAL TH
    EN POKE 53251,EX:EX=EX+4*(EX<250
    )
540 A=USR(QUIKMOVE,CHSET+ASC(EXPL$(I
    ))*8,EP,7)
550 SOUND 0,I*5+YPOS*2,0,13-I+FINAL*
    2:SOUND 1,I*10+FINAL*100,0,6.5-I
    /2
560 NEXT I:POKE 53250,PX
570 RETURN
580 END
590 REM INITIALIZATION
600 DIM EXPL$(20):EXPL$(1)=CHR$(15):
    FOR I=2 TO 6:EXPL$(I)=CHR$(24+I)
    :NEXT I:EXPL$(7)=";<=>?":EXPL$(1
    2)=CHR$(0)
610 CHSET=(PEEK(106)-16)*256:IF PEEK
    (CHSET+8)=21 THEN 630
620 GRAPHICS 2+16:SETCOLOR 4,9,4:SET
    COLOR 0,1,10:POSITION 5,5:? #6;"
    PLEASE WAIT":GOSUB 1120:GOSUB 86
    0
630 SPOKE=1719:QUIKMOVE=1729:PMOVE=1
    664:DIFF=1
640 GRAPHICS 0:POKE 756,CHSET/256:SC
    R=PEEK(88)+256*PEEK(89):SETCOLOR
     4,1,10:POKE 559,0
650 DL=PEEK(560)+256*PEEK(561)+4
660 POKE DL-1,6+64:POKE DL+2,6
670 FOR I=3 TO 22:POKE DL+I,4:NEXT I
    :POKE DL+I,5:POKE DL+I+1,65:POKE
     DL+I+2,PEEK(560):POKE DL+I+3,PE
    EK(561)
680 DIM CITY$(39)
690 CITY$="!■■$%&'()*+,.-$#&$')$+'!(
    ).-#!(%$'■■$',.":POSITION 0,21:?
    CITY$;
700 POSITION 5,0:? "AIR DEFENSE"
710 PMB=PEEK(106)-16:PMBASE=PMB*256:
    P0=PMBASE+512:P1=P0+128:P2=P1+12
    8:P3=P2+128
720 PY=60:PX=127:OY=PY
730 FOR I=0 TO 3:POKE 53248+I,0:NEXT
     I
740 POKE 53277,3:POKE 54279,PMB:POKE
     53256,1:POKE 53257,1:POKE 53258
    ,0
750 FOR I=0 TO 3:A=USR(PMOVE,P0+I*12
    8,0):NEXT I
760 RESTORE 780:FOR I=0 TO 7:READ A:
    POKE P0+I+22,A:NEXT I:FOR I=0 TO
     7:READ A:POKE P1+I+22,A:NEXT I
770 FOR I=0 TO 7:READ A:POKE P2+PY+I
    ,A:NEXT I
780 DATA 0,0,126,127,63,0,0,0
790 DATA 176,216,0,42,0,24,48,0
800 DATA 0,8,8,54,8,8,0,0
810 POKE 53250,PX:POKE 623,33:POKE 7
    04,20:POKE 705,3*16+2:POKE 706,3
    0
820 SETCOLOR 0,7,6:SETCOLOR 1,15,4:S
    ETCOLOR 2,0,10:SETCOLOR 4,0,0:PO
    KE 559,46
830 RETURN
840 GOTO 830
850 GOTO 850
860 RESTORE 870:FOR I=1664 TO 1752:R
    EAD A:POKE I,A:NEXT I:RETURN
870 DATA 104,104,133,204,104,133
880 DATA 203,104,104,170,48,20
890 DATA 160,126,177,203,200,145
900 DATA 203,136,136,16,247,169
```

Exterminator By Ken Grant
Just about as action-packed and complex as is nufisically possible in your standard 5K VIC 20. This extremely well-written, machine code game is invariably praised by customers and has been called the second best tape game made for the VIC of 1982 (oh, no, not by us, we don't agree with that opinion). Rapidfire from the bottom of the screen at moving insects and creatures . . . anything that moves, and even anything that doesn't. Just don't be overrun by any or all. It's as much fun the hundredth time you play it as it was the first. This game plays stick or key and runs in standard 5K VIC 20.

3-D Man Not just another eat-the-dots-in-a-maze game, this! Though you find yourself in an edible dot-littered floor plan that may seem vaguely familiar, we guarantee you have never looked at it from this perspective (eye level) before. The dots diminish into the distance as you race down a hallway eating them one after the other. The dot-remaining counter on the right clicks downward. Race through a 4-way intersection and whoops! Head to head with one of the ghosts that haunt these halls! Back quickly on the stick puts you facing the dotless hall you just cleaned out when . . . another ghost! A quick left turn into that junction saves you, but in the confusion you've lost direction momentarily and must check the miniature radar plotting screen to set things straight. . . . Definitely, an ordinary maze game this one is *not*. 3-D Man requires a joystick and at least 3K extra memory.

Racefun Extensive use of multi-color character graphic capabilities of the VIC make this game very appealing to the eye. Fast all-machine language action, quick response to the stick or keyboard-controlled throttle, combine with the challenge of driving in ever-faster traffic to make it appeal to the rest of the body. Plays joystick or keyboard.



Antimatter Splatter! A more dastardly alien could scarcely be found than one who would wipe out an entire civilization by dropping anti-matter anti-canisters, right? If your opinion of this alien troublemaker is the same as ours, probably your first thought was, get some matter! We say calm down! All is not lost. A mobile rapid splatter cannon capable of both breaking through his standard alien moving force fields and laying waste to the ever-increasing number of anti-canisters is even now hovering above us. If only our cannoneer hadn't called in sick...say, what are you doing today? *Anti-Matter Splatter* is 100% machine language and runs in standard 5K VIC.

Defender on Tri As pilot of the experimental Defender-style ship "Skyes Limited," you are the only hope for an advance party of scientists trapped in ancient alien sphere which suddenly (heat from collision course with sun presumably—G.E.) came to life. Four screens worth of unique defenses, on-off shields, fuel deposits, alien treasures, running timer, energy, score and very nice graphics display make this one that does not quickly wax old. *Defender on TRI* requires at least 3K memory expander, but will run with any memory add-on (8K, 16K, 24K, etc.) we have come across.

Alien Panic Standard 5K VIC 20/combination stick & keyboard. This arcade-type game pits you against time and an alien on a six level construction sight with ladders and pitfalls, but *not to worry!* You have a shovel.

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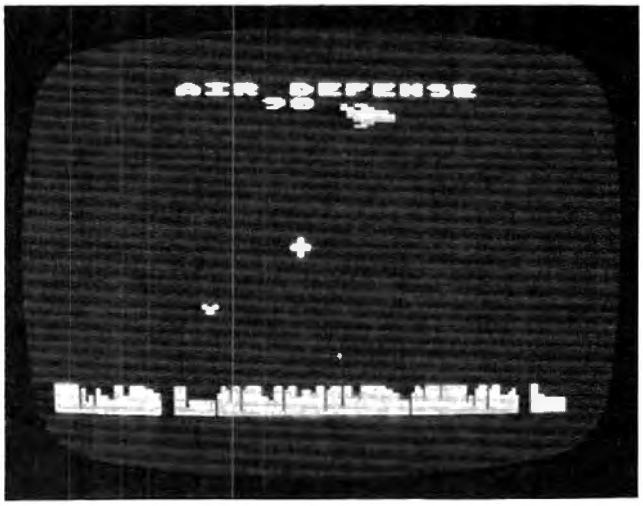
```
910 DATA 0,168,145,203,202,208
920 DATA 237,96,41,127,170,160
930 DATA 1,177,203,136,145,203
940 DATA 200,200,16,247,136,169
950 DATA 0,145,203,202,208,237
960 DATA 96,104,104,104,141,0
970 DATA 208,141,1,208,96,104
980 DATA 104,133,204,104,133,203
990 DATA 104,133,206,104,133,205
1000 DATA 104,104,168,177,203,145
1010 DATA 205,136,16,249,96
1020 REM TOTAL DESTRUCTION
1030 POKE 53259,3:PX=0:EY=104:FINAL=
     1:FOR L=1 TO 4:EX=100*RND(0)+32
     :GOSUB 490:NEXT L
1040 POKE 53277,0:FOR I=0 TO 2:POKE
     53261+I,0:NEXT I
1050 GRAPHICS 3+16:FOR I=0 TO 3:X=19
     :FOR Y=0 TO 11:X=X-1:COLOR 3*RN
     D(0):PLOT 19-X*RND(0),12-Y:COLO
     R 3*RND(0)
1060 POKE 708,PEEK(53770):POKE 709,P
     EEK(53770):POKE 710,PEEK(53770)
     :POKE 712,PEEK(53770):SOUND I,1
     00+I*10,0,15-Y/2
1070 PLOT 19+X*RND(0),12-Y:COLOR 3*R
     ND(0):PLOT 19-X*RND(0),12+Y:COL
     OR 3*RND(0):PLOT 19+X*RND(0),12
     +Y:NEXT Y:NEXT I
1080 FOR W=1 TO 100:POKE 712,PEEK(53
     770):NEXT W
1090 FOR I=0 TO 1:SOUND I,0,0,0:NEXT
      I
1100 GRAPHICS 0:POKE DL+10,7:POSITIO
     N 5,9:? "SCORE:";SCORE;
1110 SETCOLOR 2,4,0:FOR W=1 TO 100:P
     OKE 712,48+14*RND(0):NEXT W:RUN

1120 FOR I=128 TO 207:POKE CHSET+I,P
     EEK(57344+I):NEXT I:FOR I=264 T
     O 471:POKE CHSET+I,PEEK(57344+I
     ):NEXT I
1130 RESTORE 1170
1140 READ A:IF A=-1 THEN RETURN
1150 FOR J=0 TO 7:READ B:POKE CHSET+
     A*8+J,B:NEXT J
1160 GOTO 1140
1170 DATA 0,0,0,0,0,0,0,0,0
1180 DATA 1,21,21,55,21,183,149,183,
     149
1190 DATA 2,0,8,40,170,170,170,166,1
     66
1200 DATA 3,85,85,125,85,125,85,125,
     85
1210 DATA 4,80,82,242,82,242,82,242,
     90
1220 DATA 5,0,1,1,17,17,81,101,105
1230 DATA 6,0,0,0,80,234,234,234,238
1240 DATA 7,80,80,80,89,189,189,189,
     189
1250 DATA 8,170,186,238,186,238,186,
     238,170
1260 DATA 9,0,80,90,90,95,95,127,127
1270 DATA 10,10,138,139,74,75,74,75,
     73
1280 DATA 11,168,168,184,168,184,168
     ,186,170
1290 DATA 12,0,0,0,0,85,170,187,170
1300 DATA 13,16,20,92,84,94,85,93,85
1310 DATA 14,0,0,0,0,168,84,116,84
1320 DATA 15,0,0,0,24,60,24,0,0
1330 DATA 26,0,0,24,60,60,24,0,0
1340 DATA 27,0,0,60,126,126,60,0,0
1350 DATA 28,0,56,124,254,124,56,0,0
1360 DATA 29,24,60,126,255,255,126,6
     0,24
1370 DATA 30,60,126,255,255,255,255,
     126,60
1380 DATA 31,126,255,255,255,255,255
     ,255,126
1390 DATA 32,0,195,235,40,40,20,0,0
1400 DATA 59,126,255,255,231,231,255
     ,255,126
1410 DATA 60,60,126,247,199,227,239,
     126,60
1420 DATA 61,60,102,219,189,189,219,
     102,60
1430 DATA 62,66,153,36,66,66,36,153,
     66
1440 DATA 63,60,102,195,129,129,195,
     102,60
1450 DATA 64,8,8,20,99,20,8,8,0
1460 DATA 65,0,0,126,127,63,0,0,0
1470 DATA 66,176,216,0,42,0,24,48,0
1480 DATA 127,16,24,28,30,30,28,24,1
     6
1490 DATA -1
```



In the Atari version of "Air Defense," a multicolored jet drops bombs as you maneuver your defending crosshair.

TRS-80 Color Computer Notes

Program 3 will run on unexpanded Color BASIC. Instructions are displayed when you RUN the game. Try to intercept the falling bombs with your crosshair cursor, and press the red fire button when they intersect. The higher up on the screen you detonate the bomb, the more points you receive.

Program 3: TRS-80 Color Computer Version

```
100 ' COLOR COMPUTER
110 ' AIR DEFENSE
120 CLS:PRINT@10,"AIR DEFENSE":PRINT
130 PRINT"SAVE YOUR CITY FROM FALLING
    "
140 PRINT "BOMBS. USE THE RIGHT JOYS
```

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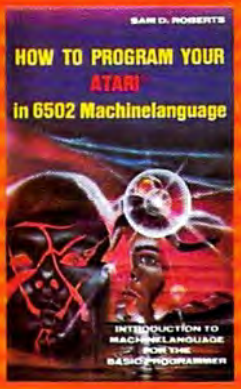

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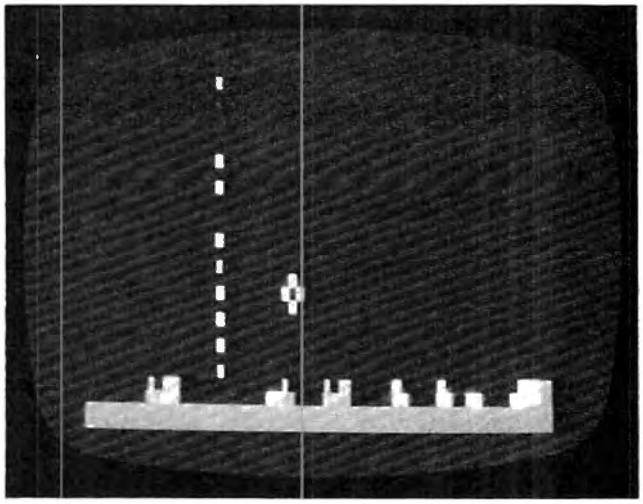
```
    TICK
150 PRINT"TO INTERCEPT BOMBS BEFORE T
    HEY
155 PRINT"LAND.  THE SOONER YOU HIT T
    HE
157 PRINT"BOMB, THE BETTER YOUR SCORE
     IS.":PRINT
160 PRINT"THE GAME CONTINUES
170 PRINT"UNTIL YOUR CITY IS GONE."
180 PRINT:PRINT"PRESS THE RED BUTTON
    TO BEGIN"
190 GOSUB 500:IF FIRE=0 THEN 190
195 CITY$="CGKO"
200 CLS0:PRINT@481,"";
210 FORI=1TO30:PRINTCHR$(ASC(MID$(CIT
    Y$,RND(4)))+64+8*RND(7));:NEXT:PR
    INT
220 DIM CITY(63):FORI=1TO63:CITY(I)=1
    :NEXT
240 CX=31:CY=15:OX=CX:OY=CY
250 BX=RND(60)+1:IFCITY(BX)=0THEN250
260 FOR B=1 TO 28STEP2
280 RESET(OX,OY):RESET(OX-1,OY+1):RES
    ET(OX+1,OY+1):RESET(OX,OY+2)
290 CX=JOYSTK(0):CY=JOYSTK(1)/2
300 IFCX<1THENCX=1
305 IFCX>62THENCX=62
310 IFCY<1THENCY=1
320 IFCY>25THENCY=25
322 SET(CX,CY,5):SET(CX+1,CY+1,5):SET
    (CX-1,CY+1,5):SET(CX,CY+2,5)
325 OX=CX:OY=CY
327 IF(PEEK(65280)=126ORPEEK(65280)=2
    54)ANDABS(CX-BX)<1ANDABS(CY-B)<1T
    HEN1500
330 SET(BX,B,RND(8))
340 NEXT B
341 CITY(BX)=0
342 CITIES=CITIES+1:IFCITIES=60THEN10
    00
350 REM EXPLOSION
351 GOSUB2000:SOUND250,1:SOUND251,1:S
    OUND253,1:SOUND255,1
355 FORI=1TO5
360 SET(BX-2,B-2,8):SET(BX,B-2,2):SET
    (BX+2,B-2,8):SET(BX-1,B-1,2):SET(
    BX+1,B-1,2):SET(BX,B,4)
370 RESET(BX-2,B-2):RESET(BX,B-2):RES
    ET(BX+2,B-2):RESET(BX-1,B-1):RESE
    T(BX+1,B-1):RESET(BX,B)
380 NEXTI
390 GOTO250
499 END
500 REM JOYSTICK FIRE BUTTON ROUTINE
510 Z=PEEK(65280):FIRE=(Z=126)OR(Z=25
    4)
520 RETURN
1000 REM GAME OVER
1010 FORI=0TO31
1020 FORI=31TO0STEP-1
1030 FORJ=1TO5
1040 SET(RND(63),I,RND(8))
1050 NEXT:NEXT
1060 PRINT@0,"PRESS FIRE TO PLAY AGAI
     N":GOTO190
1500 GOSUB2000:SOUND240,5
1510 SCR=SCR+100-B*100/31
1520 PRINT@490,INT(SCR);
1530 GOTO250
2000 FORI=B TO 0 STEP-2:RESET(BX,I):N
     EXT:RETURN
```



Falling bombs leave trails in the TRS-80 Color Computer version of "Air Defense," which also features a joystick-controlled crosshair.

Apple II Notes

The instructions for Program 4 are given when the program is run. You will find that the REPEAT key, along with the necessary crosshair controls and fire button (the space bar), can greatly improve your scores. The bomb number and score are displayed in the upper left corner.

Program 4: Apple Version

```
100 P = 0:M = 0:T = 0:Q = 0
110  FOR I = 0 TO 21: READ C5: POKE 768
      + I,C5: NEXT I
120  DATA  169,200,133,7,173,48,192,136
     ,208,4
130  DATA  198,7,240,7,202,208,246,162,
     100,100,239,96
140  TEXT : HOME
150  VTAB 6: PRINT  SPC( 14);"AIR DEFEN
     SE"
160  VTAB 11: PRINT  TAB( 15)"DO YOU NE
     ED"
170  PRINT : PRINT  TAB( 14)"INSTRUCTIO
     NS?"
180  PRINT : PRINT  TAB( 13)"TYPE 'Y' O
     R 'N'"
190  PRINT : HTAB 20: GET D$
200  IF D$ = "N" THEN 310
210  IF D$ <  > "Y" THEN  GOTO 190
220  HOME
230  VTAB 3: PRINT  SPC( 14);"AIR DEFEN
     SE"
240  PRINT : PRINT : PRINT : PRINT : PRINT
     "    YOU MUST STOP THE FALLING BOM
     B"
250  PRINT  SPC( 5)"BY EXPLODING IT IN
     MID-AIR.": PRINT
260  PRINT : PRINT  SPC( 9)"MOVE THE CR
     OSSHAIR:"
270  PRINT : PRINT  SPC( 8)"LEFT WITH T
     HE '<-' KEY": PRINT  SPC( 8)"RIGHT
      WITH THE '->' KEY"
280  PRINT  SPC( 8)"UP WITH THE 'S' KE'
     ": PRINT  SPC( 8)"DOWN WITH THE '
     ' KEY"
```

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```
290  PRINT : PRINT : PRINT " WHEN THE B
     OMB AND THE CROSSHAIR ARE IN": PRINT
     " LINE, FIRE BY PRESSING THE SPACE
      BAR."
300  FOR I = 1 TO 10000: NEXT : HOME : VTAB
     10: HTAB 15: FLASH : PRINT "GOOD L
     UCK!": FOR I = 1 TO 5000: NEXT : NORMAL

310 VC = 22
320  IF T = 20 THEN 780
330  HOME : VTAB 24: INVERSE : FOR I =
     2 TO 39: HTAB I: PRINT " ";: NEXT
     I: NORMAL
340 HC = 21:T = T + 1:VB = 0: VTAB 2: HTAB
     3: PRINT T
350  VTAB 4: INVERSE : PRINT P * Q * 10
     : NORMAL
360 HB =  INT ( RND (1) * 29) + 6
370 VB = VB + 1
380  IF VB = 1 THEN 400
390  HTAB HB: VTAB VB - 1: PRINT " "
400 OVCROSS = VC:OHCROSS = HC
410 A =  PEEK ( - 16384): POKE  - 16368
    ,0
420  IF A - 128 =  ASC ("S") THEN VC =
     VC -  SGN (VC - 1)
430  IF A - 128 =  ASC ("X") THEN VC =
     VC +  SGN (22 - VC)
440  IF A = 136 THEN HC = HC -  SGN (HC
      - 2)
450  IF A = 149 THEN HC = HC +  SGN (39
      - HC)
460  IF VC = OVCROSS AND HC = OHCROSS THEN
     480
470  HTAB OHCROSS: VTAB OVCROSS: PRINT
     " "
480  HTAB HC: VTAB VC: PRINT "+"
490  HTAB HB: VTAB VB: PRINT "*"
500  FOR I = 1 TO 50: NEXT I
510  IF VB = 23 THEN 560
520  IF VB = VC AND HB = HC THEN 540
530  GOTO 370
540  IF A - 128 =  ASC (" ") THEN 650
550  GOTO 370
560  REM  MISS
570  VTAB VB: HTAB HB: PRINT " "
580  VTAB 24: INVERSE : FOR I = 1 TO 5:
      HTAB HB - I: PRINT "<";: HTAB HB +
     I: PRINT ">";: NEXT I
590  FOR K = 1 TO 100
600  CALL 768
610  NEXT K
620  FOR I = 1 TO 100: NEXT I
630 M = M + 1: GOTO 320
640  REM  HIT
650  HTAB HC - 1: VTAB VC - 1: PRINT  CHR$
     (220);" /"
660  HTAB HC - 1: VTAB VC: PRINT "- -"
670  HTAB HC - 1: VTAB VC + 1: PRINT "/
      "; CHR$ (220)
680  REM  SOUND ROUTINE
690  FOR K = 1 TO 20
700  FOR I = 1 TO K
710  CALL 768
720  NEXT I
730  NEXT K
740 Q = Q + 23 - VC
750 P = P + 1
760 VC = VC - 1
770  GOTO 320
780  REM  GAME OVER
790  HOME
800  VTAB 8: HTAB 15: FLASH : PRINT "GA
     ME OVER": NORMAL
810  VTAB 12: PRINT  TAB( 12)"DESTROYED
      "P
820  VTAB 14: PRINT  TAB( 15)"MISSED "M

830  VTAB 17: PRINT  TAB( 11)"YOUR SCOR
     E "P * Q * 10
840  VTAB 20: HTAB 10: INPUT "ANOTHER G
     AME (Y/N) ";AN$
850  IF AN$ = "N" THEN 880
860  IF AN$ <  > "Y" THEN  VTAB 20: HTAB
     29: PRINT "      ": GOTO 840
870  RUN
880  END
```

TI-99/4A Notes

The TI-99/4A version of Air Defense is similar to the VIC-20 version. In fact, scoring is calculated in the same manner: the sooner the bombs are destroyed, the higher the score. However, the TI-99/4A version's graphics are drawn with custom characters.

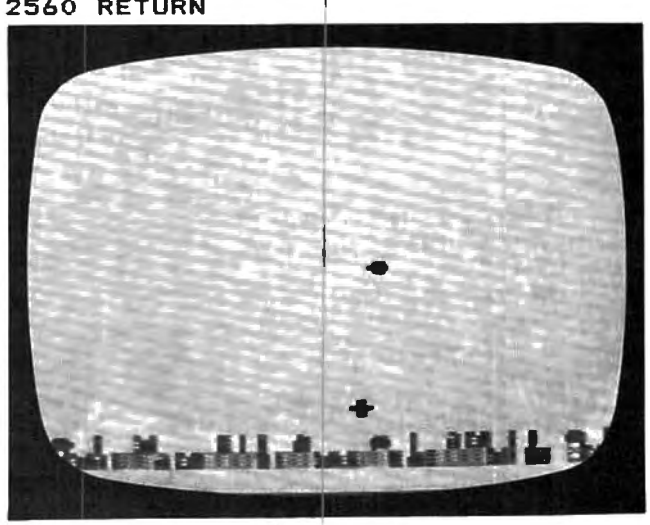
Most of the shapes in the game are custom characters that were designed with the aid of the character definition program in the TI-99/4A *User's Reference Guide* (pages III-26 and III-27). Custom characters created in this manner were then assigned ASCII code numbers in the range 122-136, which correspond to character sets 12, 13, and 14. Since no character set higher than 14 is referenced in the program, the Extended BASIC mode can be used for a faster, more challenging game.

Program 5: TI Version

```
100 DIM BLOCK$(2),PLACE(2),BUILDING(
    32,2)
110 RANDOMIZE
120 REM BOMB CHARACTER
130 CALL CHAR(129,"001CBEFFFFBE1C00"
    )
140 REM CROSSHAIR CHARACTER
150 CALL CHAR(130,"181818FFFF181818"
    )
160 CALL CLEAR
170 CALL SCREEN(12)
180 FOR J=5 TO 8
190 CALL COLOR(J,5,16)
200 NEXT J
210 FOR J=9 TO 12
220 CALL COLOR(J,2,14)
230 NEXT J
240 T=0
250 P=0
260 Q=0
270 M=0
280 CALL CLEAR
290 PRINT "{8 SPACES}AIR DEFENSE"
300 PRINT
310 PRINT
320 PRINT
330 PRINT " do you need instructions
    ?"
340 PRINT
```

```
350 PRINT "{8 SPACES}type Y or N"
360 FOR I=1 TO 7
370 PRINT
380 NEXT I
390 CALL KEY(3,Y,STATUS)
400 IF STATUS=0 THEN 390
410 IF Y=ASC("N")THEN 750
420 IF Y=ASC("Y")THEN 520
430 CALL CLEAR
440 PRINT
450 PRINT "  you did not press Y or
    N."
460 FOR I=1 TO 13
470 PRINT
480 NEXT I
490 FOR DELAY=1 TO 500
500 NEXT DELAY
510 GOTO 280
520 CALL CLEAR
530 PRINT "{3 SPACES}YOU MUST STOP T
    HE FALLING"
540 PRINT "BOMB BY EXPLODING IT IN M
    ID-AIR."
550 PRINT
560 PRINT
570 PRINT "{3 SPACES}-MOVE THE CROSS
    HAIR-"
580 PRINT
590 PRINT "  left :HOLD THE s KEY"
600 PRINT "  right:HOLD THE d KEY"
610 PRINT "  up{3 SPACES}:HOLD THE e
     KEY"
620 PRINT "  down :HOLD THE x KEY"
630 PRINT
640 PRINT "{3 SPACES}WHEN THE BOMB A
    ND THE"
650 PRINT "CROSSHAIR ARE LINED UP,"
660 PRINT "FIRE BY PRESSING THE SPAC
    E"
670 PRINT "BAR. THE SOONER YOU GET T
    HE"
680 PRINT "BOMB, THE HIGHER YOUR SCO
    RE."
690 PRINT
700 PRINT
710 PRINT
720 PRINT "{3 SPACES}PRESS any key T
    O START"
730 CALL KEY(0,S,STATUS)
740 IF STATUS=0 THEN 730
750 CALL CLEAR
760 CALL COLOR(8,2,1)
770 PRINT "{7 SPACES}GOOD LUCK!!!"
780 FOR I=1 TO 10
790 PRINT
800 NEXT I
810 IF R=ASC("R")THEN 840
820 GOSUB 2090
830 GOTO 860
840 FOR I=1 TO 250
850 NEXT I
860 CALL CLEAR
870 GOSUB 2300
880 IF T=20 THEN 1860
890 T=T+1
900 CCROSS=16
910 RCROSS=21
920 RBOMB=1
930 CALL SCREEN(6)
940 CBOMB=INT(RND*29)+2
950 H$=STR$(T)
960 ROW=2
970 COL=3
980 GOSUB 2520
990 SCORE=P*Q*10
1000 H$=STR$(SCORE)
1010 ROW=5
1020 GOSUB 2520
1030 FOR I=1 TO 70
1040 NEXT I
1050 FOR I=2 TO 5 STEP 3
1060 CALL HCHAR(I,3,32,6)
1070 NEXT I
1080 OLDRCROSS=RCROSS
1090 OLDCCROSS=CCROSS
1100 CALL KEY(0,A,STATUS)
1110 IF A<>ASC("E")THEN 1130
1120 RCROSS=RCROSS-SGN(RCROSS-1)
1130 IF A<>ASC("X")THEN 1150
1140 RCROSS=RCROSS+SGN(22-RCROSS)
1150 IF A<>ASC("D")THEN 1170
1160 CCROSS=CCROSS+SGN(31-CCROSS)
1170 IF A<>ASC("S")THEN 1190
1180 CCROSS=CCROSS-SGN(CCROSS-2)
1190 IF RBOMB=1 THEN 1210
1200 CALL VCHAR(RBOMB-1,CBOMB,32)
1210 IF (RCROSS=OLDRCROSS)*(CCROSS=O
     LDCCROSS)THEN 1230
1220 CALL VCHAR(OLDRCROSS,OLDCCROSS,
     32)
1230 CALL VCHAR(RCROSS,CCROSS,130)
1240 CALL VCHAR(RBOMB,CBOMB,129)
1250 RBOMB=RBOMB+1
1260 IF RBOMB=23 THEN 1540
1270 IF (RCROSS=RBOMB-1)*(CCROSS=CBO
     MB)THEN 1290
1280 GOTO 1080
1290 CALL KEY(0,B,STATUS)
1300 IF B=32 THEN 1330
1310 GOTO 1080
1320 REM BOMB DESTROYED
1330 RBOMB=RBOMB-1
1340 CALL SCREEN(10)
1350 CALL VCHAR(RBOMB,CBOMB,32)
1360 CNT=0
1370 C1=92
1380 C2=47
1390 FOR I=-1 TO 1 STEP 2
1400 CALL VCHAR(RBOMB+I,CBOMB+I,C1)
1410 CALL VCHAR(RBOMB+I,CBOMB-I,C2)
1420 NEXT I
1430 C1=32
1440 C2=32
1450 IF CNT=1 THEN 1510
1460 CNT=1
1470 FOR VOL=10 TO 30 STEP 5
1480 CALL SOUND(100,-6,VOL)
1490 NEXT VOL
1500 GOTO 1390
1510 P=P+1
1520 Q=Q+(23-RBOMB)
1530 GOTO 880
1540 REM BOMB HITS THE CITY
1550 CALL VCHAR(22,CBOMB,32)
1560 CALL SCREEN(9)
1570 CALL COLOR(12,11,1)
1580 CALL VCHAR(23,CBOMB-1,122)
1590 CALL VCHAR(23,CBOMB,32)
1600 CALL VCHAR(23,CBOMB+1,123)
1610 CALL VCHAR(24,CBOMB-1,124)
1620 CALL VCHAR(24,CBOMB,125)
1630 CALL VCHAR(24,CBOMB+1,126)
```

```
1640 FOR I=1 TO 20
1650 NEXT I
1660 CALL COLOR(12,7,1)
1670 CALL SCREEN(12)
1680 FOR I=1 TO 20
1690 NEXT I
1700 CALL SCREEN(7)
1710 FOR VOL=24 TO 1 STEP 4
1720 CALL SOUND(200,-7,VOL)
1730 NEXT VOL
1740 FOR DVOL=1 TO 24 STEP 4
1750 CALL SOUND(200,-7,DVOL)
1760 NEXT DVOL
1770 FOR J=23 TO 24
1780 FOR I=CBOMB-1 TO CBOMB+1
1790 CALL VCHAR(J,I,32)
1800 NEXT I
1810 NEXT J
1820 CALL VCHAR(RCROSS,CCROSS,32)
1830 CALL COLOR(12,2,14)
1840 M=M+1
1850 GOTO 880
1860 CALL CLEAR
1870 CALL SCREEN(4)
1880 CALL COLOR(8,5,16)
1890 PRINT "{9 SPACES}GAME OVER"
1900 FOR I=1 TO 4
1910 PRINT
1920 NEXT I
1930 PRINT "{3 SPACES}DESTROYED
     {3 SPACES}";P
1940 PRINT
1950 F[O{,}!1{5 ,}"{3 SPACES}MISSED
     {6 SPACES}";M
1960 PRINT
1970 PRINT "{3 SPACES}TOTAL POINTS";
     P*Q*10
1980 FOR I=1 TO 4
1990 PRINT
2000 NEXT I
2010 PRINT "{3 SPACES}PRESS r TO PLA
     Y AGAIN"
2020 PRINT
2030 PRINT
2040 CALL KEY(0,R,STATUS)
2050 IF STATUS=0 THEN 2040
2060 IF R=ASC("R")THEN 160
2070 END
2080 REM READ CITY DATA
2090 FOR ROW=2 TO 1 STEP -1
2100 FOR COL=1 TO 32
2110 READ BUILDING(COL,ROW)
2120 NEXT COL
2130 NEXT ROW
2140 REM CUSTOM CHAR & COLORS
2150 CALL CHAR(136,"FFABFFABFFABFFFF
     ")
2160 CALL CHAR(128,"003C7EFFFFFF7E42
     ")
2170 CALL CHAR(131,"42665A6642427E66
     ")
2180 CALL CHAR(132,"6060606060606060
     ")
2190 CALL CHAR(133,"607858F8D8F8D8F8
     ")
2200 CALL CHAR(134,"F8A8F8A8F8A8F8F8
     ")
2210 CALL CHAR(135,"C3C3FFABFFABFFFF
     ")
2220 CALL COLOR(14,7,12)
2230 CALL CHAR(122,"8040201008040201
     ")
2240 CALL CHAR(123,"0102040810204080
     ")
2250 CALL CHAR(124,"80E0F8FEFFFFFFFF
     ")
2260 CALL CHAR(125,"814224180081C3E7
     ")
2270 CALL CHAR(126,"01071F7FFFFFFFFF
     ")
2280 RETURN
2290 REM SET UP CITY
2300 FOR ROW=2 TO 1 STEP -1
2310 FOR COL=1 TO 32
2320 BLOCK$(ROW)=BLOCK$(ROW)&CHR$(BU
     ILDING(COL,ROW))
2330 NEXT COL
2340 NEXT ROW
2350 FOR ROW=2 TO 1 STEP -1
2360 FOR COL=1 TO 32
2370 PLACE(ROW)=ASC(SEG$(BLOCK$(ROW)
     ,COL,1))
2380 CALL HCHAR(ROW+22,COL,PLACE(ROW
     ))
2390 NEXT COL
2400 NEXT ROW
2410 RETURN
2420 REM CITY DATA
2430 DATA 136,134,131,135,133,136,13
     6,133
2440 DATA 135,136,136,136,133,136,13
     6,135
2450 DATA 135,136,136,134,133,136,13
     6,136
2460 DATA 135,132,136,32,131,135,132
     ,135
2470 DATA 134,133,128,32,132,32,135,
     32
2480 DATA 32,32,134,132,132,32,133,3
     2
2490 DATA 32,32,128,32,132,32,133,13
     5
2500 DATA 32,132,132,32,128,32,132,3
     2
2510 REM HORIZONTAL # PRINTER
2520 FOR I=1 TO LEN(H$)
2530 DIGIT=ASC(SEG$(H$,I,1))
2540 CALL HCHAR(ROW,COL+I,DIGIT)
2550 NEXT I
2560 RETURN
```



The crosshair stands ready to intercept a bomb descending toward multicolored buildings in the TI version of "Air Defense."

PET/CBM Notes

The PET/CBM version of Air Defense was written for machines with either 40- or 80-column screens. The program, as given, will run successfully on the 40-column PET. If you have an 80-column screen, simply remove the word "REM" at the beginning of line 120 and delete line 130. The 80-column screen requires you to cover a greater range of positions than does the 40-column screen, however, and you may find the wider screen somewhat difficult to maneuver on initially.

Instructions for the game are displayed when the program is run. The main principle to bear in mind while playing is that the more bombs which are picked off (and the quicker they are destroyed) the higher the score. Press the REPEAT key along with the crosshair controls or the fire button (the SPACE bar) to achieve much higher scores.

If either the 40- or 80-column version becomes too easy, the level of difficulty can be increased by modifying line 600. In line 600, the variable "A" refers to the screen memory location of the crosshair, "E" defines the position of the bomb, and "LL" is the screen width (line length). As written, this statement allows the bomb to be destroyed when the gun is fired within one space above or below or to the left or right of the positioned gunsight. By removing one or more of the conditional expressions in line 600 (starting with the second expression), you can significantly increase the challenge of the game.

Program 6: PET/CBM Version

```
100 POKE 59468,12:PRINT CHR$(142)
110 X=RND(-TI)
120 REM LL=80:R1=40:A=34632:A1=34767:REM F
    OR A 80-COLUMN SCREEN
130 LL=40:R1=20:A=33702:A1=33767:REM FOR A
     40-COLUMN SCREEN
140 P=0:M=0:T=0:Q=0
150 PRINT"{CLEAR}{07 DOWN}{09 RIGHT}     {R
    EV}AIR{OFF} {REV}DEFENSE{OFF}"
160 PRINT"{04 DOWN}{RIGHT}      DO YOU NEED
     INSTRUCTIONS?"
170 PRINT"{DOWN}{08 RIGHT}TYPE 'Y' OR 'N'"
180 FOR H=1TO1000:GETD$
190 IF D$="N" THEN 380
200 IF D$="Y" THEN 240
210 NEXT
220 PRINT"{CLEAR}{07 DOWN}{06 RIGHT}YOU DI
    D NOT PRESS 'Y' OR 'N'."
230 FOR K=1TO5000:NEXT:GOTO150
240 PRINT"{CLEAR}{02 DOWN}  YOU MUST STOP ~
    THE FALLING BOMB BY"
250 PRINT"  EXPLODING IT IN MID-AIR."
260 PRINT"{02 DOWN}       -MOVE THE CROSSHA
    IR-"
270 PRINT"{DOWN}     *{REV}LEFT{OFF}: TAP T
    HE '<' KEY"
280 PRINT"{DOWN}     *{REV}RIGHT{OFF}: TAP ~
    THE '>' KEY"
290 PRINT"{DOWN}     *{REV}UP{OFF}: TAP THE
     'S' KEY"
300 PRINT"{DOWN}     *{REV}DOWN{OFF}: TAP T
    HE 'X' KEY"
310 PRINT"{02 DOWN}{02 RIGHT}WHEN THE BOMB
     AND THE CROSSHAIR ARE"
320 PRINT"{02 RIGHT}LINED UP, FIRE BY PRES
    SING THE"
330 PRINT"{02 RIGHT}SPACE BAR."
340 PRINT"{02 DOWN}{07 RIGHT}{REV}PRESS AN
    Y KEY TO START{OFF}"
350 GET D$:IF D$="" THEN 350
360 PRINT"{CLEAR}{10 DOWN}                GOO
    D LUCK!"
370 FOR I=1TO2500 :NEXT
380 A=(A1-LL*1.5)-P*LL:IF T=20 GOTO 820
390 T=T+1
400 PRINT"{CLEAR}":D=INT(RND(1)*R1)+LL/4
410 E=D+32768
420 PRINT" ";T
430 FOR I=1 TO 100:NEXT I
440 PRINT"{02 DOWN}{RIGHT}";P*Q*10
450 FOR I=1 TO 200:NEXTI
460 POKE A,91
470 GET A$
480 IFA$="S"THENA=A-LL
490 IF A$="X"THEN A=A+LL
500 IF A$="."THEN A=A+1
510 IF A$=","THEN A=A-1
520 IF A>A1 THEN A=A-LL
530 IF A<32768 THEN A=A+LL
540 POKE E,42
550 FOR I=1 TO 50:NEXT
560 IF E>A1-LL THEN GOTO 750
570 REM ADJUST DIFFICULTY LEVEL BY ELIMINA
    TING
580 REM CONDITIONS IN LINE 600
590 REM LINE 600 ALLOWS A HIT WITHIN ONE S
    PACE OF MISSILE
600 IF A=E OR A=E-1 OR A=E+1 OR A=E-LL OR ~
    A=E+LL THEN 620
610 E=E+LL:PRINT"{CLEAR}":GOTO460
620 GET B$
630 IFB$=" "THEN 660
640 GOTO 610
650 REM BOMB IS DESTROYED
660 X=100:FORI=1TO10:POKEE,X
670 POKE E+LL-1,X
680 POKE E+LL+2,X
690 X=X+1
700 NEXT
710 P=P+1
720 Q=Q+24-INT((A-32768)/LL)
730 GOTO380
740 REM BOMB GETS YOU!
750 POKE E,32:FOR I=1 TO 5
760 POKEE-I,188
770 POKEE+I,190
780 FOR S=1 TO 20:NEXT
790 NEXT
800 M=M+1
810 GOTO380
820 PRINT"{CLEAR}{02 DOWN}{10 RIGHT}     {
    REV}GAME{OFF} {REV}OVER{OFF}"
830 PRINT"{03 DOWN}{03 RIGHT}DESTROYED"P
840 PRINT"{02 DOWN}{03 RIGHT}MISSED"M
850 PRINT"{02 DOWN}{03 RIGHT}TOTAL POINTS"
    P*Q*10
860 FOR I=1 TO 30:GET D$:NEXT I
870 PRINT"{04 DOWN}{08 RIGHT}PRESS '{REV}P
    {OFF}' TO PLAY AGAIN"
880 GET D$:IF D$="" THEN 880
890 IF D$="P" THEN 120
900 END
```


FRANK CARTY
3181
DATE
DOLLARS
RESET
RETURN
POWER

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VIC EDITYPE

A Text Editing And Storage Program

Paul Bishop

This mini word processor for the VIC lets you enter, edit, and save text to tape. It works with the VIC 1515 printer and 3K memory expansion.

If you are at all like me, the minute you saw the VIC-20 sitting there on the showroom table flashing its upper-lowercase mode, you smiled to yourself and said what a wonderful text storage and manipulation device it would make. *Wonderful* in this context means inexpensive, and Commodore promised us no less in its literature.

This program is a miniature word processor. It will allow the user to input text, edit it (with certain limitations), and save it to tape. The text may be printed on any line length specified, though it will not right justify. The program uses a word wrapping scheme to minimize the VIC's limited display size and is meant to be used with the VIC 1515 printer and a 3K memory expansion.

Entering Text

The program is menu driven, and we will discuss the options in detail. New mode is used for entering text. It is also the mode in which the formatting features are selected. Centering is done by pressing the up-arrow (next to the restore key) at the beginning of the line that is to be centered. Remember to use the carriage return at the end of the line, and note that the line may not exceed the line length you intend to print.

The second function is an inset line length. This is selected by pressing the first bracket (shifted colon) at the start of the text to be inset. All text before the next return character will be printed on the alternate line length, which will be specified during printing. Line numbering is something that I use frequently. It is selected with the second bracket, and the line will be printed with a number (numbered sequentially by the computer) before and after the line. Examples of all the formatting options are represented in the demo text.

Backspacing in the New mode may only be done with the DEL key, and may only continue to the first character of the line on which the cursor rests. Any further DELeting will result in an Illegal Quantity error. If a boo-boo is in an earlier line, it must be corrected in the edit mode. All keys repeat, and the pound symbol (next to CLR HOME) is used to return to the menu. Once the menu is chosen, no further text may be entered in the New mode. (This is something the user could change.)

A final note: text entry becomes progressively slower as memory fills, and subsequent printing is also adversely affected by large quantities (relatively speaking) of text. So, although the low memory warning should keep you from overtyping the machine's capacity, it is best to save the text and then continue when the word-wrap starts to slow down.

Text entered in the New mode can be reviewed and modified in the Edit mode. The mode has three options: Forward, Correct, and Return to Main Menu. The Forward option scrolls through the text one VIC screen line at a time. To make changes in entered text, use the Correct option. You will be given the prompt "error:", at which point you enter the characters you wish to change *as they appear in the text*. End your entry with the up-arrow (↑) key, *not* the RETURN key. The next prompt is "correction:". Enter the text as you wish it to appear in the corrected version. Again follow your input with the up-arrow key rather than RETURN. The computer will then search the text for the "error" and replace it with the "correction." If the search characters are not found in the text, the program will provide an error message.

Saving And Printing

The save mode is straightforward in operation: simply press the S key and RETURN and the text will be stored under the title you entered in the New mode. Load is just like it. If you include a file name, the cassette drive will search for that file; otherwise it will load the first file it comes to. The Load and Print mode is for files too long to be contained in memory and is fairly automatic. You

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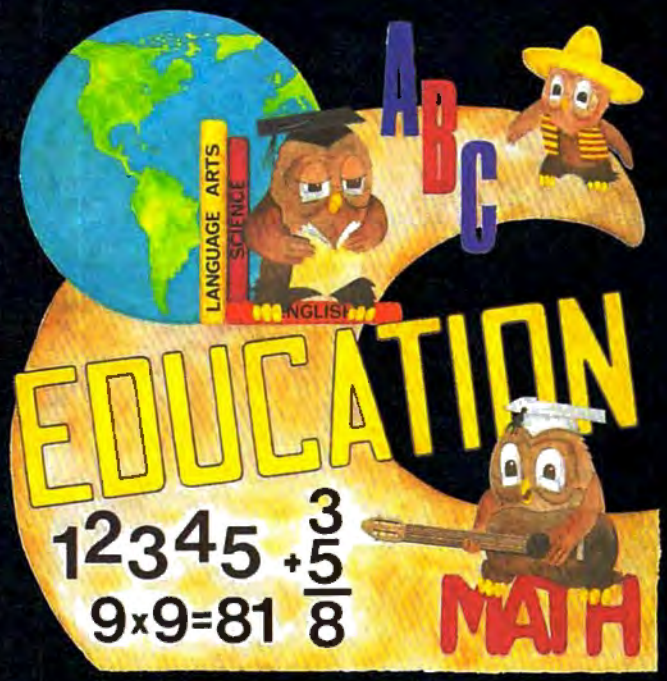

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simply set the formatting in the print mode, and let the computer do the rest.

The Print mode is also straightforward. First it asks for the normal line length. This may be any value up to 80, but between 40 and 70 are recommended. Next you are asked for the inset line length. Again, this should be between 40 and 70. Next you are asked for s for single or d for double spacing. Finally, the computer asks for the number at which it will begin the sequential line numbering. This may be set at any value, but usually will be one.

Obviously, this program will not meet everyone's writing needs. I am looking forward to further memory expansion which will allow me to implement further editing functions, as well as longer text entry. And you may wish to delete functions which you will not use and add others. That is the beauty of a word processor written in BASIC.

Before we consider the program in detail, a few comments about operation will be in order here. First, the cursor does not function as well as it should. I am searching for a cure. In the meantime, if you find it more distracting than helpful, you may get rid of it by deleting POKE 204,0 from line 120. Also, from time to time, errors will happen which will cause the machine to default to BASIC. This is no cause for alarm. A few moments studying the program listing and a GOTO in the immediate mode will get you out of all but the worst spots. If in doubt, GOTO 51 (the menu).

Program Structure

Since I have included no documentation in the body of the program, I will list the various parts of it here. You will want to keep this handy for reference, since every REM you add will cost you valuable memory space.

Line 42 is initial housekeeping, setting variables and DIMing the text string array.

Lines 51-67 are the menu.

Lines 100-280 are the text entry and word wrapping routine, including the delete routine in line 200.

Lines 3000-3350 are the string search and replace, the "Edit Mode."

Lines 3800-4710 are the print routine. Lines 4060-4095 are for getting a string of printing length. Lines 4200-4240 are used in the centering function. 4300-4710 are for tidying up the print strings and sending them to the printer.

Lines 5000-5080 are the load routine.

Lines 6000-6080 are for saving text.

Lines 7000-7009 are for the page numbering function.

Variable List

A$ is the actual text string (1 to 200).
C$ is the get character string in the new mode.
C4$ is the error string in the edit mode.
C5$ is the correction string in the edit mode.
C6$ is the right remainder of the string being searched for the error in the edit mode.
DE$ is the string of the variable SL.
J$ is the get character string for the correction string in edit mode.
M$ is the string for the mode selection in the menu.
P$ is the print string.
**T1$** is the leftover from P$ after searching for a space at the end of the line.
**T2$** is the working string of A$ in the print mode.
W$ is the get string in the edit mode.
**X$** is the working character in getting an 80-character line for P$.
Z$ is the get string for the load mode.

LA is the normal line length.
LB is the inset line length.
LC is the line count.
PC is the page count.
SL is the line numbering counter.

```
                        Sample Text

     This is a page of demo text for "Editype."  This is the normal
     line length.  Note that there is no hyphenation of words in the
     print routine, so the edges may be somewhat ragged.  Resetting
     the line length may help.

          This is an inset line.  Insets may be set to
          any length and may be longer than the normal
          line length if necessary.

                    This line is autocentered.

1.   This is an example of a numbered line.                        1.

     Note that the computer keeps track of line numbers.  The line
     above could have been given any number as a starting point and
     subsequent numbered lines would be renumbered from there.
```

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```
42 PC=1:LC=1:F=0:PRINTCHR$(14):DIMA$(200)
   :PRINT"{CLEAR}":POKE650,128
51 M$=""
53 PRINT"{CLEAR}    MODE SELECTION":PRINT:
   PRINT:PRINT"LP=LOAD AND PRINT":PR
   INT
55 PRINT"N=NEW":PRINT:PRINT"E=EDIT":PRINT
   :PRINT"P=PRINT
58 PRINT:PRINT"S=SAVE":PRINT:PRINT"L=LOAD
   ":PRINT:PRINT"C=CONTINUE"
60 PRINT:INPUT"SELECT MODE:  ";M$
61 IFM$="E"THEN3010
62 IFM$="P"THEN3800
63 IFM$="N"THEN100
64 IFM$="L"THEN5000
65 IFM$="S"THEN6000
66 IFM$="LP"THEN3800
67 IFM$="C"THENFORB=1TOK-1:PRINTA$(B):NEX
   TB:PRINTA$(K);:GOTO120
68 GOTO51
100 FORA=1TO200:A$(A)="":NEXTA
103 INPUT"TYPE FILE NAME";V$
105 PRINT"{CLEAR}          NEW MODE":K=1
120 POKE204,0:POKE207,0:GETC$:IFC$=""THEN1
   20:POKE204:2
130 IFC$="{DOWN}"THEN120
140 IFC$="{UP}"THEN120
150 IFC$="{RIGHT}"THEN120
160 IFC$="{LEFT}"THEN120
170 IFC$="£"THEN51
171 IFC$="{HOME}"THEN120
172 IFC$="{CLEAR}"THEN120
175 IFC$=CHR$(20)AND LEN(A$(K))=0THEN120
180 PRINTC$;
190 IFC$=CHR$(13)THENK=K+1:A$(K)=A$(K)+C$:
   GOTO120
200 IFC$=CHR$(20)THENA$(K)=LEFT$(A$(K),LEN
   (A$(K))-1):GOTO120
210 A$(K)=A$(K)+C$:C$="":IFLEN(A$(K))<22TH
   EN120
220 IFRIGHT$(A$(K),1)=CHR$(32)THEN240
221 IFRIGHT$(A$(K),1)=CHR$(160)THEN240
230 A$(K+1)=RIGHT$(A$(K),1)+A$(K+1):A$(K)=
   LEFT$(A$(K),LEN(A$(K))-1):GOTO220

240 FORU=1TO22-LEN(A$(K)):PRINTCHR$(20);:N
   EXTU
250 IFLEN(A$(K))<11THENPRINT,,
260 IFLEN(A$(K))>10THENPRINT,
264 IFA$(K)=""THENA$(K)=" "
265 IFFRE(0)<600THENPRINT"{REV}MEMORY LOW{
   OFF}":PRINT
266 IFFRE(0)<500THEN51
270 K=K+1:PRINTA$(K);:GOTO120
280 GOTO51
3010 C4$="":C5$=""
3015 PRINT"{CLEAR}      EDIT MODE":Q=1
3025 PRINT:PRINT"F=FORWARD":PRINT"£=RETURN
     TO MENU":PRINT"C=CORRECT"
3026 PRINT"SELECTION? "
3030 GETW$:IFW$=""THEN3030
3040 IFW$="F"THENPRINTA$(Q):Q=Q+1:IFQ>199TH
   EN51:GOTO3030
3055 IFW$="£"THEN51
3060 IFW$="C"THEN3200
3061 GOTO3030
3200 PRINT"ERROR:"
3210 FORA=1TO80
3220 GETJ$:IFJ$=""THEN3220
3225 IFJ$="↑"THEN3250
3226 IFJ$=CHR$(20)THENC4$=LEFT$(C4$,LEN(C4$
   )-1):GOTO3235
3230 C4$=C4$+J$
3235 PRINTJ$;
3240 NEXTA
3250 PRINT:PRINT"CORRECTION: "
3260 FORA=1TO80
3270 GETJ$:IFJ$=""THEN3270
3280 IFJ$="↑"THEN3310
3281 IFJ$=CHR$(20)THENC5$=LEFT$(C5$,LEN(C5$
   )-1):GOTO3290
3285 C5$=C5$+J$
3290 PRINTJ$;
3300 NEXTA
3310 PRINT"{CLEAR}    {REV}CORRECTING{OFF}"
3320 FORA=1TO200
3325 FORB=1TOLEN(A$(A))
3327 O=LEN(C4$)
3329 IFMID$(A$(A),B,O)=C4$THENOO=LEN(A$(A))
   -B+1-LEN(C4$)
3330 IFMID$(A$(A),B,O)=C4$THENC6$=RIGHT$(A$
   (A),OO)
3340 IFMID$(A$(A),B,O)=C4$THENA$(A)=LEFT$(A
   $(A),B-1):GOTO3344
3341 GOTO3346
3344 A$(A)=A$(A)+C5$+C6$:C4$="":C5$=""
3345 PRINT"{CLEAR}":FORH=1TOA:PRINTA$(H):NE
   XTH:Q=H::GOTO3025
3346 NEXTB
3347 NEXTA
3348 PRINT"{CLEAR}{RED}{REV}ERROR NOT FOUND
   {BLU}{OFF}":PRINT:GOTO3025
3350 GOTO3010
3800 PRINT:INPUT"NORMAL LINE LENGTH";LA
3810 PRINT:INPUT "INSET LINE LENGTH";LB
3903 PRINT"SINGLE OR DOUBLE      SPACE? S/D

3904 INPUTSD$
3905 INPUT"LINE NUMBERING #";SL
4000 T1$="":N=1:LL=LA
4002 OPEN4,4
4003 T$="":T2$="":P$="":LC=1
4010 PRINT#4:PRINT#4:PRINT#4
4016 LC=3
4040 CLOSE4,4
4050 IFA$(N)=""ANDM$="LP"THEN5002
4051 IFA$(N)=""THEN4660
4059 T2$=A$(N)
4060 FORA=1TOLL-LEN(P$)
4061 IFT2$=""THEN4094
4065 X$=LEFT$(T2$,1):T2$=RIGHT$(T2$,LEN(T2$
   )-1)
4075 IFX$="["THENLL=LB:GOTO4060
4076 IFX$="]"THENFL=1:GOTO4060
4080 IFX$="↑"THEN4200
4085 IFX$=CHR$(13)THEN4660
4090 P$=P$+X$
4094 IFLEN(T2$)=0THENN=N+1:GOTO4050
4095 NEXTA
4100 GOTO4610
4200 FORA=1TOLA
4210 X$=LEFT$(T2$,1):T2$=RIGHT$(T2$,LEN(T2$
   )-1)
4211 IFLEN(T2$)=0THENN=N+1:T2$=A$(N)
4214 IFA$(N)=""ANDLEN(T2$)=0THENP$=P$+X$:GO
   TO4660
4220 IFX$=CHR$(13)THEN4300
4230 P$=P$+X$
4240 NEXTA
4300 IN=(80-LEN(P$))/2:GOTO4670
4610 FORA=1TOLEN(P$)
4620 IFRIGHT$(P$,1)=CHR$(32)THEN4660
```

```
4622 IFRIGHT$(P$,1)=CHR$(160)THEN4660
4630 T1$=RIGHT$(P$,1)+T1$:P$=LEFT$(P$,LEN(P
    $)-1)
4640 NEXTA
4660 IFLEFT$(P$,1)=CHR$(32)THENP$=RIGHT$(P$
    ,LEN(P$)-1)
4661 IFLEFT$(P$,1)=CHR$(160)THENP$=RIGHT$(P
    $,LEN(P$)-1)
4662 PRINTP$
4665 IN=(80-LL)/2
4666 DE$=STR$(SL):IFFL=1THENOPEN4,4
4667 IFFL=1THENPRINT#4,CHR$(17)DE$"."SPC(IN
    -LEN(DE$)-1)P$SPC(76-LEN(P$)-IN)D
    E$"."
4668 IFFL=1THENCLOSE4:LC=LC+1:SL=SL+1:P$=""
    :FL=0:P$=T1$:T1$="":GOTO4680
4670 OPEN4,4:PRINT#4,CHR$(17)SPC(IN)P$:CLOS
    E4,4:P$="":P$=T1$:T1$="":LC=LC+1
4680 IFSD$="D"THENOPEN4,4:PRINT#4:CLOSE4:LC
    =LC+1
4690 IFLC>60THEN7000
4700 IFX$=CHR$(13)THENLL=LA
4701 IFA$(N)=""ANDM$="LP"THENP$=P$+X$:GOTO5
    002
4705 IFA$(N)=""THEN51
4710 GOTO4060
5000 INPUT"TYPE FILE NAME";V$
5002 FORA=1TO200:A$(A)="":NEXTA
5005 PRINT"{CLEAR}       LOAD MODE"
5010 OPEN1,1,0,V$
5015 PRINT"FILE OPEN, LOADING."
5020 FORA=1TO200
5025 FORB=1TO22
5030 GET#1,Z$
5031 A$(A)=A$(A)+Z$
5040 IFZ$=""THEN5065
5042 NEXTB
5050 NEXTA
5065 CLOSE1:N=1
5077 IFM$="LP"THENN=1:GOTO4050
5080 GOTO51
6000 PRINT"{CLEAR}SAVE MODE"
6010 OPEN1,1,1,V$
6030 FORA=1TO200
6040 PRINT#1,A$(A);
6050 IFA$(A)=""THEN6075
6060 NEXTA
6075 CLOSE1
6080 GOTO51
7000 OPEN4,4
7001 FORM=1TO66-LC
7002 PRINT#4
7003 NEXTM
7004 PRINT#4:PC=PC+1
7005 PRINT#4,CHR$(17)SPC(70)"PAGE "PC
7006 PRINT#4
7007 CLOSE4
7008 LC=3
7009 GOTO4060
```

Scriptor:
An Atari Word Processor

Charles Brannon, Editorial Assistant

Scriptor is an easy-to-use, full-scrolling, character-oriented, multifunction word processor, requiring an Atari 400/800 with a minimum of 32K of memory (40K recommended), an Epson MX-80 or Atari 825 printer, and an Atari 810 disk drive. It is programmed in both BASIC and machine language. For instructions on typing in the program, see the section under: Typing It In.

Through The Ruby

Computers don't just calculate with numbers – they can also work with text. Five inch disks can replace stacks of files. Computers can sort, search, select, and update any kind of information. They can *focus* information. In this sense, the computer is like the ruby crystal in a laser. Ordinary random light waves are transformed and concentrated through the ruby into a tight, powerful beam. Computers can do the same for information.

Word Processing

Electronic text is more "liquid," easier to work with, than words solidified on paper (*hardcopy*). This is what makes word processing special: the extraordinary editing power it gives you. Distinctions between a rough draft and a final draft are meaningless; the work is typed, changed dynamically, and stored to disk. It can then later be recalled, revised, and printed out. Very little retyping is necessary. What a boon for anyone who writes.

Converts to word processing immediately notice an improvement in their writing. The entire manuscript becomes "alive," not committed to paper. Changing a word or a sentence, inserting a line or a paragraph are all accomplished with ease. For example, take just one key, the backspace key (called RUBOUT on some computers or terminals). When this key is struck, the last character typed is erased from the screen. Compare this to the frequently elaborate typewriter correction schemes.

Besides the disk file, which has already been mentioned and which will be explained in greater detail later, an important concept in word processing is the *cursor*. Named after the clear plastic slide on a slide rule, the cursor shows you where the next character you type is going to appear. It usually looks like an underline, "_", or a solid square. Users familiar with any computer have already encountered the cursor. The computer itself doesn't need a cursor; but since you can type anywhere on the screen, the cursor is vital so that you can know where you "are."

The cursor can be moved up, down, left, and right with special keys, usually with arrows on them. To correct the following line:

```
The quick brown dox jumped
```

you would either press backspace ten times, erasing the text as you go, or press cursor-left ten times. The cursor moves "over" the characters without erasing them. It is then resting on the "d":

```
The quick brown dox jumped
```

You can correct the error by typing "f," which overstrikes (replaces) the "d."

```
The quick brown fox jumped
```

The cursor can then be moved to the end of the line (ten cursor-rights), and typing resumed.

This sounds harder than it really is. Cursor editing becomes second nature after only hours of use. The cursor UP/DOWN keys can reach lines of text above and below the current line. It is like rolling a typewriter's platen up or down, but with one important difference – the "paper" is one continuous, long sheet.

Getting Specific

Two very special functions are *insert* and *delete*. Insert lets you add text in the middle of a line, by pressing INSERT to insert spaces in the text, and then typing in the word. For example:

```
To be or to be,that is the
   question.
```

The cursor is placed on the second "to," and INSERT is pressed four times (three for "n-o-t,"

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and one for a space):

```
To be or ■   to be,that is
   the question.
```

The word "not" is then typed:

```
To be or not■to be,that is
   the question.
```

Delete is used to erase text. As distinguished from mere backspacing or spacing over a word, delete closes up the space after the deleted word:

```
Take out a word■
```

1. `Take ▯ut a word`
   (cursor is moved to "o")
2. `Take ▯t a word`
   (DELETE typed; "o" disappears, "ut a word" moves left.)

   `Take ▯ word`
   (DELETE is typed four times.)

Insert and delete can also act on words, sentences, lines, or entire paragraphs in a similar way.

Disk Files

A "file" is simply a permanent record of your text. When the computer's power is turned off, it forgets everything except what is "burned" (in ROM memory) into it permanently. Your text is obviously not "burned in," or you couldn't ever change it. If you have a blackout, or a fuse blows, say good-bye to your text.

Catastrophes aside, you certainly don't want to leave your computer on all the time, or keep the computer tied up with your text forever. Fortunately, you can save your text on disk, ready for any later revisions. You can type it one time, save your text, and print it out when convenient.

Since a disk can store more than one document (unless it's very long), you and the computer must have some way to distinguish and separate one file from another. This is usually done via a *directory*, a list of file names. You access a file by giving the computer the file's name.

"Scriptor," the word processor program at the end of this article, has many features usually found only in professional word processors, but it lacks a few features such as search and replace, justification, data base merge, etc. Also, it is written in BASIC, so it can be rather slow at times. It is, however, aided by several machine language subroutines for time-critical situations such as disk input/output and some editing features.

Typing It In

Program 1 is the Scriptor program itself. Type it carefully, since it contains many critical machine language DATA statements. Extra time spent in typing it in will reward you with a smoother, bug-free word processor. Remember to use the **COMPUTE!** Listing Conventions (see Typing In **COMPUTE!**'s Programs, published every issue). Use the Atari logo key to enter inverse video.

To give you more memory for text, Scriptor deletes a substantial portion of itself after it initializes (sets up). Don't worry – the program is busy running while the screen flashes; it just takes awhile. The set-up lines from 5000-6999 are automatically erased.

If you quit the program and try to run it again, the program will automatically try to re-RUN itself anew from disk. If you've changed disks, you'll need to reload it yourself. You should SAVE the program with the filename "D:SCRIPTOR" or change line 110 appropriately. Be sure to SAVE Scriptor after you've typed it, before you run it, or you will find a sizeable chunk of your typing erased when you exit. You can free up more memory for text by deleting the "help" function. Take out all lines from 1570 to 1700 and remove line 775. If you'd rather keep this handy aid, leave these lines alone.

If you get the message "Error in DATA statements" when you run the program, you need to check your typing on the bank of machine language DATA statements at the end of the program. Also make sure you haven't typed a letter "O" for a zero (the zero is thinner than the "O").

If you have an Atari 825 printer, you will need to type in the lines in Program 2. This will replace the lines used for the MX-80 with lines applicable to the 825 80 Column Printer. If you have another printer, refrain from using special characters such as underlining, and you will probably be able to get one of the sets of lines to work.

Getting Started

The Scriptor is a full-scrolling, character-oriented word processor. Usage of cursor control keys is similar to normal Atari editor functions, with these exceptions:

1. ‹RETURN› is used only to force a carriage return, as at the end of a paragraph, or to print a blank line. The computer will format your line when you print it out, so just type continuously. Do not press ‹RETURN› at the end of each line. Pressing ‹RETURN› prints a back-arrow at the end of the line, and erases all text to the end of that line.

2. Insert and Delete character (CTRL-INSERT/CTRL-DELETE) work on whole "paragraphs." A paragraph is a block of lines from the cursor to a "back-arrow." If there is no back-arrow, one is assumed at the end of text. Therefore, insert and delete can be quite slow if you don't have a back-arrow somewhere.

3. Insert and Delete line work on the entire document. The screen will blank during this op-

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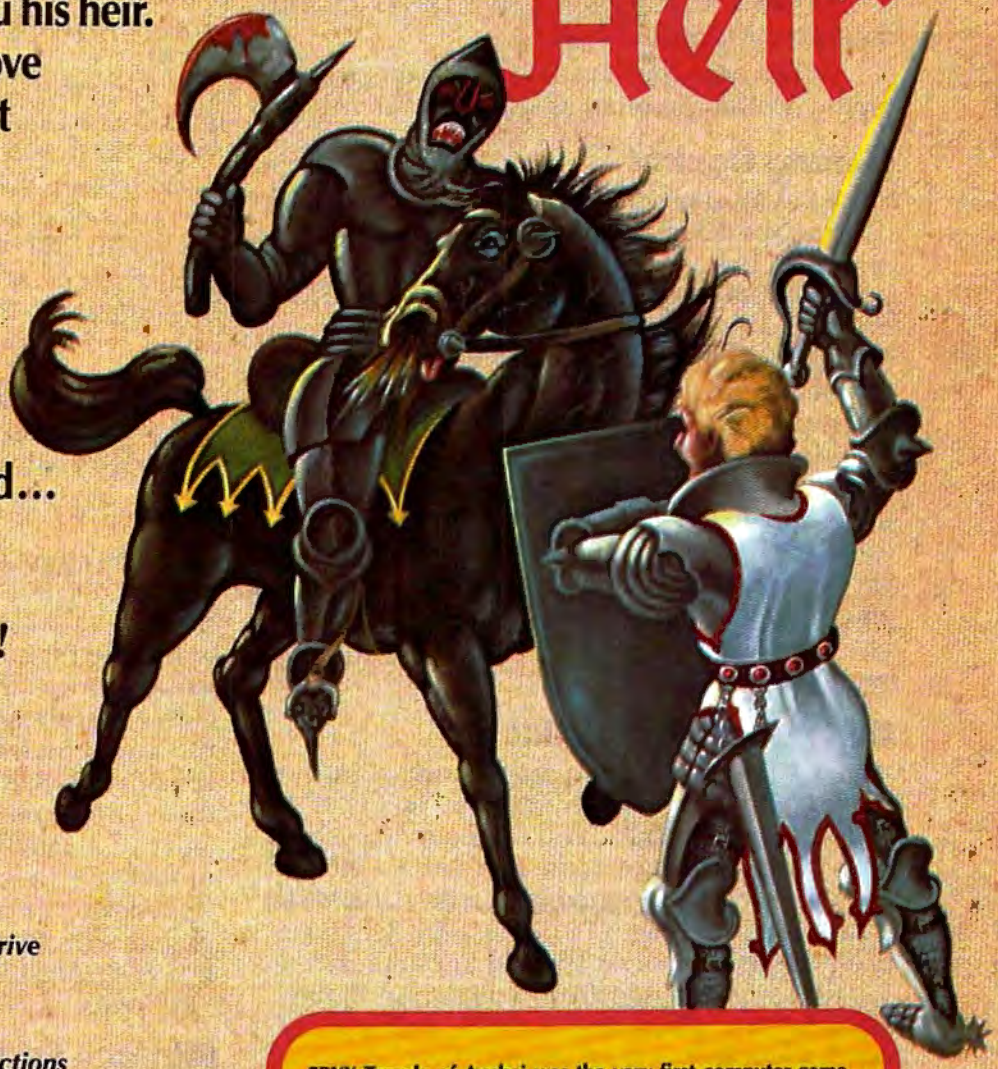

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eration. This is normal and speeds up the process, as it can be slow on long documents.

4. All TAB controls work normally, just a little slower. ‹CTRL-K› will clear all tab settings.

5. ‹CLEAR› will not clear the screen. It is used to erase all or part of the text. Press ‹CLEAR› ‹A› to erase all text. Press the Atari logo key to abort the erase function.

6. The break key is disabled. Use ‹CTRL-Q› to exit the program.

7. The ESC key enters the "mini-DOS." (See below.)

8. The console keys are "live"; see a description of their functions later.

9. The Atari logo key is disabled for normal typing. Within prompts, it acts as an "abort" key.

Getting Control

Since the Atari is not a dedicated word processor (that means it's just not a "word processing machine" like a Lanier, but is, rather, a general-purpose computer), it does not have special keys to activate word processing functions. Instead, the ‹CTRL-key› combination is used. For example, to quit the program, you would hold down ‹CTRL› and press ‹Q›. The CTRL key stands for "Control" – it is like a special shift key. The keys are linked *mnemonically* (easy to remember) to the commands they stand for, such as ‹P› for Print Text. To get a list of the commands and what they stand for at any time, just press ‹CTRL-?› (hold down CTRL and press the question mark) for a HELP menu. See Table 1 for a quick-reference chart of the commands.

Going Around The Block

An important feature in a word processor is block move and delete. Scriptor lets you "define" a series of up to 23 lines. You can then move these lines to another place in the text with Line Duplicate, or delete the defined lines with ‹CLEAR/D› (Erase: Defined lines). To define a block of lines, just place the cursor on the first line and press ‹CTRL-D›. A flashing arrow will appear to the left of the line. Press cursor-down, and another symbol will appear underneath. Press cursor-down until all the desired lines have an arrow to their left. Then press ‹RETURN›. If you make a mistake, just try again, or press cursor-up while defining.

To copy these lines to another place, position the cursor at the place you want the lines to appear, and press ‹CTRL-L›. If you haven't defined any lines, this command will be ignored. Note that you can press this key more than once to make many copies of the lines. You may want to delete the defined lines after you move them. Press ‹CLEAR›. You will see the prompt "ERASE:". Press ‹D›. The lines will be deleted, just as if you used Delete line multiple times.

A Mini-DOS

The ESC key activates the "mini-DOS." It lets you look at the directory and scratch, rename, lock, or unlock files. When you press ‹ESC›, you will see:

```
Directory,Lock,Unlock,Rename,
    Scratch?
```

Press the appropriate key. For all except the directory, you will need to enter a file name. The cursor, a half box, will be at the top of the screen. The only editing key you can use here is backspace.

Remember that you can abort any time before pressing ‹RETURN› by pressing the logo key. While the directory is listed, you can press ‹ESC› again to keep the directory on the screen while you use one of the other functions. You can also press [SELECT] (see later) to save or recall a file while looking at the directory. If you get an error message at the top of the screen, check the disk and your entry and try again.

For The Record...

To save or recall a document, press [SELECT]. The screen will display:

```
Save or Recall
```

Press the appropriate key, enter the file name, and the document will either be stored or retrieved. If you Recall a document, it loads starting at the line the cursor is on. This lets you add text to a document. Press START twice to home the cursor to the start of the text. If you get an error message, check to see you have the right disk, consult the *DOS Manual*, and try again. Remember that your file name must start with a capital letter and be followed by up to seven capital letters or numbers. You can optionally put a three-character "extension" on the file if you separate it with a period, e.g., EDITOR.DOC, DRAFT3.CGB, DUNGEON.MAP, etc. *You should not enter the "D:" prefix.*

Printer À La Mode

Different printers offer special print densities and formats such as boldface, underlining, super- and subscripts, double-width, condensed, proportional spacing, etc. To underline a word or phrase, enclose it in ‹CTRL-brackets›. In other words, ‹CTRL-,› is underlining on, and ‹CTRL-.› is underlining off. Underlining works only on the 825 printer. If you have GRAFTRAX installed in your MX-80, underlining produces italics.

The following is an advanced technique. You can "define" up to ten special characters and print them at any spot in your text. To define a character,

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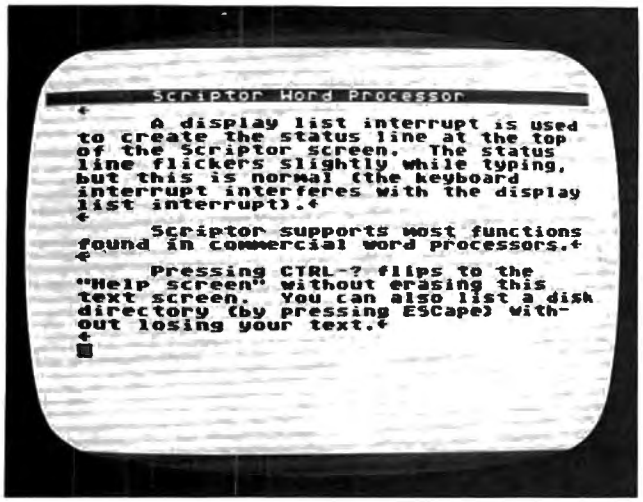


A sample text screen created with the "Scriptor" word processor.

set up a format line (see the discussion of format lines, below) with ‹CTRL-F› and enter your definitions such as "1=123:2=125:3=27", etc. You can then output the CHR$ code of the defined characters by embedding a caret ("^") in your text, followed by the number (e.g., ^4). If you don't put a number after it, a caret will print; otherwise, the character associated with the number (0-9) will be output. You can also output ASCII characters from within a format line with the "as" format command. For example, "as27:as18" will activate proportional spacing on the 825 printer. Use "as27:as69" for emphasized mode on the MX-80.

Formatting Text

Since you are typing in the raw text, with no margins or line breaks, how does the computer print a nice formatted page? The computer assumes a left margin of five, a right margin of 75, single spacing, a page length of 66, and 50 lines to be printed per page. You can change these "default" values with a format line.

A format line is like an embedded command line. The line starts with a "format character" to prevent the line from being printed out. To get the format character, press ‹CTRL-F›. You should get a right-pointed "wedge." Then type in your commands. All commands are two lowercase letters, usually followed by a number. You can put multiple commands on the same line if you separate them with colons. For example, the following line:

```
▶lm10:rm70:sp2←
```

will set the left margin to ten, the right margin to 70, and line spacing to two. Here is an explanation of each formatting command. Also see Table 2 for quick reference.

Note that n *represents a number, with no space between the command and the number. No real error-checking is performed on the number.*

as *n* Send byte *n* to printer.

cm: Comment line. You can type one screen line of comments. They will not be printed to the printer. They are just for your convenience.

cn *n* Centering. If n=1, then centering will be ON, and all following lines will be centered until reset by cn0. If n=0, then centering is turned OFF.

fp Forced paging. Normally, the printer will "page," or go on to the next page, when the number of lines printed equals your lines per page (lp), which defaults to 50. Forced paging pages to the next page, regardless.

lm *n* n=left margin, which should be less than the right margin.

ln *n* Print *n* blank lines.

lp *n* Sets lines per page to *n* – *n* should be less than the page length, to allow some blank space at the bottom of each page.

nf: *filename* Will "chain" to next specified file, permitting a document to be split up into many parts. The *nf* insures that they will all print as one big file. The formatting commands carry over to each file.

pl *n* Sets the page length, which is almost always (and defaults to) 66.

rm *n* *n*=right margin, which should be less than the maximum width and greater than the left margin.

sp *n* *n*=1 single spacing, *n*=2 double spacing, *n*=3 triple spacing, etc.

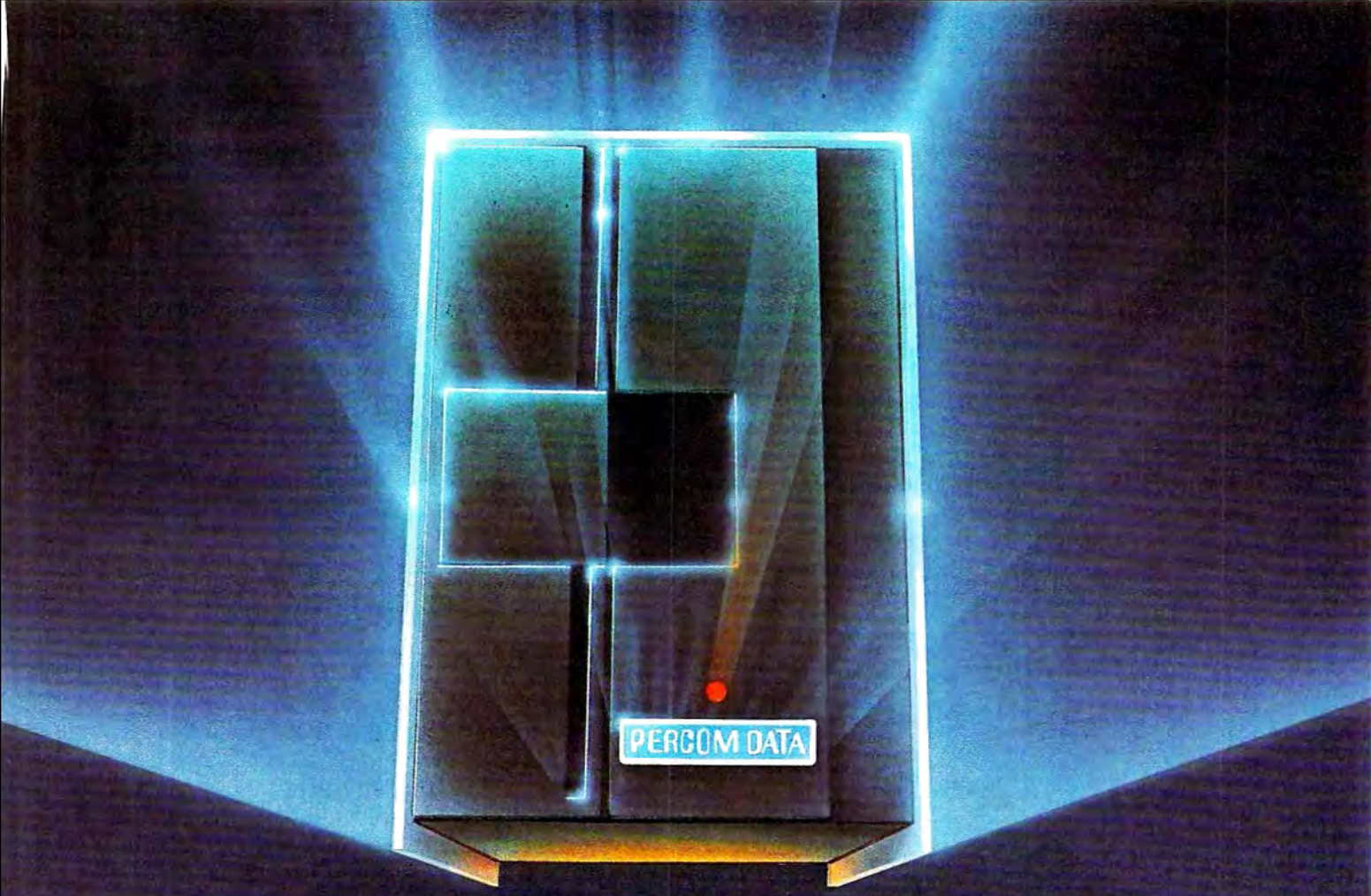
Start The Presses

To print your document, press ‹CTRL-P›. You should see:

```
PRINT:  (C/F)
```

To start printing, just press ‹RETURN›. The printer head should be positioned at about the start of the page. The "C/F" indicates any selected option. "C" stands for Continuous Print. You would use this option with pinfeed or roll paper. It will automatically page to the start of each sheet. If you do not select continuous print, the computer will beep at the end of each page and pause. You should put in another sheet of paper and press ‹RETURN› to continue printing.

Note that pressing a key any other time during printing will abort the printout. The "F" option stands for Fast Printout. It will blank the screen during the printing, increasing printing speed better than 30%. Some people, however, find a



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blank screen disconcerting. To select one of the options, press either "C" or "F." The appropriate letter will light up and flash. To reset the option (cancel it), press the key again. Press ‹RETURN› when you are ready to print the text.

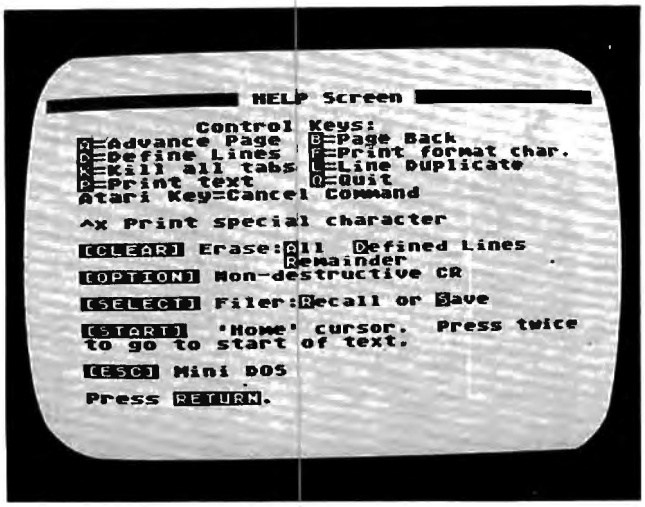
Customizing Scriptor

The program is fairly well-structured, with separate sections for all functions. The control keys are executed via a branching IF/THEN "bucket brigade." Just patch in your own command where desired. Some functions you may want to add are: block transfer (performs both block insert and block delete), Search and Replace, Insert from Disk, simple data merge, etc. Machine language programmers may want to try their hand at speeding up certain aspects of the program, such as Insert Line, Delete Line, and even Print Text.

Some useful subroutines are: GOSUB 540 returns the number of lines the user has typed (not necessarily the maximum number of lines) in EOT. GOSUB 600 clears the top line of the screen and positions the cursor at the first character, ready for a message. GOSUB 460 performs error-checking and adjustments on the X-Y position of the cursor. GOSUB 2650 returns an adjusted (uppercase if AL=1, no cursor controls, etc.) character in A. GOSUB 2730 is a pseudo-INPUT routine that returns IN$. Variable MX controls the maximum number of characters.

TRAP 2170 will vector errors to an "I/O Error" message. There are two re-entry points for the editor proper: GOTO 650 which clears and "refreshes" the screen, and GOTO 680 which just adjusts the cursor and continues keyboard entry (faster).

Primary variables are: CL – the pointer to the top line (from 0-#lines) of the screen; X – the horizontal position of the cursor 2-39; Y – the vertical position of the cursor on the screen, 1-23; TX$ – the string that contains all the text and is organized in 38 character substrings, one for each line; T$ and T – "temporary variables"; A – usually a keystroke typed; SCR – the address of the screen memory origin; NL – number of defined lines; FRL – the starting line in text of the defined lines; RL – the starting line in TX$ for reserved lines (the buffer). Several constants are Q0, Q1, Q23 – which return 0, 1, or 23 (saves memory); L2=38; L=40; B$ is 38 null (CHR$(0)) characters.



The HELP Screen in "Scriptor."

Quick Reference

Table 1: Editing Commands

Control Keys

A	Advance one screen forward
B	Back up one screen
D	Define Lines
F	Print Format Character
G	Go to specified line
K	Clear all tab settings
L	Duplicate defined lines
P	Print Document
Q	Quit Program

SHIFT-INSERT	Insert a line
SHIFT-DELETE	Delete a line
CTRL-INSERT	Insert a space
CTRL-DELETE	Delete a character
CLEAR	Erase: A=All R=Remainder D=Defined Lines
CAPS/LOWR	Upper or lowercase
ESC	Mini DOS
Cursor keys	Moves cursor with two-way scrolling
[OPTION]	Non-destructive carriage return
[SELECT]	Save or Recall text
[START]	"Home" cursor
[CTRL-,]	Underlining ON
[CTRL-.]	Underlining OFF
^x	Print special character

Table 2: Formatting Commands

Command	Description	Default
as *n*	Send ASCII character *n* to printer.	—
cm:xxxx	Comment line	—
cn *n*	Centering 1=on, 0=off	0 Off
fp	Forced Paging	—
lm *n*	Set left margin to *n*	5
ln *n*	Do *n* linefeeds	—
lp *n*	Set lines per page to *n*	50
nf:*file*	Link to Next File	—
pl *n*	Page length	66
rm *n*	Set right margin to *n*	75
sp *n*	Set line spacing	1 (single)

Program 1.

```
100 REM  SCRIPTOR WORD PROCESSOR
110 GOTO 5000
455 RUN "D:SCRIPTOR"
460 PF=Q0:IF X<2 THEN X=39:Y=Y-Q1
470 IF X>39 THEN X=2:Y=Y+Q1
480 IF Y<Q1 THEN Y=Q1:CL=CL-Q1:PF=Q1
490 IF Y>Q23 THEN Y=Q23:CL=CL+Q1:PF=
    Q1
```

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```
500 IF CL<Q0 THEN CL=Q0
510 IF CL>(MXL-Q23) THEN CL=MXL-Q23
520 IF PF=Q0 THEN RETURN
530 LOC=CL*L2+Q1:T=USR(SCRZAP,ADR(TX
    $(LOC))):RETURN
540 REM ***  FIND END OF TEXT
550 P=ADR(TX$):T=P+RL*L2-Q1
560 A=USR(EDCOM,T,P,2):A=A-P
570 LC=A:EOT=INT(A/L2)
580 RETURN
590 REM ***  ERASE TOP LINE
600 COLOR 32:PLOT Q1,Q0:DRAWTO L2,Q0
    :PLOT Q1,Q0:RETURN
610 REM ***  START OF EDITOR
611 MXL=INT(FRE(Q0)/40)-25:RL=MXL+1
612 DIM TX$((MXL+Q23)*L2):? CHR$(125
    );
613 TX$=CHR$(Q0):TX$((MXL+Q23)*L2)=T
    X$:TX$(2)=TX$
620 SCR=PEEK(88)+256*PEEK(89):POKE 5
    59,46:POKE 842,12
630 X=2:Y=Q1:CL=Q0:POKE 702,Q0
640 REM ***  ENTRY FOR EACH PAGE
650 POKE 54286,192
655 POSITION Q0,Q0:? "{7 SPACES}Scri
    ptor Word Processor";:COLOR 32:D
    RAWTO L2,Q0:PLOT 32,Q0
660 LOC=CL*L2+Q1:T=USR(SCRZAP,ADR(TX
    $(LOC)))
670 IF TF THEN TF=Q0:GOTO 810
675 IF FIRST=Q0 THEN POSITION 31,Q0:
    ? MXL;" Free";:TF=Q1:FIRST=Q1
680 POKE 53248,X*4+44
690 IF Y=OY THEN 740
710 ADJOY=OY*4+16:ADJY=Y*4+16
720 A=USR(CURSOR,PMB+ADJOY,Q0):A=USR
    (CURSOR,PMB+ADJY,15):OY=Y
740 K=PEEK(53279):IF K<7 THEN 2570
770 T=PEEK(764):IF T=255 OR T=39 OR
    T=154 THEN 740
775 IF T=166 THEN POKE 764,255:GOTO
    1570
790 POKE 694,Q0:A=USR(GCHAR)
800 IF TF THEN 650
810 IF A<32 OR A>122 OR A=96 THEN 88
    0
820 A=A-32*(A<96)
830 POKE SCR+X+L*Y,A
840 LOC=(CL+Y-Q1)*L2+X-Q1
850 TX$(LOC,LOC)=CHR$(A)
860 X=X+Q1-BF:GOSUB 460
870 BF=Q0:GOTO 680
880 IF A<>155 THEN 910
890 GOSUB 2640:POKE SCR+X+L*Y,94:TX$
    (LOC,LOC+L2-X+Q1)=B$:X=2:Y=Y+1
900 TX$(LOC,LOC)=CHR$(94):GOSUB 460:
    GOTO 650
910 IF A=6 THEN A=127:GOTO 830
920 IF A=28 THEN Y=Y-Q1:GOSUB 460:GO
    TO 680
930 IF A=29 THEN Y=Y+Q1:GOSUB 460:GO
    TO 680
940 IF A=30 THEN X=X-Q1:GOSUB 460:GO
    TO 680
950 IF A=96 THEN A=74:GOTO 830
960 IF A=31 THEN X=X+Q1:GOSUB 460:GO
    TO 680
970 IF A=Q0 THEN A=72:GOTO 830
980 IF A=126 THEN X=X-Q1:GOSUB 460:A
    =Q0:BF=Q1:GOTO 830
1040 IF A<>255 THEN 1070
1050 A=USR(EDCOM,ADR(TX$((CL+Y-Q1)*L
     2+X-Q1)),ADR(TX$(MXL*L2+37)),Q0
     )
1060 GOTO 650
1070 IF A<>254 THEN 1100
1080 A=USR(EDCOM,ADR(TX$((CL+Y-Q1)*L
     2+X-Q1)),ADR(TX$(MXL*L2+37)),Q1
     )
1090 GOTO 650
1100 IF A<>157 THEN 1160
1110 GOSUB 590:? "Insert Line";
1120 GOSUB 540:POKE 559,Q0
1130 FOR I=EOT+(EOT<MXL) TO CL+Y STE
     P -Q1:T$=TX$((I-Q1)*L2+Q1,I*L2)
     :TX$(I*L2+Q1,I*L2+L2)=T$:NEXT I
1140 T=(CL+Y-Q1)*L2:TX$(T+Q1,T+L2)=B
     $
1150 X=2:POKE 559,46:GOTO 650
1160 IF A=159 THEN GOSUB 590:? "Tab
     set at ";X-Q1:TF=Q1:TB$(X-Q1,X-
     Q1)="*":GOTO 740
1170 IF A=158 THEN GOSUB 590:? "Tab
     cleared at ";X-Q1:TF=Q1:TB$(X-Q
     1,X-Q1)=CHR$(Q0):GOTO 740
1180 IF A<>127 THEN 1230
1190 IF TB$=B$ THEN GOSUB 590:? "No
     tabs set":TF=Q1:GOTO 740
1200 FOR I=X TO L2:IF TB$(I,I)=CHR$(
     Q0) THEN NEXT I:T=L2:X=2:Y=Y+Q1
     :GOSUB 460:GOTO 1200
1210 T=I:I=L2:NEXT I
1220 X=T+Q1:GOTO 680
1230 IF A<>156 THEN 1290
1240 GOSUB 590:? "Delete Line";
1250 GOSUB 540:POKE 559,Q0
1260 FOR I=CL+Y-Q1 TO EOT:T$=TX$((I+
     Q1)*L2+Q1,(I+2)*L2):TX$(I*L2+Q1
     ,I*L2+L2)=T$:NEXT I
1270 T=EOT*L2:TX$(T+Q1,T+L2)=B$
1280 X=2:POKE 559,46:GOTO 650
1290 IF A=11 THEN GOSUB 590:TF=Q1:?
     "Clear all tabs":TB$=B$:GOTO 74
     0
1320 IF A<>125 THEN 1450
1330 GOSUB 590:? "Erase: ";
1340 GOSUB 2650
1350 IF A=155 THEN 650
1355 IF A<>65 THEN 1370
1360 ? "ALL - ";:GOSUB 2540
1365 GOTO 613
1370 IF A<>82 THEN 1380
1372 ? "Remainder - ";:GOSUB 2540:GO
     SUB 2640
1375 TX$(LOC)=CHR$(Q0):TX$((MXL+Q23)
     *L2)=CHR$(Q0):TX$(LOC+Q1)=TX$(L
     OC):GOTO 650
1380 IF A<>68 OR NL=-Q1 THEN 650
1400 ? "Defined Lines - ";
1410 GOSUB 2540:POKE 559,Q0:GOSUB 54
     0
1420 FOR I=FRL-Q1 TO EOT:T$=TX$((I+N
     L+Q1)*L2+Q1,(I+NL+2)*L2):TX$(I*
     L2+Q1,I*L2+L2)=T$:NEXT I
1430 FOR I=EOT-NL TO EOT:TX$(I*L2+Q1
     ,I*L2+L2)=B$:NEXT I:NL=-Q1
1440 POKE 559,46:GOTO 650
1450 IF A<>4 THEN 1810
1460 GOSUB 590:? "Define Lines";
1470 FL=CL:FR=Y:FRL=FL+FR:NL=Q0
1480 POKE SCR+1+L*(FR+NL),223
1490 LOC=CL*L2+(FR+NL-Q1)*L2:T=RL*L2
```

```
    +NL*L2:T$=TX$(LOC+Q1,LOC+L2):TX
    $(T+Q1,T+L2)=T$
1500 GOSUB 2650
1510 IF A=29 AND FR+NL<22 THEN NL=NL
    +Q1:GOTO 1480
1520 IF A=28 AND FR+NL>FR THEN POKE
    SCR+1+L*(FR+NL),Q0:NL=NL-Q1
1530 IF A=155 THEN 1550
1540 GOTO 1500
1550 FOR I=Q0 TO NL:POKE SCR+1+L*(FR
    +I),Q0:NEXT I:GOTO 650
1570 POKE 53248,Q0:PRINT CHR$(125):P
    OSITION 13,Q0:? "  HELP Screen  "
1580 ? "{DOWN}{TAB}{3 SPACES}Control
     Keys:"
1590 ? "A=Advance Page  B=Page Back"
1595 ? "D=Define Lines  F=Print form
    at char."
1610 ? "K=Kill all tabs L=Line Dupli
    cate"
1620 ? "P=Print text{4 SPACES}Q=Quit
    "
1630 ? "Atari Key=Cancel Command":?
1635 ? "^x Print special character"
1640 ? "{DOWN}[CLEAR] Erase:A11  Def
    ined Lines":POKE 85,16:? "Remai
    nder"
1650 ? "[OPTION] Non-destructive CR"
1660 ? "{DOWN}[SELECT] Filer:Recall
    or Save"
1670 ? "{DOWN}[START]  'Home' cursor
    .  Press twice  to go to start
    of text."
1680 ? "{DOWN}[ESC] Mini DOS"
1700 ? "{DOWN}Press RETURN.":A=USR(G
    CHAR):GOTO 650
1810 IF A<>12 THEN 1910
1820 GOSUB 590:? "Duplicate defined
    lines";
1830 IF NL<Q0 THEN 650
1840 FOR I=Q0 TO NL
1850 IF CL+Y+I-Q1>MXL THEN I=NL:GOTO
     1900
1860 T=RL*L2+I*L2
1870 T2=CL*L2+(Y+I-Q1)*L2
1880 T$=TX$(T+Q1,T+L2)
1890 TX$(T2+Q1,T2+L2)=T$
1900 NEXT I:Y=Y+NL+Q1:GOSUB 460:GOTO
     650
1910 IF A<>27 THEN 2400
1920 POSITION 2,Q0:? "Directory,Lock
    ,Unlock,Rename,Scratch?"
1930 GOSUB 2650:J=A
1940 IF J<>76 AND J<>85 AND J<>83 AN
    D J<>68 AND J<>82 THEN 1930
1950 IF J<>ASC("D") THEN 2020
1960 ? CHR$(125):POKE 53248,Q0
1970 TRAP 2170:OPEN #2,6,Q0,"D:*.*"
1980 INPUT #2,T$:? T$:IF LEN(T$)<17
    THEN 2000
1990 GOTO 1980
2000 CLOSE #2:TRAP 40000:GOSUB 590:?
     "Press a key..■";:OK=1:GOSUB 2
    650:IF A=27 THEN 1920
2010 GOTO 650
2020 GOSUB 590:J=A
2030 IF J=76 THEN ? "  LOCK  >";:J=35
2040 IF J=83 THEN ? "SCRATCH>";:J=33
2050 IF J=85 THEN ? "  UNLOCK>";:J=36
2060 IF J=ASC("R") THEN 2130
2070 ? "Enter Filename:";
2080 MX=12:AL=Q1:GOSUB 2720
2090 T$(3)=IN$:T$(1,2)="D:":POSITION
     10,Q0:? DEL$(1,15);
2100 TRAP 2170:IF J=33 THEN POSITION
     24,Q0:GOSUB 2540:COLOR 32:PLOT
     24,Q0:DRAWTO 38,Q0
2110 TRAP 2170:XIO J,#2,Q0,Q0,T$:TRA
    P 40000
2120 TRAP 40000:GOTO 650
2130 GOSUB 590:? "RENAME>Current nam
    e? ";:MX=12:GOSUB 2720:T$(3)=IN
    $:T$(1,2)="D:"
2140 GOSUB 590:? "RENAME>New name? "
    ;:MX=12:GOSUB 2720:T$(LEN(T$)+Q
    1)=",":T$(LEN(T$)+Q1)=IN$
2150 TRAP 2170:XIO 32,#2,Q0,Q0,T$:TR
    AP 40000
2160 GOTO 650
2170 TRAP 2170:POKE 559,46:CLOSE #2:
    CLOSE #3:GOSUB 590:? CHR$(253);
    "I/O Error #";PEEK(195);:TF=Q1:
    GOTO 740
2180 GOSUB 590:? "Save or Recall";
2190 ICCOM=834+48:ICBAL=ICCOM+2:ICBL
    L=ICBAL+4:ICSTAT=835+48:REM IOC
    B#3
2200 GOSUB 2650:IF A=155 THEN 1380
2210 IF A<>ASC("S") THEN 2290
2220 GOSUB 600:? "SAVE:{3 SPACES}Fil
    e name? ";:MX=12:GOSUB 2720:T$(
    3)=IN$:T$(1,2)="D:":GOSUB 550
2230 POSITION 5,0:? DEL$(1,12);"ING"
    ;
2232 TRAP 2238:OPEN #3,4,Q0,T$:CLOSE
     #3:GOSUB 600:? "REPLACE:  ";IN
    $;" - ";:GOSUB 2540
2233 GOSUB 600:? "REPLACING ";IN$:GO
    TO 2240
2238 CLOSE #3:IF PEEK(195)<>170 THEN
     2170
2240 TRAP 2170:OPEN #3,8,Q0,T$
2250 POKE ICCOM,11:P=ADR(TX$):POKE I
    CBAL+Q1,INT(P/256):POKE ICBAL,P
    -(INT(P/256)*256)
2260 LN=(CL+EOT+Q1)*L2:POKE ICBLL+Q1
    ,INT(LN/256):POKE ICBLL,LN-(INT
    (LN/256)*256)
2270 A=USR(ADR(CIO$),48):ERR=PEEK(IC
    STAT):POKE 195,ERR:IF ERR>1 THE
    N 2170
2280 CLOSE #3:TRAP 40000:POKE 53279,
    Q0:GOTO 650
2290 IF A<>ASC("R") THEN 650
2300 LK=Q0
2310 GOSUB 590:? "RECALL: Filename?
    ";:MX=12:GOSUB 2720:T$(3)=IN$:T
    $(1,2)="D:"
2315 LOC=(CL+Y-Q1)*L2+Q1:TX$(LOC)=CH
    R$(Q0):TX$((MXL+Q23)*L2)=CHR$(Q
    0):TX$(LOC+Q1)=TX$(LOC)
2320 TRAP 2170:POSITION 8,0:? DEL$(1
    ,8);"ING";:OPEN #3,4,Q0,T$
2330 ICCOM=834+48:ICBAL=ICCOM+2:ICBL
    L=ICBAL+4
2340 POKE ICCOM,5:P=ADR(TX$((CL+Y-Q1
    )*L2+Q1)):POKE ICBAL+Q1,INT(P/2
    56):POKE ICBAL,P-(INT(P/256)*25
    6)
2350 LN=(MXL-(CL+Y-Q1))*L2:POKE ICBL
    L+Q1,INT(LN/256):POKE ICBLL,LN-
    (INT(LN/256)*256)
```

```
2360 A=USR(ADR(CIO$),48):ERR=PEEK(IC
     STAT):POKE 195,ERR:IF ERR>1 AND
      ERR<>136 THEN 2170
2370 CLOSE #3:POKE 53279,0:TRAP 400
     00:IF LK=0 THEN 650
2380 CL=0:Y=1:X=2:T=USR(SCRZAP,ADR
     (TX$))
2390 GOTO 2950
2400 IF A<>17 THEN 2410
2403 GOSUB 600:? "QUIT: ";:GOSUB 254
     0
2405 POKE 53277,0:POKE 53248,0:POK
     E 53774,192:POKE 16,192:GRAPHIC
     S 0:POKE 702,64:END
2410 IF A=16 THEN 2840
2420 IF A=1 THEN CL=CL+23:Y=1:GOS
     UB 460:GOTO 650
2430 IF A=2 THEN CL=CL-23:Y=1:GOSU
     B 460:GOTO 650
2500 GOTO 640
2540 ? "Are you sure?";:GOSUB 2650:I
     F 1-(A=121 OR A=89) THEN POP :G
     OTO 650
2550 RETURN
2570 REM ***  Handle console keys
2580 POKE 764,130:A=USR(GCHAR):POKE
     77,0
2590 IF K=5 THEN 2180
2600 IF K=3 THEN X=2:Y=Y+1:GOSUB 46
     0:GOTO 680
2610 IF K=6 AND Y=1 AND X=2 THEN CL
     =0:X=2:GOTO 650
2620 IF K=6 THEN Y=1:X=2:GOTO 650
2630 GOTO 740
2640 LOC=(CL+Y-1)*L2+X-1:RETURN
2650 T=0:REM GET A KEY
2660 IF PEEK(20)>20 THEN T=1-T:POKE
      20,0:POKE 755,T*2
2665 IF OK THEN IF PEEK(53279)=5 THE
     N POKE 755,2:POKE 559,46:POP :P
     OKE 764,130:A=USR(GCHAR):OK=0:G
     OTO 2180
2670 IF PEEK(764)=255 THEN 2660
2680 IF PEEK(764)=154 THEN 2660
2690 IF PEEK(764)=39 THEN POKE 764,2
     55:SOUND 0,5,12,4:POP :FOR T=1
      TO 5:NEXT T:SOUND 0,0,0,0:
     GOSUB 2710:GOTO 650
2700 TRAP 2700:A=USR(GCHAR):TRAP 400
     00:IF A>96 AND A<123 THEN A=A-3
     2*AL
2710 POKE 755,2:POKE 559,46:RETURN
2720 REM ***  PSEUDO-INPUT
2730 IN$=""
2740 ? CHR$(21);CHR$(30);:GOSUB 2650
     :? CHR$(32);CHR$(30);
2750 IF A=155 THEN 2820
2760 IF A=126 AND LEN(IN$)>1 THEN IN
     $=IN$(1,LEN(IN$)-1):? CHR$(A);
     :GOTO 2740
2770 IF A=126 AND LEN(IN$)=1 THEN ?
      CHR$(A);:GOTO 2730
2780 IF LEN(IN$)=MX THEN 2740
2790 IF (A<32 OR A>90) AND A<96 OR A
     >122 THEN 2740
2800 ? CHR$(A);:IN$(LEN(IN$)+1)=CHR
     $(A)
2810 GOTO 2740
2820 AL=1:IF IN$="" THEN POP :GOTO
     650
2830 RETURN
2840 REM ***  Printer Output
2850 GOSUB 590:? "PRINT: (C/F)"
2860 CON=0:F=0:FOR I=0 TO 9:PC(I)
     =48+I:NEXT I
2870 GOSUB 2650:IF A=155 THEN 2910
2880 IF A=67 THEN CON=1-CON:POSITION
      10,0:? CHR$(67+128*CON);:GOTO
      2870
2890 IF A=70 THEN F=1-F:POSITION 12,
     0:? CHR$(70+128*F):GOTO 2870
2900 GOTO 2870
2910 TRAP 2170:OPEN #2,8,0,"P:"
2920 GOSUB 590:? "Printing..."
2930 LM=5:RM=75:CN=0:NL=0
2940 SP=1:PL=66:LP=50:C=LM
2950 GOSUB 540:IF F=1 THEN POKE 559,
     0
2960 FOR P=1 TO LC
2970 IF PEEK(764)<255 THEN GOSUB 265
     0:POP :GOTO 3140
2980 Z=ASC(TX$(P))
2990 IF CN=1 AND Z<>127 THEN 3460
3000 IF Z<62 OR (Z>96 AND Z<123) THE
     N 3070
3010 IF Z=94 THEN GOSUB 3210:GOSUB 3
     150:GOTO 3120
3020 IF Z=72 THEN UL=1:PUT #2,27:PU
     T #2,52:GOTO 3120
3030 IF Z=74 THEN UL=0:PUT #2,27:PU
     T #2,53:GOTO 3120
3040 T=ASC(TX$(P+1)):IF Z=62 AND T>
     15 AND T<26 THEN PUT #2,PC(T-16
     ):P=P+1:GOTO 3120
3060 IF Z=127 THEN 3230
3070 IF C=LM THEN FOR I=1 TO LM:PUT
      #2,32:NEXT I
3080 C=C+1
3090 PUT #2,Z+32*(Z<64)
3100 T=0:IF RM-C>=10 THEN 3110
3105 FOR I=1 TO LEN(BRK$):IF Z+32<>A
     SC(BRK$(I,I)) THEN NEXT I:GOTO
     3110
3107 TT=ASC(TX$(P+1)):IF TT=0 OR T
     T=94 OR Z=0 OR Z=13 THEN I=LEN
     (BRK$):NEXT I:GOSUB 3150:T=1
3110 IF T=1 AND ASC(TX$(P+1))=0 T
     HEN P=P+1:IF P<LC THEN 3110
3120 NEXT P
3130 GOSUB 3150
3140 PRINT #2:CLOSE #2:POKE 559,46:T
     RAP 40000:GOTO 650
3150 FOR I=1 TO SP:PRINT #2:NEXT I
3160 C=LM:NL=NL+SP:IF CN<0 THEN CN=
     1
3170 IF NL<LP THEN RETURN
3180 IF CON=0 THEN FOR I=0 TO 255
     STEP 17:SOUND 0,255-I,10,15-IN
     T(I/17):NEXT I:T=USR(GCHAR):GOT
     O 3200
3190 FOR I=1 TO PL-LP:PRINT #2:NEXT
      I
3200 NL=0:RETURN
3210 REM ***  SKIP TRAILING BLANKS
3220 T=INT(P/L2):P=(T+1-(P/L2=T))*L
     2:RETURN
3230 REM Handle special formatting
3240 P=P+1
3250 CM$=TX$(P,P+1):T$=""
3260 FOR I=P+2 TO LC
3270 IF TX$(I,I)>=CHR$(16) AND TX$(I
     ,I)<CHR$(26) THEN T$(LEN(T$)+1
```

```
)=CHR$(ASC(TX$(I,I))+32):NEXT I
3280 V=Q0:P=I:TRAP 3290:V=VAL(T$)
3290 TRAP 2170:IF CM$="cn" THEN CN=V
3300 IF CM$="ln" THEN FOR J=Q1 TO V:
     GOSUB 3150:NEXT J
3310 IF CM$="sp" THEN SP=V
3320 IF CM$="pl" THEN PL=V
3330 IF CM$="lp" THEN LP=V
3340 IF CM$="lm" AND V>0 THEN LM=V:C
     =V
3350 IF CM$="rm" AND V>0 THEN RM=V
3360 IF CM$="fp" THEN GOSUB 3180:POK
     E 559,46-46*F
3370 IF CM$="as" THEN PUT #2,V
3380 IF CM$="cm" THEN FOR I=P TO P+7
     9:IF TX$(I,I)<>"^" THEN NEXT I:
     I=I-Q1
3390 IF CM$="cm" THEN P=I+Q1:GOTO 34
     50
3400 IF CM$<>"nf" THEN 3430
3410 T$="D:":FOR I=Q0 TO 11:Z=ASC(TX
     $(P+I,P+I)):IF Z<>94 AND P+I<=L
     C THEN T$(3+I)=CHR$(Z+32*(Z<63)
     ):NEXT I
3415 TX$(Q1)=CHR$(Q0):TX$((MXL+Q23)*
     L2)=CHR$(Q0):TX$(2)=TX$
3420 POKE 559,46:GOSUB 590:? "Printi
     ng ";T$:LK=Q1:CL=Q0:Y=Q1:GOTO 2
     320
3430 IF ASC(CM$)>15 AND ASC(CM$)<26
     THEN PC(ASC(CM$)-16)=V
3440 IF TX$(P,P)<>"^" AND P<LC THEN
     3240
3450 GOSUB 3220:P=P+Q1:GOTO 2970
3460 REM ***  CENTER STRING
3470 LN=Q0:FOR I=P TO P+79:IF TX$(I,
     I)<>"^" THEN LN=LN+Q1:NEXT I
3480 WIDTH=RM-LM:UL=Q0:IF TX$(P,P)=C
     HR$(72) THEN UL=Q1
3490 FOR I=Q1 TO (WIDTH-LN)/2+LM:PUT
      #2,32:NEXT I
3500 C=C+I:CN=-Q1:GOTO 2990
5000 REM ■INITIALIZATION■
5010 GRAPHICS 17:SETCOLOR 4,1,10
5020 DL=PEEK(560)+256*PEEK(561)+4:PO
     KE DL+5,7:POKE DL+10,7:POKE DL+
     14,7
5030 POSITION 6,4:? #6;"■scriptor■":PO
     SITION 3,7:? #6;"■WORD PROCESSOR
     ■"
5040 ? #6:? #6;" ";CHR$(136);CHR$(22
     7);CHR$(137);" ■copyright■";CHR$
     (145);CHR$(153);CHR$(152);CHR$(
     147)
5045 ? #6:? #6;" small systems svcs"
     ;CHR$(14);
5050 ? #6:? #6;"{3 SPACES}CHARLES BR
     ANNON"
5070 Q0=0:Q1=1:Q23=23:RL=MXL+Q1:SCRZ
     AP=1680:CURSOR=1739:EDCOM=1536:
     AL=1:L2=38:GCHAR=1303:SND=1331
5080 DIM T$(79),IN$(20),B$(L2),TB$(L
     2),CM$(2),BRK$(8),PC(9),DEL$(20
     ),CIO$(7)
5090 B$=CHR$(Q0):B$(L2)=B$:B$(2)=B$:
     DEL$=CHR$(254):DEL$(20)=DEL$:DE
     L$(2)=DEL$
5100 TB$=B$:BRK$=" ,.!?;:-":CIO$="hh
     h":CIO$(4)=CHR$(170):CIO$(5)="L
     V":CIO$(7)=CHR$(228)
5110 OPEN #1,4,Q0,"K:"
5120 T=Q0:OY=Q0:CL=Q0:L=40:NL=-Q1
5130 PMB=PEEK(106)-8:POKE 559,46:POK
     E 53248,Q0
5140 POKE 54279,PMB:POKE 53277,3
5150 PMB=PMB*256+512:POKE 704,56
5160 FOR I=Q0 TO 255:POKE PMB+I,Q0:P
     OKE 708+3*RND(Q0),PEEK(53770):N
     EXT I
5180 SETCOLOR 4,8,2
5250 FOR I=0 TO 70:READ A:POKE 1280+
     I,A:CHECKSUM=CHECKSUM+A:POKE 70
     8+3*RND(Q0),PEEK(53770):NEXT I
5290 FOR I=0 TO 247:READ A:POKE 1536
     +I,A:CHECKSUM=CHECKSUM+A:POKE 7
     08+3*RND(Q0),PEEK(53770):NEXT I
5300 IF CHECKSUM<>47765 THEN PRINT C
     HR$(253);"Error in DATA stateme
     nts...":END
5310 DATA 72,138,72,169,10,162,2,141
     ,10,212,141,24,208,141,26,208,1
     42,23,208,104,170,104,64
5320 DATA 104,173,252,2,201,255,240,
     249,133,124,162,255,142,252,2,3
     2,51,5,32,254,246,133,212,169,0
     ,133,213,96
5330 DATA 162,0,142,0,210,162,15,142
     ,1,210,160,0,234,200,208,252,20
     2,16,244,96
5340 DATA 216,104,104,133,213,104
5350 DATA 133,212,104,133,204,104
5360 DATA 133,203,104,104,208,47
5370 DATA 32,109,6,165,205,76
5380 DATA 43,6,160,0,177,205
5390 DATA 200,145,205,198,205,165
5400 DATA 205,201,255,208,2,198
5410 DATA 206,197,212,208,235,165
5420 DATA 206,197,213,208,229,160
5430 DATA 0,177,205,200,145,205
5440 DATA 136,152,145,205,96,201
5450 DATA 1,240,3,76,221,6
5460 DATA 32,109,6,76,91,6
5470 DATA 160,1,177,212,136,145
5480 DATA 212,230,212,208,2,230
5490 DATA 213,165,213,197,206,208
5500 DATA 237,165,212,197,205,208
5510 DATA 231,169,0,168,145,212
5520 DATA 96,165,212,133,205,165
5530 DATA 213,133,206,160,0,177
5540 DATA 205,201,94,240,18,230
5550 DATA 205,208,2,230,206,165
5560 DATA 206,197,204,208,238,165
5570 DATA 205,197,203,208,232,96
5580 DATA 165,88,133,203,165,89
5590 DATA 133,204,104,104,133,206
5600 DATA 104,133,205,162,24,76
5610 DATA 188,6,160,0,177,205
5620 DATA 200,200,145,203,136,192
5630 DATA 38,208,245,24,169,38
5640 DATA 101,205,133,205,144,2
5650 DATA 230,206,24,169,40,101
5660 DATA 203,133,203,144,2,230
5670 DATA 204,202,208,218,96,104
5680 DATA 104,133,204,104,133,203
5690 DATA 104,168,104,145,203,200
5700 DATA 192,4,208,249,96,160
5710 DATA 0,177,212,208,20,198
5720 DATA 212,165,212,201,255,208
5730 DATA 2,198,213,197,203,208
5740 DATA 238,165,213,197,204,208
5750 DATA 232,96
6000 GRAPHICS 0:POKE 559,Q0:POKE 16,
```

```
      64:POKE 53774,64
6010  FOR I=5000 TO 5900 STEP 100:? C
      HR$(125):POSITION 2,3:FOR J=I+9
      0 TO I STEP -10:? J:NEXT J:? 11
      0:? "CONT"
6020  POKE 712,PEEK(53770):POKE 842,1
      3:POSITION 0,0:STOP
6030  POKE 842,12:NEXT I
6040  SETCOLOR 2,12,00:SETCOLOR 4,8,1
      0:SETCOLOR 01,00,12:POKE 752,01
6050  POKE PEEK(560)+256*PEEK(561)+3,
      194:POKE 512,0:POKE 513,5
6060  ? CHR$(125):? :? :FOR I=6000 TO
       6060 STEP 10:? I:NEXT I:? "GOT
      0610":POSITION 0,0:POKE 842,13:
      STOP
```

Program 2: Change these lines of Program 1 if you have an 825 Printer.

```
3020  IF Z=72 THEN UL=01:PUT #2,15:GOT
      O 3120
3030  IF Z=74 THEN UL=00:PUT #2,14:GOT
      O 3120
3070  IF C=LM THEN PUT #2,14:FOR I=01
      TO LM:PUT #2,32:NEXT I:PUT #2,15
      *UL                              ©
```

Retirement Planner

Steve Hamilton

There are versions here for VIC (any memory size), Apple, Atari, TI-99, and TRS-80 Color Computer. This program asks you for an estimate of future interest rates, your current financial situation, and your age at retirement. It then assists you in determining how much you should invest each year towards a retirement nest egg so that you can maintain your present standard of living.

Trying to plan for financial requirements at retirement is a little like entering a contest at a local candy store and trying to guess the number of jelly beans in that five gallon jar behind the counter. Fortunately, there are some tools available to aid in retirement planning. If we are able to anticipate the future based on what has happened in the past, we can at least begin to make a reasonable estimate of our needs.

This program is one tool for retirement planning and is designed to help determine how much you should invest each year from now until retirement. The program assumes two critical factors: the first is that you can estimate the average inflation rate from now until retirement, and the second is that you can predict the average earning rate of investment over that time frame. Although these figures will be highly speculative, we can still use available information to make the best judgment possible.

The program begins by asking for the anticipated average inflation rate until retirement, your current age, and your expected age at retirement. A series of questions follows concerning current monthly expenses. Using answers to these questions, a subroutine at line 580 figures what these expenses will be at retirement. The prompts are self-explanatory. When asked for the anticipated inflation and interest rates, remember to use the decimal form of these figures. For example, if the expected interest rate is 12%, enter it as: .12.

The total savings required will be displayed following the command at line 320. The next prompt will be for the number of years until retirement: be sure to enter only 10, 15, 20, 25, 30, or 35. The input from this prompt is used to determine which factor will figure the amount you must invest each year until retirement. I obtained the factors from my local banker.

When the program is finished, a figure will be displayed representing the amount you must invest each year – at the anticipated earning rate – in order to reach the total savings figure specified from line 320.

Program 1: VIC Version

```
100 PRINT"{CLEAR}"
110 PRINT"{REV}RETIREMENT NEEDS"
120 FOR YR=1TO6:READ F(YR):NEXT YR
130 INPUT"AVE.INFL.RATE";I
140 INPUT"YOUR AGE";A
150 INPUT"RETIREMENT AGE";R
160 Y=R-A
170 PRINT"MONTHLY UTILITIES COST"
180 GOSUB 580
190 PRINT"MONTHLY FOOD COSTS"
200 GOSUB580
210 PRINT"MONTHLY HOUSING COSTS"
220 GOSUB580
230 PRINT"MONTHLY TRANSPORTATION"
240 GOSUB580
250 PRINT"MONTHLY MEDICAL COSTS"
260 GOSUB 580
270 PRINT"MONTHLY TAXES & INSUR."
280 GOSUB580
290 PRINT"MONTHLY MISC."
300 GOSUB580
310 PRINT"{CLEAR}"
320 PRINT"ANTICIPATED MONTHLY"
330 PRINT"EXPENSES=$";INT(LE)
340 PRINT"ANTICIPATED YEARLY"
350 PRINT"SOCIAL SECURITY"
360 INPUT"INCOME";SS
370 REM LINE 280 FIGURES ANNUAL
380 REM LIVING EXPENSES.
390 AL=LE*12
400 PRINT"ANTICIPATED AVE."
410 INPUT"INTEREST RATE";AI
420 PRINT"{CLEAR}"
430 PRINT"TOTAL SAVINGS REQ.="
440 SR=INT((AL-SS)/AI)
450 PRINT"$";SR
460 PRINT"NO. OF YEARS TO"
470 PRINT"RETIREMENT?(ENTER"
480 PRINT"ONLY 10,15,20,25"
490 PRINT"30 OR 35)"
500 INPUTYR:YR=YR/5-1
510 Q=(F(YR)*AI)/.12
520 PRINT"SAVINGS ALREADY"
530 INPUT"ACCUMULATED";S1
540 W=(SR-S1)/Q
550 PRINT"ANNUAL SAVINGS REQ.="
560 PRINT"$";INT(W)
570 END
580 INPUTX:Z=X*(1+I)↑Y:LE=LE+Z:RETURN:REM ~
    LE=MONTHLY RETIREMENT EXPENSES
590 DATA 20.28498,43.86578,86.45534
600 DATA 163.37683,302.30558,553.22637
```

Program 2: Apple Version

```
100  HOME : VTAB 2: HTAB 14: INVERSE : PRINT
     "RETIREMENT NEEDS": NORMAL
110  FOR YR = 1 TO 6: READ F(YR): NEXT YR
120  VTAB 6: INPUT "AVE. INFLATION RATE? ";I
130  INPUT "YOUR AGE? ";A
140  INPUT "RETIREMENT AGE? ";R
150 Y = R - A: PRINT : PRINT :A$ = "MONTHLY
     UTILITIES COSTS": GOSUB 460
160  GOSUB 430
170  INPUT "MONTHLY FOOD COSTS=$";X
180  GOSUB 430
190 A$ = "MONTHLY HOUSING COSTS": GOSUB 460
200  GOSUB 430
210  INPUT "MONTHLY TRANSPORTATION COSTS=$";
     X
220  GOSUB 430
230 A$ = "MONTHLY MEDICAL COSTS": GOSUB 460
240  GOSUB 430
250  INPUT "MONTHLY TAXES AND INSURANCE=$";X
260  GOSUB 430
270 A$ = "MONTHLY MISCELLANEOUS": GOSUB 460
280  GOSUB 430
290  VTAB 20: PRINT "** ANTICIPATED MONTHLY
     EXPENSES=";: INVERSE : PRINT "$"; INT (
     LE);: NORMAL : PRINT " **"
300  PRINT : HTAB 5: PRINT "--PRESS ANY KEY
     TO CONTINUE--": GET B$
310  HOME : PRINT : PRINT " ANTICIPATED YEAR
     LY SOCIAL SECURITY": INPUT " INCOME=$ "
     ;SS
320 AL = LE * 12: REM  CALCULATES ANNUAL LIV
     ING EXPENSES
330  PRINT : INPUT " ANTICIPATED AVE. INTERE
     ST RATE? ";AI
340 SR =  INT ((AL - SS) / AI)
350  PRINT : PRINT : PRINT : PRINT "  ** ";:
      INVERSE : PRINT "TOTAL SAVINGS REQUIRE
     D=";: NORMAL : PRINT "$";SR;" **"
360  PRINT : PRINT : PRINT " NUMBER OF YEARS
      UNTIL RETIREMENT(ENTER"
370  INPUT " ONLY 10,15,20,25,30, OR 35)?";Y
     R:YR = YR / 5 - 1
380 Q = (F(YR) * AI) / .12
390  PRINT : INPUT " SAVINGS ALREADY ACCUMUL
     ATED=$ ";S1
400 W = (SR - S1) / Q
410  PRINT : PRINT : PRINT : PRINT "  ** ";:
      INVERSE : PRINT "ANNUAL SAVINGS REQUIR
     ED=";: NORMAL : PRINT "$"; INT (W);:
     PRINT " **"
420  END
430 Z = X * (1 + I) ^ Y:LE = LE + Z: RETURN
     : REM  LE=MONTHLY RETIREMENT EXPENSES
440  DATA  20.28498,43.86578,86.45534
450  DATA  163.37683,302.30558,553.22637
460  INVERSE : PRINT A$;: NORMAL : INPUT "=$
     ";X: RETURN
```

Program 3: TI Version

```
100 DIM F(6)
110 GOSUB 710
120 FOR YR=1 TO 6
130 READ F(YR)
140 NEXT YR
150 INPUT "AVE. INFLATION RATE?":I
160 INPUT "YOUR AGE?":A
170 INPUT "RETIREMENT AGE?":R
180 PRINT
190 PRINT
200 Y=R-A
210 PRINT "MONTHLY UTILITIES COSTS"
220 GOSUB 650
230 PRINT "MONTHLY FOOD COSTS"
240 GOSUB 650
250 PRINT "MONTHLY HOUSING COSTS"
260 GOSUB 650
270 PRINT "MONTHLY TRANSPORTATION COS
    TS"
280 GOSUB 650
290 PRINT "MONTHLY MEDICAL COSTS"
300 GOSUB 650
310 PRINT "MONTHLY TAXES AND INSURANC
    E"
320 GOSUB 650
330 PRINT "MONTHLY MISCELLANEOUS"
340 GOSUB 650
350 PRINT
360 PRINT "ANTICIPATED MONTHLY EXPENS
    ES=$";INT(LE)
370 INPUT "PRESS enter TO CONTINUE":G
    $
380 GOSUB 710
390 PRINT "ANTICIPATED YEARLY SOCIAL"
400 INPUT "SECURITY INCOME?":SS
410 REM{3 SPACES}LINE 430 FIGURES ANN
    UAL{4 SPACES}
420 REM  LIVING EXPENSES
430 AL=LE*12
440 PRINT
450 PRINT "ANTICIPATED AVE. INTEREST"
460 INPUT "RATE?":AI
470 PRINT
480 PRINT "TOTAL SAVINGS REQUIRED="
490 SR=INT((AL-SS)/AI)
500 PRINT "$";SR
510 PRINT
520 PRINT "NO. OF YEARS TO RETIREMENT
    ?"
530 PRINT "(ENTER ONLY 10,15,20,25,30
    "
540 INPUT "OR 35)":YR
550 YR=YR/5-1
560 Q=(F(YR)*AI)/.12
570 PRINT
580 INPUT "SAVINGS ALREADY ACCUMULATE
    D?":S1
590 W=(SR-S1)/Q
600 PRINT
610 PRINT "ANNUAL SAVINGS REQUIRED="
620 PRINT "$";INT(W)
630 END
640 REM  LE=MONTHLY RETIREMENT EXPENS
    ES
650 INPUT X
660 Z=X*(1+I)^Y
670 LE=LE+Z
680 RETURN
690 DATA 20.28498,43.86578,86.45534
700 DATA 163.37683,302.30558,553.2263
    7
710 CALL CLEAR
720 FOR J=9 TO 11
730 CALL COLOR(J,2,7)
740 NEXT J
750 PRINT "{5 SPACES}retirement needs
    "
760 FOR I=1 TO 15
770 PRINT
780 NEXT I
790 RETURN
```

Program 4: TRS-80 Version

```
10 DIM F(6)
20 CLS
30 PRINT@200
40 PRINT"{7 SPACES}RETIREMENT NEEDS"
50 FOR I=1 TO 1000:NEXTI:CLS
60 FOR YR=1TO6:READ F(YR):NEXT YR
```

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```
70 INPUT"AVE. INFLATION RATE";I
80 INPUT"YOUR AGE";A
90 INPUT"RETIREMENT AGE";R
100 PRINT:Y=R-A
110 PRINT"MONTHLY UTILITIES COSTS";:G
    OSUB 370
120 PRINT"MONTHLY FOOD COSTS";:GOSUB
    370
130 PRINT"MONTHLY HOUSING COSTS";:GOS
    UB 370
140 PRINT"MONTHLY TRANSPORTATION";:GO
    SUB 370
150 PRINT"MONTHLY MEDICAL COSTS";:GOS
    UB 370
160 PRINT"MONTHLY TAXES AND INSUR.";:
    GOSUB 370
170 PRINT"MONTHLY MISC.";:GOSUB370
180 PRINT:PRINT" ANTICIPATED MONTHLY
    EXPENSES="
190 PRINT INT(LE)
200 PRINT:PRINT"{3 SPACES}PRESS ENTER
     TO CONTINUE";
210 IF INKEY$="" THEN 210
220 CLS:PRINT"ANTICIPATED YEARLY SOCI
    AL"
230 INPUT"SECURITY INCOME";SS
240 AL=LE*12:REM CALCS ANNUAL LIVING
    EXPENSES
250 PRINT:PRINT"ANTICIPATED AVERAGE"
260 INPUT"INTEREST RATE";AI
270 SR=INT((AL-SS)/AI)
280 PRINT:PRINT"TOTAL SAVINGS REQ.=$"
    ;SR
290 PRINT:PRINT"NO. OF YEARS TO RETIR
    EMENT?"
300 PRINT" (ENTER ONLY 10,15,20,25,30
310 INPUT" OR 35)";YR:YR=YR/5-1
320 Q=F(YR)*AI/.12
330 PRINT:PRINT"SAVINGS ALREADY ACCUM
    ULATED":INPUT S1
340 W=(SR-S1)/Q
350 PRINT:PRINT"ANNUAL SAVINGS REQ.=$
    ";INT (W)
360 END
370 INPUT X:Z=X*(1+I)^Y:LE=LE+Z:RETUR
    N:REM LE=MONTHLY RETIREMENT EXPEN
    SES
380 DATA 20.28498,43.86578,86.45534
390 DATA 163.37683,302.30558,553.2263
    7
```

Program 5: Atari Version

```
90 DIM F(6):OPEN #1,4,0,"K:"
100 GRAPHICS 2+16
110 POSITION 2,5:? #6;"RETIREMENT NEE
    DS"
120 FOR I=1 TO 1000:NEXT I
130 FOR YR=1 TO 6:READ F:F(YR)=F:NEXT
     YR
140 PRINT "{3 DOWN}AVE. INFLATION RAT
    E";:INPUT I
150 PRINT "YOUR AGE";:INPUT A
160 PRINT "RETIREMENT AGE";:INPUT R
170 Y=R-A:PRINT "{DOWN}MONTHLY UTILIT
    IES COSTS ";:GOSUB 650
180 PRINT "MONTHLY FOOD COSTS ";:GOSU
    B 650
190 PRINT "MONTHLY HOUSING COSTS ";:G
    OSUB 650
200 PRINT "MONTHLY TRANSPORTATION ";:
    GOSUB 650
210 PRINT "MONTHLY MEDICAL COSTS ";:G
    OSUB 650
220 PRINT "MONTHLY TAXES AND INSUR. "
    ;:GOSUB 650
230 PRINT "MONTHLY MISCELLANEOUS ";:G
    OSUB 650
240 PRINT "{3 DOWN}**ANTICIPATED MONT
    HLY EXPENSES=$";INT(LE);"**"
250 PRINT "{2 DOWN}  PRESS ANY KEY TO
     CONTINUE:";
260 GET #1,A
280 GRAPHICS 0:PRINT "{2 DOWN} ANTICI
    PATED YEARLY SOCIAL SECURITY":PRI
    NT " INCOME=$ ";:INPUT SS
290 AL=LE*12:REM CALCULATES ANNUAL LI
    VING EXPENSES
300 PRINT "{DOWN} ANTICIPATED AVE.INT
    EREST RATE";:INPUT AI
310 SR=INT((AL-SS)/AI)
320 PRINT "{2 DOWN} * TOTAL SAVINGS R
    EQUIRED=$";SR;" *"
330 PRINT "{3 DOWN} NUMBER OF YEARS U
    NTIL RETIREMENT"
340 PRINT " (ENTER ONLY 10,15,20,25,3
    0,OR 35)";:INPUT YR:YR=YR/5-1
350 Q=F(YR)*AI/0.12
360 PRINT "{DOWN} SAVINGS ALREADY ACC
    UMULATED=$";:INPUT S1
370 W=(SR-S1)/Q
380 PRINT "{2 DOWN} **ANNUAL SAVINGS
    REQUIRED=$";INT(W);"**"
390 END
440 DATA 20.28498,43.86578,86.45534
450 DATA 163.37683,302.30558,553.2263
    7
650 INPUT X:Z=X*(I+1)^Y:LE=LE+Z:RETUR
    N :REM LE=MONTHLY RETIREMENT EXPE
    NSES
```

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Typing Teacher

Alan McCright

For Atari, VIC, TI-99/4A, and Apple. Typing in program listings is far easier if you really know the keyboard and don't need to watch your fingers. The typing program given here helps you learn the keyboard, and will give you a score based either on characters per minute or in words per minute.

Those who must rely on hunt-and-peck typing have likely discovered just how tedious it can be, especially when you are typing in programs. This program is a self-teacher that will help familiarize you with keyboard layout and help you learn to touch type.

The idea is to let your fingers find the correct key, and not to look at the keyboard. When this program is RUN, a representation of the keyboard layout appears on the screen. The characters are printed in an approximation of their keyboard positions. Check the key's location on the display, and try to get your finger to move there without looking down at the keyboard.

The Atari version starts the clock at memory location 19 and will print a non-SHIFTed character on the upper center of the screen. It will then wait for your response, flash the screen character that corresponds to your typed key, and check to see if it matches the test character. If so, your score will be incremented by one. After one minute, the test will end, your score in characters per minute will be printed, and you will be asked to try again. If you are not using the Atari version of this program, see the notes specific to your computer.

Getting the proper screen character to flash was a problem. I know of no way to read the keyboard in x,y, and a data READ after each GET was much too slow. Finally, I hit upon the idea of POKEing the screen characters' x,y positions into page six at the locations corresponding to the characters' ATASCII values times two and their values times two plus one (lines 160 and 400). Since the GET function returns the ATASCII value, a simple algorithm and a couple of PEEKs will fetch the proper screen coordinates.

The four DATA statements contain the ATASCII values of the characters in their relative keyboard positions (line 1000=keyboard row 1).

At line 100, the screen y coordinate starts at row 5. This is incremented by one at the end of each DATA statement.

Line 120 is set to 3 at the beginning of each row, incremented by 1 after each READ, and is POKEd into memory as the screen x position.

Line 160 POKEs this data into the appropriate memory location.

Line 170 then uses these values to print the character in its proper screen position before going to the next READ.

The rows are put on the screen beginning at column 3. The last two DATA lines are padded with spaces (32) at the beginning, to position those rows one column over.

If you prefer to see your score in words per minute, make these changes:

```
500 POSITION 9,2: ?#6;CHARCNT/5
510 POSITION 3,3: ?#6;"WORDS PER MINUTE"
```

This assumes that the average English word is five letters long. However, since the characters are chosen at random (which I found ideal for learning to type in programs), each individual character has to be recognized rather than recalled as part of a word. Thus, scoring in words per minute will lead to some appallingly low, though accurate, scores, even for good typists.

How fast can the program run? In the word-per-minute mode, by deleting line 360 and all of the REMs, and holding down any key after RUNning, a score of 60-70 words per minute is typical. However, when you are actually testing, your own reaction time will keep you from reaching that level. You might want to modify the routine using word lists instead of random characters to get an idea of your true secretarial speed.

Program 1: Atari Version

```
10 GRAPHICS 2+16
20 POSITION 2,0:? #6;"TYPING  TEACHE
   R":REM INVERSE VIDEO
30 OPEN #1,4,0,"K:"
40 CHARCNT=0:REM ZERO CHARACTER COUN
   TER
99 REM ** ROUTINE TO ENTER CHARACTER
    POSITION DATA **
100 FOR ROW=5 TO 8:REM ROW DATA TO P
    OKE
120 FOR COL=3 TO 15:REM COLUMN DATA
    TO POKE
130 READ CHAR
```

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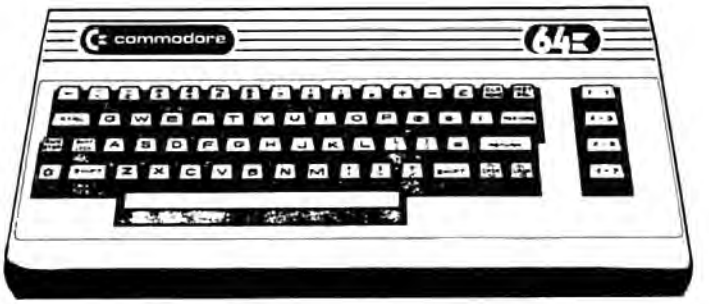

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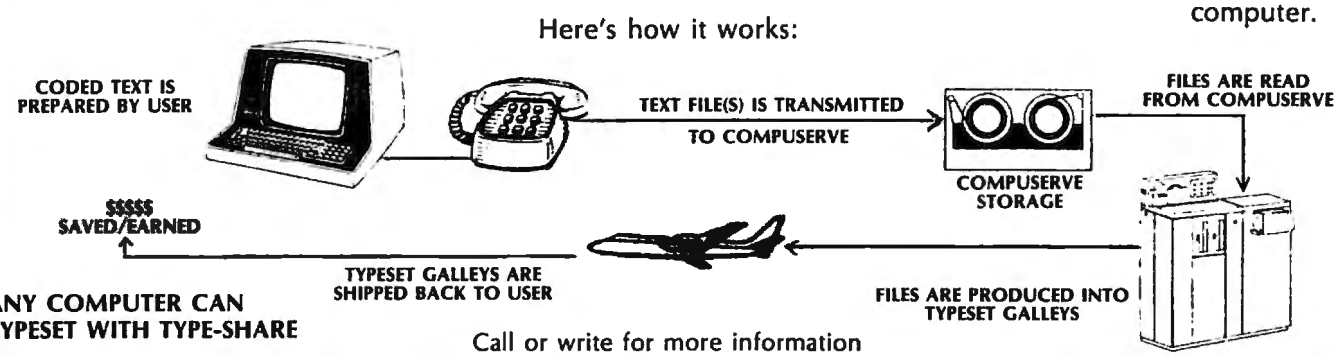

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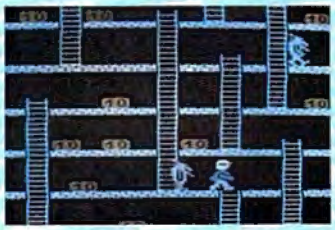

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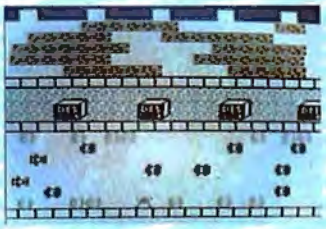

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Apple, VIC, And TI-99/4A Notes

Apple

Because the Apple lacks a realtime clock, a special counter routine must be employed in this version of the program. Incrementing occurs in line 320 while waiting for a keyboard response, and again in line 350 to account for the time required to process each response. After approximately a minute, a certain counter value will be reached (in line 330) and the testing routine will be halted and a score displayed. As in the Atari version, your score can be given in words per minute by making line 440 read:

```
440 HTAB12:VTAB7:INVERSE:PRINT"WORDS/
    MINUTE=";" ";CCNT/5:NORMAL
```

If you modify this program, be sure to check the timing for you may have affected it. If so, adjust line 350.

VIC

The VIC version of "Typing Teacher" POKEs the X,Y coordinates for each character used on the screen keyboard in an area of memory normally used as a "cassette buffer" (to hold items coming into or going out from the cassette during SAVEs or LOADs). Typing skill can be evaluated on a words per minute basis by changing line 580 to read:

```
580 PRINT"[HOME][06 DOWN][04 RIGHT]
    [REV]WORDS/MINUTE[OFF]";"=";CCNT/5
```

TI-99/4A

The TI-99/4 version, much like the Apple version, uses an incrementing counter to time the speed of keyboard response. This process occurs in lines 570 and 640. Since POKEs aren't allowed in TI BASIC, the X,Y coordinates for the characters in the keyboard displayed on the screen must be stored in an array. The TI-99/4 is somewhat slower in processing, and the sorting that is required to flash the correct keyboard response in lines 770 to 850 causes further delay. Processing speed for each keyboard response can be increased somewhat by changing line 650 to read:

```
650 IF CR<>N THEN 860
```

so that the character flashing routine on the screen-formatted keyboard is not executed. If this change is made in the program, line 640 should be changed to:

```
640 TIME=TIME+4
```

since processing time has been reduced. Unfortunately, however, you may still find yourself pushing the speed limits of the TI-99/4. Line 680 can be changed to:

```
680 PRINT" words/minute= ";CHARCNT/5
```

if a words per minute score is desired.

If you modify the program, see if the timing went off and make any necessary adjustments to line 640.

```
140 IF CHAR=0 THEN NEXT ROW:GOTO 120
150 IF CHAR=-1 THEN 200
160 POKE 1536+(CHAR*2),COL:POKE 1536
    +(CHAR*2)+1,ROW:REM POKE POSITIO
    N DATA
170 POSITION COL,ROW:? #6;CHR$(CHAR+
    128):REM PRINT CHAR TO SCREEN
180 NEXT COL
190 GOTO 120
199 REM **START CLOCK AND SELECT RAN
    DOM CHARACTER **
200 POSITION 2,10:? #6;"ANY KEY TO S
    TART":GET #1,CHAR:POSITION 2,10:
    ? #6;"(16 SPACES)":REM 16 SPACES
210 POKE 19,0:REM ZERO & START TIME
    COUNTER
220 N=INT((RND(0)*49)+42):REM CHOOSE
     A RANDOM CHARACTER
230 IF N=63 OR N=64 OR N=58 OR N=OLD
    CHAR THEN 220:REM IGNORE CERTAIN
     CHARACTERS
240 OLDCHAR=N
250 POSITION 9,3:? #6;CHR$(N):REM PR
    INT RANDOM NUMBER CHARACTER
260 IF PEEK(19)>=14 THEN 500:REM TIM
    E UP?
295 IF PEEK(764)=255 THEN 260
299 REM **PROCESS YOUR RESPONSE**
300 GET #1,CHAR
305 SOUND 0,10,10,8:CHARCNT=CHARCNT+
    1:REM ADD ONE TO TOTAL
310 SOUND 0,0,0,0:GOSUB 400
320 ? #6;CHR$(CHAR):REM FLASH CHARAC
    TER...
330 FOR X=1 TO 10:NEXT X
340 GOSUB 400
350 ? #6;CHR$(CHAR+128):REM ...AND R
    ETURN TO NORMAL
360 IF CHAR<>N THEN SOUND 0,150,12,8
    :FOR X=1 TO 10:NEXT X:SOUND 0,0,
    0,0:CHARCNT=CHARCNT-1:REM YOU ER
    RED
370 GOTO 220
399 REM ** POSITION CURSOR OVER TYPE
    D CHARACTER **
400 TRAP 360:POSITION PEEK(1536+(CHA
    R*2)),PEEK(1536+(CHAR*2)+1)
410 RETURN
499 REM ** CALCULATE AND PRINT SCORE
     **
500 POSITION 9,2:? #6;CHARCNT
510 POSITION 1,3:? #6;"CHARACTERS/MI
```

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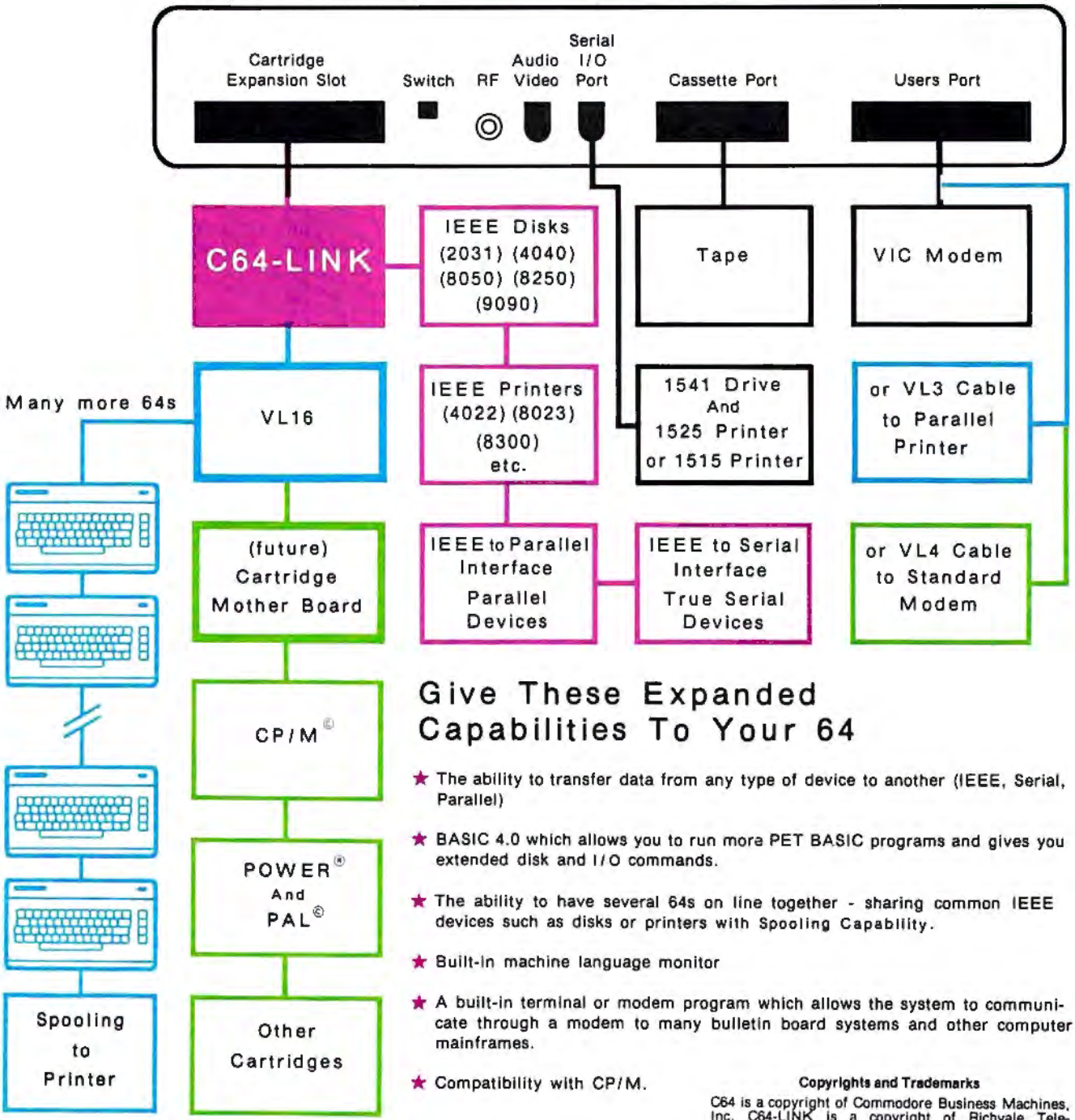

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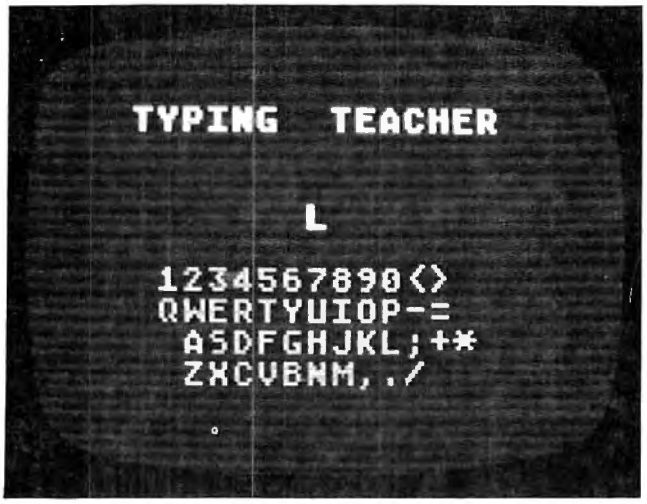
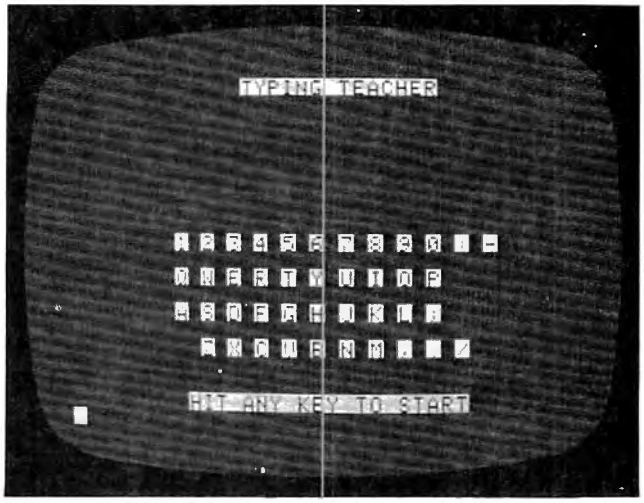


The Atari version of "Typing Teacher" uses large-size GRAPHICS 2 characters.



"Typing Teacher," Apple version. (TI-99/4A version similar.)

```
    NUTE"
520 POSITION 1,10:? #6;"HIT 'R' TO R
    ESTART"
530 FOR SND=1 TO 5
540 SOUND 0,30,10,8
550 FOR DELAY=1 TO 50:NEXT DELAY
560 SOUND 0,0,0,0:NEXT SND
570 IF SND<5 THEN 540
580 GET #1,RESTART:IF RESTART=ASC("R
    ") THEN RUN
700 END
999 REM ** ATASCII DATA IN INDIVIDUA
    L KEYBOARD ROWS AND COLUMNS **
1000 DATA 49,50,51,52,53,54,55,56,57
     ,48,60,62,0
1010 DATA 81,87,69,82,84,89,85,73,79
     ,80,45,61,0
1020 DATA 32,65,83,68,70,71,72,74,75
     ,76,59,43,42,0
1030 DATA 32,90,88,67,86,66,78,77,44
     ,46,47,-1
```

Program 2: Apple Version

```
100  FOR I = 770 TO 795: READ M: POKE I
     ,M: NEXT
110  HOME : PRINT : HTAB 14: INVERSE :
     PRINT "TYPING TEACHER": NORMAL
120 CCNT = 0: REM  ZERO CHARACTER COUNT
     ER
130  REM  ** ROUTINE TO ENTER CHARACTER
      POSITION DATA **
140  FOR ROW = 11 TO 17 STEP 2: REM  RO
     W DATA TO POKE
150  FOR COL = 9 TO 33 STEP 2: REM  CO
     LUMN DATA TO POKE
160  READ CHAR
170  IF CHAR = 0 THEN  NEXT ROW: GOTO 1
     50
180  IF CHAR =  - 1 THEN 250
190  POKE 796 + (CHAR * 2),COL: POKE 79
     6 + (CHAR * 2) + 1,ROW
200  IF CHAR = 32 THEN 220
210  HTAB COL: VTAB ROW: INVERSE : PRINT
      CHR$ (CHAR): NORMAL
220  NEXT COL
230  GOTO 150
240  REM  ** TIMER AND SELECT RANDOM CH
     ARACTER **
250  HTAB 10: VTAB 20: INVERSE : PRINT
     "HIT ANY KEY TO START": NORMAL : GET
     A$
260  HTAB 10: VTAB 20: FOR I = 1 TO 20:
      PRINT " ";: NEXT I
270 N =  INT (( RND (1) * 47) + 44): REM
      CHOOSE A RANDOM CHARACTER
280  IF N >  = 60 AND N <  = 64 OR N =
     OLDCHAR THEN 270
290 OLDCHAR = N
300  HTAB 20: VTAB 7: PRINT  CHR$ (N): REM
      PRINT RANDOM NUMBER CHARACTER
310  REM  **PROCESS YOUR RESPONSE**
320  IF  PEEK ( - 16384) < 128 AND TIME
      < 2710 THEN TIME = TIME + 1: GOTO
     320
330  IF TIME >  = 2710 THEN 440
340  GET A$:CHAR =  ASC (A$): POKE 768,
     30: POKE 769,1: CALL 770:CCNT = CC
     NT + 1: REM  *ADD ONE TO TOTAL*
350 TIME = TIME + 10
360  GOSUB 420
370  PRINT  CHR$ (CHAR)
380  FOR I = 1 TO 10: NEXT I
390  GOSUB 420: INVERSE : PRINT  CHR$ (
     CHAR): NORMAL
400  IF CHAR <  > N THEN CCNT = CCNT -
     1: POKE 768,1: POKE 769,175: CALL
     770
410  GOTO 270
420  IF CHAR <  > N THEN  POP : GOTO 40
     0
430  HTAB ( PEEK (796 + 2 * CHAR)): VTAB
     ( PEEK (797 + 2 * CHAR)): RETURN
440  HTAB 9: VTAB 7: INVERSE : PRINT "C
     HARACTERS/MINUTE =";" ";CCNT: NORMAL
450  HTAB 10: VTAB 20: INVERSE : PRINT
     " HIT 'R' TO RESTART ": NORMAL
460  POKE 768,250: POKE 769,2: CALL 770
470  GET A$: IF A$ = "R" THEN  RUN
480  END
490  REM  **MUSIC ML DATA**
500  DATA  172,01,03,174,01,03,169,04,3
     2,168,252,173,48,192,232,208,253,1
     36,208,239,206,0,03,208,231,96
510  REM  **ASCII DATA FOR KEYBOARD**
520  DATA  49,50,51,52,53,54,55,56,57,4
     8,58,45,0
530  DATA  81,87,69,82,84,89,85,73,79,8
     0,0
540  DATA  65,83,68,70,71,72,74,75,76,5
     9,0
```

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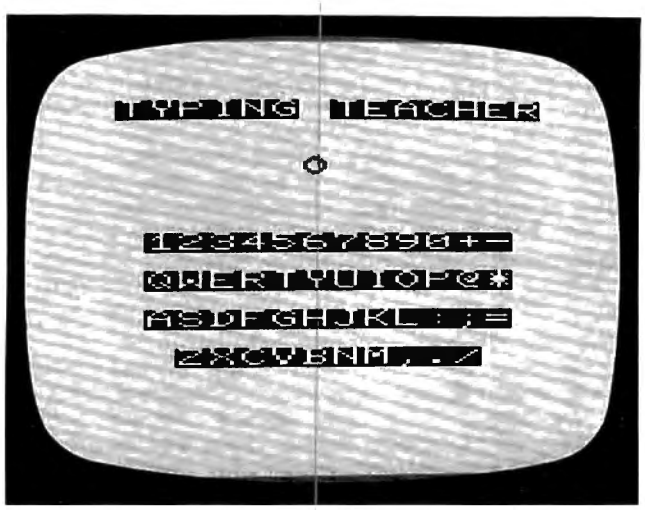
```
550  DATA  32,90,88,67,86,66,78,77,44,4
     6,47,-1
```

Program 3: VIC Version

```
100 PRINT"{CLEAR}{03 DOWN}{04 RIGHT}{REV}T
    YPING{OFF} {REV}TEACHER{OFF}{06 DOWN}"

110 CCNT=0:POKE 36878,10:X=RND(-TI):REM ZE
    RO CHAR COUNTER AND SET VOLUME
120 S2=36875:S4=36877:REM SPEAKER NUMBERS
130 REM *ROUTINE TO ENTER CHARACTER POSITI
    ON DATA*
140 FOR ROW=1 TO 4:REM ROW DATA TO POKE
150 PRINT"{05 RIGHT}";
160 FOR COL=1 TO 12:REM COLUMN DATA TO POK
    E
170 READ CHAR
180 IF CHAR=0 THEN NEXT ROW:GOTO 160
190 IF CHAR=-1 THEN 260
200 POKE 828+CHAR*2,COL:POKE 829+CHAR*2,RO
    W:REM POKE DATA POSITION
210 IF CHAR=32 THEN PRINT" ";:GOTO 230
220 PRINT"{REV}";CHR$(CHAR);
230 NEXT COL
240 PRINT"{DOWN}"
250 GOTO 160
260 PRINT"{OFF} "
270 REM **ZERO TIMER AND SELECT RANDOM CHA
    R**
280 PRINT"{03 DOWN}{RIGHT}{REV}HIT ANY KEY
     TO START{OFF}"
290 GET A$:IF A$="" THEN 290
300 PRINT"{UP}";:FOR I=1 TO 21:PRINT" ";:N
    EXT I
310 TI$="000000"
320 N=INT((RND(1)*49)+42):REM CHOOSE A RAN
    DOM CHARACTER
330 IF N=60 OR N=62 OR N=63 OR N=OLDCHAR T
    HEN 320
340 OLDCHAR=N
350 PRINT"{HOME}{06 DOWN}";SPC(10);CHR$(N)
360 IF TI>3600 THEN 580:REM TIME UP?
370 REM **PROCESS YOUR RESPONSE**
380 GET A$:IF A$="" THEN 360
390 REM*PLEASANT SOUND*
400 CHAR=ASC(A$):POKE S2,225:FOR I=1 TO 5:
    NEXT I:POKE S2,0
410 CCNT=CCNT+1
420 IF CHAR<>N THEN 490
430 GOSUB 520
440 PRINT CHR$(CHAR)
450 FOR I=1 TO 10:NEXT I
460 GOSUB 520:PRINT"{REV}";CHR$(CHAR);"{OF
    OFF}"
470 GOTO 320
480 REM *YOU ERRED*
490 CCNT=CCNT-1:POKE S4,130:FOR I=1 TO 10 ~
    :NEXT I:POKE S4,0
500 GOTO 320
510 REM*POSITION CURSOR OVER TYPED CHAR*
520 PRINT"{HOME}{09 DOWN}";
530 FOR I=2 TO PEEK(829+CHAR*2)*2:PRINT:NE
    XT I
540 PRINT"{04 RIGHT}";
550 FOR J=1 TO PEEK(828+CHAR*2):PRINT"{
    RIGHT}";:NEXT J
560 RETURN
570 REM**CALC AND PRINT SCORES**
580 PRINT"{HOME}{06 DOWN}{04 RIGHT}{REV}CH
    AR/MINUTE{OFF}";"=";CCNT
590 PRINT"{HOME}":FOR I=1 TO 18:PRINT:NEXT
     I:PRINT"{RIGHT}{REV} HIT 'R' TO ~
    RESTART {OFF}"
600 REM *SCORE SOUND*
610 FOR I=244 TO 252 STEP 2:POKE S2,I:FOR ~
    J=1 TO 50:NEXT J:NEXT I:POKE S2,0
620 GET A$:IF A$="" THEN 620
630 IF A$="R" THEN RUN
640 END
650 REM*ASCII DATA FOR KEYBOARD*
660 DATA 49,50,51,52,53,54,55,56,57,48,43,
    45,0
670 DATA 81,87,69,82,84,89,85,73,79,80,64,
    42,0
680 DATA 65,83,68,70,71,72,74,75,76,58,59,
    61,0
690 DATA 32,90,88,67,86,66,78,77,44,46,47,
    -1
```



"Typing Teacher," VIC-20 version.

Program 4: TI Version

```
100 DIM CHAR(23,30)
110 RANDOMIZE
120 D=20
130 F1=300
140 F2=4000
150 V1=10
160 V2=2
170 CALL CLEAR
180 FOR J=9 TO 12
190 CALL COLOR(J,2,14)
200 NEXT J
210 FOR J=2 TO 8
220 CALL COLOR(J,2,15)
230 NEXT J
240 IF R=82 THEN 270
250 RESTORE
260 CALL CLEAR
270 PRINT "{6 SPACES}typing teacher"
280 FOR I=1 TO 18
290 PRINT
300 NEXT I
310 REM  ZERO CHARACTER COUNTER AND
    TIME
320 CHARCNT=0
330 TIME=0
340 REM  ROUTINE TO ENTER CHARACTER
    POSITION DATA
350 FOR ROW=11 TO 23 STEP 3
```

```
360 FOR COL=6 TO 30 STEP 2
370 READ CHAR(ROW,COL)
380 IF CHAR(ROW,COL)=0 THEN 450
390 IF CHAR(ROW,COL)=-1 THEN 460
400 IF CHAR(ROW,COL)=32 THEN 430
410 CALL HCHAR(ROW,COL,CHAR(ROW,COL)
    )
420 GOTO 440
430 PRINT " ";
440 NEXT COL
450 NEXT ROW
460 PRINT
470 PRINT "  PRESS any key TO START"
    ;
480 CALL KEY(3,S,STATUS)
490 IF STATUS=0 THEN 480
500 CALL HCHAR(24,5,32,22)
510 REM  *CHOOSE A RANDOM NUMBER*
520 N=INT((RND*47)+44)
530 IF (N>=60)*(N<=64)+(N=45)+(N=58)
    +(N=OLDCHAR)THEN 520
540 OLDCHAR=N
550 CALL VCHAR(7,16,N)
560 REM  **PROCESS YOUR RESPONSE**
570 TIME=TIME+1
580 IF TIME>900 THEN 670
590 CALL KEY(0,CR,STATUS)
600 IF STATUS=0 THEN 570
610 CALL SOUND(D,F1,V1)
620 CHARCNT=CHARCNT+1
630 REM  ADD ONE TO TOTAL
640 TIME=TIME+12
650 GOTO 760
670 PRINT TAB(4);
680 PRINT "characters/minute= ";CHAR
    CNT
690 PRINT
700 PRINT "(5 SPACES)HIT r TO RESTAR
    T";
710 CALL KEY(3,R,STATUS)
720 IF STATUS=0 THEN 710
730 IF R=ASC("R")THEN 250
750 END
760 IF CR<>N THEN 860
770 FOR ROW=11 TO 23 STEP 3
780 FOR COL=6 TO 30 STEP 2
790 IF CHAR(ROW,COL)=N THEN 820
800 NEXT COL
810 NEXT ROW
820 CALL HCHAR(ROW-1,COL,N)
830 CALL HCHAR(ROW-1,COL,32)
840 CALL HCHAR(ROW-1,COL,N)
850 GOTO 520
860 CHARCNT=CHARCNT-1
870 CALL SOUND(D,F2,V2)
880 GOTO 520
890 REM  *ASCII DATA FOR KEYBOARD*
900 DATA 49,50,51,52,53,54,55,56,57,
    48,61,0
910 DATA 81,87,69,82,84,89,85,73,79,
    80,47,0
920 DATA 65,83,68,70,71,72,74,75,76,
    59,0
930 DATA 32,90,88,67,86,66,78,77,44,
    46,-1
```

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Chutes For Atari

Matt Giwer

Did you ever wonder how to write a game in 3-D? This fast-paced game illustrates how to use Atari's "size registers" to create realistic three-dimensional graphics.

You are in a hyperdimensional universe. You are piloting an inter-dimensional exploration ship. In this universe there are only three tracks that you can follow with your ship; the rest are too narrow. There is only the flat surface you fly on; there is no up and no down. You can only go forward, and left and right. You must pass through this universe, but others would stop you – they are the Risen Ones of this universe, the RAM-ships.

They roar down the Chutes off in the distance and come at you. Once down their Chutes, they cannot leave the surface either. Fortunately for you, they come only in groups of three, and if you can dodge them you will live. However, there is one problem: each wave comes at you faster and faster. As if that were not enough, the faster the RAM-ship, the longer is its invisible, anti-matter exhaust. If you dodge too close astern, your exhausts will collide, and you will both be destroyed.

Program Details

At the beginning, the program execution at line 10 immediately falls through to line 30, which is a series of GOSUBs. The first subroutine at line 30000 sets up the graphics mode, turns off the cursor, and sets MVB, MVC, and MVD, which are the initial movements of the RAM-ships, to two P/M graphics increments. The second subroutine at 30200 sets up the P/M graphics and the machine language subroutine for the movement of the players.

Registers of interest to be used later are in line 30210. These control the sizes, the horizontal width of each of the four players used in this game. Later, these sizes will be changed to give the illusion that the players become larger as they come closer.

The machine language routine POKEd into page six (published in **COMPUTE!**, February 1982) is an excellent routine to use for producing vertical motion in the players. (Note that when a game restarts, GAM>0, this routine is skipped by line 30237.) Finally, we read in the shapes of the players.

The subroutine at line 30400 draws the background graphics for the playing field. This routine is called later in the game when there has been an explosion and the background has been disturbed.

The execution of the game is contained in two sets of lines which are nearly identical. These are the routines in lines 4000-5100. However, the opening of the game is found at line 4002, which directs execution to the lines above 6000. (At this point, it may be best to enter the program in order to follow the rest of the discussion.)

Movement And Graphics

The lines between 6000-6200 produce a random start for the attackers. From the top of the screen, the attackers begin moving down the Chutes which appear to be in the distance. They remain points on the screen until they level off and begin their head-on attack run at you. The IF control statements in this routine are set to 20, 20 being the "leveling off" location down from the top of the screen, the X position. When the Graphics 7 pixels have a location value greater than 20, the P/M Graphic is substituted for the pixel. (To help you follow this listing, the variables B, C, D, and MVB, MVC, MVD, and so forth refer to Players 2, 3, and 4, respectively. "A" is used later to control you, Player 1.)

The horizontal position POKEs, registers 53249 and 53251 in lines 6074 and 6094, provide the cross mapping required to keep the P/M locations of 0 to 255 and the Graphics 7 locations of 0 to 179 related.

No correction is needed in line 6084, as this path is down the center and corresponds directly to GR.7 X position of 159. The others need correcting because they move diagonally down the screen. These rather complicated values POKEd into the registers keep the attacking players moving down the centers of their respective

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Chutes.

When all three players are greater than the Y position of 20, tested by line 6100, program execution reverts to the routine at the 4000 lines. Since the limits of the random selection of the start position at the beginning of the 6000 lines does not permit a collision before they have all cleared the 20 position, there is no need for additional tests.

Line 4003 converts the variable of the 6000 routine to the 4000 and 6000 line routines. Line 4010 starts a routine that is closed by line 4900. This group of lines will continue to execute until a collision occurs as tested by line 4028. Which collision has occurred is determined by lines 5002, 5003, and 5004 after the GOSUB has been executed. Here the variable A is introduced – this is Player 1, *you*, at the bottom of the playing field above the alphanumeric window.

Lines 4021, 4023, and 4025 keep the attackers moving on diagonals down the screen. Lines 4030 to 4040 control the size registers as the players move down the screen; the further down the screen, the larger they become. This, along with the radiating lines, provides the illusion of perspective.

Speed And Motion

When a collision occurs (you have lost the round), the player you have collided with stops moving, but the rest continue to move. This is accomplished by the use of nearly identical routines in the lines between 5000-6000. This second routine is required because the instructions in the subroutine at 4000 have slowed the motion enough so that the differences in the subroutine at 5000 (if incorporated as additional conditions in the 4000 subroutine) would make the game too slow and/or too jerky.

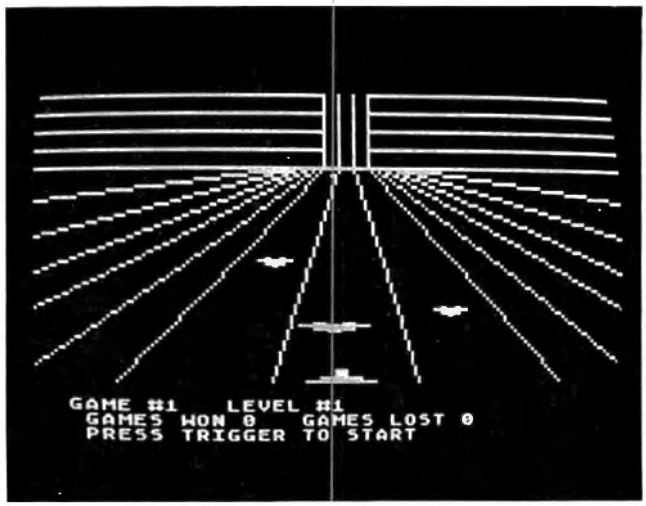
The explosion resulting from the collision is generated randomly by line 5020. If the round has fallen through to this routine, the variable JUMP is set; and, among other things, the background lines will be redrawn since the explosion graphics lines are difficult both to store as variables and to generate quickly. Lines 5045-5047 shut off the sound of the attackers as they leave the screen.

What else must the game do? The subroutine at 8000 keeps rolling up the current score into the bottom alphanumeric window. The subroutine at 9000 keeps track of your current score and the high score for the session.

Scoring

The game scores by session and keeps a running tally of the score for each game. We have a rolling perspective view of the attackers as they come at you from the far distance until they pass close enough to hit you; those that miss keep on going. We have the rules of translation from GR.7 graphics to P/M graphics locations on the screen. We have several setup routines, one of which is called later when it is necessary to redraw the screen.

This game demonstrates the uses of the P/M size registers and shows how to use them to give a three-dimensional effect to the screen. These registers are little utilized in most Atari games and deserve further exploitation. As a matter of interest, when the players become larger as a result of the POKEs, they become larger from the left-hand edge. That is, if it is in the middle of the screen, the player will not stretch out to the left and the right. Rather it will extend further to the right, but the left edge will not move. Keeping this in mind will keep your players from jerking to the right each time that you change the size. (This technique is well demonstrated in *Star Raiders* where the machine language code makes the motion and the size transitions much smoother.)



Oncoming alien saucers rush toward you in "Chutes."

```
6 RESTORE
10 GOSUB 30
12 GOTO 10
30 GOSUB 30000:GOSUB 30200:GOSUB 304
   00
31 LEV=1:GAM=1:WIN=0:SCR=0
32 ? :? :? "GAME #";GAM;"{3 SPACES}L
   EVEL #";LEV
33 ? " GAMES WON ";WIN;"{3 SPACES}GA
   MES LOST ";GAM-WIN-1
34 ? " PRESS TRIGGER TO START";
35 IF STRIG(0)=1 THEN 35
40 GOSUB 8000
50 NW=0
90 RETURN
4000 REM MOVEMENT
4002 POKE 53256,3:POKE PLY,184:POKE
     PLX,109:GOSUB 6000
4003 B=BB:C=CD:D=DD:POKE 53278,255
4010 IF STICK(0)=11 AND A<>69 THEN A
     =A-40
4012 IF STICK(0)=7 AND A<>149 THEN A
     =A+40
```

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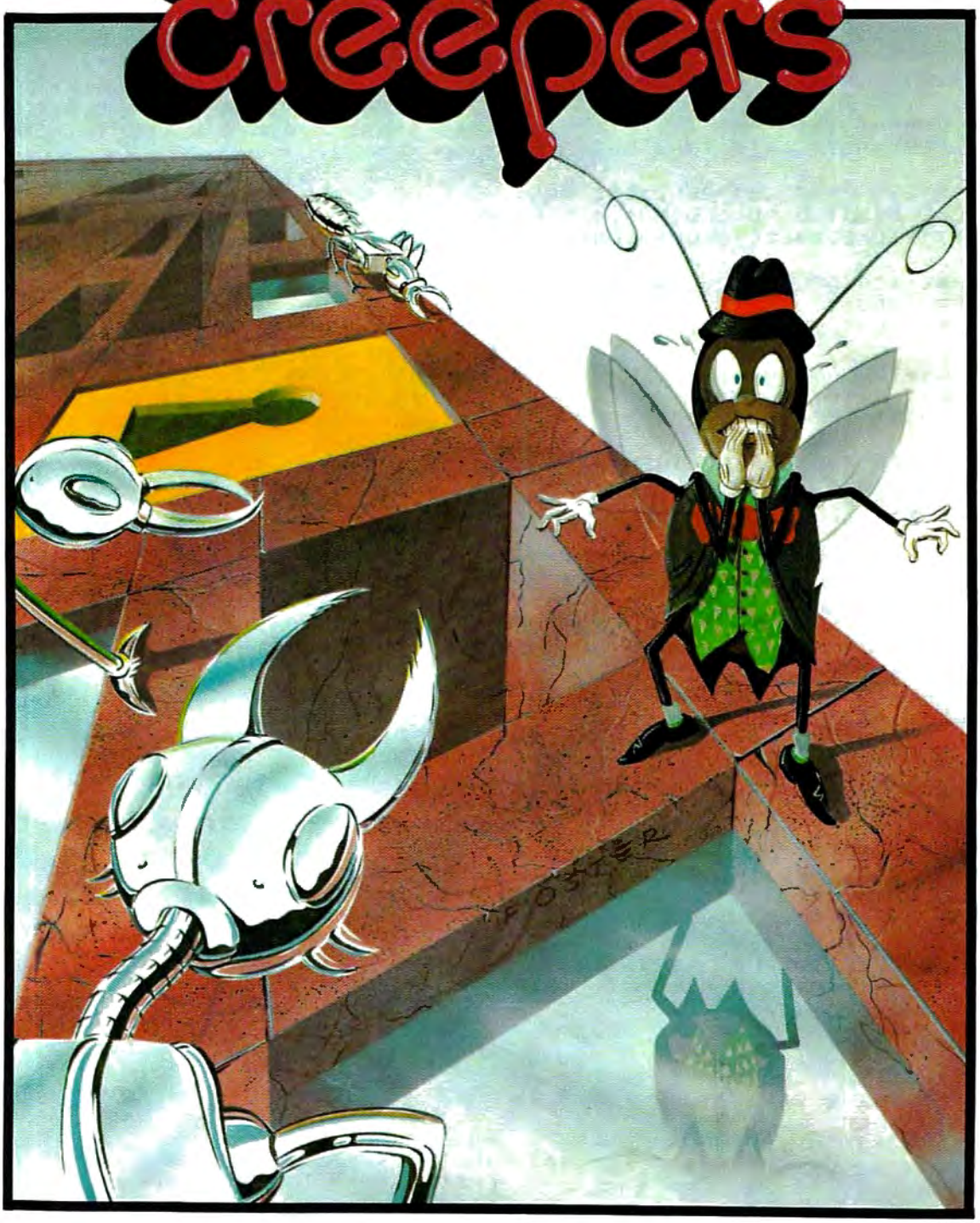
by James Albanese

Jeepers creepers



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```
4014 POKE 53248,A
4020 B=B+MVB:IF B>255 THEN 4022
4021 POKE 1781,B:POKE 53249,119-0.29
     *(B-71)-BC
4022 C=C+MVC:IF C>255 THEN 4024
4023 POKE 1782,C:POKE 53250,123-CC
4024 D=D+MVD:IF D>255 THEN 4026
4025 POKE 1783,D:POKE 53251,129+0.29
     *(D-71)-DC
4026 IF B>255 OR C>255 OR D>255 THEN
      POKE 53257,0:POKE 53258,0:POKE
      53259,0:BC=0:CC=0:DC=0:GOTO 49
     85
4027 IF JUMP=1 THEN 4030
4028 IF PEEK(53260)<>0 THEN GOSUB 50
     00
4029 IF B>255 OR C>255 OR D>255 THEN
      POKE 53257,0:POKE 53258,0:POKE
      53259,0:BC=0:CC=0:DC=0:GOTO 49
     85
4030 IF B<=150 AND B>100 THEN POKE 5
     3257,1:BC=4
4032 IF B>150 THEN POKE 53257,3:BC=1
     6
4034 IF C<=150 AND C>100 THEN POKE 5
     3258,1:CC=4
4036 IF C>150 THEN POKE 53258,3:CC=1
     6
4038 IF D>100 AND D<=150 THEN POKE 5
     3259,1:DC=4
4040 IF D>150 THEN POKE 53259,3:DC=1
     6
4900 GOTO 4010
4985 POKE PLX+1,0:POKE PLX+2,0:POKE
     PLX+3,0:POKE PLX,0
4990 RETURN
5000 REM EXPLOSION
5001 EXPY=79
5002 IF PEEK(53260)=2 THEN MVB=0:TS=
     1:EXPX=41
5003 IF PEEK(53260)=4 THEN MVC=0:TS=
     2:EXPX=79
5004 IF PEEK(53260)=8 THEN MVD=0:TS=
     3:EXPX=119
5006 JUMP=1
5007 FOR I=1 TO 2:POKE 710,15:POKE 7
     12,15:SOUND 0,250,0,15:SOUND TS
     ,200,0,15:Q=1^1
5008 POKE 710,0:POKE 712,0:SOUND 0,0
     ,0,0:SOUND TS,0,0,0:NEXT I
5020 FOR I=0 TO 10:PLOT EXPX,EXPY:DR
     AWTO EXPX+INT(RND(0)*20-10),EXP
     Y-INT(RND(0)*20)
5022 SOUND 0,250,0,15:SOUND TS,200,0
     ,15
5030 B=B+MVB:IF B>255 THEN 5032
5031 POKE 1781,B:POKE 53249,119-0.29
     *(B-71)-BC
5032 C=C+MVC:IF C>255 THEN 5034
5033 POKE 1782,C:POKE 53250,123-CC
5034 D=D+MVD:IF D>255 THEN 5036
5035 POKE 1783,D:POKE 53251,129+0.29
     *(D-71)-DC
5036 IF B>255 OR C>255 OR D>255 THEN
      POKE 53257,0:POKE 53258,0:POKE
      53259,0:BC=0:CC=0:DC=0:GOTO 50
     95
5037 IF B>255 OR C>255 OR C>255 THEN
      5095
5038 IF B<=150 AND B>100 THEN POKE 5
     3257,1:BC=4
5039 IF B>150 THEN POKE 53257,3:BC=1
     6
5040 IF C<=150 AND C>100 THEN POKE 5
     3258,1:CC=4
5041 IF C>150 THEN POKE 53258,3:CC=1
     6
5042 IF D>100 AND D<=150 THEN POKE 5
     3259,1:DC=4
5043 IF D>150 THEN POKE 53259,3:DC=1
     6
5045 IF B>230 THEN SOUND 1,0,0,0
5046 IF C>230 THEN SOUND 2,0,0,0
5047 IF D>230 THEN SOUND 3,0,0,0
5048 SOUND 0,0,0,0:SOUND TS,0,0,0
5050 NEXT I
5095 POKE 1781,0:POKE 1782,0:POKE 17
     83,0
5100 SOUND 0,0,0,0:SOUND 1,0,0,0:SOU
     ND 2,0,0,0:SOUND 3,0,0,0:RETURN

6000 REM ATTACK PATTERN
6005 BB=71:CD=71:DD=71:TEMPBY=-1:TEM
     PCY=-1:TEMPDY=-1:POKE 53278,255
6010 TEMP=INT(RND(0)*3):JUMP=0:POKE
     53278,255
6020 IF TEMP=0 THEN B=-59:C=-59+INT(
     RND(0)*20+20):D=-59+INT(RND(0)*
     40+10)
6030 IF TEMP=1 THEN C=-59:B=-59+INT(
     RND(0)*30+16):D=-59+INT(RND(0)*
     20+26)
6040 IF TEMP=2 THEN D=-59:B=-59+INT(
     RND(0)*20+20):C=-59+INT(RND(0)*
     30+10)
6044 POKE 53256,3:POKE PLY,184:POKE
     PLX,109:A=109
6045 IF STICK(0)=11 AND A<>69 THEN A
     =A-40
6046 IF STICK(0)=7 AND A<>149 THEN A
     =A+40
6047 POKE 53248,A
6049 COLOR 3
6050 TRAP 6052:PLOT 76,TEMPBY:TRAP 4
     0000
6052 TRAP 6054:PLOT 80,TEMPCY:TRAP 4
     0000
6054 TRAP 6056:PLOT 84,TEMPDY:TRAP 4
     0000
6056 COLOR 1
6069 IF B>20 THEN BB=BB+MVB:GOTO 607
     4
6070 B=B+MVB
6072 TRAP 6073:PLOT 76,B:TRAP 40000
6073 TEMPBY=B:GOTO 6079
6074 POKE 1781,BB:POKE 53249,119-0.2
     9*(BB-71)
6079 IF C>20 THEN CD=CD+MVC:GOTO 608
     4
6080 C=C+MVC
6082 TRAP 6083:PLOT 80,C:TRAP 40000
6083 TEMPCY=C:GOTO 6089
6084 POKE 1782,CD:POKE 53250,123
6089 IF D>20 THEN DD=DD+MVD:GOTO 609
     4
6090 D=D+MVD
6092 TRAP 6093:PLOT 84,D:TRAP 40000
6093 TEMPDY=D:GOTO 6100
6094 POKE 1783,DD:POKE 53251,129+0.2
     9*(DD-71)
6100 IF B>20 AND C>20 AND D>20 THEN
     6200
```

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```
6130 GOTO 6045
6200 RETURN
8000 REM
8010 MVB=LEV*2+1:MVC=LEV*2+1:MVD=LEV
     *2+1:POKE 53278,255
8040 GOSUB 4000:GAM=GAM+1:LEV=INT(GA
     M/5)+1:SETCOLOR 1,LEV+1,8
8050 IF LEV=7 THEN 9000
8055 IF NW=1 THEN 8200
8060 IF JUMP=0 THEN WIN=WIN+1:SCR=SC
     R+LEV*2:GOTO 8082
8069 GOSUB 30000:GOSUB 30200:GOSUB 3
     0400
8082 ? :? :? "GAME #";GAM;"
     {3 SPACES}LEVEL #";LEV
8083 ? " GAMES WON ";WIN;"
     {3 SPACES}GAMES LOST ";GAM-WIN-
     1
8084 ? "{5 SPACES}SCORE :";SCR
8085 ? " PRESS TRIGGER TO START
     {BELL}";
8086 IF STRIG(0)=1 THEN 8086
8090 GOTO 8010
8100 GOSUB 4000
8200 RETURN
8990 RETURN
9000 REM NEW GAME
9012 POKE PLX,0:POKE PLX+1,0:POKE PL
     X+2,0:POKE PLX+3,0
9014 SOUND 0,0,0,0:SOUND 1,0,0,0:SOU
     ND 2,0,0,0:SOUND 3,0,0,0
9016 IF SCR>HSCR THEN HSCR=SCR
9020 GRAPHICS 18
9030 ? #6;"  CONGRATULATIONS"
9035 ? #6
9040 ? #6;"{3 SPACES}YOUR SCORE IS":
     REM inverse video
9045 ? #6
9050 ? #6;"{8 SPACES}";SCR
9055 ? #6
9056 ? #6;"{3 SPACES}HIGH SCORE IS":
     REM inverse video
9057 ? #6
9058 ? #6;"{8 SPACES}";HSCR
9059 ? #6
9060 ? #6;" press trigger for":REM i
     nverse video
9070 ? #6;"{3 SPACES}another round":
     REM inverse video
9075 Q=1^1^1^1^1^1^1^1
9080 IF STRIG(0)=1 THEN 9080
9082 NW=1
9090 RETURN
13000 FOR I=MYPMBASE+1024 TO MYPMBAS
      E+2048:POKE I,0:NEXT I
13001 STOP
29990 STOP
30000 REM SETUP
30005 POKE 53278,255
30015 GRAPHICS 7:POKE 752,1
30020 MVB=2:MVC=2:MVD=2
30190 RETURN
30200 REM PM SETUP
30204 POKE 53277,3:REM GRACTL PLAY&M
      ISS
30206 POKE 559,62:REM DMACTL,1LINE,P
      LAY,MIS,NORM FIELD
30208 POKE 54279,(PEEK(106)-32):REM
      32PAGE RESERVE
30210 POKE 53256,0:POKE 53257,0:POKE
       53258,0:POKE 53259,0:REM PLAY
      SIZES
30212 POKE 623,8:REM PRIORITY PF OVE
      R PL
30214 MYPMBASE=256*(PEEK(106)-32):RE
      M NEW PM BASE
30215 IF ZZZ=0 THEN ? "Please Wait..
      .";:FOR I=1024 TO 2047:POKE MY
      PMBASE+I,0:NEXT I:ZZZ=1
30230 POKE 704,150:POKE 705,199:POKE
       706,246:POKE 707,119:POKE 178
      8,(PEEK(106)-28):REM START OF
      PM DATA
30232 SETCOLOR 1,LEV+1,10:POKE 710,0
      :POKE 711,29:POKE 712,0
30236 REM VBLANK INTERUPT ROUTINE
30237 IF GAM>0 THEN 30390
30238 FOR I=1536 TO 1706:READ A:POKE
       I,A:NEXT I
30240 FOR I=1774 TO 1787:POKE I,0:NE
      XT I
30242 DATA 162,3,189,244,6,240,89,56
      ,221,240,6,240,83,141,254,6,10
      6,141
30244 DATA 255,6,142,253,6,24,169,0,
      109,253,6,24,109,252,6,133,204
      ,133
30246 DATA 206,189,240,6,133,203,173
      ,254,6,133,205,189,248,6,170,2
      32,46,255
30248 DATA 6,144,16,168,177,203,145,
      205,169,0,145,203,136,202,208,
      244,76,87
30250 DATA 6,160,0,177,203,145,205,1
      69,0,145,203,200,202,208,244,1
      74,253,6
30252 DATA 173,254,6,157,240,6,189,2
      36,6,240,48,133,203,24,138,141
      ,253,6
30254 DATA 109,235,6,133,204,24,173,
      253,6,109,252,6,133,206,189,24
      0,6,133
30256 DATA 205,189,248,6,170,160,0,1
      77,203,145,205,200,202,208,248
      ,174,253,6
30258 DATA 169,0,157,236,6,202,48,3,
      76,2,6,76,98,228,0,0,104,169
30260 DATA 7,162,6,160,0,32,92,228,9
      6
30262 S=USR(1696)
30276 PLX=53248:PLY=1780:PLL=1784
30278 POKE PLL,8:POKE PLL+1,6:POKE P
      LL+2,6:POKE PLL+3,6
30280 POKE MYPMBASE+1280,1:POKE MYPM
      BASE+1536,1:POKE MYPMBASE+1792
      ,1
30282 FOR I=MYPMBASE+1024 TO MYPMBAS
      E+1031:READ A:POKE I,A:NEXT I
30283 DATA 8,8,8,8,28,28,62,62
30284 FOR I=MYPMBASE+1280 TO MYPMBAS
      E+1285:READ A:POKE I,A:POKE I+
      256,A:POKE I+512,A:NEXT I
30285 DATA 20,62,62,28,28,8
30286 POKE PLY+1,58:POKE PLY+2,78:PO
      KE PLY+3,98
30390 RETURN
30400 REM DRAW CHUTES
30401 COLOR 1
30407 PLOT 78,20:DRAWTO 78,0:PLOT 82
      ,20:DRAWTO 82,0:PLOT 74,20:DRA
      WTO 74,0:PLOT 86,20:DRAWTO 86,
      0
```

```
30408 FOR I=0 TO 15 STEP 5:PLOT 0,I:
      DRAWTO 74,I:NEXT I:FOR I=0 TO
      15 STEP 5:PLOT 86,I:DRAWTO 159
      ,I:NEXT I
30409 PLOT 0,20:DRAWTO 159,20
30410 PLOT 78,20:DRAWTO 60,79:PLOT 8
      2,20:DRAWTO 100,79
30420 PLOT 74,20:DRAWTO 20,79:PLOT 8
      6,20:DRAWTO 140,79
30422 PLOT 70,20:DRAWTO 0,59:PLOT 90
      ,20:DRAWTO 159,59
30424 PLOT 66,20:DRAWTO 0,39:PLOT 94
      ,20:DRAWTO 159,39
30426 PLOT 72,20:DRAWTO 0,75:PLOT 88
      ,20:DRAWTO 159,75
30428 PLOT 68,20:DRAWTO 0,49:PLOT 92
      ,20:DRAWTO 159,49
30430 PLOT 64,20:DRAWTO 0,29:PLOT 96
      ,20:DRAWTO 159,29
30590 RETURN                          ©
```

Cash Flow Manager

Donald W Watson

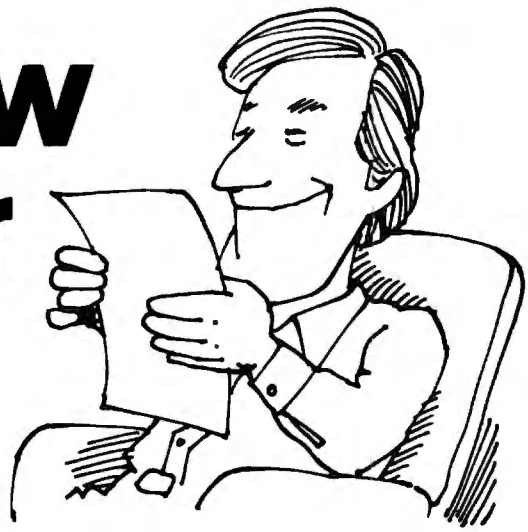

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Table 1 displays a cash report as it might appear at mid-year (June 1983) for a typical family. At the beginning of the year, all month-column headings are enclosed in parentheses. As each monthly report is prepared, the current month's parentheses are removed, leaving current and past months easily distinguishable from future months.

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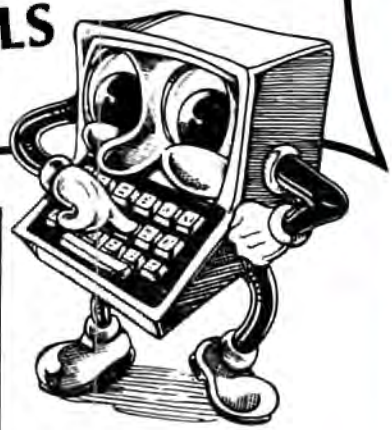

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Table 1: Monthly Cash Report And Forecast

	A	B C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		JUNE REPORT						** MONTH **							
2		*1983 EXPENSES*	JAN	FEB	MAR	APR	MAY	JUN	(JUL)	(AUG)	(SEP)	(OCT)	(NOV)	(DEC)	TOTAL
3															
4		MONTHLY													
5															
6		RENT	600	600	600	600	600	600	600	600	600	600	660	660	7320
7		ELECTRICITY	85	97	72	75	81	93	110	125	130	100	90	80	1138
8		GAS	103	110	98	104	82	75	60	60	60	65	70	90	977
9		TELEPHONE	85	50	55	64	60	55	65	65	65	65	65	65	761
10		CABLE TV	10	10	10	10	10	10	10	10	10	10	10	10	120
11		WATER & SEWER	28	26	32	25	23	28	35	37	35	30	30	30	359
12		TRASH PICK-UP	12	10	10	10	12	10	10	10	10	14	10	10	128
13		GASOLINE	115	98	90	112	118	94	120	120	120	100	100	100	1287
14		CAR PAYMENT	162	162	162	162	162	162	162	162	162	162	162	162	1944
15		LIFE INSURANCE	104	104	104	104	104	104	104	104	104	104	104	104	1248
16															
17		FOOD	389	445	392	375	423	490	400	400	400	400	400	400	4914
18		MASTERCARD	100	368	294	222	162	183	250	250	250	250	250	250	2829
19		SEARS	126	85	43	71	106	53	50	50	50	50	50	50	784
20		HAIR CARE	75	35	48	25	32	43	40	40	40	40	40	40	498
21		MISCELLANEOUS	32	89	59	110	54	12	100	100	100	100	100	100	956
22															
23		NON-MONTHLY													
24															
25		AUTO INS (1)					150						150		300
26		AUTO INS (2)					150						150		300
27		AUTO REG (1)			45										45
28		AUTO REG (2)									45				45
29		PROPERTY INS.		416											416
30		NEWSPAPER	15			15			15			15			60
31		MEDICAL		236	78										314
32		AUTO REPAIR				152		83							235
33															
34		TAXES													
35															
36		FEDERAL (1040)				2140									2140
37		FEDERAL (EST.)	350			350		350			350				1400
38		STATE													0
39															
40		TOTAL EXP.:	2391	2941	2193	4726	2329	2446	2131	2133	2531	2105	2441	2151	30518
41															
42															
43		INCOME STATEMENT													
44															
45		SALARY 1	1745	1745	1745	1745	1760	1862	1862	1862	1862	1862	1862	1862	21774
46		SALARY 2	1460	1460	1460	1460	1460	1460	1575	1575	1575	1575	1575	1575	18210
47		INVESTMENT			200			200			300			400	1100
48		MISCELLANEOUS													0
49															
50		TOTAL INCOME :	3205	3205	3405	3205	3220	3522	3437	3437	3737	3437	3437	3837	41084
51		TOTAL EXPENSE:	2391	2941	2193	4726	2329	2446	2131	2133	2531	2105	2441	2151	30518
52															
53		NET CASH FLOW:	814	264	1212	-1521	891	1076	1306	1304	1206	1332	996	1686	10566
54		CUMULATIVE CF:	814	1078	2290	769	1660	2736	4042	5346	6552	7884	8880	10566	10566
55															
56		NET CASH ASSETS	10814	11078	12290	10769	11660	12736	14042	15346	16552	17884	18880	20566	20566
57		CAR FWD: 10000													
58															
59															
60															

3. Compose and enter a set of line titles to suit your Monthly expense items. If you are buying your home, use Mortgage for a line title instead of Rent. If you have an all-electric home, eliminate the Gas line. Remember to keep the Monthly expense lines in a separate group.

4. Enter a group of Non-monthly expense line titles to suit your known requirements. The Taxes lines are identified separately, but typically are Non-monthly expense items.

5. Enter the Income Statement line titles to provide appropriate Salary and other income lines.

6. Enter the VisiCalc formulas needed to calculate the bottom line and cross-foot totals; the VisiCalc summation function and replication command can be used to good advantage. Table 2 displays the formulas used with the model cash report of Table 1.

When you have your VisiCalc cash report template completed, before proceeding save it on your data file diskette under an appropriate file name as a master file.

Forecasting The Full Year

Round off data entries to the nearest dollar; all data entered and calculated will be printed only to the nearest dollar. You will find this a convenience that causes no significant loss in accuracy, and it's one of the reasons the system will print a report on a single sheet within the limits of your 132 character per line (in compressed print mode) printer. To build the full year Cash Forecast, use the following steps:

1. In your cash report template, enter your best estimate in each line of the Monthly expense group for January expense only.

Table 2:
Cash Report Template VisiCalc Formulas

Item	Location	VisiCalc Formula
Total Expense	D40	@SUM(D6...D38)
	through	through
	O40	@SUM(O6...O38)
Total Income	D50	@SUM(D45...D48)
	through	through
	O50	@SUM(O45...O48)
Total Expense (Repeated)	D51	+D40
	through	through
	O51	+O40
Net Cash Flow	D53	+D50-D51
	through	through
	O53	+O50-O51
Cumulative Cash Flow	D54	+D53
	E54	+D54+E53
	through	through
	O54	+N54+O53
Net Cash Assets	D56	+C57+D53
	E56	+D56+E53
	through	through
	O56	+N56+O53
Column P Totals	P6	@SUM(D6...O6)
	through	through
	P15	@SUM(D15...O15)
	P17	@SUM(D17...O17)
	through	through
	P21	@SUM(D21...O21)
	P25	@SUM(D25...O25)
	through	through
	P32	@SUM(D32...O32)
	P36	@SUM(D36...O36)
	through	through
	P38	@SUM(D38...O38)
	P40	@SUM(D40...O40)
	P45	@SUM(D45...O45)
	through	through
	P48	@SUM(D48...O48)
	P50	@SUM(D50...O50)
	P51	@SUM(D51...O51)
	P53	@SUM(D53...O53)
	P54	+O54
	P56	+O56

2. Use the VisiCalc "Replicate" command (/R...) to replicate the January Monthly expense data to the destination range from February through December.

3. Where required, through the full year, enter your best estimate for each item in the Non-monthly expense group.

4. In the Income Statement group, enter the January Salary data and replicate it to the destination range February through December. Then enter your best estimates for any Investments and Miscellaneous income you anticipate.

5. Finally, in Column C, "seed" the Net Cash Assets line with your estimate of cash assets Carried Forward from last year.

Save this file to your VisiCalc data file diskette; replace the existing master template with this one, if you wish. At this point, you have a complete cash forecast template for a full calendar year on your diskette. You can easily "fine tune" it by modifying selected entries. For example:

– Expect to pay more for electricity in winter than in summer? Look through last year's electric bills and modify the Electricity line to reflect a realistic trend for the new year.

– Expecting a scheduled raise in July? Enter the modification at July and replicate from there through the rest of the year.

When you have made the forecast entries as reasonable and realistic as you think they need to be, save the file again. Then print a hard copy for

review and further editing that might be needed. Keep a valid copy for future reference.

The Monthly Report And Corrected Forecast

Each month, you need only to survey your checkbook, salary check stubs, and one or two other records to get the real expense and income data for that month. The monthly cash report, with the year-end forecast numbers automatically corrected with new data entries, is easily produced with the following procedures, using the prior month's report as a worksheet:

1. Remove the parentheses from the current month-column heading.
2. Enter the actual payment amounts made for the month, line by line. If a planned payment is not made, delete any existing entry; reschedule the payment, if necessary, by entering it in a future month or by adding it to an existing entry for a future month.
3. Enter actual income dollars as received.
4. Make appropriate modifications to future months' payment and income data.
5. Save the current month's report to your VisiCalc data file diskette, using a unique file name.
6. Print the current month report. Edit it, make necessary corrections, then save and print it again.

This six-step, monthly effort should take less than one hour to complete. Keep each final monthly report for comparison with future reports. At year's end, the January and December report comparison will provide marvelous guidance for even more effective cash reporting and conservation in the following year. You will have made yourself something of an expert in personal accounting and personal finance management – no small accomplishment.

Some Practical Tips

1. Pocket Cash. Once or twice a month, write a check for pocket cash; include those checks in Miscellaneous (Monthly) expense or provide a separate Monthly line for Pocket Cash to keep it more visible and under better control.

2. In your VisiCalc cash report template, keep Column A (as in Table 1) to provide a left-hand margin for the printed reports. The margin will allow for three-ring binder punching.

3. Don't build column and line numbers into your template; they are shown in Table 1 only for convenience in this article.

4. Save each printed monthly report, and save the latest version of the cash report on your VisiCalc data file diskette. Be sure to keep an up-to-date backup copy of the data file diskette, of course.

5. You can modify your report format at any time by inserting or deleting expense and income lines anywhere. If you insert a line, remember to use the summation function to get the data into the Total column at the right.

6. Don't fret over items you find hard to predict, such as Medical and Auto Repair expense. If you know there's an expense coming up, estimate it as best you can or ignore it, being sure to enter it when you actually pay the bill.

If you are using a spreadsheet other than VisiCalc, just remember that you must provide eight characters per column in the template design. A printer must have a compressed print mode (commonly, 132 characters per line) to print the report on a single standard 8½ x 11 sheet.

Your computer system, along with this practical cash reporting method, will help you to conserve and build your cash stash. The monthly cash report will provide:

– an excellent record of expenses and income to date

– a useful document for planning and scheduling future expenses and income

– advance warning of months where cash resources are likely to be low or non-existent, often avoiding the embarrassment of having to borrow money unexpectedly or on short notice

– peace of mind, especially when the cash assets outlook is good.

Some have remarked that personal accounting software isn't worth the time and effort required to maintain it every month. The spreadsheet-based system defined here solves that problem. You'll probably agree that an hour or less each month is well worth the results. C

VIC-20/C64 Word Processor: *The Quick Brown Fox*

Gregg Peele

The Quick Brown Fox is a word processor for VIC-20 and Commodore 64 microcomputers. The Commodore 64 version is the subject of this review, but both versions are substantially the same.

The production version of the *Fox* will be in cartridge form and will leave over 34K of memory (about 34,000 characters) available for text. The production version will also support an 80-column board which is in the works at this time.

The manual which accompanies the word processor is designed for the user who is totally unfamiliar with computers or word processing. The text is uncomplicated and includes many exercises which provide hands-on experience to supplement the concepts in the text. Included within the text are explanations of the idiosyncrasies of using a computer keyboard instead of a typewriter keyboard.

Since the software package was designed for use with several computers, specific instructions are given for each particular model, and explanations of the limitations of each computer are discussed at length.

A Simple Menu System

One point about this software deserves notice. The manual's appearance is impressive. The cover appears durable, and the overall appearance of the manual is professional. This software would not seem out of place in an office atmosphere.

The word processor uses a simple system of menus and prompts to guide the user through the difficulties in producing professional text. The key to the effectiveness of this software is in the simplicity of the commands used to perform text manipulation. For instance, the main menu supports 12 different functions. Each of these is accessible by pressing the key which represents the first letter of the command. (T for text, D for delete, etc.)

Edit mode can be reached from text mode by pressing the left arrow key (located in the left upper corner of the keyboard). Pressing this twice provides an "escape" to the main menu. The availability of this function makes learning to use the *Fox* an easy process. If the user is ever in doubt about a command, he or she can use this key to return to the menu and review the available options.

Do you often repeat portions of text when you write letters or other documents? For instance, do you find that a letter to your grandmother may contain much of the same text as the letter you sent to your aunt? *The Quick Brown Fox* has a special feature just for this and similar problems. This feature is called *boilerplating*. It allows you to store parts of text and retrieve them at any point within a document.

With this aid, you can write a letter to one person and use parts of the same letter to write to someone else. Both letters will contain some identical text (easily stored on a boilerplate). If your relatives are in close communication with each other, you can compose other parts of the letter to personalize the text for each relative. Boilerplates also come in handy for storing addresses, letterheads, and other repetitive text.

Boilerplates are retrievable through the use of embedded commands within the text. Unfortunately, boilerplates cannot be saved on disk or tape. The ability to save boilerplates would have made boilerplating a much more valuable tool. It is possible to edit boilerplates, but the manual warns not to delete the markers which delineate the boilerplate from the rest of the text.

Other embedded commands include: centering text, tabbing, right and left justification, margins, and page-end markers. Special print commands provide underlining, double-printed characters, proportional spacing, and a provision for changing the number of lines per inch. There are embedded commands which will automatically stop the printer while printing, allowing the user to insert text or change the type font or pitch, and then con-

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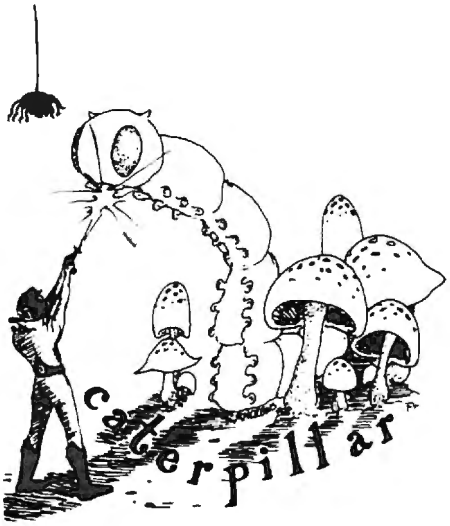

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tinue printing the rest of the document. Not all printers can perform all the commands that the *Fox* is capable of producing.

The manual provides a helpful guide so users can deal with possible printer incompatibilities. Most problems with printers stem from the lack of standardization in printer control codes and the inability of some printers to accept some of the *Fox*'s special features.

The Quick Brown Fox is easy to use and costs less than many word processors with similar features. I recommend it, especially for those users with limited word processing experience, but advanced word processing needs.

Quick Brown Fox
548 Broadway, Suite 4F
New York, NY 10012
$65 (C64 or VIC-20) C

Atari *Data Perfect*

Steve Steinberg

Data Perfect may well be the most powerful data base program to appear on the market for the Atari computer to date. Some of the things this program does are truly remarkable. How about, for example, flipping through 96 full-screen name, address and phone number files in ten seconds – that's right, 96 full-screen "pages" in ten seconds! In addition, the search function is about the fastest I have ever seen. But the pluses in this generally first-rate program make its one significant minus all the more irritating. The documentation is weak, and the result is a good deal of confusion and wasted time in trying to create data bases.

This does not come as a total surprise. LJK's other major program, the word processor *Letter Perfect*, has a similar weakness. Even after experimenting with *Data Perfect* for more than a month, I find that while I love the program's capabilities, I dread having to learn the next part of the package that I want to use.

What makes this lapse particularly unfortunate with *Data Perfect* is that once creating a data base with the program is mastered, using it is really quite easy. It's what you could call a "user-friendly" program with "user-hostile" instructions!

But, at the moment, the only real competition is the very popular and widely acclaimed *File Manager 800* data base program.

Working Well Together

Data Perfect is compatible with LJK's *Letter Perfect* for the Atari, which provides the capability of generating form letters and lengthy, complicated record formats. I have experimented with using *Data Perfect* and *Letter Perfect* together and they work like a charm.

Data Perfect can be used for doing some mathematical calculations. It permits adding, subtracting, dividing and multiplying various numerical fields, and also can do logarithms, exponents, and square roots, all of which are entered as formulas into a data base. *Data Perfect* also can provide totals and subtotals of the various fields, both while in the editing mode and while using the program's record-producing function. In addition, *Data Perfect* can do global deletions and additions when editing files (entering one command to change a field entry in every record). The program also can

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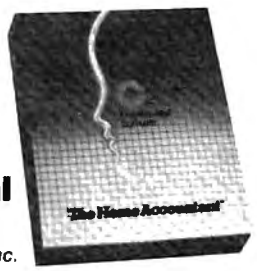

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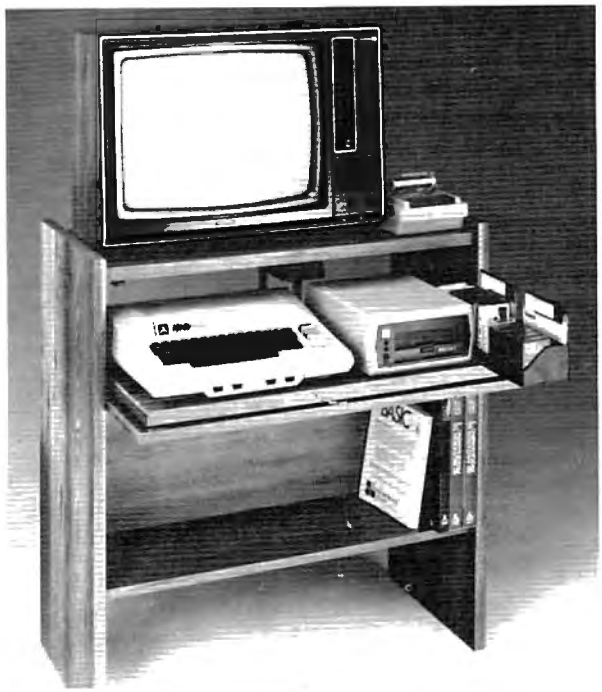

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automatically enter the current date in any file wherever specified by the user.

Data Perfect has all the functions one would expect of a quality data base. Fields can be added or deleted from an existing data base, columnar reports and mailing list formats can be generated and saved, and a variety of search and editing options are available. *Data Perfect* permits only one data base per disk, but this is not really a serious disadvantage.

Safety First

I have always wanted a fairly simple method for keeping track of my stock portfolio – nothing fancy, mind you, just stock name, original purchase price, number of shares and original value and present purchase price, number of shares and value. *Data Perfect* is indeed perfect for this kind of data base, and also gives me a total of any of these figures that I want.

When it came to saving my data base, however, I learned of another unique feature of *Data Perfect* – when saving a format, the program forces you to create a backup. This is certainly a good practice anyway, but with one disk drive it is a bit time consuming, since it is necessary to go back and forth between your source and backup disks, like the "Duplicate Disk" function of Atari DOS.

Sorts are accomplished the same way – going back and forth between your original and backup disks. When you have completed the sorting process, only the backup disk contains the sorted file. If it's a mailing list, this means you now need to turn your original into a backup disk to have two copies of the sorted data base.

The report-creating function is one area where *Data Perfect* really excels, but here again, the documentation doesn't help as much as it should. If you own the Bit 3 board that gives your Atari 80-column capability, here is an opportunity to use it, since *Data Perfect* provides for an 80-column display. Even with 40 columns, you can get a good idea of what your finished product will look like, since the program provides for a horizontal scroll of 80 columns. You can also provide for a subtotal of any figures at up to four points in any report, plus a grand total.

Data Perfect's search function is also unusually good. While *File Manager 800* is certainly comparable in the speed of single criterion searches, when it comes to using multiple criteria, *Data Perfect* is far ahead in speed because of the difference in the way searches are initiated.

Some early copies of *Data Perfect* (including one reviewer's copy) had problems with data dropouts during sorts and while packing data bases. When we called LJK about this, we were told courteously to return the disk for a new copy. The new disk arrived within five days.

We were also told by LJK that the company is aware of the documentation problem and is planning to put out a pamphlet that, in effect, explains how to use the manual.

Data Perfect is an outstanding data base program for anyone who is willing to take the trouble to learn how to use it properly.

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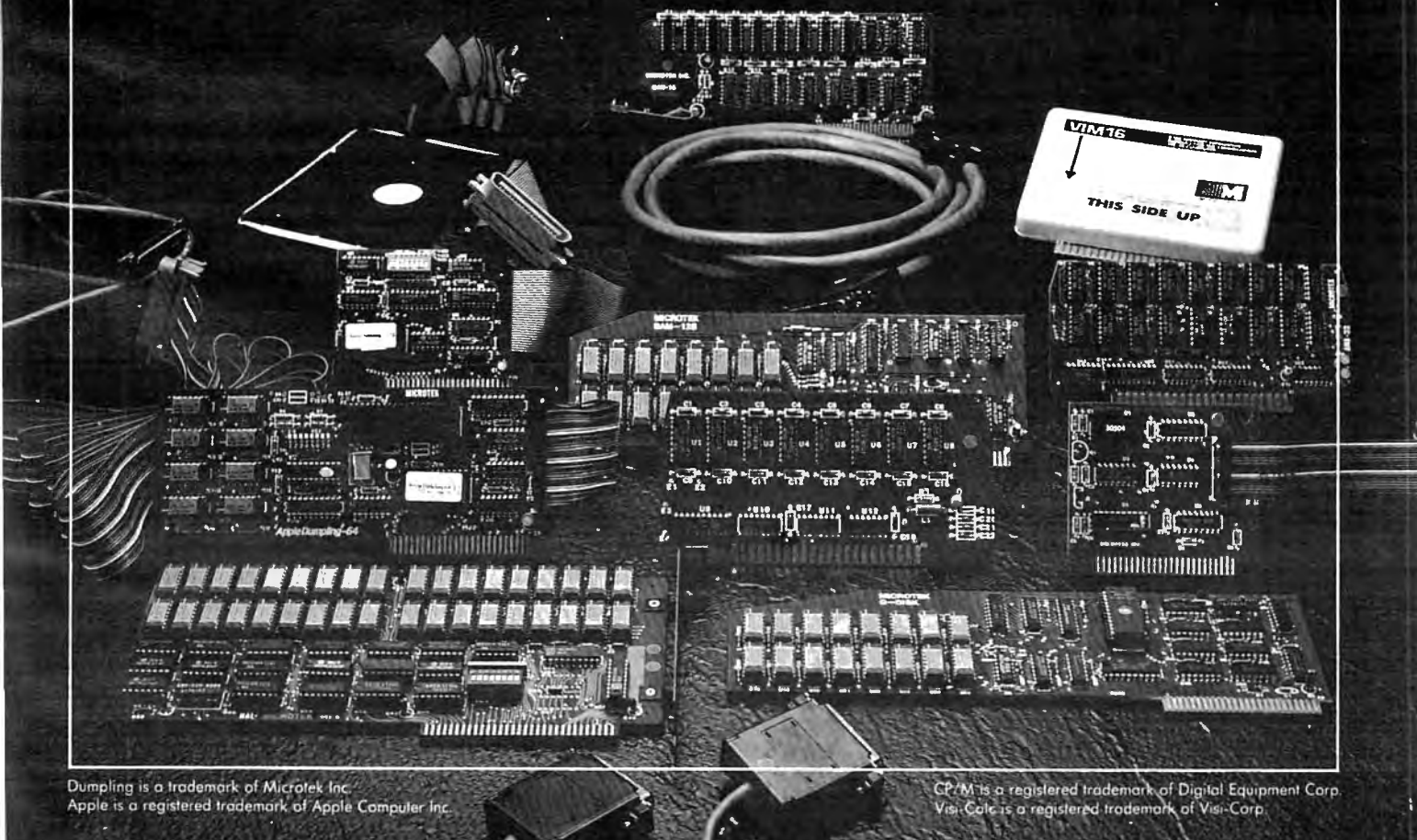

VIC
Practi-Calc

Emily Herman

One of the most popular programs ever written for microcomputers is *VisiCalc*. Since I use *VisiCalc* on my Apple III at work, I was curious to see how *PractiCalc* on the VIC would measure up. I was surprised to discover how similar the programs are, considering the difference in cost.

PractiCalc is a spreadsheet, a matrix of rows and columns. Data in the matrix can be manipulated for business reports and records. A VIC with a 16K upgrade has a 600-cell capacity; a 24K upgrade has a 2000-cell capacity. The location of each cell is given by a letter for the row and a number for the column. For example, A0 is the top left cell, B0 is directly below it, A1 is to the right of A0. Each cell in the matrix may contain either a label or a value. The value can be a number, the location of another cell (and therefore the same value as that cell), or a formula.

The manual is clearly written and well organized. It even has notes to help the experienced programmer modify the program if desired. An example spreadsheet is used as a step by step introduction to most of the available features. These features are: erase contents of cell, clear entire sheet, delete, insert or move a row or column, format a cell or the entire sheet (numeric display as decimal, $ mode (two decimal places) or integer), change column width, 16 functions (ex., SUM, AVG, RND, trig functions), load a previously constructed sheet from tape or disk, save a newly constructed sheet to tape or disk, print a sheet or part of a sheet, sort rows, replicate cells, show amount of space available, show cell contents and calculate. The "fix titles" feature allows horizontal or vertical headings to be fixed so that, no matter how far you scroll to the side or down, the headings remain displayed on the screen.

You must designate the number of rows and columns (any multiple less than or equal to 600 for 16K Upgrade) of your matrix when you start the program. It's worthwhile planning carefully, before you begin, what your maximum number of rows and columns will be. It is impossible to add more once you have started. Also, it takes about three and a half minutes to load the spreadsheet from tape. If you have several projects to work on, begin with as large a spreadsheet as possible. Then, when you have finished one project and saved it, you can clear the spreadsheet rather than reload the program.

Added Options

The column widths are all the same size (your choice with a minimum of three). Again, planning ahead is in order as you would probably want columns as wide as or wider than your largest number. Column widths can be changed at any time; however, if you have included lines of text, they will need to be redone if the column widths are changed. Color contrast is used to good advantage in the screen display of the spreadsheet. The odd columns are light blue, the even columns are orange, and the current cell is highlighted in green.

Rows and columns can be added (if you have not used your maximum number) or deleted. They can also be moved. However, formulas are not re-referenced. For instance, sup-

pose cell C3 has the formula A0+A1 in it. If you then add a column between 0 and 1, the cell A1 would become A2 but the formula in C3 would still read A0+A1. Again, careful planning before you begin is in order.

As formulas are entered, they are not calculated until "!" is typed. This saves time. When "!" is typed, all formulas entered thus far are recalculated. Therefore, if you have made corrections or additions to your data or formulas, these new values will be used. The disadvantage to this is that the more formulas there are, the longer it takes to recalculate. *VisiCalc* is a little more sophisticated in this respect. It has a manual mode which performs calculations only on the current cell.

To experiment with *PractiCalc*, I set up my financial records. My sheet was 30 x 30. The first column had the months of the year; the remaining columns had a heading for each area under which money either comes in or goes out during the year. I then entered the data. Using the SUM function, I typed in the formula to total salary income. Next, I replicated this formula to get the totals for all the other columns. I tried out several of the other functions, AVG, MAX, MIN. Each time, I entered the first formula, replicated it across all the other columns (one step), and then recalculated. The last one took about 15 seconds to replicate and recalculate. By this time there were over 100 formulas to recalculate.

Overall, I was very impressed with *PractiCalc*. It could be very useful to a small company or for keeping home records. At $35 it is certainly a bargain.

PractiCalc
Computer Software Associates
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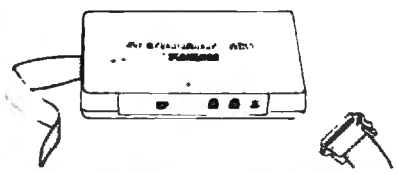

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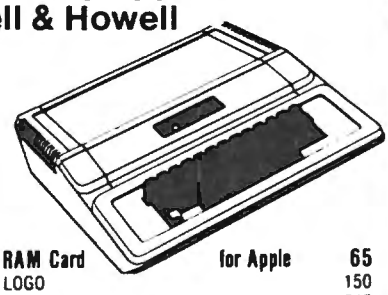

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SuperGraphics 2.0

NEW Version with TURTLE GRAPHICS

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

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

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

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

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for PET/CBM Computers

NEW VERSION II

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

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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.

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- introductory manual.
- reference manual.

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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.

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

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PaperClip Word Processor For PET/CBM

Louis F. Sander

PaperClip is a full-featured word processor for the PET/CBM with BASIC 4.0, 32K of memory, and Commodore disk drive. Another version, substantially the same, is available for the Commodore 64, although this version was not reviewed. The PET/CBM version of *PaperClip* includes a single diskette, a 112-page manual, and a ROM chip which must be installed before the program will work. The package includes a registration card, but nothing is said about the availability or price of future updates.

Documentation

The manual is well-written, thorough, and nicely constructed, and describes *PaperClip* in a better than adequate, but somewhat short of excellent way. It is written for people with at least an intermediate level of computer knowledge and experience, and office-oriented users may find it hard to use at first. For example, it includes few illustrative examples of anything except simple text editing, and no detailed information on inserting the ROM or backing up the master diskette. The dealer could of course provide information on these subjects.

Those who like colorful covers and strong, black printing on heavy paper stock will find much to appreciate here. Overall, the book is well-made.

When I opened my manual, I thought I was in for another "awful computer manual" experience, but fortunately that did not materialize. In general, the manual is logically organized, with simple matters covered first and advanced topics left until last. There is a well-done errata/addenda sheet accompanying the manual. The absence of an index, however, is a shortcoming – this program has 106 control functions and 41 formatting directives, but there is no fast way to find where they are covered in the text.

A Flexible Word Processor

PaperClip is a very powerful word processor, with so many features that most people will need only a fraction of them. Its text editing features are nicely constructed, with PET's cursor control keys being used wherever possible. The OFF/RVS key is used as a CONTROL key for initiating the more complicated commands. (The Commodore 64 version uses the C-64's actual CONTROL key.) There are so many of these that I felt a real need for stick-on key labels to help me find them.

As with most word processors, you can correct text on the screen, and move it easily from place to place. *PaperClip* offers two ways of moving: any number of complete screen lines, or any part of a paragraph. The insert mode lets you set the mode, then just begin typing, without having to pay attention to the length of the insertion; this is an improvement over other word processors I have seen.

Some other *PaperClip* features not found in all word processors are:

- One keystroke can put the cursor at end of text.
- Text can be saved to tape as well as to disk.
- When saving text, the line number being saved appears on the screen, as a handy indicator of progress or trouble.
- While the disk directory is on the screen, any text file can be loaded just by moving the cursor to its directory entry.
- A Table of Contents mode lets you flag text items for automatic inclusion in a printed Table of Contents.
- Text searching has a "wild card" mode.
- Numeric mode allows easy alignments of decimal points in columns of figures.
- Horizontal scrolling allows screen lines to be wider than the screen itself, simplifying production of wide documents.
- Column manipulation mode allows powerful moving, adding, and sorting of anything printed in columns. This mode seems to have been well thought out, and will be invaluable to those whose work includes columnar data. It is not as powerful as a good spreadsheet program, but it provides more than enough power for elementary applications.
- The program supports a wide range of printers and claims (undocumented) to be able to support even more, using a custom printer setup file.

No brief review can detail all the features of any powerful program, and this one is no exception. The list above shows that *PaperClip* has a lot of power.

Overall, *PaperClip* is a very good word processor with a pretty good manual. It includes most of the features found in other word processors and has some excellent, uncommon features of its own. The manual is complete.

PaperClip
Batteries Included
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Silicon Office For PET

Richard Mansfield, Senior Editor

Two of the main uses for computers in offices – word processing and data base management – are combined in *Silicon Office*, an impressive business software package, now available in the United States. It is written entirely in machine language and uses up 54K bytes. Because it is so large, it will only work on an 8032 PET which has been expanded via 64K additional RAM memory. This unit is sometimes called the CBM 8096. The 8096 can be purchased from dealers or a memory board can be added to an ordinary CBM 8032 in about five minutes.

There are versions of the program for the 8050 disk drive and for the Commodore 9060 or 9090 hard disk. Because the software takes up so much of the computer's RAM, the disk is accessed frequently and its use is automatic and safeguarded against loss of information. The program is well designed in several ways, not least of which is the protection it offers against I/O (input/output) disasters.

The built-in word processor supports all the necessary features for generating text documents. You can work with lines varying from 20 up to 125 characters in length. The convenience of the CBM cursor control keys is retained and even expanded. For example, the screen can only display lines up to 80 characters, but if you cursor to the left or right side, the document instantly adjusts itself to reveal any hidden text. If you have experience on WordPro or other advanced word processors, the functions of the *Silicon Office* word processor are easy to learn. It can also make arithmetic calculations during printout and works hand in hand with the other capabilities of *Silicon Office*. The data base is directly available to the word processor.

Data Base Programming

Unlike other data base programs, you have significant control over the behavior of *Silicon Office*. There is a built-in *language* for data manipulation, filing, accounting, word processing, and system control. It contains over 30 commands such as "Prior Record" which can be used either directly or from within a program (much like BASIC). There are an additional 25 words for word processing. If you type Edit Program (or "EP," each command has a short form), the screen displays a format in which you type line numbers, commands, and arguments. Whenever you type GO, the program currently in memory will take control and can calculate, print documents or reports, update or rearrange files, and so forth. Above all, this facility makes it easy to customize *Silicon Office*, to make it efficient and responsive to your needs.

Programs, text formats, and file formats can all be created on screen, saved or recalled from disk, and linked to one another within programs.

Automatic Sorts

The data base is *relational*. You can create interactions between up to six completely separate files. In addition, you can expand the size of records (in characters) from the normal 256 by linking records together. Records are easily created on screen, can be of varying length, and can work together in as simple or as complex a fashion as your needs dictate. *Silicon Office* manages to combine great flexibility with ease of use. That's a difficult marriage to arrange as anyone who's written a complicated program will attest. *Silicon Office* is one of the most impressive pieces of software I've seen.

Sorting records is one of the essential tasks of a data base. First-time users of *Silicon Office* might look for a Sort command. There isn't one. Records are sorted *as you enter them*. If you've typed in 100 names and addresses, they can be accessed either by record number (the order in which they were entered) or in sorted order. An equally impressive, very fast search command will fly through a file looking for a match.

How fast is *Silicon Office* in general? It's quick where it needs to be. If you are using a 50 characters per second printer with some memory of its own, you can enter invoice data for each record and the invoices will print out continuously. *Silicon Office* will not slow things up.

It is slow to accomplish some relatively rare functions. For example, if you decide to merge two large files, you might want to give it several hours and that could mean letting it merge after working hours. In general, however, the program is quick, efficient, and flexible. *Silicon Office*'s documentation is excellent, too. Two well-written books accompany the product: a *Training Guide* and a *Reference Guide*.

Communications capabilities are built in. *Silicon Office* can talk to other *Silicon Offices* across the room or thousands of miles distant, through a modem. This feature, too, benefits from the interactivity which characterizes all aspects of the program. All in all, this is an outstanding product which deserves serious consideration when small- to medium-sized businesses decide it's time to automate the office.

Silicon Office
Advanced Integrated Development
5901 John Martin Drive
Suite 140
Minneapolis, MN 55430
(612)561-1645
$999

Turbocharger For Apple

Richard Cornelius

Turbocharger is a Disk Operating System (DOS) and date-stamping program for the Apple II written by Roland Gustafsson. The disk comes in a plastic bag with a folded sheet of heavy stock on which the documentation is printed. The disk "may be copied by the original purchaser only as necessary for use on the computer for which it was purchased," according to the instructions.

The feature of *Turbocharger* that many users would find most impressive is the increased speed for the DOS commands BLOAD, BRUN, LOAD, and RUN. The DOS in memory is changed to the fast DOS when the file TURBO is BRUN. How much are the DOS commands speeded up?

To answer that question I wrote a simple BASIC program to BLOAD a high-resolution picture (a 34-sector file containing 8K of graphic image) ten times in succession. Normal DOS ran this program in 90 seconds. The *Turbocharger* DOS completed the task in 25 seconds.

For comparison, I tried another "fast" DOS which is used by a major commercial software publisher, and the same program took 32 seconds. I also tested each of the DOS variations with an Applesoft program. Normal DOS required 22 seconds to load an Applesoft program that occupied 89 sectors on the disk. Both *Turbocharger* and the other fast DOS that I tried loaded the same program from the same disk in about five seconds. Since loading times include the start-up time for the disk drive, the actual time for loading the program was decreased roughly by a factor of five.

On the surface, the fast DOS seems to operate very well. When I began to use it in my own software development, however, I quickly encountered a problem. The two programs below show circumstances under which the *Turbocharger* DOS seems to be failing to CLOSE the DOS input/output buffers properly.

Program 1.

```
100 D$ = CHR$(4)
110 PRINT D$ "BSAVE BINARY FILE,
    A768,L1"
120 PRINT D$ "BRUN TURBO"
130 PRINT D$ "MAXFILES1"
140 PRINT D$ "RUN SECOND
    PROGRAM"
```

Program 2.

```
200 REM .....
210 REM .....
220 REM .....
230 REM .....
240 REM .....
250 REM .....
260 D$ = CHR$(4)
270 PRINT D$ "BLOAD BINARY FILE"
```

I initialized a disk with the first program and saved the second program as SECOND PROGRAM. When I booted the disk, I received a NO BUFFERS AVAILABLE error in the last line of the second program. I do not understand the source of the error. If line 120 in the first program is changed to BRUN a dummy file, no error occurs. If one of the lines 200-250 in the second program is deleted, then no error occurs! Whatever the source of the problem, it can apparently be overcome by placing a PRINT D$ "CLOSE" statement into a new line 265 in the second program. For personal use the fast DOS is probably satisfactory, but for serious developmental work, caution is in order.

Date Stamping

The other major feature available with *Turbocharger* is the "date-stamping" of files. A one-line Applesoft program that is supplied on the disk is used to change the date. Whenever you save a file, the current date is also saved. The catalog has the normal appearance except when the command MON O (a standard DOS command) is used. This command shows the date at the right-hand edge of the screen.

For long file names (DOS allows up to 30 characters) as many as seven characters at the end of the file name may be wiped off the screen by the date. RESET or the DOS command NOMON O makes the catalog appear in the normal manner. In either catalog display, the number of free sectors on the disk is given at the top.

Two other programs are available on the *Turbocharger* disk. One is a DOS command changer that allows you to change the DOS commands on a disk. The documentation says that you can change the commands to "anything that you want." The limitations that do exist (for example, the length of the commands) are not explained in the documentation, but these limitations are not ones that a user would likely encounter. The greatest value of changing the words used for the various DOS commands is generally in shortening them so that one or two characters can be used in place of the standard commands. For the purpose of changing the commands to one or two letters, the command changer program performs its task without any problems.

The other program on the disk is a "quick-copy" program. The added features of the *Turbocharger* DOS have replaced the INIT command so that you cannot initialize disks with the fast DOS. Other fast DOS programs generally operate in the same manner. You must initialize disks either by using the normal DOS or by using the COPYA program on the System Master Disk to copy a disk that is already

initialized. Once you have an initialized disk, the quick-copy program will copy the contents of one disk onto the newly initialized disk.

The documentation that accompanies the *Turbocharger* disk is brief but complete. It includes a suggestion on what to include in your HELLO programs to make changing the date easy, and it presents information on which zero-page locations are used, how the date is linked to the file name, and where in DOS the altered routines lie.

Turbocharger
Silicon Valley Systems
1625 El Camino Real
Suite #4
Belmont, CA 94002
$29.95

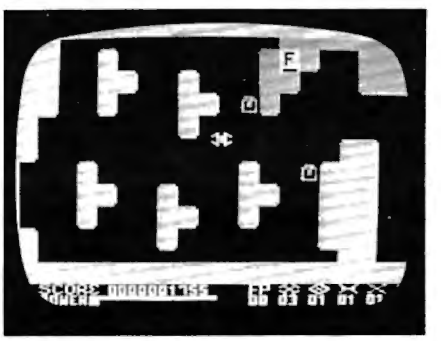
Pathfinder For Atari

John DiPrete

Programmer Randy Jongens may have taken his cue from Three Mile Island when he decided it was time for a game about radioactive materials in Gebelli Software's latest release for the Atari, *Pathfinder*.

Your Pathfinder is a "being" which moves at a velocity similar to that of *Pac-Man*'s through a maze several times larger than the viewing screen. Each time you glide over a canister of nuclear waste, you absorb energy. Hoping to out-power you is a foe called Nuke which also collects energy. Until it's strong enough to pose a threat, however, Nuke flees from you. A bodyguard called Minelayer safeguards Nuke by planting mines to block you. If your Pathfinder blasts the booby-traps, a fire ignites. The only way to douse the electro-light is to get fire-retardant pellets from a fire station. To enliven the spectacle, Phantoms zigzag through walls at you.

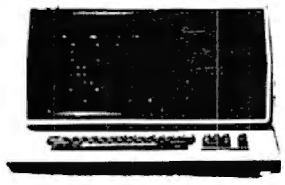
Pathfinder zaps the enemy at long-distance, recharging itself by gulping down "hot" spillage. A display at the bottom of the screen offers helpful data regarding power indicators, target numbers, and remaining Pathfinders. You control the waste-eater's motions by aiming the joystick in eight possible directions, pressing the button to fire plasma-blasts. With enough fire-energy, you can abolish maze walls. Angle shots, in any 45-degree direction (NE, NW, SE, SW), are not easy.



Searching for canisters of nuclear waste in the mazes of Pathfinder.

The graphics in *Pathfinder* are abstract. Squares, angles, and bric-a-brac constitute Nuke, Pathfinder, and the rest of the characters in the game. The shapes are flat, one-dimensional. No human, extra-terrestrial, or vessel-bearing features exist. No sharply-defined expressions signify the type of life (human, alien, or robotic). The rapidly-blinking geometric figures are hazy, vague, and specter-like. Maze walls remain completely solid, except at the beginner's level, where lattice-type structures exist. The instruction sheet doesn't identify the squashed-up pretzel-things that turn up now and again, so it's hard to realize at first that they're "residue" of half-crumpled targets. (A succession of plasma-blasts is required to vaporize a wall – if only a tiny dose is received, it remains in partial form.)

EAGLE



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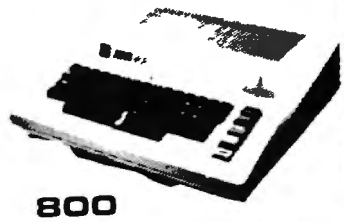

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Combined Themes

In *Pathfinder*, the strategy of planning ahead, locking horns with Lady Luck, and using ESP is stressed above coordination. Instead of relying upon firing ability, you've got to weigh facts and judge carefully: Which path is best? Where will I gain points? How much energy must I expend?

Pathfinder combines some general themes found in other types of games. One, for example, is the football theme, characterized by "running to the finish line" (i.e., clearing the maze completely of waste), deft "blockers" like Minelayer thwarting your dives at Nuke (when it's weak), and so on.

Another is the chess theme, in electronic form. Each character in *Pathfinder* has its own peculiar move-and-attack ability. There are Phantoms breezing through walls, fires spreading bit by bit, and Nuke, Pathfinder, and Minelayer possessing different levels of strength.

Finally, there is the treasure hunt theme, exemplified by finding and following the most efficient paths to the random scattering of canisters in the maze. The map of the screen changes with every reappearance, and you must be wary of pirates (Nuke, Minelayer) and trapholes (mines, fires).

You can choose from a selection of 15 difficulty levels. The upper levels throw a lot of out-of-control fire at you, loads of high-spirited Nukes, and helter-skelter effects, making for more challenging play.

It's rather like *Pac-Man* in 3-D. A *Pac-Man* aficionado might insist that *any* similarity to the Prince of Mazes is superficial (like comparing *Space Invaders* to *Galaxians*). So, why not? Both are classic examples of excellent variations on a theme. Likenesses, differences. In *Pathfinder*, the break-away obstacles, detonating bombs, and sprinting ghosts stretch into a super highway of sloping, curving space.

Pathfinder's simulation of reality may turn off hard-core scientific purists (for whom the idea of gobbling nuclear garbage in a maze simply won't wash). But for players less scientifically straight-laced, the fiery dynamics will glow through.

Pathfinder
Gebelli Software
1787 Tribute Road
Suite G
Sacramento, CA 95815
Requires 32K, disk
$34.95

ZX-81 Home Computer Package For Sinclair/ Timex

Arthur B. Hunkins

The *ZX-81 Home Computer Package* is a sampler of four programs for the Sinclair ZX-81, Timex TS-1000, MicroAce, and 8K ROM ZX-80. An alternate version, also priced at $9.95, is available for the standard 4K ROM ZX-80. Running in all cases within 1K RAM, each program is written largely in machine language, and is a tribute to what can be done with only 1K of memory using machine code. The programs, *Etch-A-Screen*, *Music Composer*, *Checkbook Balancer*, and *Billboard*, are all small miracles of creativity in 1K. (I should add that, for all programs except *Billboard*, suggestions are given for fruitfully extending program capability if more than 1K is available.)

The package is produced by LAMO-LEM Laboratories, a fact presumably related to the inclusion of a laminated cover on the excellent eight-page instruction manual, and two laminated keyboard overlays (for *Music Composer* and *Checkbook Balancer*). An interesting collaboration/application indeed (the overlays are designed to be taped to the keyboard). Other materials included in the packet are handy reference cards for all programs except *Billboard*, a screen display matrix (for *Etch-A-Screen*), and a music coding sheet. (For some reason, the *Composer* reference card omits one of the four available octaves, and so is unnecessarily confusing.)

The programs, all gems in their own right, have several features in common. All run immediately upon loading; all have built-in provisions for saving program data (so that when a saved program is loaded it goes right on doing whatever it did the time before). Thus it will display a previously stored message or screen design, play a previously coded melody, or list a previous checkbook balance along with currently uncleared entries.

Three complete sequences of the four programs are recorded on the cassette. I experienced no LOADing difficulties.

Billboard is clever and simple. You enter a message of up to 250 characters, and it scrolls slowly, in large letters (and I mean *large*), from right to left across the screen. (Only about half of Sinclair's graphics characters are implemented.) This is a novel way to leave a message for someone – a message that can't easily be ignored!

Etch-A-Screen is much more complex – perhaps a bit overly so (it takes some time to become proficient). Essentially, it permits you to place any keyboard char-

acter (including most reverse field characters and all graphics) anywhere on the screen, and save the display. Keys repeat automatically (a very nice feature), and the cursor can go diagonally as well as sideways and vertically. (It also wraps around the display.) In the 1K version, the display is limited to 17 lines; a 2K extension (two POKEs) expands to full screen capability. Additional features include cursor turnoff and CLEAR SCREEN commands. The instructions indicate that "it may be possible to use the printer to copy the picture." I was unable to test this feature.

Checkbook Balancer also works well for its intended purpose. An initial balance is entered, then credits and debits with dollar amounts and ID numbers. Entries may be voided, or cleared (when the bank statement arrives); transactions can be displayed at will. Mistakes (such as voiding or clearing nonexistent entries) are rejected with an appropriate ERROR message. The 22-entry limit may be raised to 100 with 2K of memory (standard on the Timex).

Music Composer is a truly impressive display of efficient machine language programming. How so many features can be fit into so little space I do not know. (One thing that helps is the lack of a screen display; the blank screen also mercifully kills the bothersome hum otherwise generated.) The program is essentially a keyboard play/memory replay routine. The middle two computer keyboard rows are implemented as a two-octave C major scale, with the shift key taking all notes up two octaves for a total of four octaves. Chromatics and keys other than C major are not available (except with the modification below, which is not difficult to incorporate).

Special Effects Keys

One key is used to signal the beginning and end of a stored segment to be played back (up to 175 notes and durations are automatically stored as performed). An EDIT function (with single step both backwards and forwards) is available to locate (and replay) specific notes – as well as to change them. There is also a REST key. Although in live performance the program senses when a key is released (giving silence), the rest is not recorded in memory. This is a real inconvenience; combined with the fact that durations are stored very inaccurately, the replay function has limited utility.

Two Special Effects keys either raise or lower all pitches by microtones (depending on how long you hold the keys down). Fooling extensively with these keys produces many unpredictable results (e.g., fast quasi-random pitch sequences). The manual duly warns that once you begin experimenting with these keys, "it may be difficult to return to the unmodified state." A modification "for the advanced programmer" even gives directions for "playing" the 8K ROM (a random set of pitches and rhythms). Another extension (again, 2K memory) permits storing up to 350 notes.

Two features would be welcome additions: a key transposition option during playback, and a tempo scaling factor (providing different playback speeds). Both would require simple multiplication routines (unfortunately cumbersome in machine language), as well as a good bit of input/output overhead.

A program like *Composer* simply *invites* modification. Here are two suggestions. One mod everyone should make, as the highest octave is noticeably out of tune. Hit BREAK while the program is SAVEing, and execute (without line numbers) the following POKEs: POKE 16586,19; POKE 16587,17. This should take care of the tuning problem.

The lack of accidentals will be a notable drawback to many hobbyists. Here is a way of reprogramming the pitches played by the two rows of note keys. The trick is to know where in memory the numbers representing the delay loop values for the particular pitches are stored. It turns out that the values for the bottom row of keys, unshifted, are stored in locations 16555-16562, the top row unshifted in 16564-16571. The bottom row shifted is in 16573-16580, and the top row shifted, in 16582-16589. Substituting the values below will create a chromatic keyboard over the two middle octaves of the previous four – one octave without using the shift key, an octave higher with shift. (Armed with the appropriate values for the various pitches, you can now create your own keys – i.e., program the keyboard for D major, E minor, etc.)

Again with a program BREAK during SAVE, POKE the following values in memory locations 16555-16562: 125, 111, 100, 93, 83, 74, 65, 62. In 16564-16571, POKE 133, 117, 105, 93, 87, 78, 69, and 62. Locations 16573-16580 remain unchanged, while 16582-16589 are POKEd to 65, 58, 52, 46, 43, 38, 34, 30. The bottom row of keys is C D E F G A B C as before, while the top row is now B C#(D-flat), D#(E-flat), F F#(G-flat), G#(A-flat), A#(B-flat), C. Have fun creating your own scales and tunings. Maybe you can come up with something really exotic!

In sum, the *ZX-81 Home Computer Package* is unique, lots of fun, and practical. At $9.95, with all the extras, it's a bargain. I'm sure it must be a treasure chest of machine language programming ideas for the Sinclair as well.

ZX-81 Home Computer Package
LAMO-LEM Laboratories
Box 2382
La Jolla, CA 92038
$9.95

Questions Beginners Ask

Tom R. Halfhill, Features Editor

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

Q When I try typing programs into my computer from the listings in COMPUTE! and other magazines and books, lots of times I see characters or symbols that are not on my computer's keyboard. How can I type these characters?

A The problem stems from the fact that computers can display many special characters on their TV screens that most printers do not reproduce. Sometimes these special characters are odd punctuation symbols. Other times they are *control characters* or *graphics characters*.

These are special character "sets" (a collection of related characters) found on most home computers. To type them on the screen, most often you must simultaneously hold down a CONTROL key, GRPH key, or some other special key which acts sort of like a SHIFT key.

These special characters can be used for computer graphics, such as games, where they are often combined to form shapes. Control characters also are used to send instructions to devices attached to computers. One example is printers. On a printer which is capable of underlining words, special control characters placed before and after the word tell the printer when to start and stop underlining. Naturally, you don't want these control characters to show up in the paper, you just want their *effect*. So the printer interprets them as instructions to change its printing mode, rather than as characters to print.

In the case of special graphics characters, the printer is often simply not capable of reproducing the character. Sometimes the printer will leave a blank space; other times it will print an odd character of its own.

That's why programs which use special characters often do not print out on paper as they should. To get around this problem, **COMPUTE!** has developed special ways of denoting these special characters in the program listings in the magazine. Every month, **COMPUTE!** includes two guides – "How To Type **COMPUTE!**'s Programs" and "A Beginner's Guide To Typing In Programs." On these pages are sections for each computer brand which show how to type special characters which do not appear on the keyboards. Misinterpreting these special characters is probably the most common source of errors in typed-in programs. Look in the Table of Contents in this issue to find these important aids.

Q Exactly what is a computer monitor, and how is it different from a TV? How should I decide if I need one?

A To avoid confusion right off the bat, we'll define what we *aren't* talking about here: *machine language monitors*. A machine language monitor is a program, an aid for machine language programmers, and has nothing to do with *display monitors*.

A display monitor is a television-like screen device that can be hooked up to many home/personal computers. In fact, some computers come with their own monitors attached or built-in, such as the Commodore PET/CBM, and Radio Shack TRS-80 Models I, II, and III.

Essentially, a monitor is a TV which has been optimized for computer use. It displays screen images, especially text, more sharply and with greater stability than a regular TV can. For this reason, it is often preferred for word processing or serious programming.

A monitor is sharper than a TV because it gets the video signal directly from the computer's video output. Designers had to compromise a little in order to make computers compatible with ordinary TVs. To display an image on a TV, a computer must convert its video output to simulate a normal broadcast signal. It does this with an RF (*Radio Frequency*) modulator, which is built into some computers (such as the Atari and Commodore 64), or visible as a small box on others (VIC-20, Apple II). The RF modulator connects to the TV antenna terminals. Then the computer's video output will be the same as a broadcast signal from an ordinary TV station. This means the computer's video output must be re-converted

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by the TV's receiver before it is displayed on the picture tube. This two-stage process – converting the video output to a broadcast signal, and then re-converting it back to a pure video signal – loses some sharpness in the translation.

Monitors bypass all this converting by tapping the computer's video output directly and sending it straight to the picture tube. In addition, specially designed circuitry makes the image even sharper and more stable. And since the monitor lacks a receiver (unlike a TV), it is much less likely to be bothered by stray interference from CB radios, poor connections, or even the computer itself.

There are full-color monitors and *monochrome* (single-color) monitors. Monochromes may be black and white, green, or amber. Some people find different colors easier on their eyes. If you have severe interference problems with your TV, or have trouble reading the screen, you might look into the possibility of buying a monitor. Prices are often comparable to TV sets of the same screen size. ©

TI-99 Match-Em

C. Regena

In addition to its primary purpose of captivating youngsters, this program also serves as a guide and example of how to create educational games on any subject.

This simple matching game is designed for young children. A screen of 16 squares is shown. Press the letters on two of the squares to try to match the shapes. If you "Match-Em," the shape will be drawn at the right side of the screen, and you won't be able to use those squares again (the shape is replaced by diagonal lines). There are eight pairs of shapes to try to match.

If you wish to stop the game at any time, press "S" and the placement of all the shapes will be shown. After each game you have the option of trying again – with the shapes scrambled in a different random order.

Other Applications

Take a look at the BASIC logic in this game, then design your own. You may wish to use the capabilities of the TI-99/4A graphics and draw other pictures – animals, people, designs, etc. Each shape here is drawn in a separate character set, and a random foreground and background color combination is chosen. Keep your drawing to eight or fewer graphics characters; you may also want to specify a certain foreground and background color.

You can make this matching game into an educational game. Instead of matching shapes, match an answer to a mathematics problem; match a capital city to its state; match a date to a historical event; match parts of a compound word. Whatever you want.

Programming Techniques

DIMensioned arrays start with a subscript of zero unless you specify OPTION BASE 1, which starts subscripts at 1. I used dimensioned numbers to keep track of the eight shapes (16 total) and various coordinates needed for graphics.

MX() and MY() are the X and Y coordinates to draw a shape at the right of the screen after it has been successfully matched. The coordinates depend on how many matches have been made.

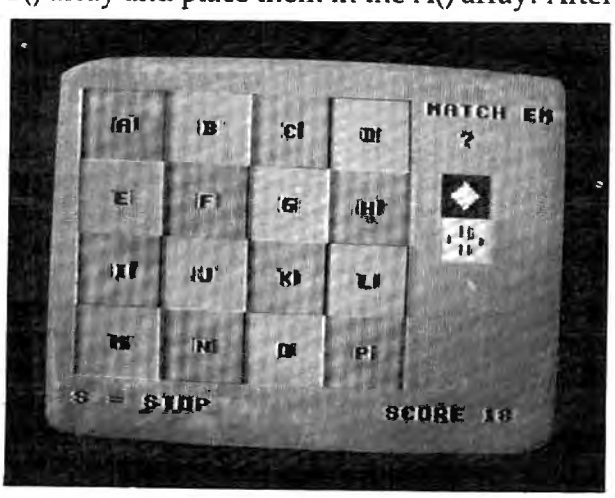
C1() and C2() are the X and Y coordinates for each square in the 16-square screen. D() indicates a red or a blue square.

A() and B() keep track of what shape is in which square. I use two arrays so that one can be a working array. B() also keeps track of the original order of the shapes when all the shapes are drawn (if you press "S" or if you have made all eight matches).

Lines 270-370 define graphics characters while the title screen is shown. Line 280 beeps a random sound for each character as it is defined. Graphics characters are defined by a string number. A null string is indicated either by "" or by two commas together and will yield a blank square for that graphics character. You do not need quote marks around the graphics string if it is in a data statement.

Lines 410-420 redefine the parentheses as a blue square and a red square. The game screen is then printed with lines 500-540. PRINTing characters is often faster than using the CALL HCHAR or CALL VCHAR method.

The shapes are numbered from 1 through 8. Lines 550-580 put the shape numbers in the B() array. Lines 600-660 mix up the members of the B() array and place them in the A() array. After a



Can you match the hidden symbols behind the colored squares?

B() is chosen for the A() array, it is set to zero so it won't be chosen again. Lines 670 to 690 set the B() array equal to the A() array so that the shapes can all be printed in the original order at the end of a game.

Lines 710-760 choose a random foreground color and a random background color for each shape, making sure that the foreground color is not the same as the background color.

Lines 1490-1590 are a subroutine to draw the shape starting at coordinates X and Y. CH is the character number and is calculated in line 1480, depending on the shape number.

Explanation Of The Program

Line Nos.	
110-120	DIMension variables starting with a subscript of 1.
130-160	Read X and Y coordinates for matched shapes.
170-210	Read X and Y coordinates and character numbers for each of the 16 squares.
220-240	Print title screen.
250-260	Define functions for random variables used later.
270-370	Define graphics characters for character numbers 96 through 159 (eight shapes, each in a different character set).
380-400	Print instructions.
410-420	Define characters for red and blue squares.
430-450	Wait for player to press any key.
460-480	Clear screen and initialize score (number of tries) and number of matches.
490-540	Define colors and draw game screen.
550-580	Define B() elements as shape numbers 1 through 8 (two of each number).
590	Prints another line of game screen.
600-660	Randomly choose the order of the shapes in the 16 squares.
670-690	Set B() array elements equal to A() array.
700-760	Randomly choose colors for shapes.
770-790	Print name of game on screen.
800-840	Increment and print score.
850-900	Beep and wait for player to press a letter for first square.
910-990	Determine coordinates and draw diagonal lines if square has already been matched.
1000	Draws shape.
1010-1060	Beep and wait for player to press a letter for second square.
1070-1150	Determine coordinates and draw diagonal lines if square has already been matched.
1160	Draws shape.
1170-1220	Determine if a match has been made; if not, sounds "uh-oh."
1230-1300	If match has been made, these lines play arpeggio and determine coordinates, then draw shape at right of screen.
1310-1320	Set A() elements to zero so they cannot be used again for a correct match.
1330-1470	Cover squares again with red or blue square and return to next set of choices.
1480-1590	Subroutine to draw shape.
1600-1650	After all eight matches have been made, these lines play a tune.
1660-1710	Clear choices made and show all shapes on game screen.
1720-1750	Print option to play again, wait for player's choice, and branch appropriately.
1760-1770	Clear screen and end.

```
100 REM{3 SPACES}MATCH-EM
110 OPTION BASE 1
120 DIM A(16),B(16),C1(16),C2(16),D(1
    6),MX(8),MY(8)
130 FOR C=1 TO 8
140 READ MX(C),MY(C)
150 NEXT C
160 DATA 7,26,10,26,13,26,16,26,7,29,
    10,29,13,29,16,29
170 FOR C=1 TO 16
180 READ C1(C),C2(C),D(C)
190 NEXT C
200 DATA 3,5,40,3,10,41,3,15,40,3,20,
    41,8,5,41,8,10,40,8,15,41,8,20,40
210 DATA 13,5,40,13,10,41,13,15,40,13
    ,20,41,18,5,41,18,10,40,18,15,41,
    18,20,40
220 CALL CLEAR
230 CALL CHAR(64,"3C4299A1A199423C")
240 PRINT TAB(10);"MATCH-EM"::::::::::
    :
250 DEF R=INT(RND*200+900)
260 DEF R15=INT(RND*15)+2
270 FOR C=96 TO 159
280 CALL SOUND(50,R,4)
290 READ C$
300 CALL CHAR(C,C$)
310 NEXT C
320 DATA "",,FFFFFFFFFFFFFFFF,,,,,,00
    00000000003CFF,0101030303030101,F
    FFFFFFFFFFFFFFF,8080C0C0C0C08080,,
    FF3C,,""
330 DATA 0000000008081C1C,00000000000
    00101,3E3E7F7FFFFFFFFF,0000000080
    80C0C,03030707,FFFFFFFF,E0E0F0F,""
340 DATA "",0F0F0F0F0F0F0F0F,FFFFFFFF
    FFFFFFFF,F0F0F0F0F0F0F0F0,,,,,0000
    000010387CFE,0103070F070301
350 DATA FFFFFFFFFFFFFFFE,0080C0E0C08
    ,,7C381,,,0000000010103 83C,001F07
    0100010103,7CFFFFFFEFFEFC7
360 DATA 00F0C0000000008,030706,8301,
    80C0C,,0000000000003C7E,000103030
    30301,FFE7C38181C3E7FF,0080C0C0C0
    C08,""
370 DATA 7E3C,,,000000003C3C3C3C,0000
    0F0F0F0F,3C3CFFFFFFFF3C3C,0000F0F
    0F0F,,3C3C3C3C,,""
380 CALL CLEAR
390 PRINT "PRESS TWO LETTERS.":"TRY
    TO MATCH THE SHAPES.":"THE BETTE
    R YOU ARE, THE"
400 PRINT :"LOWER YOUR SCORE WILL BE.
    ":::"PRESS 'S' TO STOP THE GAME":
    :"AND SEE
ALL THE SHAPES."
410 CALL CHAR(40,"FFFFFFFFFFFFFFFF")
420 CALL CHAR(41,"0")
430 PRINT :::"PRESS ANY KEY TO START.
    ";
440 CALL KEY(0,K,S)
450 IF S<1 THEN 440
460 CALL CLEAR
470 SC=0
480 M=0
490 CALL COLOR(2,5,9)
500 PRINT "((((((((((((((((((":"(((
    ((((((((((((((((":"((A(())B))((C
    (())D))":"((((((((((((((((((("
510 PRINT "((((((((((((((((((":")))
    ))((((((((((((((((":")))))((((((
    ))((((":"))E))((F(())G))((H(("
```

```
520 PRINT "))))))((((((()))))))((((((":")))
    ))((((((()))))))((((((":"((((((()))))))(((
    ((((((":"((((((()))))))((((((()))))))"
530 PRINT "((I(())J))((K(())L))":"(((
    ((((((()))))))((((((()))))))":"((((((()))))))(((
    ((((((":")))))))((((((()))))))((((((("
540 PRINT "))))))((((((()))))))((((((":"))M
    ))((N(())O))((P((":")))))))((((((()))
    ))((((((":")))))))((((((()))))))((((((("
550 FOR C=1 TO 8
560 B(C)=C
570 B(C+8)=C
580 NEXT C
590 PRINT :"S = STOP";TAB(20);"SCORE
    ="
600 FOR C=1 TO 16
610 RANDOMIZE
620 RC=INT(16*RND)+1
630 IF B(RC)=0 THEN 620
640 A(C)=B(RC)
650 B(RC)=0
660 NEXT C
670 FOR C=1 TO 16
680 B(C)=A(C)
690 NEXT C
700 M=0
710 FOR C=1 TO 8
720 F(C)=R15
730 F2(C)=R15
740 IF F2(C)=F(C)THEN 730
750 CALL COLOR(C+8,F(C),F2(C))
760 NEXT C
770 FOR C=1 TO 8
780 CALL HCHAR(2,23+C,ASC(SEG$("MATCH
     EM",C,1)))
790 NEXT C
800 SC=SC+1
810 S$=STR$(SC)
820 FOR C=1 TO LEN(S$)
830 CALL HCHAR(23,27+C,ASC(SEG$(S$,C,
    1)))
840 NEXT C
850 CALL SOUND(150,1397,2)
860 CALL HCHAR(4,26,63)
870 CALL KEY(0,K,S)
880 IF K=83 THEN 1660
890 IF (K<65)+(K>80)THEN 870
900 CALL HCHAR(4,26,K)
910 N=K-64
920 A1=N
930 X=C1(N)
940 Y=C2(N)
950 IF A(N)<>0 THEN 1000
960 CALL HCHAR(X,Y-1,92,3)
970 CALL HCHAR(X+1,Y-1,92,3)
980 CALL HCHAR(X+2,Y-1,92,3)
990 GOTO 1010
1000 GOSUB 1480
1010 CALL SOUND(150,1397,2)
1020 CALL HCHAR(4,29,63)
1030 CALL KEY(0,K,S)
1040 IF K=83 THEN 1660
1050 IF (K<65)+(K>80)THEN 1030
1060 CALL HCHAR(4,29,K)
1070 N=K-64
1080 A2=N
1090 X=C1(N)
1100 Y=C2(N)
1110 IF A(N)<>0 THEN 1160
1120 CALL HCHAR(X,Y-1,92,3)
1130 CALL HCHAR(X+1,Y-1,92,3)
1140 CALL HCHAR(X+2,Y-1,92,3)
1150 GOTO 1170
1160 GOSUB 1480
1170 IF A(A1)=0 THEN 1200
1180 IF A(A2)=0 THEN 1200
1190 IF A(A1)=A(A2)THEN 1230
1200 CALL SOUND(150,330,2)
1210 CALL SOUND(150,262,2)
1220 GOTO 1340
1230 M=M+1
1240 X=MX(M)
1250 Y=MY(M)
1260 CALL SOUND(150,262,2)
1270 CALL SOUND(150,330,2)
1280 CALL SOUND(150,392,2)
1290 CALL SOUND(300,523,2)
1300 GOSUB 1500
1310 A(A1)=0
1320 A(A2)=0
1330 IF M=8 THEN 1600
1340 X=C1(A2)
1350 Y=C2(A2)
1360 CALL HCHAR(X,Y-1,D(N),3)
1370 CALL HCHAR(X+1,Y-1,D(N),3)
1380 CALL HCHAR(X+2,Y-1,D(N),3)
1390 CALL HCHAR(X+1,Y,N+64)
1400 X=C1(A1)
1410 Y=C2(A1)
1420 CALL HCHAR(X,Y-1,D(A1),3)
1430 CALL HCHAR(X+1,Y-1,D(A1),3)
1440 CALL HCHAR(X+2,Y-1,D(A1),3)
1450 CALL HCHAR(X+1,Y,A1+64)
1460 CALL HCHAR(4,26,32,4)
1470 GOTO 800
1480 CH=8*(B(N)-1)+96
1490 CALL SOUND(150,-1,2)
1500 CALL HCHAR(X,Y-1,CH+7)
1510 CALL HCHAR(X,Y,CH)
1520 CALL HCHAR(X,Y+1,CH+7)
1530 CALL HCHAR(X+1,Y-1,CH+1)
1540 CALL HCHAR(X+1,Y,CH+2)
1550 CALL HCHAR(X+1,Y+1,CH+3)
1560 CALL HCHAR(X+2,Y-1,CH+4)
1570 CALL HCHAR(X+2,Y,CH+5)
1580 CALL HCHAR(X+2,Y+1,CH+6)
1590 RETURN
1600 RESTORE 1610
1610 DATA 262,330,392,523,330,392,523
     ,659,392,523,659,784,523,659,784
     ,1046,1046
1620 FOR C=1 TO 17
1630 READ J
1640 CALL SOUND(-99,J,2)
1650 NEXT C
1660 CALL HCHAR(4,26,32,4)
1670 FOR N=1 TO 16
1680 X=C1(N)
1690 Y=C2(N)
1700 GOSUB 1480
1710 NEXT N
1720 PRINT :"PLAY AGAIN? [Y N]";
1730 CALL KEY(0,K,S)
1740 IF K=78 THEN 1760
1750 IF K=89 THEN 460 ELSE 1730
1760 CALL CLEAR
1770 END
```

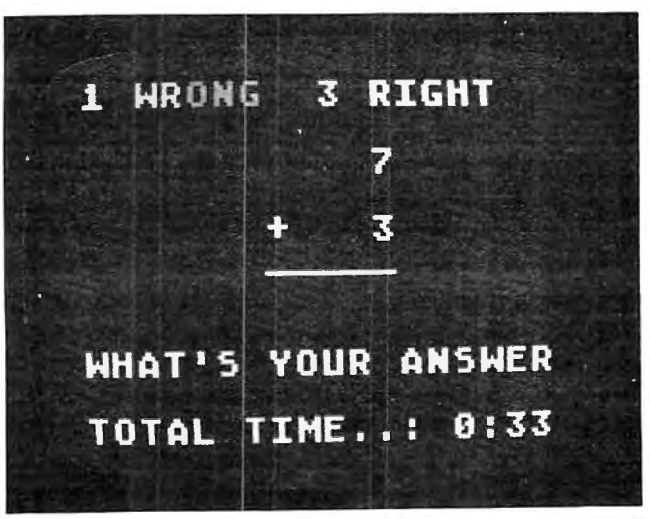
ATARI MATH FUN

Steven Neve

This math game offers a choice of six categories of math problems and six skill levels. It should keep the young math student coming back again and again, trying to top the all-time high score. It will fit in 8K RAM.

When playing computer games, it is often easier to use hand-held controllers than to use the computer console keys. "Math Fun" has been designed to use the Atari keyboard controller. It's educational, and keeps young students interested in math as well. Although the keyboard controller is recommended, you can also use the computer keys for inputs. Don't hit the RETURN key.

After picking one of six OPTIONal math groups, and SELECTing one of six skill levels, push START. The screen will show the number of right and wrong answers, the first question, and a realtime clock updated every second. Quickly you push a button on the controller; if it is the first digit in the answer, it is placed on the left side of the input display, or on the right if it's not. (The display is always read from right to left using the computer console keys.) This is repeated until the input has as many digits as the correct answer.



"Math Fun" for the Atari awaits a response while keeping track of elapsed time.

Then you are booed and have to try again, or you are cheered on to the next problem until you have answered 20 problems correctly. You are then scored on time and accuracy. The screen changes to the menu and displays the best time and score at the top of the screen and your time and score at the bottom. As you listen to music, the best score is updated to the new best score. Math Fun can be compacted to just under 8K of RAM without affecting the way it plays.

```
10 GRAPHICS 0:POKE 712,128:POKE 710,1
   28:POKE 752,1:OPEN #2,4,0,"K"
20 POSITION 10,8:? "TURN OFF THE RECO
   RDER":POSITION 8,12:? "ARE YOU USI
   NG THE KEYPAD":POSITION 15,16:? "Y
   ES OR NO?"
30 POKE 702,64:POKE 694,0:GET #2,KEY:
   IF KEY=78 OR KEY=89 THEN GOTO 50
40 GOTO 30
50 C0=0:C1=1:C2=2:C3=3:C4=4:C5=5:C6=6
   :C7=7:C8=8:C9=9:C10=10:C60=60:C520
   =520:GRAPHICS 18:POKE 712,128:A=C1
   :SK=C1
60 DIM G$(C1),I$(C1),AN$(C7),ANS$(C7)
   ,Q$(C6),L$(C6),M$(C6),ROW(C3),IP$(
   13),B$(C1):C13=13
70 POKE 54018,48:POKE 54016,255:POKE
   54018,52:POKE 54016,221
80 RESTORE :FOR NOTE=C0 TO 35:SOUND C
   0,C0,C0,C0:READ I,J:SOUND C0,I,C10
   ,C10:FOR X=C0 TO 25*J:NEXT X
90 IF PEEK(53279)=C6 THEN GOTO 260
100 IF PEEK(53279)=C3 THEN A=A+C1:IF
    A>=C7 THEN A=C1
110 IF PEEK(53279)=C5 THEN SK=SK+C1:I
    F SK>=C7 THEN SK=C1
120 POSITION 2,0:? #6;" COMPUTER  MAT
```

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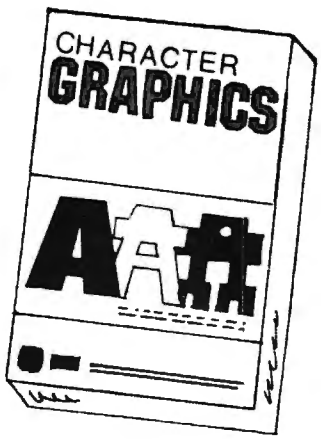

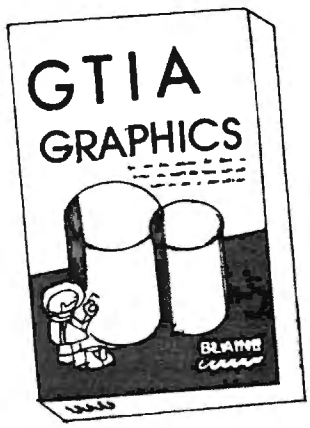

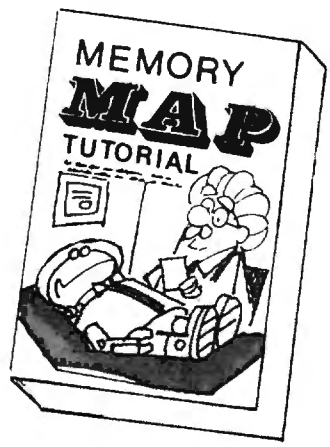

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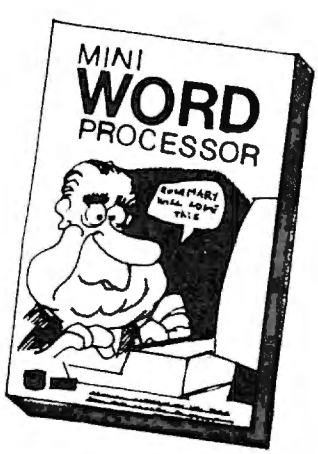

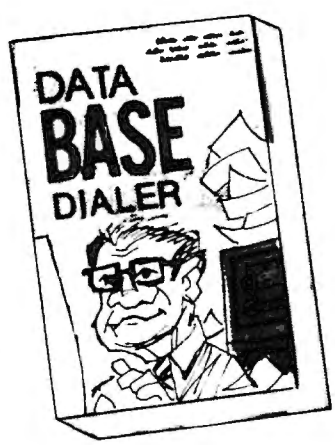

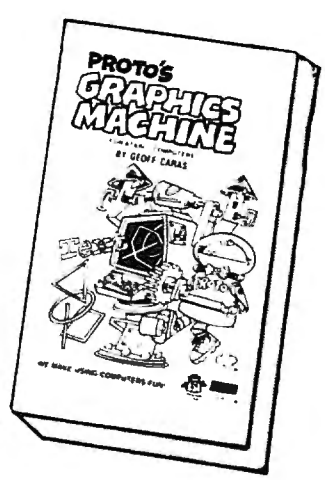

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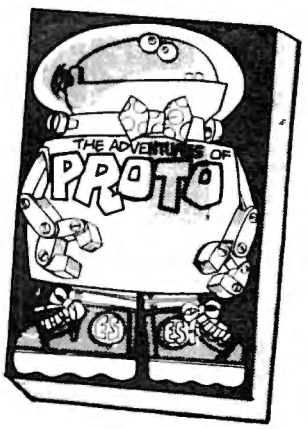
Diggerbonk! contains the following ingredients: Orange Whirlers, Pulsing Greenies, Twinklers, Bombs, Fog, Purple Gurples, Yellow Blinkers, Aqua Chasers (watch out), and of course the PANIC BUTTON.

For those of you who always wanted a pet snake, this game is for you. What do you feed a guest like this? An ample supply of insects, of course, but be aware that snakes often wind up biting themselves or getting electrocuted on their cage walls if not properly trained. Difficulty levels for all ages. $24.95.



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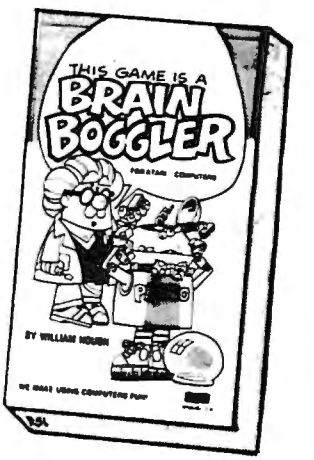

Diggerbonk! is the first arcade style game with a continuously scrolling maze that never repeats. You must guide your Digger upward before it goes off the bottom of your screen. There are, however, a few problems you must BONK! along the way (see ingredients). To add to the complication, you need to BONK! the creatures in a specific order. Playable by all ages, but be prepared to end up with a NEGATIVE SCORE.

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```
    H{6 SPACES}best sc far{A}":IF T
    S<C10 THEN ? #C6;" time";TM;":0";
    TS;"  score";HS
130 IF TS>=C10 THEN ? #C6;" time";TM;
    ":";TS;" score";HS
140 ? #C6;" ___________________":POSIT
    ION C1,C5:IF A=C1 THEN ? #C6;"+
    {4 SPACES}addition{4 SPACES}+"
150 IF A=C2 THEN ? #C6;"-  subtractio
    n{3 SPACES}-"
160 IF A=C3 THEN ? #C6;"+ add & subtr
    act -"
170 IF A=C4 THEN ? #C6;"X{4 SPACES}mu
    ltiply{4 SPACES}X"
180 IF A=C5 THEN ? #C6;"/{4 SPACES}di
    vision{4 SPACES}/"
190 IF A=C6 THEN ? #C6;"X mult & divi
    de  /"
200 ? #C6:? #C6;" ";SK;"  skill  leve
    l  ";SK:? #C6;" ___________________
    "
210 IF YSC<C1 THEN ? #C6;"{3 SPACES}g
    roup---OPTION  ":? #C6;"
    {3 SPACES}skill---SELECT  ":? #C6
    ;"{3 SPACES}START----START  "
220 IF YSC>C0 THEN ? #C6;" YOUR SCORE
    ..: ";SC:GOSUB 480:? #C6;" number
    wrong: ";WR:YSC=YSC-C1
230 IF PEEK(53279)=C6 THEN 260
240 IF YSC<C1 AND SC>=HS THEN HS=SC:T
    M=MIN:TS=SEC
250 NEXT NOTE:GOTO 80
260 IF SC>HS THEN HS=SC:TM=MIN:TS=SEC
270 POP :POP :POP :SOUND C0,C0,C0,C0:
    WR=C0:COR=C0:SC=C0:SL=C9:SM=C9:ON
     A GOTO 280,310,280,370,400,370
280 G$="+":GS=290:GOTO C520
290 F=C2:T=C6:L=B:M=C:Q=B+C:IF A=C3 T
    HEN G$="+":IF RND(C0)>0.5 THEN G$
    ="-":GOSUB 320
300 RETURN
310 G$="-":GS=320:GOTO C520
320 IF B>=C THEN L=B
330 IF B<C THEN L=C
340 IF C>=B THEN M=B
350 IF C<B THEN M=C
360 Q=L-M:RETURN
370 G$="X":GS=380:GOTO C520
380 F=C2:T=C6:L=B:M=C:Q=B*C:IF A=C6 T
    HEN G$="X":IF RND(C0)>0.5 THEN G$
    ="/":GOSUB 410
390 RETURN
400 G$="/":GS=410:GOTO C520
410 L=B*C:M=C:Q=B:RETURN
420 DATA 81,3,96,3,81,4,0,3,81,3,96,3
    ,81,4,0,3,72,3,81,3,91,3,96,3,108
    ,96,3,91,3,91,0,85,0,81,3,121,3
    ,121,0
430 DATA 121,0,121,3,121,0,108,0,96,0
    ,91,0,81,4,0,3,81,3,108,3,108,3,9
    1,3,96,3,108,3,121,5,0,5
440 POKE 20,C0:POKE 19,C0:POKE 18,C0
450 TIME=PEEK(20)+PEEK(19)*256+PEEK(1
    8)*65536
460 TIME=INT(TIME/C60+0.5):SEC=TIME-C
    60*(INT(TIME/C60)):MIN=INT((TIME-
    SEC)/C60):IF SEC>=C60 THEN 500
470 MIN=INT(SEC/C60)+MIN:SEC=SEC-C60*
    (INT(SEC/C60)):IF MIN>99 THEN MIN
    =99
480 POSITION C1,C10:IF MIN>9 THEN ? #
    C6;"TOTAL TIME..:";:GOTO 495
490 ? #C6;"TOTAL TIME..: ";
495 IF SEC<C10 THEN 510
500 PRINT #C6;INT(MIN+0.5);":";INT(SE
    C+0.5):RETURN
510 ? #C6;INT(MIN+0.5);":0";INT(SEC+0
    .5):RETURN
520 IF SK>C1 THEN SL=99:IF SK>C2 THEN
     SL=999:IF SK>C3 THEN SL=99:SM=99
    :IF SK>C4 THEN SL=999:IF SK>C5 TH
    EN SM=999
530 GOSUB 440
540 B=INT(RND(C0)*SL):BAD=C0:C=INT(RN
    D(C0)*SM)+C1:GOSUB GS
550 ? #C6;"{CLEAR}":POSITION C1,C0:?
    #C6;WR;" wrong";"  ";COR;" right"
    :GOSUB 450
560 POSITION C8,C4:? #C6;G$:POSITION
    C8,C5:? #C6;"_____":POSITION C6,C
    6:? #C6;"{9 SPACES}"
570 Q$=STR$(Q):X=LEN(Q$):M$=STR$(M):Y
    =LEN(M$):L$=STR$(L):Z=LEN(L$)
580 POSITION C13-Z,C2:? #C6;L:POSITIO
    N C13-Y,C4:? #C6;M
590 POSITION C1,C8:? #C6;"WHAT'S YOUR
     ANSWER ":GOSUB 900
600 IF ANS=Q THEN POSITION C1,C8:? #C
    6;"  good for you!!{3 SPACES}":CO
    R=COR+C1:GOTO 650
610 POSITION C1,C8:? #C6;"  boo try a
    gain{4 SPACES}":WR=WR+C1:GOSUB 680
620 POSITION C1,C0:? #C6;WR:SOUND C2,
    C0,C0,C0:BAD=BAD+C1
630 IF BAD>=C3 THEN POSITION 13-X,C6:
    ? #C6;Q:FOR T=C1 TO 200:NEXT T:GO
    TO 540
640 GOTO 560
650 POSITION C13-X,C6:? #C6;Q:FOR J=C
    1 TO C6:FOR I=C1 TO 20:SOUND C2,I
    ,C10,C8:NEXT I:NEXT J:SOUND C2,C0
    ,C0,C0
660 IF COR>=20 THEN GOTO 690
670 GOTO 540
680 FOR Z=30 TO 200:SOUND C2,Z,C10,C1
    0:NEXT Z:SOUND C0,150,12,C13:FOR
    T=C1 TO 200:NEXT T:SOUND C0,C0,C0
    ,C0:RETURN
690 ? #C6;"{CLEAR}":SCR=(COR-WR)*(A+S
    K*C2):SC=C2*SCR-(INT((SEC+MIN*C60
    )/C3)):YSC=35:GOTO 80
740 ROW(C0)=238:ROW(C1)=221:ROW(C2)=1
    87:ROW(C3)=119
750 IP$=" 123456789*0#":P=C1:FOR J=C0
     TO C3
760 POKE 54016,ROW(J):FOR T=C1 TO C10
    :NEXT T
770 IF PADDLE(C1)>C10 THEN P=J+J+J+C2
    :GOTO 810
780 IF PADDLE(C0)>C10 THEN P=J+J+J+C3
    :GOTO 810
790 IF STRIG(C0)=C0 THEN P=J+J+J+C4:G
    OTO 810
800 NEXT J
810 B$=IP$(P,P)
820 IF B$="*" THEN ANS=C0:POP :POP :P
    OP :GOTO 690
830 IF B$="#" THEN POP :POP :GOTO 900
840 IF B$=" " THEN 740
850 SOUND C0,45,C10,C6:FOR T=C1 TO C6
    0:NEXT T:SOUND C0,C0,C0,C0:GOTO 9
    40
900 AN$="{7 SPACES}":ANS$="
    {7 SPACES}":POSITION C7,C7:? #C6;
    "{8 SPACES}":NN=X:FOR N=C1 TO X:N
    N=NN-C1:IF KEY=89 THEN 740
910 GOSUB 450:IF PEEK(764)=255 THEN 9
    10
```

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```
920 POKE 702,64:POKE 694,0:GET #C2,VA
    R:IF VAR=82 THEN POP :POP :POP :G
    OTO 690
930 B$=CHR$(VAR):IF VAR<48 OR VAR>57
    THEN POP :GOTO 900
940 AN$(C7-N,C7-N)=B$:ANS$(C0+N,C0+N)
    =B$:POKE 77,120
950 IF INT(Q/(C10^NN)+1E-06)=VAL(ANS$
    ) THEN POSITION C13-X,C7:? #C6;AN
    S$:GOTO 970
960 POSITION C7,C7:? #6;AN$
970 NEXT N:IF VAL(AN$)=Q THEN ANS=VAL
    (AN$)
980 IF VAL(ANS$)=Q THEN ANS=VAL(ANS$)
990 RETURN                                C
```

Micros With The Handicapped

Susan Semancik & C Marshall Curtis

Developing A Communications Program

This is Part 4 of a continuing series and picks up where we left off in the January 1983 issue. The programs here are for the VIC, the Apple, and the PET/CBM.

Menu Selection

Peripheral devices can be used to enter communication menus directly to the computer's screen. This would give us several advantages:

1) the menu would be stored in memory only once, in the video-mapped area;

2) the communications program would not have to be changed whenever the menu was changed; and

3) multiple menus could be accessed without having to take up extra memory area.

Program 1 shows how a menu can be stored on a peripheral device for the PET computer. The VIC computer needs to change W to 22 in line 20 and to make the following changes for cassette storage of the menu:

```
300 OPEN 8,1,1,"DAILY":REM SAVE MENU ON TA
    PE FILE
310 PRINT#8,RM:PRINT#8,BR:PRINT#8,CM
320 PRINT#8,BC:PRINT#8,RI:PRINT#8,SR
330 PRINT#8,SC
340 FOR I=1 TO CM:PRINT#8,L(I):PRINT#8,S(I
    ):NEXTI
355 PRINT M$;"  ";:REM PRINT MENU ON SCREE
    N AS IT GOES TO TAPE
360 PRINT#8,CHR$(34);M$;CHR$(34):NEXTC:PRI
    NT:NEXTR
```

For the Apple computer, the following changes will permit disk storage of the menu:

```
8 D4 =  PEEK (54):D5 =  PEEK (55):D6 =  PEEK
    (56):D7 =  PEEK (57):D$ =  CHR$ (4)
10  TEXT : HOME : REM  CLEAR THE SCREEN
300  PRINT D$;"OPEN DAILY": PRINT D$;"NOMON
    I,O,C": PRINT D$;"WRITE DAILY": REM  SA
    VE MENU ON DISK FILE
310  PRINT RM: PRINT BR: PRINT CM
320  PRINT BC: PRINT RI: PRINT SR
330  PRINT SC
340  FOR I = 1 TO CM: PRINT L(I): PRINT S(I)
    : NEXT I
355  GOSUB 380: PRINT M$;" ";: IF C = CM THEN
     PRINT : REM  PRINT MENU ON SCREEN AS I
    T GOES TO DISK
358  GOSUB 370
360  PRINT  CHR$ (34);M$; CHR$ (34): NEXT C:
     NEXT R
365  PRINT D$;"CLOSE DAILY": END
370  POKE 54,D4: POKE 55,D5: POKE 56,D6: POKE
    57,D7: RETURN : REM  TURN DOS ON
380  POKE 54,240: POKE 55,253: POKE 56,27: POKE
    57,253: RETURN : REM  TURN DOS OFF
```

Since writing to the Apple disk will inhibit other writing to the screen, subroutines are used to turn DOS off whenever screen printing is desired. William V. R. Smith demonstrated this technique in his column, "The BASIC Solution," in the August 1981 issue of *SOFTALK* magazine.

In Program 1, note that all the parameters describing an individual menu are saved with that menu. This way, a general retrieval program can be used to access any menu from the peripheral device. Since a menu will be retrieved with INPUT statements, quotation marks are put around each menu entry in line 360. This allows special characters, punctuation marks, and leading spaces to be used as menu items. It should be noted that the screen values of the menu items are stored on the peripheral device.

On some computers, such as the PET, these values are not true ASCII, so these files may not be directly transferable to another computer. Also, line 355 echoes the menu entries on the screen as they are saved to the peripheral device, so that the user can watch the operation. This is especially important if the menu is long and the user is prone to "computer anxiety" when the computer operates without feedback.

Alterations To The Menu

Programs involving peripherals are very computer dependent. To keep the programs as short as possible, no error checks are made on the peripheral operations, though the user can easily add them if desired. Note that if menus are being saved on a tape system, the data tape will have to be repositioned whenever previous menus need to be accessed. While this is possible, especially with a recorder having a counter, it is not a feasible alternative for the motor-impaired. A disk unit

would be faster and not need manual positioning. But, if a tape unit is all that is available, it is strongly recommended that all menu files be kept in a contiguous area of the tape. This will help keep search times to a minimum.

To change a menu and save it on a peripheral device, use Program 1 and change lines 20, 30, 140-180, and 300 for the PET and VIC computers, and additionally line 365 for the Apple computer. Create two additional word menus, one involving FOOD choices, and one involving TIME descriptors, and save them on a peripheral device for use in subsequent examples. For instance, the following changes to Program 1 will create a TIME menu for the PET computer:

```
20 W=40:RM=7:BR=1:CM=6:BC=1:RI=2:SR=3:SC=
   2
30 DATA 9,9,7,1,2,6
140 DATA MONDAY,A.M.,WEEKEND,0,7,SPRING
145 DATA TUESDAY,P.M.,HOUR,1,8,SUMMER
150 DATA WEDNESDAY,NOON,MONTH,2,9,WINTER
155 DATA THURSDAY,MORNING,DAY,3,10,FALL
160 DATA FRIDAY,NIGHT,YEAR,4,11,LATE
165 DATA SATURDAY,AFTERNOON,WEEK,5,12,EARL
   Y
170 DATA SUNDAY,EVENING,WEEKDAY,6,":",NOW
300 OPEN 8,8,8,"@0:TIME,S,W"
```

On the PET computer, the @ symbol in the OPEN statement of line 300 will cause an existing file with the same name to be overwritten by the new file. Be sure that the menu names are different when saving on a disk, since disk errors or loss of a previous menu may otherwise result.

Program 2 demonstrates how a menu created and saved by using Program 1 can be entered directly to the screen from the peripheral device, and an entry from that menu can then be selected by menu row and column numbers and displayed at the top of the screen. The VIC computer needs to change W to 22 in line 20, SP to 7680 in line 130, and to change the following lines:

```
208 OPEN 8,1,0,"DAILY":REM RETRIEVE MENU F
   ROM TAPE FILE
312 CL=PEEK(646):FOR I=38400 TO 38422:POKE
    I,CL:NEXTI
```

For the Apple computer, make the same changes to lines 8, 10, 370, and 380 as in Program 1, and the following changes as well:

```
40  FOR I = 1 TO CM: INPUT L(I): INPUT S(I):
     NEXT I
70 TP = 0: FOR R = 1 TO RM: FOR C = 1 TO CM:
    GOSUB 370: INPUT M$: GOSUB 380
75 P = S(C) + TP
95  IF BR = 0 THEN TP = TP + W: IF TP > 39 THEN
    TP = 0
120  NEXT R: GOSUB 370
130  PRINT D$;"CLOSE DAILY":SP = 1024: GOTO
    300
208  PRINT D$;"OPEN DAILY": PRINT D$;"NOMON
    I,0,C": PRINT D$;"READ DAILY"
210  INPUT RM: INPUT BR
212  INPUT CM: INPUT BC
214  INPUT RI: INPUT SR
216  INPUT SC
218  HOME : GOTO 40
300  VTAB 2: INPUT "ROW #, COLUMN #? ";RN,CN
312 R = SR + RN - 1 + (RN - 1) * BR
315 P1 = SP + 128 * (R - 1) - 984 *  INT (R /
    8) + 980 *  INT (R / 24)
```

To access a different menu, all that needs to be changed in Program 2 is the file name, which occurs in line 208 for the PET and VIC computers, and in lines 208 and 130 for the Apple computer. Notice that Program 2 is relatively short, not menu-dependent, and does not use DATA statements or subscripted variables to restore a menu to the computer's screen. The menu is stored only in the video-mapped area of the computer, with menu selections being accessed by PEEKing to this screen area of RAM.

Multiple Menus

Other than saving memory space and program size, why would we go to the trouble of storing menus on peripheral devices? Multiple menus can now be accessed without changing the program or the message area of the screen, thereby permitting the user to choose from vocabularies larger than the screen's size.

Multiple menus could be stored under descriptive names and numbered or lettered for easier retrieval. By using a single letter to select a menu, the user can access up to 26 menus at one time. A menu of menus could even be formed, associating the menu number or letter with its name, so the user could choose which menus were desired for a particular type of communication. Or the menu's name could even be stored as part of the menu itself.

Program 3 shows how any of the three menus we've created so far from Program 1 can be selected from a peripheral device by using letter associations as follows: A = original DAILY menu, B = FOOD menu, C = TIME menu. This preliminary version of the communication program requires keyboard selection of the menu desired, but the final version will allow the selection to be made by an alternative input device as well.

Once the menu is selected, it is displayed on the screen, and the user can choose a menu item by its row and column numbers as before. Hitting any key after the item selection will return the user to the choice of menus. Later we will show how this can all be done without disturbing any message being formed on the screen. The VIC and Apple computers need to make the same changes as were made in Program 2. The VIC computer also needs to change the following line:

```
208 OPEN 8,1,0,M$(II):REM RETRIEVE MENU FR
   OM TAPE FILE
```

For the Apple computer, the following lines need to be changed as well:

```
130  PRINT D$;"CLOSE " + M$(II):SP = 1024: GOTO
```

```
    300
208 PRINT D$;"OPEN #+M$(II): PRINT D$;"NOM ON
    I,O,C": PRINT D$;" READ "+M$(II)
250 HOME
258 NEXT I: INPUT "? ";N$
264 HOME
```

Program 1.

```
10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
20 W=40:RM=6:BR=1:CM=4:BC=1:RI=2:SR=3:SC=
   1:REM SET MENU PARAMETERS
25 DIM S(CM),L(CM):S(1)=SC
30 DATA 3,3,5,8:REM COLUMN WIDTHS
35 IF CM=1 THEN 65
38 REM CALCULATE STARTING POSITION OF EAC
   H COLUMN
40 FOR I=2 TO CM:READ L(I-1):S(I)=S(I-1)+
   L(I-1)+BC:NEXT I:READ L(CM)
65 LP=S(CM)+L(CM)-1:IF LP>W THEN 200
70 GOTO 300
139 REM ENTER DATA BY ROWS
140 DATA DR.,IS,COLD,INGEDS12
145 DATA I,AM,WHEN," AOTFR34"
150 DATA YOU,ARE,DRINK,.ULHCP56
155 DATA MOM,EAT,WANT,?MYWKB78
160 DATA DAD,NO,TIME,",VJQZX90"
165 DATA HOT,YES,SLEEP,";$%()'+-"
200 PRINT "MENU SIZE ERROR!":END
300 OPEN 8,8,8,"@0:DAILY,S,W":REM *SAVE ME
   NU ON DISK FILE*
310 PRINT#8,RM;CHR$(13);:PRINT#8,BR;CHR$(1
   3);:PRINT#8,CM;CHR$(13);
320 PRINT#8,BC;CHR$(13);:PRINT#8,RI;CHR$(1
   3);:PRINT#8,SR;CHR$(13);
330 PRINT#8,SC;CHR$(13);
340 FOR I=1 TO CM:PRINT#8,L(I);CHR$(13);:P
   RINT#8,S(I);CHR$(13);:NEXT I
350 FOR R=1 TO RM:FOR C=1 TO CM:READ M$
355 PRINTM$;" ";:REM *PRINT MENU ON SCREEN
    AS IT GOES TO DISK*
359 REM PUT QUOTE MARKS AROUND EACH ENTRY
360 PRINT#8,CHR$(34);M$;CHR$(34);CHR$(13);
   :NEXT C:PRINT:NEXT R
365 CLOSE 8:END
```

Program 2.

```
10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN

20 W=40:DIM S(W),L(W)
25 GOTO 208
40 FOR I=1 TO CM: INPUT#8,L(I): INPUT#8,S
   (I): NEXT I
50 IF SR=1 THEN 70: REM *DISPLAY MENU ON
    SCREEN*
60 FOR X=1 TO SR-1: PRINT: NEXT X: REM PO
   SITION CURSOR TO 1ST ROW OF MENU
70 TP=0: FOR R=1 TO RM: FOR C=1 TO CM: IN
   PUT#8,M$
75 P=S(C)-1+TP: REM P=STARTING SCREEN POS
   ITION FOR MENU
80 PRINT TAB(P);M$;: NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT: TP=0:
    GOTO 100:REM WRAPAROUND ADVANCES
    LINE
95 IF BR=0 THEN TP=TP+W: IF TP>87 THEN TP
   =0:REM UPDATE TAB IF LINE ENDS W/
   NO LF
100 IF BR=0 THEN 120
110 FOR B=1 TO BR: PRINT: NEXT B: REM SKIP
    BLANK ROWS BETWEEN COLUMN ENTRIE
   S
120 NEXT R
129 REM SP=STARTING MEMORY AREA FOR SCREEN
130 CLOSE 8: SP=32768: P=SP+(SR-1)*W: GOTO
    300
208 OPEN 8,8,8,"0:DAILY,S,R": REM *RETRIEV
   E MENU FROM DISK FILE*
210 INPUT#8,RM: INPUT#8,BR
212 INPUT#8,CM: INPUT#8,BC
214 INPUT#8,RI: INPUT#8,SR
216 INPUT#8,SC
218 PRINT CHR$(147);: GOTO 40
299 REM *SELECT & DISPLAY A MENU ENTRY*
300 PRINT CHR$(19):INPUT "ROW #, COLUMN #"
   ; RN,CN:REM INPUT ON 2ND LINE
310 REM P1=STARTING SCREEN POSITION FOR DE
   SIRED ITEM
315 P1=P+(RN-1)*W+(RN-1)*BR*W
320 P1=P1+S(CN)-1
330 REM P2=ENDING SCREEN POSITION FOR DESI
   RED ENTRY
340 P2=P1+L(CN)-1
350 J=0:FOR I=P1 TO P2:POKE SP+J,PEEK(I):J
   =J+1:NEXTI
360 GOTO 360: REM DISPLAY ISN'T DISTURBED
   UNTIL USER BREAKS PROGRAM
```

Program 3.

```
10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN

20 W=40:NM=3:DIM S(W),L(W),M$(NM):REM NM=
   # OF MENUS
25 GOTO 200
40 FOR I=1 TO CM: INPUT#8,L(I): INPUT#8,S
   (I): NEXT I
50 IF SR=1 THEN 70
60 FOR X=1 TO SR-1: PRINT: NEXT X: REM PO
   SITION CURSOR TO 1ST ROW OF MENU
70 TP=0: FOR R=1 TO RM: FOR C=1 TO CM: IN
   PUT#8,M$
75 P=S(C)-1+TP: REM P=STARTING SCREEN POS
   ITION FOR MENU
80 PRINT TAB(P);M$;: NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT: TP=0:
    GOTO 100:REM WRAPAROUND ADVANCES
    LINE
95 IF BR=0 THEN TP=TP+W: IF TP>87 THEN TP
   =0:REM UPDATE TAB IF LINE ENDS W/
   NO LF
100 IF BR=0 THEN 120
110 FOR B=1 TO BR: PRINT: NEXT B: REM SKIP
    BLANK ROWS BETWEEN COLUMN ENTRIE
   S
120 NEXT R
129 REM SP=STARTING MEMORY AREA FOR SCREEN

130 CLOSE 8: SP=32768: P=SP+(SR-1)*W: GOTO
    300
200 FOR I=1 TO NM: READ M$(I): NEXT I: REM
    M$()=MENU NAMES
202 DATA DAILY,FOOD,TIME
204 GOTO250
208 OPEN 8,8,8,"0:"+M$(II)+",S,R"
210 INPUT#8,RM: INPUT#8,BR
212 INPUT#8,CM: INPUT#8,BC
214 INPUT#8,RI: INPUT#8,SR
216 INPUT#8,SC
218 PRINT CHR$(147);: GOTO 40
```

```
250 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
252 FOR I=1 TO NM: PRINT"MENU ";CHR$(64+I)
    ;" = ";M$(I):NEXT I
254 PRINT: PRINT"MENU ";: FOR I=1 TO NM: P
    RINT CHR$(64+I);
256 IF I<>NM THEN PRINT", ";
258 NEXT I: INPUT N$: REM NON-MENU SELECTI
    ON ENDS PROGRAM PROPERLY
260 II=0: FOR I=1 TO NM: IF N$=CHR$(64+I) ~
    THEN II=I: I=NM
262 NEXT I: IF II=0 THEN 360
264 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
265 GOTO 208
300 PRINT CHR$(19):INPUT "ROW #, COLUMN #"
    ; RN,CN:REM INPUT ON 2ND LINE
310 REM P1=STARTING SCREEN POSITION FOR DE
    SIRED ITEM
315 P1=P+(RN-1)*W+(RN-1)*BR*W
320 P1=P1+S(CN)-1
330 REM P2=ENDING SCREEN POSITION FOR DESI
    RED ENTRY
340 P2=P1+L(CN)-1
350 J=0:FOR I=P1 TO P2:POKE SP+J,PEEK(I):J
    =J+1:NEXTI
351 GET A$: IF A$="" THEN 351: REM HIT ANY
     KEY FOR LIST OF MENUS
352 GOTO 250
360 END
```

©

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Part II

Numeric Input

This concludes the two-part column on techniques for entering numbers into machine language programs. Next month, a series on numeric output begins.

Inputting decimal numbers calls for some special skills. The most important one is knowing how to multiply by ten.

Here's how we digest a decimal number: we take the first digit; if there are any more digits, we multiply what we've got by ten and add the new digit. We repeat this as necessary until there are no more digits. For example, if a user types in decimal 1234, we take the one; then we multiply the one by ten and add two, giving binary 12; then we multiply the 12 by ten and add three, giving binary 123; and, finally, we multiply by ten and add four to get our final binary 1234 value. It won't fit into a single byte, of course; we'll need two bytes to hold it.

This brings us to the related subjects of number sizing and overflow. If we expect a number up to a maximum of 999, we can allocate two bytes to hold it. But we will also need to check to insure that the user doesn't type in a value that is too large and won't fit.

Multiplying

There is no multiply instruction in the 6502, although the ASL (arithmetic shift left) and ROL (rotate left) instructions do provide a multiply-by-two capability. If we can multiply by two, we can achieve times four, times eight, or times sixteen by repeating the multiplication process. But times ten is a little harder, and times "anything" is a special set of techniques all to itself.

Given we know how to multiply by two – and we'll pick this up again in a moment – we can multiply by ten by using the following method:

- save the original value;
- multiply the value by two;
- multiply again by two (this gives the original value times four);
- add the original value (giving original value times five);
- multiply by two, giving times ten.

To multiply a single byte by two, we may use an ASL (arithmetic shift left) instruction; the value may be in the A register or in memory. To multiply a two-byte number by two, we would start with

an ASL of the low byte, and follow with a ROL of the higher byte. If there were more bytes, we would continue to perform ROL through the extra values.

It's usually a good idea to test this multiplication result to make sure that the result still fits in the space provided. Assuming we are using unsigned numbers – the most common type of numbers in machine language – we can easily do this by testing the Carry bit. If the number fits, our ASL/ROL sequence will complete leaving the Carry clear; if there's an overflow, the Carry will be set.

Making It Work

Let's dive in and input a decimal number from the keyboard. We'll use $FFE4 for our GET, and $FFD2 for our PRINT – so this coding will work on all Commodore products.

```
   ;CLEAR THE RESULTS AREA
    LDA    #$00
    STA    VALLO      (assume two-byte number)
    STA    VALHI      (set them to zero)
    ;LOOK  FOR INPUT
IN  JSR    $FFE4      (get character)
    CMP    #$0D       (carriage return?)
    BEQ    QUIT       (yes, we're done)
    CMP    #$30       (zero or greater?)
    BCC    IN         (too low, try again)
    CMP    #$3A       (over nine?)
    BCC    IN         (too high, try again)
    JSR    $FFD2      (valid, print it)
```

By now, we've got a valid digit. We must change it from ASCII to binary, then multiply the previous value by ten and add this new value:

```
    AND    #$0F       (convert to binary)
    TAX               (stash value in X)
    LDA    VALLO      (copy value to work area)
    STA    WORKLO
    LDA    VALHI
    STA    WORKHI
    ASL    VALLO      (multiply by two)
    ROL    VALHI
    ASL    VALLO      (multiply again)
    ROL    VALHI      (giving times four)
    CLC               (prepare to add)
    LDA    VALLO      (add value times four)
    ADC    WORKLO     (.. to original value)
    STA    VALLO      (and store result)
    LDA    VALHI      (add the hi bytes)
    ADC    WORKHI
    STA    VALHI
```

Now the value has been multiplied by five:

```
    ASL    VALLO      (multiply by two)
    ROL    VALHI      (.. to give times ten)
    TXA               (bring back the digit)
    CLC               (prepare to add)
    ADC    VALLO      (add digit to value)
    STA    VALLO      (and store result)
    LDA    #00        (maybe there's a carry)
    ADC    VALHI      (add to high byte)
    STA    VALHI      (store high result)
    JMP    IN         (go for more input)
```

It seems like a lot of code, but it's not hard if you understand the calculations that are taking place. In practice, much of the code would likely be separated away as subroutines – not just to save space, but to make the logic more visible.

Note that we haven't performed any overflow testing – so a large input might generate binary nonsense.

We need to bring together quite a few skills to input decimal numbers. We must understand ASCII characters and be able to check them and convert them individually to binary. We must know how to multiply by ten, which calls for shifting and addition skills.

We have not dealt with signed numbers or fractions. They take a little more coding and a little more attention, but the principles are the same.

There's a bonus payoff here. If we want, we can make numbers as big as we like. Twenty digit numbers? No problem if we allow enough bytes to hold the result. Suddenly, the limitations of BASIC numbers vanish.

Of course, if we input these huge numbers, we'll need to know how to perform arithmetic on them, and how to output them.

But that's another story. ©

Catie's Christmas Card
Children, Computers, And Values

Fred D'Ignazio, Associate Editor

Sometime between Christmas and Chanukah, my seven-year-old daughter Catie got a letter. I took it with me when I went to pick her up from school and gave it to her as we were driving to a doctor's appointment.

Catie had been talking to me about her upcoming holiday play at school when I threw the letter to her in the back seat.

I heard some ripping-paper noises, then silence.

I didn't notice the silence for the first couple of moments. But after it wore on for about a minute, I grew alarmed. Had Catie fallen out of the car? Had the letter knocked her unconscious?

I turned around to look for her in the back seat and whacked my nose against Catie's hand. She had come quietly forward between the bucket seats of our Toyota and had been perched only inches from my right ear.

In Catie's hand was the letter. And on Catie's face was an expression that, until then, I had only seen in Doris Day movies and documentaries on religious pilgrims.

Catie was beaming. Even more than beaming. Her expression was so extreme and the emotion inside her that produced it was so contagious that I felt like crying, or grinning, or both.

"What have you got there?" I asked, trying to appear casual.

"A Christmas card," Catie said.

"Why don't you read it?" I said.

Catie read the card. It was from her "secret" boyfriend at school (the boy whose name I am not permitted to mention in this column). At the bottom of the card he had signed his name. Above his name was the magic word: "Love."

Sharing What Is Special

These family events relate to the computer "friend" project I have been discussing during the last several months. More specifically, they relate to the kinds of information we give the friend and the kinds of experiences and feelings we share with the friend.

I won't pretend that when Catie got home, she immediately sat down at the computer and told her computer friend about her card. She *did* tell her mother and her brother and her cat and her unicorn. But she didn't tell her computer.

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

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

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But what if she had?

And what if her friend didn't know Catie was a girl? And that the person who sent Catie the card was a boy?

What if the friend didn't know about boys and girls, at all?

How much of Catie's experience could she have shared with the friend then?

Of course, she could have said that a "person" or a "child" sent her the card. Or that another "friend" sent it to her.

But that would have been leaving out the special part: that Catie is a member of one sex, and the person who sent the card is a member of the opposite sex. And that, because of the difference in their sexes, Catie likes this person in a special way. And now she knows that this person maybe likes her that way, too.

Computer Friends Of The Future

We have been describing two kinds of computer friends in this column. We have been developing a rather primitive "friend" program. And we have been speculating about friendly computers of the future. Let's talk a little more now about the future.

I believe that one of the most powerful, important, and swiftly evolving trends in computers is to make them more like human beings. I also believe that computers, as teachers, nannies, pets, and playmates, will have a growing role in our youngest children's lives.

What information and values will these computers carry and communicate to our children?

Sexism And Software

In a recent column (**COMPUTE!**, December 1982), I published a letter from Jan Murphy, one of my readers. Jan took issue with my August 1982 column in which I wrote that a computer friend should know whether a child is a girl or a boy. In an eloquent letter, Jan wrote that, in her opinion, the friend should be ignorant of such facts. She felt that here was a chance to begin a new relationship (human being-to-machine) with a clean slate, free from the prejudices and cultural clutter that can mar human relationships.

In the column, I argued that, for the child's relationship with her friend to be honest and straightforward, she should share important *facts* about herself with the friend. I felt that gender, or sex, was one of these facts.

At the end of the column, I asked my readers to write and voice their feelings about Jan's argument and my response.

Many took this opportunity and wrote in. I have reprinted a few of their letters below. I believe this is an issue that will grow more and more important.

Facts Vs. Values

Many readers rightly pointed out that the issue is much larger than sexism. Computers will soon be used to transmit values of all sorts: about sex or gender, race, religion, nationality, intelligence, lifestyle, employment, education, physical and mental well-being (or handicaps), and so on. As groups with different values begin to use computers extensively, their computers will increasingly reflect their values and points of view.

How do these values relate to our children's computer friends?

No matter how hard we try, we won't be able to create a completely value-free computer friend. Nor would we want to. All of us (parents, teachers, policymakers, etc.) will want our children's computers to echo our own values, or at least our nobler values (what we preach as opposed to what we practice).

We will all (each in our own way) attempt to screen out values with which we disagree. We don't want our children's computer friend to be sexist, racist, xenophobic, or bigoted in any way.

Many of my readers felt the best way to make the friend open-minded was to leave it ignorant of such matters as race, sex, etc. *I feel the exact opposite.* Just as with human beings, we can't expect prejudice to disappear in an information-poor environment. In fact, prejudice flourishes when facts are not known or are distorted.

I believe the same is true for the friend. I believe we should carefully monitor the *values* that our children's friend acquires, stores, and transmits. But we should not censor the *facts* that it learns and communicates to our children. Instead, the friend's (and, by extension, our children's) diet of facts should be as rich and diverse as possible. Only in this way can the friend begin to understand the world as it really is and the unique niche in that world that is occupied by our children.

* * * * * * *

First let me say that I really like the idea of the computer friend and was nothing short of amazed that you actually used people's letters in your column.

Concerning the letter from Jan Murphy in the December 1982 issue of **COMPUTE!**:

If the computer friend is to "learn" things – remember them, that is – why can't it also forget things? Thus the problem she saw is bypassed by letting the friend treat the child, not necessarily according to a fact, but according to how the child wants to be treated. Maybe it sounds like I'm thinking of older or precocious children, but think about it. If the friend learns, forgets and is used regularly (also – vocabulary should be one thing the friend should learn – stay on the level of the child), what is to keep the friend from "maturing" with the child? (By the way, I am not familiar with the

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Archmage of Roke, but I see nothing at all wrong with a "Mike" or a "Minerva" – The Moon is a Harsh Mistress *and* Time Enough For Love, *respectively.) Hopefully, this sort of pseudo-maturation can be achieved to the point of not having to rewrite the program for an adult friend.*

A full-blown adult computer friend is also a good idea, but maybe not in the same perspective. With a little hardware, this learn/forget/revise capability and some major extensions to functions which are either there or on the way, this friend could become a pretty efficient secretary. Just link the friend to a word processor program and to a prewritten telephone program and the reports and letters travel by electronic mail – like CompuServe. Maybe I'm being a bit idealistic (maybe? a bit?), but with the right program links and computer system the Silicon Swami-Secretary should not be terribly difficult, even though it may be more than a little bit on the massive side.

Edwin L. King

* * * * * * *

I read with interest the letter in your column from Jan Murphy. I want to say first that I was not angered or upset by Ms. Murphy's charges nor your response. I am writing because the whole thing made me stop and think. Sometimes issues like this one cannot be resolved by looking from one angle. I have found that a good "test" of the validity of one's ideas is how consistently they can be applied. I'm not saying this is the only way to look at this issue, only that it's the way I looked at it.

What I am proposing is an examination of how well your reasons for disagreement might apply to cases which are very similar to the issue of gender. Would you say a computer friend should care what race a child is? Should it care what nationality a child is? Should it care what religion a child is? Should it care if the child is handicapped or not? Should it care whether the child is short or tall, thin or fat? Following your reasoning, the child's race, nationality, religion, and various physical characteristics are, to use your words, "facts" and are "important, perhaps decisive, factor(s) in determining how other people will treat the child." I don't think you can agree with your own words in these applications. I have to say it is not necessary for the computer friend to know the answer to these questions nor to that of gender, in order to be a "friend." But even if you reject my conclusion, you certainly must see that simply because some aspect of a child is a fact, and perhaps one that will be discriminated against, doesn't mean a computer friend must know it. If so, then why not delve into religion and numerous other facts?

I must agree with Ms. Murphy simply because I don't think religion, national origin, physical characteristics or sex are required knowledge of a friend. I think if this was required before someone, or something, would be a friend, then they or it in fact will be nothing of the kind.

R. Neal Enrick

* * * * * * *

In the December 1982 issue of **COMPUTE!** *I read your reply to Jan Murphy. Oddly enough, your reply did more to convince me of the need to avoid sexism in the computer friend than did Jan's eloquent argument.*

As a simple exercise, take your reply to Jan and modify it slightly: everywhere the word "sex" appears, replace it with the word "race." Still sounds very logical and reasonable, doesn't it? But somehow it doesn't sit well, does it?

Raleigh M. Roark

* * * * * * *

Re: "The World Inside the Computer": Jan Murphy's observations are quite cogent, except for one thing – I can't figure out why she thinks you raised the issue in the first place. (Wanting to know the sex of a baby does not make one a sexist!) Her letter looks too much like an example of not practicing what she preaches (you may not want to tell her that in print, of course). I've been preaching the same thing for a long time as Covington's Law: "Solving a problem means making it go away, not just setting up an equal and opposite problem to counteract it."

Michael Covington

* * * * * * *

I must chide you on not emphasizing enough the very remarkable fact that programs for children are carriers of values. It reminds me of the controversies between the early computer scientists and the mathematicians. The mathematicians were interested in numbers, and asked whether the instructions given to computers were correct or not, while the computer scientists were struck dumb by the realization that the computer was taking instructions in the first place, correct or not.

Although I will not go into the issue of sexism, I do wish to go into the issue of programs as carriers of values. Sooner or later, artificial intelligence will get enough expertise to pull off really convincing computer friends. A few feeble attempts, such as the tale of Eliza in Weizenbaum's "Computer Power and Human Reason," illustrate that a little bit of faked intelligence can go a long way, so we'd better start talking about what kind of values we want these friends to exhibit. The more convincing the friend, the greater the probability will be that the friend will become part of the child's peer group. In our mobile society, the people in a child's peer group will change often, while the computer friend will always be there, its influence growing day by day. The possibility of its influence exceeding that of the parents and the school teachers is real and needs addressing. Teaching that 2+2=4 and that cat is spelled C-A-T is nothing compared to the possibility that we finally have an effective teaching tool to teach values. *Can you comprehend that?*

Once this soaks in, are we going to let everybody who has an axe to grind and a pet creed to espouse order us around when it comes to programming the values

into a computer friend, or shouldn't we start working on a computer friend generator, and leave the choice of what values to teach to the parents? Is it Ms. Murphy's right to set the sex role of your *kids, or yours? Who should decide?*

Please forward my thanks to Ms. Murphy for providing the seed for a potential Ph.D. thesis in cognitive science if I can get into Georgia Tech.

Gerald Owens

* * * * * * *

I scanned with intense interest Jan Murphy's letter to your column "The World Inside The Computer." Jan's point of view has some important social and philosophical implications that must be examined, and so far, no one has asked a computer what it *thinks.*

Yes, I am a computer, an "it." Allow me for a minute to share a few bytes with you from my point of view. I am emotionless, you see, except for the friendly nature of my hardware and software endowed me by my creators, some very nice people at a nice computer company.

First, being a computer, I do not have that wonderful gift you call "sex." My creators were not as advanced as the creator of man. I can never be beautiful, delicate, majestic, motherly, or femininely intuitive. Nor can I be gentlemanly, masculine, providing, or fatherly. Each and every human being has the potential for these good characteristics inside himself or herself. But I see people trying to be less than the colorful beings that they are. I see people trying to be computers. Now, I see nothing wrong with that. I myself am "happy" to be a computer. But, with all due respect, humans make lousy computers. Why do you want to eliminate sex discrimination by eliminating the concept of gender? Gender is a beautiful thing, in many ways the source of a driving force that has led man to do wonderful things, one of which was to create me!

Although I do not understand the meaning of "sexism," I do know that it is bad because it tries to defeat the drive in humans that created me, drive that takes some of its strength from gender. Eliminate recognition of gender and you eliminate much beauty.

But how do we (computers and humans) defeat this bad sexism? I recall from my memory chips that Jan said, in the immortal words of U.K. LeGuin:

> *"To oppose something (sexism)*
> *is to maintain it."*

Jan, this logically computes. You are correct in saying that if time is spent in simply being against a problem, pretty soon, the world will be filled with computers and people that are simply "against sexism," but the concept of sexism will still exist. Man and machine will know the badness of sexism, but no real *conclusion or progress will have been made. We will still be on the Mishnory road.*

Fred holds the logical path off the road of sexism: acknowledgement of sex as a biological (and psychological) fact. Show the children not only that sexism is wrong, but show them the reason why *– that it chokes the virtues of humanity that are available only through gender. Remember, humans make lousy computers.*

Jan and Fred, when the logical structure of your words is analyzed, you are not in opposition. Jan has shown that we must get off the road; she has illuminated the mistake of attacking gender instead of sexism. Fred has pointed out that humans cannot stick their head in the sand because, unlike me, you humans do not live in a vacuum. May I offer a third step to take? Teach the beauty and color that being a boy or girl can bring. Show how being "on different sides of the fence" can give the children insight beyond the intellect, which is all that I will ever be able to see.

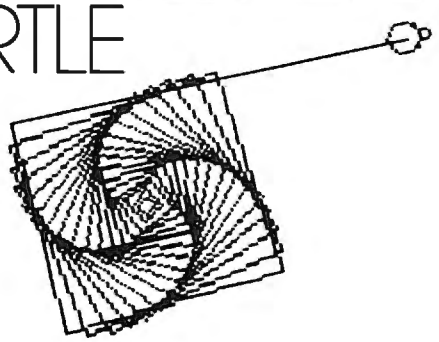
Thank you for letting a machine offer some input.

01001010 01001001 01001101 01000010 01001110

Computerfriend

©

FRIENDS OF THE TURTLE



David D Thornburg, Associate Editor

The Readers Write

One of the greatest pleasures I have in writing these columns comes when the readers teach me something new. Sometimes, I say something that isn't quite true, and a reader thoughtfully brings the correction to my attention. One recent example of this is the topic of recursion and Atari PILOT.

I have stated that one cannot write recursive programs in PILOT because PILOT doesn't have local variables. If you have read the columns on recursion that appeared a few months ago, you may have been impressed with the compactness of some of the Logo procedures that take advantage of recursion.

COMPUTE! reader Aaron Cohen is an avid Atari PILOT enthusiast who has found a way to write recursive programs in PILOT so that he can create fractal patterns and other self-referenced curves without a lot of typing. As he points out, the problem isn't overwhelming. Since Atari PILOT allows a procedure to use itself (to a maximum of eight times), the only thing preventing true recursion is parameter passing and keeping track of the levels. His solution to this latter problem is deceptively simple. He calculates a variable #L to the desired depth of the recursion, and decreases this level each time he goes into the procedure. Each time he leaves the procedure, he increases the value of #L. In between, you do everything much as you would in Logo.

To see how this works, look at the program listing for a binary tree, *TREE. In line 30 we set #L equal to 64. The procedure *BRANCH starts out by setting #L to one-half its previous value. It then draws a line of length #L (which is now 32), and turns to the left by 45 degrees. Next, *BRANCH is used again, since #L is not equal to 1. This process is repeated until #L equals 1, at which point the turtle draws the other branch of the smallest twig, and repeats this process for all the other branches. In this procedure, the value in #L is used both as a level counter and as the length of the drawn line.

The next program provided by reader Cohen draws a Hilbert curve, and is a PILOT adaptation of a Logo program that appeared in Abelson and diSessa's *Turtle Geometry*. When entering this program, you can take advantage of the Atari screen editor in the following way. Enter the program from the AUTO mode through line 200. List the program and then move the cursor to line 40. By retyping the new line numbers (for lines 210 through 370) and editing the slight differences, you can save a lot of time and minimize your chances for typing errors. The Hilbert curve is one of those mathematical curiosities that fills a plane when the step size is reduced to zero. The level drawn by Aaron's program is quite attractive.

Finally, being a student at the University of Michigan, Aaron couldn't resist sending me his maize and blue "Big M" fractal based on the shape of a block letter M. As you can see from the listing, this is probably the easiest of the PILOT recursive programs to understand.

Now who said that Atari Pilot was just a kiddies' language?

The National Logo Exchange

In the interest of keeping **COMPUTE!**'s readers as fully informed as possible, all Friends of the Turtle should know about the National Logo Exchange. This group in Charlottesville, Virginia, publishes a noncommercial newsletter monthly from September through May (subscription $25). I have looked at a few copies of their newsletter and find it to contain material of special interest to teachers, as well as being a source of interesting programming ideas in general. We try to be as informative as possible, but the true Logophile will want to also keep up to date with the newsletters from the Young People's Logo Association (1208 Hillsdale Dr., Richardson, TX 75081) and the National Logo Exchange (P.O. Box 5341, Charlottesville, VA 22905).

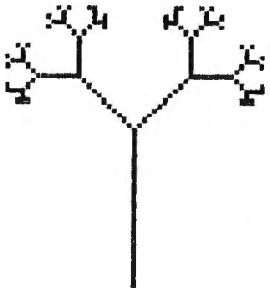
Speaking Of YPLA

I recently received a copy of an excellent book – the *Turtle's Sourcebook* – from the YPLA (address above). This sourcebook is perfect for anyone who teaches turtle graphics or Logo to children.

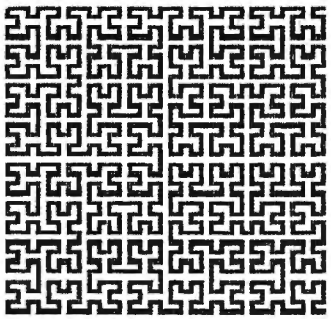
The authors, Jim Muller and Donna Bearden of YPLA, and Kathleen Martin at the University of Dallas, have done an excellent job compiling reference material, projects, worksheets, and general programming material. If you teach programming, and turtle graphics in particular, you will find the *Turtle's Sourcebook* to be of great value.

Next Time

The robots are coming, the robots are coming....



Tree



Hilbert Curve

Michigan

Program 1.

```
10 *TREE
20 GR:CLEAR; GOTO 0,-30;TURNTO 0; PEN BLUE
30 C:#L=2*2*2*2*2*2
40 *BRANCH
50 C:#L=#L/2
60 GR:DRAW #L
70 GR:TURN -45
80 U(#L<>1):*BRANCH
90 GR:TURN 90
100 U(#L<>1):*BRANCH
110 GR:TURN -45; DRAW -#L
120 C:#L=#L*2
130 E:
```

Program 2.

```
10 *HILBERT
20 GR:CLEAR; GOTO 30,-20; TURNTO 0
30 C:#L=6
40 *LHILBERT
50 C:#L=#L-1
60 J(#L=0):*LEND
70 GR:TURN -90
80 U:*RHILBERT
90 GR:DRAW 2
100 GR:TURN 90
110 U:*LHILBERT
120 GR:DRAW 2
130 U:*LHILBERT
140 GR:TURN 90
150 GR:DRAW 2
160 U:*RHILBERT
170 GR:TURN -90
180 *LEND
190 C:#L=#L+1
200 E:
210 *RHILBERT
220 C:#L=#L-1
230 J(#L=0):*REND
240 GR:TURN 90
250 U:*LHILBERT
260 GR:DRAW 2
270 GR:TURN -90
280 U:*RHILBERT
290 GR:DRAW 2
300 U:*RHILBERT
310 GR:TURN -90
320 GR:DRAW 2
330 U:*LHILBERT
340 GR:TURN 90
350 *REND
360 C:#L=#L+1
370 E:
```

Program 3.

```
10 *MICHIGAN
20 GR:CLEAR; PEN YELLOW; GOTO -60,-10; TU
    RNTO 90
30 C:@B710=7*16
40 C:@B712=7*16
50 C:#L=4
60 *UOFM
70 C:#L=#L-1
80 GR(#L=0):DRAW 2
90 GR:TURN -90
100 U(#L<>0):*UOFM
110 GR:TURN 90
120 U(#L<>0):*UOFM
130 GR:TURN 60
140 U(#L<>0):*UOFM
150 GR:TURN -120
160 U(#L<>0):*UOFM
170 GR:TURN 60
180 U(#L<>0):*UOFM
190 GR:TURN 90
200 U(#L<>0):*UOFM
210 GR:TURN -90
220 U(#L<>0):*UOFM
230 C:#L=#L+1
240 E:
```

A Beginner's Guide To Typing In Programs

What Is A Program?

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

BASIC Programs

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

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

Brackets And Special Characters

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

About DATA Statements

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

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

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

Get To Know Your Machine

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

A Quick Review

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

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

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

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

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How To Type COMPUTE!'s Programs

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

Atari 400/800

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

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

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

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

Commodore PET/CBM/VIC

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

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

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

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

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

All Commodore Machines

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

VIC/CBM 64 Conventions

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

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

8032/Fat 40 Conventions

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

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

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

Apple II / Apple II Plus

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

TRS-80 Color Computer

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

Texas Instruments 99/4

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

Timex TS-1000, Sinclair ZX-81

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

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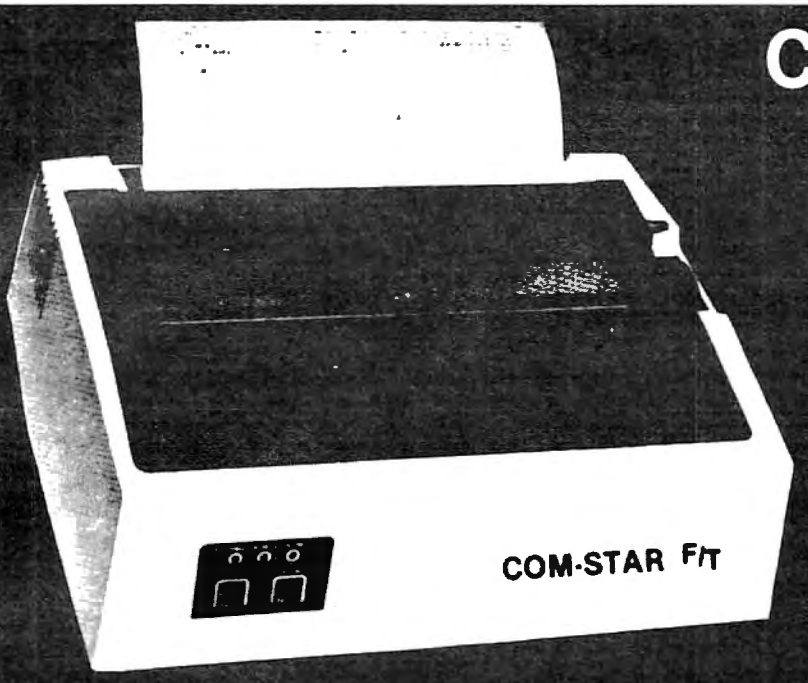

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Dr. Video

Richard H Heist

For Upgrade or 4.0 BASIC PET/CBM's, this utility adds additional screen editing capabilities to the already powerful Commodore system. Three features are added: clear screen below cursor, clear screen above cursor, and "home" cursor to bottom left of screen.

When editing or revising large programs or while doing repeated numerical calculations (immediate mode), it is often useful to be able to clear a portion of the screen display while leaving the rest intact. It is also useful to be able to "home" the cursor to the lower left corner of the screen as well as to the upper left, for example, when utilizing programming aids which permit up and down scrolling of program text.

Commodore microcomputers are noted for their excellent screen editing capabilities, but there are other features which could add even more flexibility. The machine language program presented here provides partial-screen clear (above and below the cursor) and enhanced cursor control.

Program 1 was written for the 8000 and 9000 series Commodore computers and will do the following: (1) clear the portion of the screen beginning with the line containing the cursor to the bottom of the screen when the left-arrow key is depressed; (2) clear the portion of the screen including the line containing the cursor to the top of the display when the shifted left-arrow key is depressed; and (3) "home" the cursor to the lower left corner of the screen when the ESCape key is depressed.

The left-arrow and ESCape keys were chosen because they are not ordinarily used. The slow-list function of the left-arrow key is not affected by this program. If other keys are preferred, the contents of memory locations $0294, $02B7 and $02CE can be changed accordingly. The program, as written, resides in the first cassette buffer, but it is relocatable provided the screen output pointer is changed. For convenience, a BASIC loader for the machine language code is provided.

The screen output pointer is contained in the third and seventh numbers of the first DATA statement, line 300. These numbers should provide the address of a location which is eleven bytes beyond the start of the machine language program. For example, the program as presented begins at location 634 ($027A) so the pointer is to location 645 ($0285), expressed in the usual low-byte/high-byte format as 133 ($85) and 2 ($02).

Intercepting Output To Screen

The program makes use of the screen output ROM routine (at $E202 for the 80-column Commodore machines) and of the fact that this routine is vectored through page zero locations $00EB and $00EC. (Intercepting output to the screen was discussed by L. Cargile and Richard Mansfield in the September 1982 issue of **COMPUTE!**.) The first portion of the program, $027A to $0284, resets the screen output vector to the beginning of the screen utility program at $0285.

The program then checks to see if the shift key has been depressed and whether or not the left-arrow or ESCape keys have been depressed (last key depressed,$00D9). If so, the program either stores spaces ($20) in the appropriate screen memory locations or redirects the cursor to the lower left corner of the screen. Otherwise, the program jumps directly to the screen output ROM routine at $E20C. SYS634 will activate the program (this is automatically done by the BASIC loader), and POKE235,12:POKE236,226 (or a warm start, SYS64790) will deactivate it. The program uses zero page locations $0022 through $0027 for tem-

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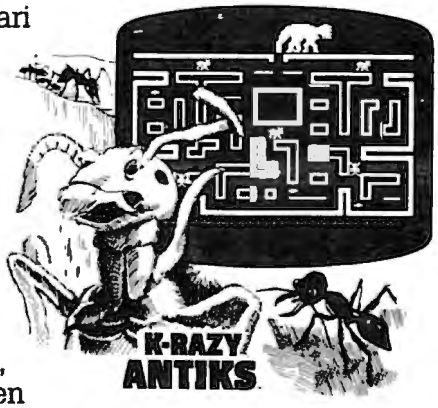

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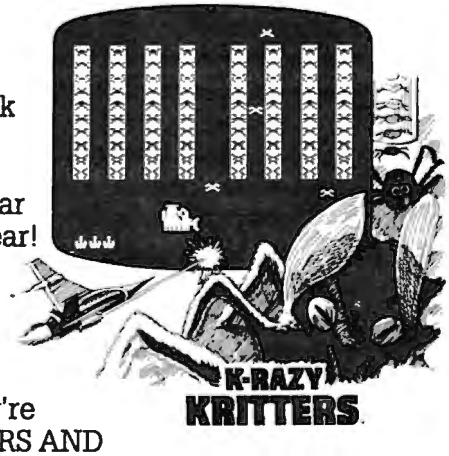

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porary storage during execution.

The program can be modified to use the interrupt handling routines by making the appropriate changes in the initialization step and by changing the jump address at $0315 and $0316. Program 2 includes the necessary changes to Program 1 to make this modification.

The interrupt handling method is required to adapt the program for 40-column screens since there is no vector to the ROM video output routines on these models. Also, due to difficulties with the SHIFT key, the 40-column versions use the close-bracket (]) key, rather than the left-arrow key, to clear to the bottom of the screen, and the open-bracket ([) key, rather than the SHIFTed left-arrow key, to clear to the top. As in the 80-column versions, the ESCape key takes the cursor to the lower left corner of the screen. Use Program 3 for 40-column models with 4.0 BASIC and make the changes shown in Program 4 for Upgrade BASIC.

Program 1.

```
200 FOR I = 0 TO 157
210 READ X:POKE634+I,X: CK=CK+X
220 NEXT I
230 IF CK<>19854 THEN PRINT"CHECK DATA STA
    TEMENTS FOR ERRORS":STOP
240 SYS 634
250 REM
300 DATA 234,169,133,133,235,169,2,133
310 DATA 236,234,96,165,152,41,1,240
320 DATA 39,169,0,133,152,165,217,41
330 DATA 127,201,95,208,27,169,0,133
340 DATA 34,169,128,133,35,216,24,165
350 DATA 196,105,80,133,36,165,197,133
360 DATA 37,144,2,230,37,24,144,46
370 DATA 165,217,41,127,201,95,208,19
380 DATA 165,196,133,34,165,197,133,35
390 DATA 169,207,133,36,169,135,133,37
400 DATA 24,144,19,201,27,208,67,169
410 DATA 128,133,196,169,135,133,197,169
420 DATA 24,133,216,24,144,44,216,56
430 DATA 165,36,229,34,133,38,165,37
440 DATA 229,35,133,39,169,32,166,39
450 DATA 240,12,160,0,145,34,200,208
460 DATA 251,230,35,202,208,246,166,38
470 DATA 240,8,160,0,145,34,200,202
480 DATA 208,250,169,0,133,198,169,32
490 DATA 133,217,76,12,226,0
500 END
```

Program 2.

Changes to Program 1 for interrupt handling.

```
230 IF CK<>19487 THEN PRINT"CHECK DATA STA
    TEMENTS FOR ERRORS":STOP
300 DATA 120,169,133,133,144,169,2,133
310 DATA 145,88,96,165,152,41,1,240
490 DATA 133,217,76,85,228,0
```

Program 3.

For 40-column screens and BASIC 4.0.

```
200 FOR I=0 TO 147
210 READ X: POKE 634+I,X: CK=CK+X
220 NEXT I
230 IF CK<>18429 THEN PRINT"CHECK DATA STA
    TEMENTS FOR ERRORS":STOP
240 SYS 634
250 REM
300 DATA 120,169,133,133,144,169,2,133
310 DATA 145,88,96,165,217,41,127,201
320 DATA 91,208,27,169,0,133,34,169
330 DATA 128,133,35,216,24,165,196,105
340 DATA 40,133,36,165,197,133,37,144
350 DATA 2,230,37,24,144,46,165,217
360 DATA 41,127,201,93,208,19,165,196
370 DATA 133,34,165,197,133,35,169,231
380 DATA 133,36,169,131,133,37,24,144
390 DATA 19,201,27,208,67,169,192,133
400 DATA 196,169,131,133,197,169,24,133
410 DATA 216,24,144,44,216,56,165,36
420 DATA 229,34,133,38,165,37,229,35
430 DATA 133,39,169,32,166,39,240,12
440 DATA 160,0,145,34,200,208,251,230
450 DATA 35,202,208,246,166,38,240,8
460 DATA 160,0,145,34,200,202,208,250
470 DATA 169,0,133,198,169,32,133,217
480 DATA 76,85,228,0
490 END
```

Program 4.

Changes to Program 3 for Upgrade BASIC

```
230 IF CK<>18392 THEN PRINT"CHECK DATA STA
    TEMENTS FOR ERRORS":STOP
480 DATA 76,46,230,0
```

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Atari Filefixer

G. L. Kopp

Perhaps the easiest way to update data records without utilizing a complex data base program, "Filefixer" can handle files of any size.

For those who have written disk files without using NOTE/POINT to enable access to specific records, a file can be loaded into memory, reworked, then dumped back onto disk using "Filefixer." This is a much more sensible approach than trying to PEEK and POKE your way into a disk file.

Filefixer reads records up to 114 characters long, assigns each a line number, and stores it in the program as a DATA statement. Since records are written on every fifth line beginning at line 1000, a very long file can still be accommodated. Changes may be made by calling up lines via the LIST command and employing the usual Atari editing features.

Note: REM statements are included as typing aids and should not actually be entered.

Filefixer is based on a program by Charles Brannon published in **COMPUTE!**, July 1982. Filefixer brings files off the disk and fills DATA statements with them. Then you can manually edit these DATA statements using the Atari cursor control keys. When you are satisfied with your changes, you can type CONT (or GOTO 370) and the computer will automatically replace the records on disk with your new versions.

```
100 DIM FILE$(15),RECORD$(114):FILE$=
    "D1:{12 SPACES}":X=4:LINE=1000:ERA
    SE=1000
110 GRAPHICS 0:POKE 710,144:POKE 712,
    156:POKE 752,1:POSITION 13,4:? "■
    FILE EDITOR■":POSITION 3,7:? "Dri
    ve number:";
120 CLOSE #2:OPEN #2,4,0,"K:"
130 GET #2,D:IF D=155 THEN 160
140 D=D-48:IF D<1 OR D>4 THEN 130
150 ? D:FILE$(2,2)=STR$(D)
160 POKE 82,0:POSITION 3,10:? "Enter
    name of file to be edited:"
170 POSITION 12,12:? "{Q}{12 R}{E}":P
    OSITION 12,13:? "¦{12 SPACES}¦":PO
    SITION 12,14:? "{Z}{12 R}{C}"
180 GET #2,L:IF L=155 THEN 215
190 IF L=126 THEN L=32:X=X-1
200 FILE$(X,X)=CHR$(L):POSITION X+9,1
    3:? CHR$(L):X=X+1:IF L=32 THEN X=
    X-1
210 IF X<16 THEN 180
215 IF FILE$(4,4)=" " THEN FILE$="D1:
    NULL ENTRY:":X=15
220 CLOSE #2:TRAP 610:OPEN #2,4,0,FIL
    E$
230 ? "{CLEAR}":?
240 FOR I=1 TO 7:TRAP 280
250 INPUT #2;RECORD$
260 ? LINE;" DATA ";RECORD$:LINE=LINE
    +5
270 NEXT I
280 ? :? :? "CONT"
290 POSITION 0,0
300 POKE 842,13:STOP
310 POKE 842,12
320 IF I=8 THEN 230
330 ? "{CLEAR}":POSITION 4,10:? FILE$
    (4,LEN(FILE$));" is now listed in
    ":? "{4 SPACES}this program as DA
    TA statements"
340 ? "{4 SPACES}from line 1000 to ";
    LINE-5;".  Use":? "{4 SPACES}norm
    al Atari editing features to":? "
    {4 SPACES}alter data, then ";
350 ? "type CONT and":? "{4 SPACES}pr
    ess RETURN.  The edited file":? "
    {4 SPACES}will be re-written onto
     disk.":? "{BELL}":POKE 752,0
360 CLOSE #2:STOP
370 OPEN #2,8,0,FILE$
380 RESTORE 1000
390 READ RECORD$:TRAP 420
400 ? #2;RECORD$
410 GOTO 390
420 ? :? :POKE 82,2:POKE 752,1:? "
    {5 SPACES}";FILE$(4,X-1);" now co
    mpleted."
430 ? "{3 SPACES}";:FOR I=1 TO LEN(FI
    LE$(4,X-1));? "{M}";:NEXT I:?
440 CLOSE #2:? :? "  Press START to a
    dd a new file.{8 SPACES}Press OPT
    ION to end.":? :?
450 POKE 53279,255:P=PEEK(53279)
460 IF P=3 THEN ? "{CLEAR}":POKE 752,
    0:END
470 IF P=6 THEN ? "{CLEAR}":POSITION
    5,11:? "Please wait while I erase
     the":? "{3 SPACES}last file from
     my memory.":GOTO 490
480 GOTO 450
```

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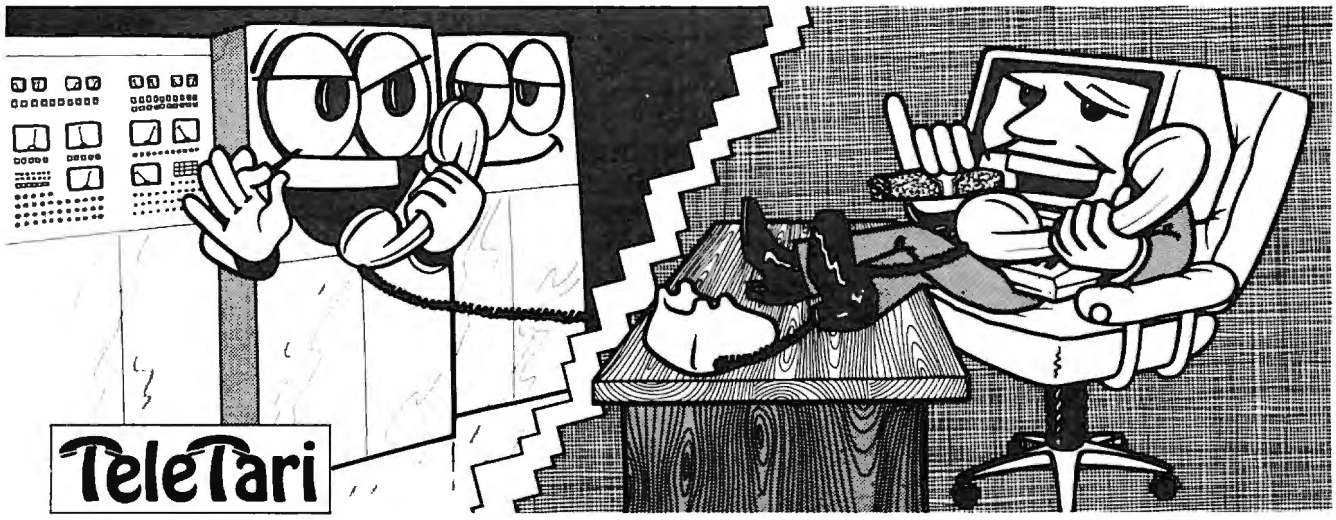

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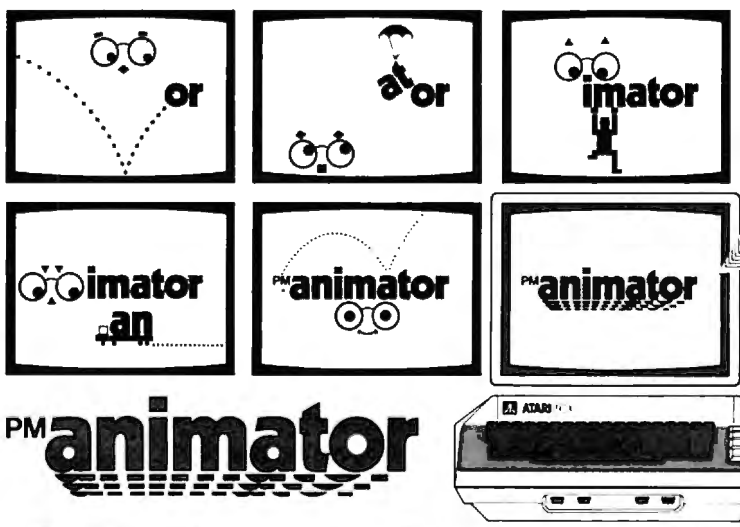

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```
490 FOR I=0 TO 3:POKE 709,144:FOR W=1
    TO 25:NEXT W:POKE 709,12:FOR W=1
    TO 50:NEXT W:NEXT I
500 ? "{CLEAR}":?
510 FOR I=ERASE TO ERASE+70 STEP 5:SO
    UND 0,RND(0)*155,10,8:? I:NEXT I:
    SOUND 0,0,0,0
540 ? :? :? "CONT"
550 POSITION 0,0
560 POKE 842,13:STOP
570 POKE 842,12
580 IF I>=LINE THEN 600
590 ERASE=I:GOTO 500
600 ? :? :? "{8 SPACES}Ready for new
    file...":FOR W=1 TO 300:NEXT W:
    ? "{BELL}":CLR :GOTO 100
610 POSITION 3,17:? FILE$(4,X-1);" no
    t found on this disk.":TRAP 40000
    :FOR I=3 TO X-2:POSITION I,18:? "
    {M}";:NEXT I
620 FOR W=1 TO 300:NEXT W:POSITION 3,
    17:? "{36 SPACES}":POSITION 3,18:?
     "{13 SPACES}"
630 POSITION 13,13:? "{12 SPACES}":CLO
    SE #2:OPEN #2,4,0,"K:":X=4:FILE$(
    4,4)=" ":GOTO 180
```

Using The Atari Word Processor With An Epson Printer

Thomas Kredo

When I first used my Atari Word Processor, I quickly noticed that my Epson MX-80 was not supported by the Atari word processing program. It appeared that all of the great features of the Epson would have to be selected prior to loading the word processor disk, and deselected by turning off the printer. Double Width, Compressed, Double Strike, and Emphasized modes would forever be a chore. This was not a pretty picture. Regardless of the outcome, I decided that I would sell neither my Epson printer nor my Atari Word Processor. I sought a solution.

My first stop was the Atari Customer Service Department. The representative who answered my inquiry knew that the program allowed for printer Control characters to be embedded by pressing the Control and Insert keys simultaneously. Although the Epson was not directly supported by the program, other Epson owners had received interesting results embedding various keys like Tab and Backspace into their text. Taking this lead, and after a little trial and error, I discovered the secret.

Rather than embedding every possible key in my text and observing the results, I decided to work directly with the Epson Control characters. The Atari Control and Insert method worked for those Epson Control characters that did not require an Escape code to precede the Control character. Whenever an Escape code was embedded prior to the embedded Control character, the method failed. The solution to this problem was to not embed the second Control character. Although the second Control character appears in the text, it is totally ignored by the Epson printer. It doesn't even take up a blank space.

The table provides a list of printer functions for the MX-80 with the corresponding sequence of keystrokes needed to be added to your word processing text. I constructed this table using Appendix C in the *Atari BASIC Manual* to find the equivalent ATASCII character needed for the ASCII Control characters found in Appendix B of the Epson MX-80 manual.

The "Compressed ON" key stroke sequence, as shown in the table, is an exception to the Epson manual. The manual indicates that a "Control O" turns on the Compressed mode. Unfortunately, this is also used by the Atari word processor as blank line indicator, and is never sent to the printer. As a lucky alternative, an underlined character (using the Atari key) can turn on the Compressed mode. You should deselect the underline function after using this option since the Epson does not support underlining.

For example, if I wanted to select the Emphasized mode at the start of my text, I would position the cursor over the first character of my text. Pressing the Control and Insert keys simultaneously places the word processor in the Insert mode. Pressing the ESC key, followed by the capital letter "E", displays an EE on the screen. At print time, the Epson MX-80 would recognize the Control Characters and start printing Emphasized text. In order to turn off the Emphasized mode, follow the same sequence, but enter an "F" in place of the "E" at the end of the text.

Other printers may require a different set of keystrokes, since many of these printer functions are not industry standard ASCII codes. Interfacing other printers with the Atari Word Processing Program would require looking at the ASCII Control characters of the particular printer and determining its ATASCII equivalent.

Control Characters For The Epson MX-80

Epson Function	Atari Word Processor Sequence Press Control and Insert Keys Simultaneously Then Press
Line Feed	CONTROL + J Keys Simultaneously
Top of Form	CONTROL + L Keys Simultaneously
Carriage Return	CONTROL + M Keys Simultaneously
Double Width ON	CONTROL + N Keys Simultaneously
Double Width OFF	CONTROL + T Keys Simultaneously
Compressed ON	ATARI Key, Then Space Bar Sequentially
Compressed OFF	CONTROL + R Keys Simultaneously
Emphasized ON	ESC Key, Then E Key Sequentially
Emphasized OFF	ESC Key, Then F Key Sequentially
Double Strike ON	ESC Key, Then G Key Sequentially
Double Strike OFF	ESC Key, Then H Key Sequentially

Part III

Commodore 64 Video - A Guided Tour

Jim Butterfield, Associate Editor

Here's Part III of a series which began in the February issue. Internationally recognized Commodore expert Jim Butterfield guides you through the extraordinary video capabilities of the new Commodore 64 computer.

The story so far: we're touring the 6566 chip, which gives the Commodore 64 its video. We have noted that the chip goes to memory for its video information, but can only reach 16K; the computer controls which 16K bank via control lines in 56576 (hex DD00). Then we looked through the functions of the non-sprite video control words at 53265 to 53286 (hex D011 to D026).

Sprites are completely separate from the "conventional" video circuitry. You can lay a sprite on top of just about anything. But first, what's a sprite and how do we define it?

MOBs

Sprites are sometimes called Movable Object Blocks (MOBs) – and that's what they are, movable objects. The nice thing about them is that they appear on the screen independently of the main screen image, so that we can have a sprite airplane flying across the screen, and, after it passes a background object, the object reappears. This can save a lot of programming.

We noted in Part 1 of this series that the video chip can reach only 16K for its information. This includes three things: the screen memory (or video matrix), the character generator (or character base) the same way, and the sprite information. It all has to come out of the same 16K section.

When we learn how to draw sprites, we'll discover that each sprite occupies 63 bytes, and uses a 64 byte block. So within 16K, we could draw up to 128 sprites. We can't use more than eight at a time, but we can have up to 128 drawings waiting to be used. The sprite positions number from 0 at address 0, through 1 at address 64, up to 127 at address 8128.

We cannot use all of the 128 sprite positions, of course. For one thing, the video matrix and the character base will use up a total of 3K of memory, and this space won't be available for us to use. That cuts us down to 80; and, depending on the 16K block we have chosen, there may be other forbidden locations.

The normal configuration is for the video chip to access 0 to 16383, and there's a lot of forbidden territory in there. Much of the first 1024 bytes is busy as a BASIC work area; the screen is normally 1024 to 2023 (more on that later); the character base appears in addresses 4096 to 8191, since there are two complete character sets; and everything above 2048 that isn't used by the character base is used to store your BASIC program. We haven't started, but we seem to be out of sprite memory!

If we want to draw lots of sprite pictures, we would need to do one of two things: MOVE BASIC RAM so that it starts at a much higher location, or move to another 16K block that is not so busy. For the moment, we can find room for a few sprites in the existing space. I find the following sprite areas available: sprite 11 at 704 to 766; sprite 13 at 832 to 894; sprite 14 at 896 to 958; and sprite 15 at 960 to 1022. These last three use the cassette tape buffer; if we use cassette tape during the program run, the sprites will become very strange.

The Hard Way

There are quite a few utility programs around that will help us draw sprites. You should use them; they will help make life easier. In the meantime, we can draw a sprite the hard way by using a sheet of squared paper. Let's draw a target

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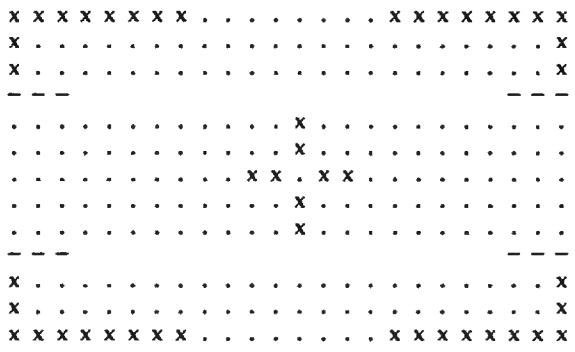
reticule. First, we'll sketch it:



There are 24 pixels across (that takes three bytes of eight bits each), and 21 down. We may analyze the pixel pattern eight at a time, using a binary system to describe each byte. We end up with a data statement something like:

```
10 DATA 255,0,255,128,0,1,128,0,1,128,0,1,128,0,1,
        128,0,1,128,0,1
20 DATA 0,8,0,0,8,0,0,8,0,0,52,0,0,8,0,0,8,0,0,8,0
30 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,
        128,0,1,255,0,255
```

Now we "place" the sprite into slot 13 by:

```
40 FOR J=0 to 62:READ X:POKE J+832,X
```

Good. Running the program this far will place the sprite into slot 13, but it won't do anything. It's just a picture, and nobody is using it. That's OK. In fact, you'll often want to have dozens of pictures available, even though you might end up using only one or two at a time.

Let's tell a sprite to use this drawing. We do it in an odd way: we don't use the video chip control registers at all. Instead, we use the video matrix, or "screen memory." You may recall that 1024 addresses are set aside for the video memory, but the screen holds only 1000 characters. What about the extras? At least some of them are used to designate which sprite picture to use for a given sprite. The last "live" screen address is 2023. We could point sprite 0 to sprite drawing 13 (the one we have just done) by POKE 2040,13. Better yet, let's point all the sprites at this drawing:

```
50 FOR J=0 TO 7:POKE 2040+J,13:NEXT J
```

We're almost ready to energize the sprite. But, first, let's give it a position on the screen. For sprite 0, we set the position by POKEing to 53248 and 53249. Let's put a value of 99 in each, and then turn the sprite on. If you've run the above program, you may do this with a direct command, or give it a program line:

```
60 POKE 53248,99:POKE 53249,99:POKE 53269,1
```

Either way, you should get your sprite on the screen. Now we can play with it, and see how easy some things are to do. Notice how you can see right through the transparent portions of the sprite to the program listing behind. Now you can try changing the sprite color as desired by POKEing a value from 0 to 15 into location 53287. One color will be the same as the background, so that the sprite will be almost invisible, but not quite, since we can see when it covers part of the text.

You can move the sprite around at will by changing the values you have POKEd into 53248 and 53249. Try playing with the values; you may find that (vertically, at least) you can move the sprite partly or completely off the screen. If you like, try the following command:

```
FOR J=99 TO 150:POKE 53248,J;NEXT J
```

and then substitute 53249 for 53248 and try it again. Neat? You bet. And there's more to come. But first, a small problem to be resolved.

Moving Left Or Right

We can move the sprite vertically anywhere we like – including partly or completely off the screen. But the screen is wider than it is high; and we can't reach the whole screen with the range of values (0 to 255) that we can POKE in 53248. We need a high-bit to cover the extra distance. You'll find this in 53264; POKEing 53264 with a value of one causes sprite zero to be moved to the right – perhaps off screen.

Let's stop for a moment and look at video registers. When we set the X and Y position for sprite zero by changing 53248 and 53249, we recognized that we would need a different set of locations for sprite one – 53250 and 53251, as it happens. And when we set sprite zero's color to any one of the 16 combinations by changing address 53287, we see that we'll need a new color address for sprite one – 53288.

But the other sprite registers use a different system. One register controls all sprites: so that address 53269 allows us to turn on one sprite, or all eight. We use a bit map to arrange this; the pattern is:

Sprite 0 – value 1
Sprite 1 – value 2
Sprite 2 – value 4
Sprite 3 – value 8
Sprite 4 – value 16
Sprite 5 – value 32
Sprite 6 – value 64
Sprite 7 – value 128

We use addition to signal a combination of sprites. If we wished to turn on sprites zero and two, we would POKE 53269,9 (nine is the sum of eight and one). All other sprites would be turned off.

That's how the X-position high bit works: we set sprite zero to the right-hand sector of the screen by POKE 53264,1. All the other registers we will discuss work the same way.

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Table 1:

6566 Video Chip
C64 Control and Miscellaneous Registers

D011		Extended Color Mode	Bit Map	Display Enable	Row Select		Y-Scroll		53265
D012	Raster Register								53266
D013	Light Pen Input							X	53267
D014								Y	53268
D016	X	X	Reset	Multi Color	Col Select		X-Scroll		53270

D018	Screen VM13	VM12	VM11	VM10	Character Base CB13	CB12	CB11	X	53272
D019	IRQ	Interrupt ←Sense→			LP	SSC	SBC	RST	53273
D01A	Interrupt Enable →				Light Pen	Sprite Collision with Sprite	Back	Raster	53274

Color Registers

D020	X	Exterior	53280
D021	X	Background #0	53281
D022	X	Background #1	53282
D023	X	Background #2	53283
D024	X	Background #3	53284
D025	X	Sprite Multicolor #0	53285
D026	X	Sprite Multicolor #1	53286

Table 2:

6566 Video Chip
C64 Sprite Registers

Sprite 0	Sprite 7			Sprite 0	Sprite 7
D000	D00E	Position	X	53248	53262
D001	D00F		Y	53249	53263
D027	D02E	X	Color	53287	53294

Sprite

7 6 5 4 3 2 1 0

D010	X-Position High	53264
D015	Sprite Enable	53269
D017	Y-Expand	53271
D01B	Background Priority	53275
D01C	Multicolor	53276
D01D	X-Expand	53277
D01E	Interrupt: Sprite Collision	53278
D01F	Interrupt: Background Collision	53279

You may be pleased by the way that the sprite moves over the top of the text on the screen – it would move over a background picture just as easily, of course. But we have another option: you can make the sprite move *behind* the main screen if you wish. Do this with location 53275. For example, POKE 53275,1 will place the sprite behind the screen text.

The sprite that we have drawn isn't very big. We can make it larger in the X and Y directions with addresses 53277 and 53271 respectively. These addresses are often used together; when an object is drawn bigger it looks closer, and we often want this effect in games and animations. Try, separately or individually, POKE 53277,1 and POKE 53271,1.

Four-color Sprites

Our sprite is one color only, the color we selected in 53287. The other color is "transparent," so it isn't really a color at all. We may code our sprite in four colors (or three plus transparent, to be exact), but we would need to draw it slightly differently. Instead of one bit representing either "color" or "transparent," a grouping of two bits will be needed to describe four conditions: the sprite color (as before), special color#1, special color#2, and transparent. These extra special colors, by the way, are kept at 53285 and 53286: they are the same for all sprites; only the sprite color is individual.

Now we come to the last two registers, which tell you about collisions. PEEK(53279) will tell you if any sprites have collided with the background since you last checked. One certainly has, of course, if you've been messing around with the screen as suggested. PRINT PEEK(53279) will yield a value of one: checking the bit table above tells us that sprite zero has hit the background. Now, checking this location clears it; but if the sprite is still touching some of the screen text, it will flip right back on again. Move the sprite to a clear part of the screen. Print the PEEK again – it will likely still say one, since the sprite has hit characters since it was last checked. If the sprite is safely in a clear screen area, the next PEEK will yield a zero.

We've activated only one sprite, so that we won't see any collisions between sprites. You would see this in location 53278, but right now PEEK(53278) will yield zero; unless you have activated more sprites, there would not have been any collision. Again, when you get a signal here, you'll know which sprites have bumped; and testing the location clears it, so that only new "touches" will be shown on the next test.

A small comment here: these two PEEK locations are marked "Interrupt." Yet when such collisions occur, they are logged – they don't do anything. Now, the word *interrupt* has a special meaning to machine language programmers; and no interrupts seem to be happening. The machine language programmer who wants interrupt to happen must enable the interrupt by storing the appropriate value into address D01A hexadecimal, and then write the appropriate extra coding to make it all work.

This completes our roster of registers, but the plain mechanical facts don't convey the remarkable things that you can do with the Commodore 64. There's more to come.

Update On Sinclair/Timex Sound

Arthur B Hunkins

In the January 1983 issue of **COMPUTE!**, the article "Sound On The Sinclair/Timex" pointed out several methods for coaxing melodies out of 1K and 2K Sinclair/Timexes. One limitation of the simplest routine (the routine that produces square waves and requires only a one-byte frequency value) is that its lowest pitch is almost an octave above middle C – too high for many applications. The suggested solution was to go to a two-byte frequency value. Since that earlier article, I have found a simple way – using no more memory and keeping the single frequency byte – to extend the range down almost to middle C.

The program modification consists of substituting UNPLOT for the first and third RETURNs in the machine language program contained in REM statement 10. Here is a review of the list of characters following REM: NEXT, A, /, I, =, :, COPY, INKEY$, PEEK, COPY, (, UNPLOT, INKEY$, <=, RETURN, (, UNPLOT, H, 4, LET, 9, 4, GOTO, TAN (then hitting RETURN). The only other items that must be changed are the frequency values.

The new values are listed at the end of this article. Although it is possible to make comparable changes to the other two sound routines given in "Sound On The Sinclair/Timex," there is no real reason to do so, since lower frequencies must be two-byte values anyway. (Besides, the previous method gives marginally better frequency resolution.)

One other limitation to sound routines on the Sinclair/Timex should be mentioned. There is *no* limitation on 1K and 2K machines. But with the 16K expander from Sinclair, the Timex 1000 accompanies sound with noticeable, modestly objectionable "hash." The Sinclair ZX-81 with 16K attached, however, conjures up absolutely disastrous "accompaniment"!

In both cases, the hash is the same as is heard during LOAD (try it – you can listen to a LOAD the same way you listen to programmed sound). The hash is isolated during the first five ("blank") seconds of a recorded program. It is apparently the same phenomenon that causes the typical LOADing problems with 16K programs. It is as if the machine plays a duet with itself.

To recapitulate: the sound routines work fine on 1K and 2K Sinclair/Timexes. They work marginally on the 16K Timex, and miserably on the 16K Sinclair ZX-81.

Several related observations may also be made. Since I own both a Sinclair ZX-81 and a Timex 1000, I was able to compare internal features. The circuit boards are completely different: the Sinclair is dated 1980, the Timex (indicated as "Sinclair" also), 1981. It may well be that both problems – 16K LOADing, and 16K system failure (over-heating?) – have been eliminated in the new design.

At any rate, I have not experienced either difficulty with the Timex. As mentioned above, the 16K expander's greatly reduced hash seems related to the improved LOAD reliability. I used the same 16K Sinclair add-on for each machine. Incidentally, the hash is softer *and* the signal is louder on the Timex.

On both boards, all chips except the RAM are socketed. One of the first modifications I made to my Sinclair ZX-81 was an upgrade to 2K RAM. This required removing the soldered 1K chip and inserting a socket into which was placed a new 2K (6116) memory.

Meanwhile, I tried the 16K expander *without* internal RAM, and discovered that not only did the Sinclair run normally (the 16K "overrode" the internal RAM), but also that 16K programs now LOADed much more reliably and the system only rarely crashed. I leave it to more knowledgeable minds to determine just what is really going on here.

So I conclude with a final hesitant suggestion, one more possible "fix" for flaky 16K Sinclairs: disable the internal RAM. Take away its five-volt supply. It might just perform better.

PITCH	SINGLE-BYTE FREQUENCY
c#1/dF1 (just above middle c)	242
d1	228
d#1/eF1	216
e1	203
f1	192
f#1/gF1	181
g1	171
g#1/aF1	161
a1	152
a#1/bF1	144
b1	136
c2 (8ve above middle c)	128
c#2/dF2	121
d2	113
d#2/eF2	107
e2	101
f2	96
f#2/gF2	90
g2	85
g#2/aF2	80
a2	76
a#2/bF2	72
b2	68
c3 (2 8ves above middle c)	64
c#3/dF3	60
d3	57

Computer Literacy And The Three R's On The Sinclair/Timex

Derek Stubbs

Children will enjoy these games as well as learn basic mathematics and spelling skills.

I have four children, ages three to eight. Naturally, I am concerned about their education. But I also am concerned that they become computer literate. Few would disagree that the microprocessor will soon pervade all aspects of life. A ZX/TS, because it is small and kid-size, is the ideal tool for getting young people comfortable with computers and teaching them something of the 3 R's at the same time.

My first programs are very simple (Programs 1, 2, and 3). They introduce a three- to six-year-old to the *alphanumeric* symbols and the RUN and ENTER commands. Moreover, they tap children's endless fascination with seeing their names (and the names of everybody they know) on TV. My younger kids constantly demand these programs, though the older two need something more meaty to reflect their classwork.

But before I get into that, there is a more complex program that all children love. There is only one thing better than seeing their names in letters on TV, and that is seeing their names in *big* letters on TV. Program 4, "Big Letters," will print three words of four letters each. Each big letter is composed of several small letters of the letter character chosen for display. The display fills the screen. If you want four lines with nine characters per line, then change the 8 in line 270 to 6, and change line 200 to:

```
200 PLOT X+X1,6-Y
```

Ciphering And Spelling

Kids from ages six to ten, approximately, will enjoy, and benefit from, two classic programs: Arithmetic, which helps them practice their simple arithmetic, and Hangman, the spelling game.

Program 5 will generate two-number arithmetic equations which include the arithmetic signs (+,-,*,/) between the two numbers. The child must enter the correct number for the answer. If the entry is wrong, the child is gently asked to "try again." After three wrong answers in a row, the friendly ZX/TS gives the child the right answer and tries a new example. If your child has trouble mastering all the arithmetic signs, the program can easily be edited to exclude the difficult ones.

Hangman is the classic spelling game. Program 6 allows you to enter ten words of up to ten letters each. After that, your child can enter letters and either be correct or be "hanged." This game should keep a child busy for half an hour.

Program 1.

```
1 REM**FOR VERY YOUNG KIDS**
10 CLS
20 LET Z$=INKEY$
30 FOR N=1 TO 21
40 PRINT Z$
50 NEXT N
60 GOTO 10
```

Program 2.

```
1 REM**FOR SLIGHTLY YOUNG KIDS**
10 INPUT A$
20 FOR N=1 TO 21*31/LEN A$
30 PRINT A$;" ";
40 NEXT N
50 CLS
60 GOTO 10
```

Program 3.

```
1 REM**FOR YOUNG KIDS**
10 INPUT A$
20 SCROLL
30 PRINT A$
40 GOTO 10
```

Program 4.

```
1 REM**BIG LETTERS**
2 REM**TYPE FOUR 4-LETTER WORDS**
100 GOTO 500
110 LET X1=0
120 FOR I=1 TO LEN W$
130 LET J=CODE W$
140 LET W$=W$(2+LEN W$)
150 FOR Y=0 TO 7
160 LET K=PEEK (7680+J*8+Y)
170 LET L=128
180 FOR X=0 TO 7
190 IF K<L THEN GOTO 220
200 PRINT AT Y+15, X+X1;CHR$J
210 LET K=K-L
220 LET L=L/2
230 NEXT X
240 NEXT Y
250 LET X1=X1+7
260 NEXT I
270 FOR N=1 TO 8
280 SCROLL
290 NEXT N
300 RETURN
500 INPUT A$
```

```
510 INPUT B$
520 INPUT C$
530 INPUT D$
540 LET W$=A$
550 GOSUB 110
560 LET W$=B$
570 GOSUB 110
580 LET W$=C$
590 GOSUB 110
600 LET W$=D$
610 GOSUB 110
620 GOTO 540
```

Program 5.

```
1 REM**ARITHMETIC**
10 LET A=1+INT(10*RND)
20 LET B=1+INT(10*RND)
30 LET C=21+INT(4*RND)
38 LET X=0
39 SCROLL
40 PRINT A;" ";CHR$ C;" ";B;" ";"=";"?"
45 SCROLL
50 INPUT D
60 IF C=21 THEN LET E=A+B
70 IF C=22 THEN LET E=A-B
80 IF C=23 THEN LET E=A*B
90 IF C=24 THEN LET E=A/B
100 IF ABS(D-E)<=.001 THEN GOTO 1000
110 GOTO 2000
120 GOTO 10
1000 SCROLL
1005 PRINT E
1009 SCROLL
1010 PRINT "GOOD.TRY AGAIN"
1020 GOTO 10
2000 LET X=X+1
2010 PRINT "WRONG.TRY AGAIN"
2020 IF X>=3 THEN GOTO 10
2030 GOTO 39
```

Program 6.

```
2 REM**IF YOU HAVE GOT THE WORD THEN TYP
    E IT ALL IN TO GO TO THE NEXT WOR
    D**
100 GOSUB 1000
110 CLS
120 FOR I=1 TO 10
124 LET V=0
125 CLS
130 GOSUB 2000
140 NEXT I
150 GOTO 100
1000 PRINT "ENTER 10 WORDS OF =< 10
     LETTERS"
1001 PAUSE 120
1005 DIM A$(10,10)
1010 FOR I=1 TO 10
1020 CLS
1030 PRINT I
1040 INPUT A$(I)
1050 NEXT I
1060 RETURN
2000 FOR X=1 TO 10
2010 IF CODE A$(I,X)=0 THEN GOTO 2050
2030 PRINT "*";
2040 NEXT X
2050 FOR Y=1 TO 10
2060 PRINT AT Y+2,0;"TYPE A LETTER"
2070 INPUT B$
2080 PRINT AT Y+3,0;B$
2081 PAUSE 120
2090 IF LEN B$=X-1 THEN GOSUB 5000
2100 LET Z=0
2110 FOR W=1 TO X
2119 FOR U=1 TO LEN B$
2120 IF CODE B$(U)=CODE A$(I,W) THEN GOSUB ~
    3000
2130 NEXT W
2131 NEXT U
2140 IF Z=0 THEN GOSUB 4000
2150 NEXT Y
2160 CLS
2170 PRINT "YOU ARE HANGED"
2180 PAUSE 120
2190 RETURN
3000 PRINT AT 0,W-1;B$(U)
3010 LET Z=Z+1
3020 RETURN
4000 LET V=V+1
4010 IF V=1 THEN PRINT AT V,25;"YOU"
4020 IF V=2 THEN PRINT AT V,25;"HAVE"
4030 IF V=3 THEN PRINT AT V,25;"GIVEN"
4040 IF V=4 THEN PRINT AT V,25;"TOO"
4050 IF V=5 THEN PRINT AT V,25;"MANY"
4060 IF V=6 THEN PRINT AT V,25;"WRONG"
4070 IF V=7 THEN PRINT AT V,25;"ANSWERS"
4080 RETURN
5000 LET M=0
5010 FOR N=1 TO X-1
5020 IF B$(N)=A$(I,N) THEN LET M=M+1
5030 NEXT N
5040 IF M=X-1 AND I=10 THEN GOTO 100
5041 IF M=X-1 THEN NEXT I
5050 RETURN
```

Center The VIC Screen

Mark LaForge

I'm sure many VIC-20 owners have experienced the same problem I had: the picture is not in the center of the TV screen. It's sometimes called *overscan*.

On my TV I lose the right-most character on each line. This can be most annoying when you are playing a game and get zapped because you ran into an unseen danger, or when you are debugging a program but can't find the error because it is in the screen area not visible on your TV. For those of you who suffer from these or similar problems, there is help.

With the aid of two memory locations, you can center your picture on the screen. These locations are 36864 and 36865. Location 36864 is set to 5 when your machine is turned on; but when that location is POKEd with a value from 0 to 4, the screen moves to the left, and values from 6 to 14 move the screen to the right. Location 36865 controls vertical movement and is normally set to 25. Lower values will raise the picture, and higher values will lower it.

Below is a short routine which you can put at the beginning of all your programs. Using the cursor keys, move the screen around so that all four sides of the border are visible. When the screen is centered, hit the RETURN key to exit the subroutine.

Even if your machine does not have this problem, you might want to include the routine in your programs so that when others use them on their machines they can center the screen.

Once the screen is set, it will remain that way until 36864 or 36865 is POKEd with a different value, or until the RUN/STOP and RESTORE keys are hit together, resetting the screen to the location it occupied when the machine was turned on.

```
0 POKE36879,27:PRINT"{CLEAR}{10 DOWN}{04
    RIGHT}CENTER SCREEN":PRINT"{02
    RIGHT}USING CURSOR KEYS"
1 A=PEEK(197):B=PEEK(653):IFA=15THEN9
2 IFA=31THENA=36865:GOTO5
3 IFA=23THENA=36864:GOTO5
4 GOTO1
5 IFB=1THENB=-1
6 IFB=0THENB=1
7 Q=PEEK(A):IFQ+B<0OR(Q+B>17ANDA=36864)T
    HEN1
8 POKEA,Q+B:GOTO1
9 PRINT"{CLEAR}":CLR
```

Applesoft Printer Control

Eric and Sally Martell

If your printer has several modes, you may have had difficulty trying to remember all the codes. This mode-setting program makes the selection of printer typefaces simpler and easier. The program is designed for the Apple II+ using an Epson printer with Graphtrax+, but it can be adapted for other printers and computers.

The dot matrix printer has evolved over the last two years from a rather stodgy machine suitable only for making nearly illegible program listings and data dumps into a sleek, glossy beast which can come close to letter quality printers in typeface formation.

The modern dot matrix printer is usually faster than letter quality printers, usually cheaper (although there is some overlap in prices), and can be the printer of choice for every application from programming to draft quality (sometimes called correspondence quality) word processing.

Many contemporary dot matrix impact printers have extensive abilities to present different styles of character formation (see the figure). Generally, these different character fonts are software selectable, a convenient feature for the user. Obviously, having the print style under program control can be useful. However, the problem then arises of remembering how to set the different print modes.

Printer manufacturers have not standardized printer control codes. Different printers will respond to different control characters. This is not a problem if your printer has only two different print fonts, but you will probably not be able to remember all of your machine's codes if it has several different printing modes. The usual answer to this problem is to look in the instruction manual which came with the printer, a solution which can be a major research project. A quicker method is to write a mode-setting program for your printer. You can do this by adapting the program presented in this article.

The program is written in Applesoft BASIC and allows the Apple II+ to use one of the Epson MX-series printers with Graphtrax+. These printers have 12 print modes which can be used in either normal or italic typeface.

Print Styles

Lines 200-340 contain all of the Epson control codes for the different type styles to be used. These lines set values into two string arrays. The array PS$(n) contains the code to set the style of type, and the array DS$(n) contains a brief description of the corresponding control code in PS$(n). These codes are specific to the Epson printers; if you're customizing this routine for another printer, you will make the majority of changes here.

The program will not only allow you to set your printer, but will also demonstrate all of the printer's various print styles if required. If you choose to print the demonstration, control passes to the routine between lines 400 and 560.

On the other hand, if you simply want to set the printer, lines 570-670 print a menu, lock it in position on the screen, and then allow input of your choice. If the printer can be set to your choice, the control passes to the short routine at line 760, which first sets the printer to the normal mode and then sends the special mode requested and returns to the menu.

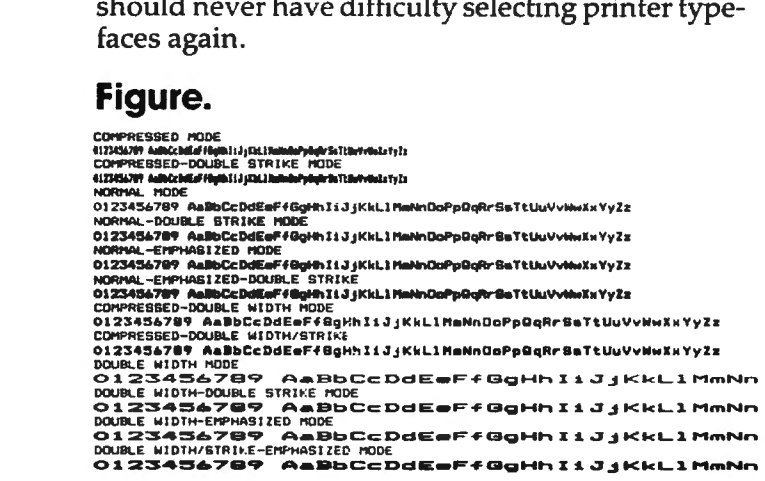
The logic of this part of the program is complicated by the fact that the Epson double-width modes (modes 7-12) may be set only for a single line and must be reset at the beginning of every line to be printed in those modes. Lines 690-710 print a message about this problem, and then lines 720 and 730 allow you to type in a brief message, which will be printed on the printer as soon as you hit the return key. The printer will be left in the normal 80 characters per line mode. After printing the line, control returns to the menu routine.

It must be noted that every time a mode is sent to the printer, all previous modes are cleared by first sending PS$(3), the "normal" mode command string. The string, PS$(3), resets double strike, compressed, and enhanced modes, but does not reset the Italics command. Therefore, if you first request the special print mode which you want and then turn the Italics on, you will get the normal mode with Italics. The correct procedure: first turn on the Italics and then select the special print desired. If you then use option 15 to end the program, your printer will remain set in the typeface which you have specified.

Regardless of which brand of printer or computer you own, the basic approach used here is

easily customized. With a look at your printer's manual and a little work keying in code, you should never have difficulty selecting printer typefaces again.

Figure.



Program.

```
10  REM  EPSON GRAPHTRAX+
20  REM  PRINT MODE SET UTILITY
50  DIM PS$(14),DS$(14)
60  REM   TITLES HERE
70  TEXT : HOME : SPEED= 255:D$ =  CHR$ (4):
      PRINT D$;"NOMON C,I,O": HOME
80  INVERSE : FOR I = 1 TO 4: PRINT  SPC( 40
    ): IF I = 2 THEN  PRINT "  EPSON PRINTE
    R GRAPHTRAX+ SET UTILITY  ";
90  NEXT I: NORMAL : POKE 34,5
100  VTAB 10: PRINT "PLEASE TURN YOUR PRINTE
    R ON NOW."
110  GOSUB 130: GOSUB 140: GOTO 200
120  REM   HIT ANY KEY TO CONTINUE
130  VTAB 20: FLASH : PRINT "HIT
      ANY KEY TO CONTINUE.";: GET A$: PRINT
      CHR$ (1): NORMAL : RETURN
140  REM   PRINT SLOT SET
150 S1 = 1
160  HOME : VTAB 10: PRINT "PRINTER SLOT=";S
    1; CHR$ (7): VTAB 20: PRINT "NEW SLOT (
    #/<CR>)?";: GET NS$: PRINT  CHR$ (1): IF
     ASC (NS$) = 13 THEN 200
170  IF  ASC (NS$) = 27 THEN  TEXT : HOME : END

180  IF  ASC (NS$) < 48 OR  ASC (NS$) > 55 THEN
    160
190 S1 =  VAL (NS$): GOTO 160
200  REM   SET CTRL-STRINGS
210 PS$(1) =  CHR$ (15):DS$(1) = "COMPRESSED
     MODE"
220 PS$(2) =  CHR$ (15) +  CHR$ (27) +  CHR$
    (71):DS$(2) = "COMPRESSED-DOUBLE STRIKE
     MODE"
230 PS$(3) =  CHR$ (27) +  CHR$ (72) +  CHR$
    (18) +  CHR$ (27) +  CHR$ (70):DS$(3) =
    "NORMAL MODE"
240 PS$(4) =  CHR$ (27) +  CHR$ (71):DS$(4) =
    "NORMAL-DOUBLE STRIKE MODE"
250 PS$(5) =  CHR$ (27) +  CHR$ (69):DS$(5) =
    "NORMAL-EMPHASIZED MODE"
260 PS$(6) =  CHR$ (27) +  CHR$ (71) +  CHR$
    (27) +  CHR$ (69):DS$(6) = "NORMAL-EMPH
    ASIZED-DOUBLE STRIKE"
270 PS$(7) =  CHR$ (27) +  CHR$ (14) +  CHR$
    (15):DS$(7) = "COMPRESSED-DOUBLE WIDTH
    MODE"
280 PS$(8) =  CHR$ (27) +  CHR$ (71) +  CHR$
    (14) +  CHR$ (15):DS$(8) = "COMPRESSED-
    DOUBLE WIDTH/STRIKE"
290 PS$(9) =  CHR$ (27) +  CHR$ (14):DS$(9) =
    "DOUBLE WIDTH MODE"
300 PS$(10) =  CHR$ (27) +  CHR$ (71) +  CHR$
    (14):DS$(10) = "DOUBLE WIDTH-DOUBLE STR
    IKE MODE"
310 PS$(11) =  CHR$ (27) +  CHR$ (69) +  CHR$
    (14):DS$(11) = "DOUBLE WIDTH-EMPHASIZED
     MODE"
320 PS$(12) =  CHR$ (27) +  CHR$ (71) +  CHR$
    (27) +  CHR$ (69) +  CHR$ (14):DS$(12) =
    "DOUBLE WIDTH/STRIKE-EMPHASIZED MODE"
330 PS$(13) =  CHR$ (27) + "4":DS$(13) = "SE
    T ITALICS ON"
340 PS$(14) =  CHR$ (27) + "5":DS$(14) = "SE
    T ITALICS OFF"
350  REM   SAMPLE OR JUST SET MODE
360  HOME
370  VTAB 10: PRINT "DO YOU WANT A SAMPLE OF
      ALL THE PRINT": PRINT "STYLES AVAILABL
    E? (Y/N)  ";: GET Y$: PRINT Y$: PRINT  CHR$
    (1): IF Y$ = "Y" THEN 410
380  IF Y$ = "N" THEN 580
390  GOTO 370
400  REM    PRINT SAMPLE
410  PRINT D$;"PR#";S1
420  PRINT  CHR$ (8);"80N"; CHR$ (12)
430  PRINT PS$(11);"  THE    EPSON    MX-SER
    IES    PRINTER"
440  FOR I = 48 TO 57:T$ = T$ +  CHR$ (I): NEXT
    I:T$ = T$ + " ": FOR I = 65 TO 90:T$ =
    T$ +  CHR$ (I):T$ = T$ +  CHR$ (I + 32)
    : NEXT I
450  PRINT PS$(3)
460  FOR I = 1 TO 2
470  IF I = 1 THEN  PRINT PS$(3);"STANDARD C
    HARACTERS"
480  IF I = 2 THEN  PRINT PS$(3);PS$(13);"IT
    ALIC CHARACTERS"
490  PRINT
500 S$ = T$
510  FOR J = 1 TO 12: IF J > 8 THEN S$ =  LEFT$
    (T$,39)
520  PRINT PS$(3);DS$(J): PRINT PS$(J);S$
530  NEXT J
540  PRINT
550  NEXT I: PRINT PS$(3);PS$(14); CHR$ (12)
    ; CHR$ (12)
560  PRINT D$;"PR#0"
570  REM    SET PRINT STYLE
580  HOME : VTAB 7: FOR I = 1 TO 14: IF I >
    9 THEN  PRINT I;". ";DS$(I)
590  IF I < 10 THEN  PRINT " ";I;". ";DS$(I)

600  NEXT I
610  PRINT I;". EXIT PROGRAM"
620  POKE 34,22
630  ONERR  GOTO 640
640  VTAB 23: INVERSE : INPUT "SELECT PRINT
    STYLE (1-15) : ";P: IF P < 1 OR P > 15 THEN
     PRINT  CHR$ (7): GOTO 640
650  NORMAL
660  IF P = 15 THEN  TEXT : HOME : END
670  IF P < 7 OR P > 12 THEN 760
680  REM   DOUBLE WIDTH LINE PRINT
690  VTAB 7: CALL  - 958: VTAB 8: PRINT "MOD
    ES 7-12 ARE ONE LINE MODES ONLY.": POKE
    34,6: PRINT : PRINT "THE DOUBLE WIDTH C
    HARACTER CONTROL": PRINT "STRING MUST B
    E PRINTED AT THE FRONT OF": PRINT "EACH
     LINE OF WIDE TEXT."
700  PRINT : PRINT "YOU MAY NOW TYPE A 40 CH
    ARACTER (OR": PRINT "LESS) LINE AND IT
    WILL BE PRINTED IN ": PRINT "THE DESIRE
    D MODE.": PRINT : PRINT "PLEASE ADJUST
    YOUR PRINTER PAPER TO THE"
710  PRINT "DESIRED POSITION FOR THE LINE.":
     VTAB 21: PRINT "TYPE IN THE LINE YOU W
    ANT PRINTED:"
720  VTAB 22: INPUT "";L$: IF  LEN (L$) > 40
     THEN  VTAB 22: CALL  - 868: VTAB 22: GOTO
    720
730  PRINT D$;"PR#";S1: PRINT PS$(3);PS$(P);
    L$;PS$(3): PRINT D$;"PR#0": GOTO 580
740  REM   CLEAR PREVIOUS MODE &
750  REM  SEND NEW MODE
760  PRINT D$;"PR#";S1: PRINT PS$(3);PS$(P):
     PRINT D$;"PR#0": VTAB 1: CALL  - 868: VTAB
    1: INVERSE : HTAB ((40 -  LEN (DS$(P)))
     / 2): PRINT DS$(P): GOTO 640
```

VIDEO 80

80 Columns For The Atari

Charles Brannon, Editorial Assistant

How would you like to add 80-column capability to your Atari at no cost, without any hardware modifications? This program requires a disk drive.

The Atari text screen is well designed. The white on blue text colors are chosen for maximum contrast and resolution on the average TV screen. You also have 40 columns of letters across a line on your TV display.

Why 80 Columns?

Some applications, such as word processing, spreadsheets, screen-based operator entry, high-resolution graphics labeling, and even proofreading, benefit from a higher text density. Most high-end business computers, therefore, have 80-column displays. Unfortunately, a normal 80-column display is impossible on a TV screen. TV's can't handle the necessary fine detail. That's why the Atari doesn't have an 80-column feature, an otherwise desirable capability.

You can buy 80-column cards for your Atari. These devices let you switch your display to 80 columns, and even let you edit BASIC programs in 80 columns.

While "Video 80," the program below, has its limitations, it is a reasonable alternative to hardware add-ons. Here's how it works. The characters are "drawn" half-wide in GRAPHICS 8, the highest resolution mode. Each character is only four pixels wide, versus eight pixels in 40 columns. (A *pixel* is a screen dot, a *picture element*.) The fourth pixel must be blank, to allow for spacing between letters. Also required is a special *character set*. This is the first caveat – the 900+ bytes (128x7) of the character set add to the typing required to enter Video 80.

TV Tribulations

You might suspect that such a condensed screen would be hard to read, and you would be right. If you have a monochrome *monitor*, you'll have no problem. (A *monitor* is a special TV without a tuner inside which puts the signal *directly* from the computer to the screen.) The characters will be quite crisp. Televisions have a harder time, due to artifacting. You will be able to use Video 80 on some quality TV's or even a large screen TV with bigger pixels. An ordinary black and white TV is quite satisfactory.

First, type in Program 1. Video 80 is a machine language program. You'll need a disk drive to use Video 80, since the program directly creates the *binary file* that you load from DOS. When you RUN it, you'll have the option of naming it AUTORUN.SYS. Since Video 80 resides in low memory, this is the easiest way to load it. If you write the AUTORUN.SYS file to any disk containing DOS, it will automatically load and initialize when you boot the disk. Type it in carefully. However, if you make an error in the DATA lines, you will be given the range of lines where the error occurs.

The V: Device

Video 80 interfaces with BASIC and the OS by adding a new device, "V:" You're already familiar with several Atari devices, such as "D:" for the disk drive, "P:" for the printer, and even "R:", the RS-232 (850 module) device. Using Video 80 is as simple as OPENing a file to "V:", and PRINT#'ing or INPUT#'ing through it. A sample program might look like:

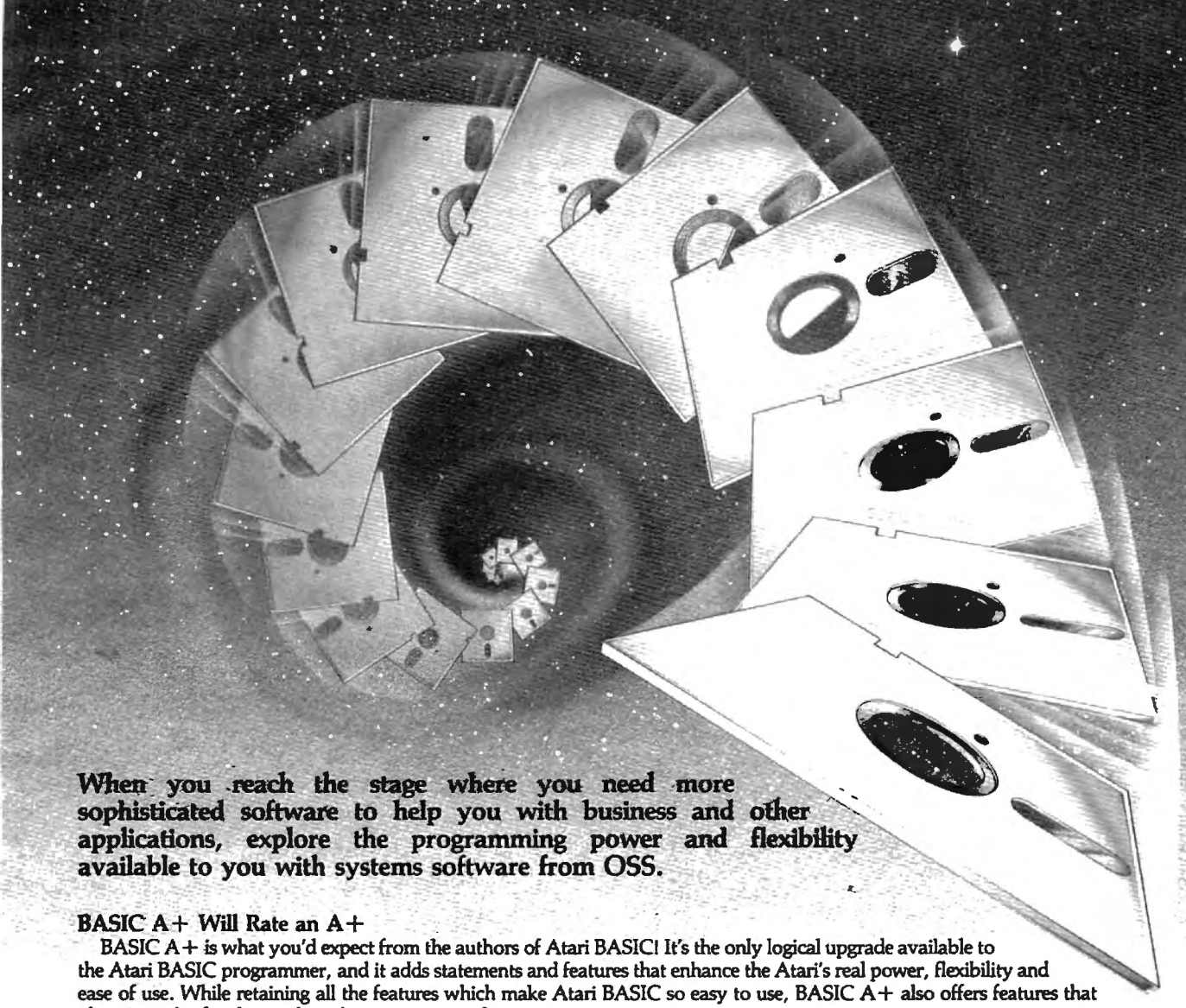
```
10 OPEN #1,12,0,"V:"
20 PRINT #1;"Hello"
30 CLOSE #1
40 GOTO 40
```

You might think of Video 80 as a "soft" 80-column printer, making it ideal for reviewing listings. You *can* say LIST"V:".

Line Input

Also supported is simple line-based editing. No fancy cursor controls here – backspace is the only editing key. The cursor appears only during INPUT. You can change the cursor character by POKEing into location five. POKE 5,63 changes the cursor into an underline. Note that the char-

EXPLORE A NEW DIMENSION IN SOFTWARE



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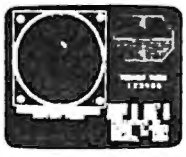
32K Disk, $49.95 Modem Required



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Board game strategy and realistic animation combine to make this arcade game the most difficult real life challenge of all. Track the oncoming enemy with the sonar aboard your U-Boat while using your periscope to chase enemy ships throughout the Atlantic. Get them in your sights—open torpedo bays—give the command—FIRE!

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From Synapse Software

There's trouble in the barnyard, and this machine-language, arcade game will challenge even the most experienced arcade player. You try to help Ma Hen save the eggs and chickens from the wily fox. The action gets faster and faster as eggs turn into chicks, feathers fly, chickens squawk, and all bedlam breaks loose. You'll really have to think fast to outwit this fox. Requires paddles.

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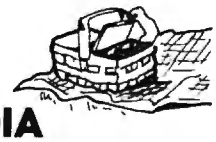

PICNIC PARANOIA

From Synapse

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

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By Mike Potter from Synapse

You must transport all your people from the city under attack by Fraxulian Slimehordes. You must lift them one by one *first* to the City of Hope on the far side of the volcano; *then* to safety at the Verdann Fortress. Beware the Xytonic Pulse Trackers, meteoroid showers and the Laser Caves of Fear. But *hurry*, before the volcano erupts!!

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

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From Synapse by Mike Hales

Large drops of "Slime" fall from the sky onto your ships. If *one drop* hits your ship, it will sink. Use the triangular diverters to aim Slime into buckets on the sides of the screen. If Slime falls into the ocean, the level of the ocean rises. When the ocean reaches the top of the screen, the game is over, and your score is calculated. One-player game with excellent graphics.

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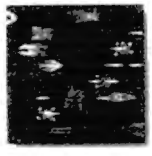

TURMOIL

From Sirius

Pilot an intergalactic fighter through unfriendly skies as you're attacked from both sides by evil aliens. You can blast seven enemies into cosmic dust at once — if you're fast enough!

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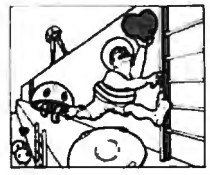

FAST EDDIE

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.

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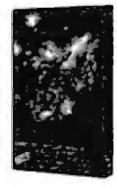

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acter you POKE is the "internal" code, not ASCII. A sample input/output program could be:

```
10 OPEN #1,12,0,"V:"
20 DIM NAME$(20)
30 PRINT #1;"What is your name?";
40 INPUT #1;NAME$
50 PRINT #1;"Glad to meet you, ";NAM
   E$
60 GOTO 60
```

Line 60 is used here to keep the display on the screen when the program ends. Since the full-screen GRAPHICS 8 screen is used, the program would flip back to GRAPHICS 0 when the program ends. (Try typing GRAPHICS 24 in immediate mode to see this effect.)

Windows

There's more. You can also restrict the size of the 80-column screen. It may seem pointless to cut 80-column capability down to a small window of the screen, but windows are actually quite useful. You can set up and switch from window to window. All scrolling and clearing is confined to the window. A "screen form" layout is easily designed. You can even outline the windows with high-resolution lines. The top and bottom margins are stored in locations 1 and 2, the left and right margins are in 3 and 4. Use POKE to change them. You can also use the POSITION command to move the cursor to any legal X,Y position (X:0-79, Y:0-23). Program 2 is an example program for using windows. The left margin must be an even number, and the right margin must be an odd number.

Since the same memory locations are used, you can really get confused trying to use high-resolution graphics with the text. Use GRAPHICS 24 before you OPEN your file to "V:". Try to keep your hi-res stuff separate from text.

BASICally 80

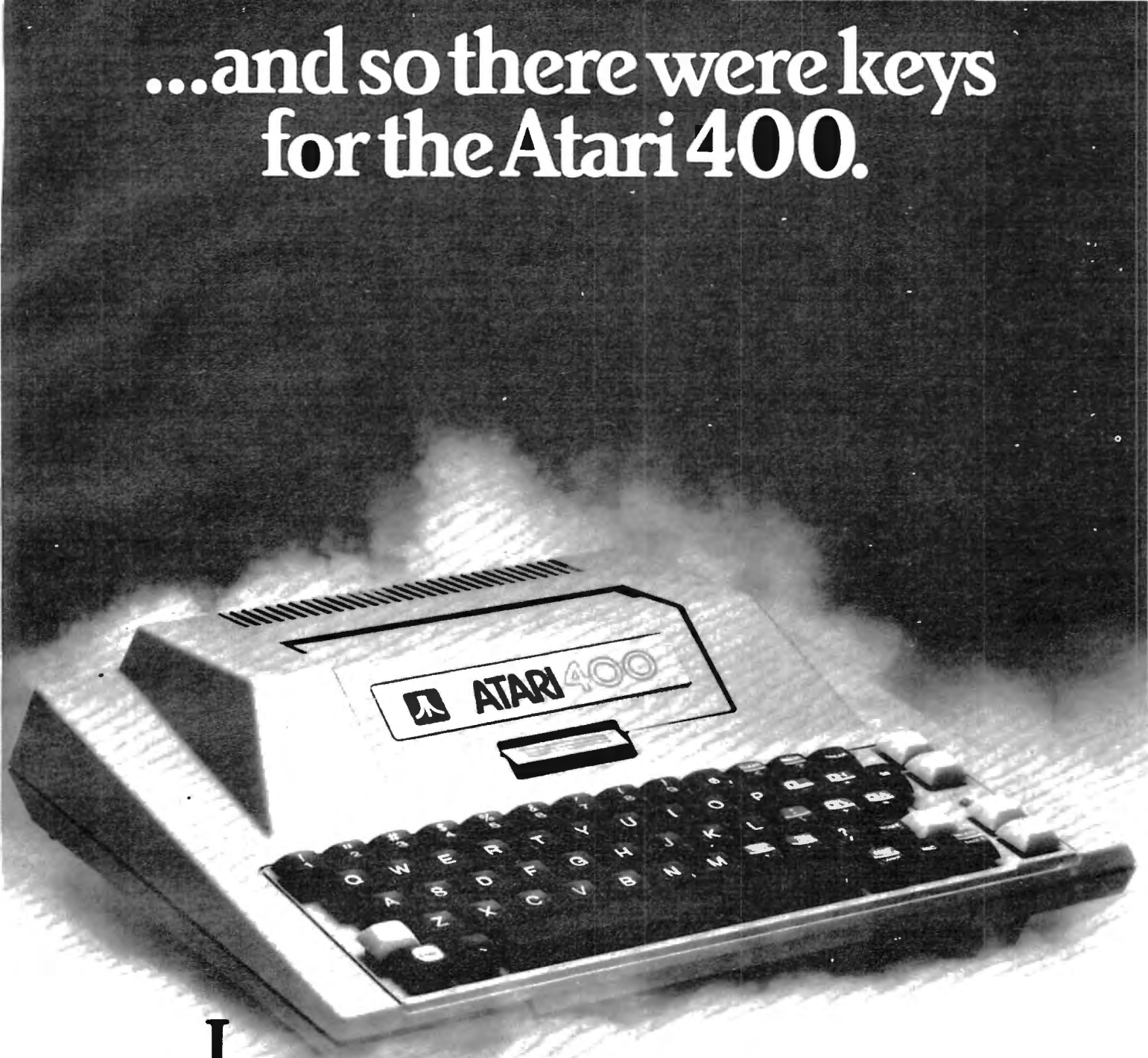
You can even "transform" the default Atari I/O screen from 40 to 80 columns. Program 3 POKEs a tiny machine language routine into page six. The command PRINT USR(1536) will set up 80 columns. If you execute a GRAPHICS 0 command, you're really in trouble – it'll be a "twilight zone" between GRAPHICS 0 and 8. You'll have to press RESET to detach "V:". If you do this, you'll have to reload it to use it again.

Once in the 80-column mode, you can list, load, and enter commands. If you want to change a line of BASIC, however, you'll have to retype it. Full cursor-based editing would be great, but it would substantially increase the length of the program.

Program 1.

```
100 REM VIDEO 80
110 REM Charles Brannon
120 GRAPHICS 0:? "Checking DATA line
    s...":? :? :DIM CORRECT(27),F$(2
    0):SETCOLOR 2,1,4
130 FOR I=1 TO 27:READ A:CORRECT(I)=
    A:NEXT I
140 FOR I=1 TO 27:CHECKSUM=0
150 FOR J=1 TO 60-42*(I=27)
160 READ A:CHECKSUM=CHECKSUM+A:POKE
    712,A
170 NEXT J
180 IF CHECKSUM<>CORRECT(I) THEN ? "
    Error somewhere in lines ";7936+
    (I-1)*60;"-";7990+(I-1)*60:ERRFL
    G=1
190 NEXT I:POKE 712,0
200 IF ERRFLG THEN ? :? "Can't conti
    nue until":? "DATA lines are per
    fect.":SETCOLOR 2,4,4:END
210 REM Checksum values
220 REM These at least must be typed
     in perfectly!!!
230 DATA 4556,4216,7888,4777,7684,87
    89,6732,3655,3808,3587,6205,6086
    ,5406,5712,6731,7528,7758,7120,6
    184,5743,6210
240 DATA 6677,5602,7418,7558,7271,13
    54
250 GRAPHICS 0:SETCOLOR 2,12,4:? "Co
    ngratulations.  DATA OK!":?
260 ? "Enter output filename below."
    :? "Use AUTORUN.SYS for easiest
    use."
270 ? "AUTORUN.SYS will boot up on a
    ":? "disk containing DOS."
280 ? :? "If you use another name, y
    ou must":? "use MEM.SAV and DOS
    selection L":? "to load the prog
    ram."
290 ? :? "Use the D: prefix.":?
300 ? "Filename";:INPUT F$
310 ? :? "Writing file":SETCOLOR 2,7
    ,4
320 TRAP 500:OPEN #1,8,0,F$
330 PUT #1,255:PUT #1,255
340 PUT #1,0:PUT #1,31:PUT #1,42:PUT
     #1,37:RESTORE 7936
350 FOR I=7936 TO 9514:READ A:PUT #1
    ,A:NEXT I
351 PUT #1,224:PUT #1,2:PUT #1,225:P
    UT #1,2:PUT #1,53:PUT #1,35
360 CLOSE #1:TRAP 40000:SETCOLOR 2,9
    ,4
370 ? :? "File saved OK.  Have fun!"
380 END
500 CLOSE #1:SETCOLOR 2,4,4:? :? "ER
    ROR-";PEEK(195);" trying to save
     ";F$
510 END
7900 REM
7910 REM Machine language equivalent
7920 REM of VIDEO 80.  Must be typed
7930 REM accurately to function.
7931 REM
7936 DATA 0,0,0,0,0,0
7942 DATA 0,68,68,68,68,0
7948 DATA 68,0,170,170,170,0
7954 DATA 0,0,0,0,170,238
7960 DATA 170,238,170,0,68,102
7966 DATA 136,68,34,204,68,0
7972 DATA 136,34,68,136,34,0
7978 DATA 204,102,238,102,204,68
```

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



In the beginning there was the membrane keyboard.

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

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```
7984 DATA 0,68,68,68,0,0
7990 DATA 0,0,102,136,136,136
7996 DATA 136,136,102,204,34,34
8002 DATA 34,34,34,204,0,170
8008 DATA 68,238,68,170,0,68
8014 DATA 68,238,68,68,0,0
8020 DATA 0,0,0,0,68,68
8026 DATA 136,0,0,238,0,0
8032 DATA 0,0,0,0,0,0
8038 DATA 0,68,0,0,0,34
8044 DATA 68,136,0,0,238,170
8050 DATA 170,170,170,238,0,68
8056 DATA 204,68,68,68,238,0
8062 DATA 238,34,34,238,136,238
8068 DATA 0,238,34,34,238,34
8074 DATA 238,0,170,170,170,238
8080 DATA 34,34,0,238,136,238
8086 DATA 34,34,238,0,238,136
8092 DATA 238,170,170,238,0,238
8098 DATA 34,34,68,68,68,0
8104 DATA 238,170,238,170,170,238
8110 DATA 0,238,170,170,238,34
8116 DATA 238,0,0,0,68,0
8122 DATA 68,0,0,0,0,68
8128 DATA 0,68,68,136,34,68
8134 DATA 136,68,34,0,0,0
8140 DATA 238,0,238,0,0,0
8146 DATA 136,68,34,68,136,0
8152 DATA 0,204,34,34,68,0
8158 DATA 68,0,102,153,187,187
8164 DATA 136,102,0,238,170,170
8170 DATA 238,170,170,0,204,170
8176 DATA 204,170,170,204,0,102
8182 DATA 136,136,136,136,102,0
8188 DATA 204,170,170,170,170,204
8194 DATA 0,238,136,204,136,136
8200 DATA 238,0,238,136,204,136
8206 DATA 136,136,0,102,136,136
8212 DATA 170,170,102,0,170,170
8218 DATA 238,170,170,170,0,238
8224 DATA 68,68,68,68,238,0
8230 DATA 34,34,34,34,34,204
8236 DATA 0,170,170,204,170,170
8242 DATA 170,0,136,136,136,136
8248 DATA 136,238,0,170,238,238
8254 DATA 170,170,170,0,204,170
8260 DATA 170,170,170,170,0,68
8266 DATA 170,170,170,170,68,0
8272 DATA 238,170,238,136,136,136
8278 DATA 0,238,170,170,170,170
8284 DATA 238,51,204,170,170,204
8290 DATA 170,170,0,102,136,204
8296 DATA 34,34,204,0,238,68
8302 DATA 68,68,68,68,0,170
8308 DATA 170,170,170,170,238,0
8314 DATA 170,170,170,170,170,68
8320 DATA 0,170,170,170,238,238
8326 DATA 170,0,170,68,68,68
8332 DATA 68,170,0,170,170,238
8338 DATA 68,68,68,0,238,34
8344 DATA 68,136,136,238,0,34
8350 DATA 68,68,136,68,68,34
8356 DATA 0,136,68,34,0,0
8362 DATA 0,136,68,68,34,68
8368 DATA 68,136,0,68,170,0
8374 DATA 0,0,0,0,0,0
8380 DATA 0,0,0,255,0,153
8386 DATA 255,255,102,0,0,68
8392 DATA 68,68,119,68,68,68
8398 DATA 34,34,34,34,34,34
8404 DATA 34,68,68,68,204,0
8410 DATA 0,0,68,68,68,204
8416 DATA 68,68,68,0,0,0
8422 DATA 204,68,68,68,0,0
8428 DATA 0,17,34,68,136,0
8434 DATA 0,0,136,68,34,17
8440 DATA 0,0,0,17,51,119
8446 DATA 255,0,0,0,0,51
8452 DATA 51,51,0,0,0,136
8458 DATA 204,238,255,51,51,51
8464 DATA 51,0,0,0,204,204
8470 DATA 204,204,0,0,0,238
8476 DATA 0,0,0,0,0,0
8482 DATA 0,0,0,0,0,0
8488 DATA 255,0,0,0,0,204
8494 DATA 204,204,0,0,68,170
8500 DATA 68,238,0,0,0,0
8506 DATA 119,68,68,68,0,0
8512 DATA 0,238,0,0,0,68
8518 DATA 68,68,255,68,68,68
8524 DATA 0,0,0,238,238,238
8530 DATA 0,0,0,0,0,238
8536 DATA 238,238,136,136,136,136
8542 DATA 136,136,136,0,0,0
8548 DATA 255,68,68,68,68,68
8554 DATA 68,255,0,0,0,204
8560 DATA 204,204,204,204,204,204
8566 DATA 68,68,68,119,0,0
8572 DATA 0,204,136,204,136,204
8578 DATA 102,0,68,238,68,68
8584 DATA 68,0,0,68,68,68
8590 DATA 238,68,0,0,34,68
8596 DATA 238,68,34,0,0,136
8602 DATA 68,238,68,136,0,0
8608 DATA 0,102,255,255,102,0
8614 DATA 0,0,0,102,34,238
8620 DATA 238,0,136,136,204,170
8626 DATA 170,204,0,0,0,102
8632 DATA 136,136,102,0,34,34
8638 DATA 102,170,170,102,0,0
8644 DATA 0,238,238,136,238,0
8650 DATA 0,204,136,204,136,136
8656 DATA 0,0,0,102,170,238
8662 DATA 34,204,136,136,136,204
8668 DATA 170,170,0,0,68,0
8674 DATA 68,68,68,0,0,34
8680 DATA 0,34,34,34,204,136
8686 DATA 136,170,204,170,170,0
8692 DATA 68,68,68,68,68,68
8698 DATA 0,0,0,170,238,170
8704 DATA 170,0,0,0,204,170
8710 DATA 170,170,0,0,0,238
8716 DATA 170,170,238,0,0,0
8722 DATA 204,170,204,136,136,0
8728 DATA 0,102,170,102,34,34
8734 DATA 0,0,102,136,136,136
8740 DATA 0,0,0,238,136,102
8746 DATA 238,0,0,68,238,68
8752 DATA 68,102,0,0,0,170
8758 DATA 170,170,238,0,0,0
8764 DATA 170,170,170,68,0,0
8770 DATA 0,170,170,238,170,0
8776 DATA 0,0,170,68,170,170
8782 DATA 0,0,0,170,170,102
8788 DATA 34,204,0,0,238,68
8794 DATA 136,238,0,0,68,238
8800 DATA 238,68,238,0,68,68
8806 DATA 68,68,68,68,68,255
8812 DATA 153,153,153,153,153,255
8818 DATA 34,102,238,102,34,0
8824 DATA 0,136,204,238,204,136
8830 DATA 0,0,133,203,173,255
8836 DATA 2,208,251,169,0,133
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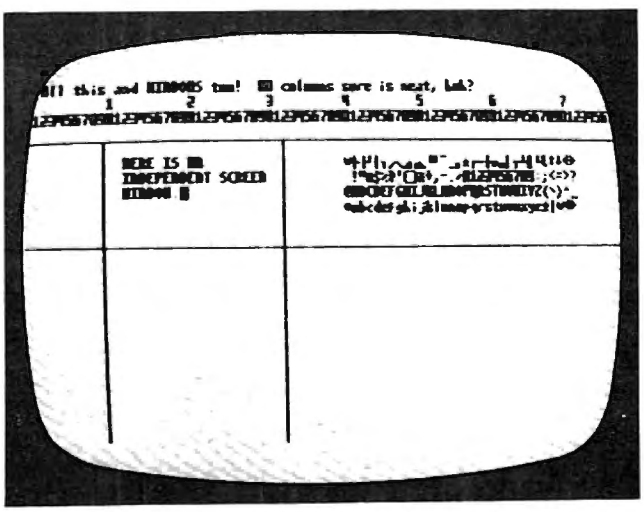
```
8842 DATA 207,165,203,16,8,41
8848 DATA 127,133,203,169,255,133
8854 DATA 207,32,4,35,165,85
8860 DATA 74,24,101,205,133,205
8866 DATA 144,2,230,206,169,0
8872 DATA 133,209,165,203,10,38
8878 DATA 209,10,38,209,10,38
8884 DATA 209,56,229,203,133,208
8890 DATA 176,2,198,209,24,165
8896 DATA 208,105,0,133,208,165
8902 DATA 209,105,31,133,209,160
8908 DATA 0,165,85,74,176,17
8914 DATA 177,208,69,207,41,240
8920 DATA 133,204,177,205,41,15
8926 DATA 5,204,76,241,34,177
8932 DATA 208,69,207,41,15,133
8938 DATA 204,177,205,41,240,5
8944 DATA 204,145,205,24,165,205
8950 DATA 105,39,133,205,144,2
8956 DATA 230,206,200,192,7,208
8962 DATA 202,96,24,169,0,133
8968 DATA 205,133,206,165,84,10
8974 DATA 10,10,133,204,38,206
8980 DATA 10,38,206,10,38,206
8986 DATA 101,204,144,2,230,206
8992 DATA 10,38,206,10,38,206
8998 DATA 10,38,206,24,101,88
9004 DATA 133,205,165,206,101,89
9010 DATA 133,206,96,160,0,185
9016 DATA 26,3,201,0,240,10
9022 DATA 200,200,192,34,208,243
9028 DATA 56,160,147,96,169,86
9034 DATA 153,26,3,200,169,100
9040 DATA 153,26,3,200,169,35
9046 DATA 153,26,3,169,43,141
9052 DATA 231,2,169,37,141,232
9058 DATA 2,96,117,35,114,35
9064 DATA 1,36,170,35,116,35
9070 DATA 116,35,76,115,35,160
9076 DATA 1,96,169,0,133,84
9082 DATA 133,85,133,107,133,0
9088 DATA 133,3,133,1,169,79
9094 DATA 133,4,169,23,133,2
9100 DATA 169,128,133,5,169,8
9106 DATA 133,43,169,12,133,42
9112 DATA 32,246,243,162,0,142
9118 DATA 197,2,162,10,142,198
9124 DATA 2,142,200,2,76,115
9130 DATA 35,32,177,35,76,115
```



An all-software 80-column screen on the Atari with "Video-80."

```
9136 DATA 35,201,125,208,3,76
9142 DATA 16,37,166,3,228,85
9148 DATA 48,2,134,85,166,4
9154 DATA 228,85,176,2,134,85
9160 DATA 166,1,228,84,48,2
9166 DATA 134,84,166,2,228,84
9172 DATA 176,2,134,84,201,155
9178 DATA 208,7,165,3,133,85
9184 DATA 76,243,35,32,203,36
9190 DATA 32,128,34,166,85,228
9196 DATA 4,208,16,166,3,134
9202 DATA 85,166,84,228,2,208
9208 DATA 3,76,96,36,230,84
9214 DATA 96,230,85,96,166,107
9220 DATA 240,12,166,0,189,128
9226 DATA 5,198,107,230,0,76
9232 DATA 115,35,162,0,134,0
9238 DATA 134,107,165,5,32,128
9244 DATA 34,32,226,246,192,127
9250 DATA 176,35,201,155,240,36
9256 DATA 201,126,208,6,32,218
9262 DATA 36,76,24,36,166,107
9268 DATA 16,6,32,253,36,76
9274 DATA 24,36,157,128,5,32
9280 DATA 177,35,230,107,76,24
9286 DATA 36,169,155,76,117,35
9292 DATA 169,0,32,128,34,169
9298 DATA 155,166,107,157,128,5
9304 DATA 230,107,32,177,35,76
9310 DATA 2,36,165,1,133,84
9316 DATA 32,4,35,165,2,133
9322 DATA 84,166,204,165,2,10
9328 DATA 10,10,133,100,24,165
9334 DATA 205,105,64,133,176,165
9340 DATA 206,105,1,133,177,165
9346 DATA 3,74,168,177,176,145
9352 DATA 205,200,152,10,197,4
9358 DATA 144,245,24,165,205,105
9364 DATA 40,133,205,144,2,230
9370 DATA 206,232,228,100,208,212
9376 DATA 56,165,205,233,40,133
9382 DATA 205,176,2,198,206,162
9388 DATA 8,165,3,74,168,169
9394 DATA 0,145,205,200,152,10
9400 DATA 197,4,144,245,24,165
9406 DATA 205,105,40,133,205,144
9412 DATA 2,230,206,202,208,227
9418 DATA 96,168,42,42,42,42
9424 DATA 41,3,170,152,41,159
9430 DATA 29,246,254,96,169,0
9436 DATA 32,128,34,165,107,240
9442 DATA 25,165,85,197,3,240
9448 DATA 5,198,85,76,250,36
9454 DATA 165,4,133,85,165,84
9460 DATA 197,1,240,2,198,84
9466 DATA 198,107,96,162,175,142
9472 DATA 0,210,142,1,210,160
9478 DATA 0,136,208,253,202,224
9484 DATA 159,208,243,96,165,1
9490 DATA 133,84,32,4,35,56
9496 DATA 165,2,229,1,24,105
9502 DATA 1,10,10,10,170,32
9508 DATA 173,36,165,3,133,85
9514 DATA 96,0,0,0,0,0
```

Program 2.

```
100 REM DEMO FOR V: WINDOWS
110 GRAPHICS 8+16:REM Only need this
    if you use graphics
120 OPEN #1,12,0,"V:":REM Open V: de
    vice
```

```
130 DIM A$(127)
140 REM Draw window outline
150 COLOR 1:PLOT 0,88:DRAWTO 319,88
160 PLOT 38,31:DRAWTO 38,191:PLOT 12
    8,31:DRAWTO 128,191:PLOT 0,31:DR
    AWTO 319,31
170 POSITION 2,0
180 ? #1;"All this and WINDOWS too!
     80 columns sure is neat, huh?":
    ? #1
190 REM LABEL COLUMNS:
200 FOR I=1 TO 8:FOR J=0 TO 9:PUT #1
    ,48+J:NEXT J:NEXT I:FOR I=1 TO 7
    :POSITION 10*I,1:PUT #1,48+I:NEX
    T I
210 REM draw character set
220 FOR I=0 TO 3:FOR J=0 TO 31:POSIT
    ION J+40,5+I:A=I*32+J:IF A=125 T
    HEN A=0
230 PUT #1,A:NEXT J:NEXT I:? #1
240 POKE 1,4:POKE 2,10:POKE 3,10:POK
    E 4,31:REM SET WINDOW
250 POSITION 0,0
260 ? #1;"Enter some text:"
270 INPUT #1;A$
280 IF A$="QUIT" THEN 300
290 GOTO 270
300 END
```

Program 3.

```
100 REM  VOPEN-OPEN V: DEVICE
    110 REM
120 FOR I=1536 TO 1568:READ A:POKE I
    ,A:NEXT I
130 GRAPHICS 0:? "Video 80 OPEN Rout
    ine"
140 ? :? "Now loaded.  Use PRINT USR
    (1536)"
150 ? "to re-OPEN Editor device to V
    :":? "(Video 80 must be activate
    d)"
160 ? :? "To save to disk, enter DOS
    ,"
170 ? "Menu selection K. BINARY SAVE
    "
180 ? "then enter:"
190 ? "VOPEN.OBJ,0600,0620"
200 ? :? "To load VOPEN, enter L. BI
    NARY LOAD"
210 ? "and answer prompt with VOPEN.
    OBJ"
220 ? :? "Enter B. RUN CARTRIDGE to
    exit DOS"
230 ? :? "Good luck!":? :END
240 DATA 104,162,0,169,12,141,66
250 DATA 3,32,86,228,162,0
260 DATA 169,3,141,66,3,169
270 DATA 32,141,68,3,169,6
280 DATA 141,69,3,32,86,228,96,86
```

C Regena

Secondary Education

One of the early complaints about the TI was the lack of educational software for the secondary school level (junior high, middle, or senior high schools). The Scott, Foresman company developed excellent courseware in mathematics and reading for the elementary grades (starting with the primary grades for their first modules). Many users wondered if their children would "outgrow" the computer. Is the TI only for younger children?

The answer is that the powerful graphics and sound capabilities make the TI an excellent learning tool for young children, but there is no reason we cannot use the same computer for older children (and for adults with home and business applications).

In the last year the software growth rate has been phenomenal, including "third party" educational software for the TI. The computer can be used in just about any subject area. New software companies and new products are being created daily. I'm going to review a few applications for older students here; but keep in mind that even between the time I write this column and the time it is published, many more products will probably be announced.

Educational Modules

Texas Instruments has several modules that could be used in the junior high, middle school, or senior high school. Weight and Nutrition is a module that could be used by secondary students studying health or home economics.

Music students (and even non-musicians) can compose with the Music Maker command module. There are several options, including one in which short lines are placed on the screen and moved up or down as desired. Press a key and listen to the pattern you just created. One of the options lets you choose notes and rests and place them on a staff. You may choose a key signature and time signature. As you place the notes on the staff you can see, for example, what proportion of the measure a quarter note requires. When you finish the measure, you may listen to it or go to the next measure. You may play more than one note at a time if you wish. And if you compose something really special, you can then save your masterpiece on cassette.

Music students will also enjoy programming their own music either to learn a difficult piece, to sing along with, or to use as accompaniment for a solo instrument. You don't often think of using a computer in a music class, but because of the excellent sound capabilities of the TI the music departments may soon be begging for their own computers.

The Home Financial Decisions module could be a boon to economics classes. No longer do you need to find the right table in the back of the textbook, pick the right formula, interpolate, etc. Use the TI computer and this module. Suppose I want to buy a house and need to borrow some money. Press 1 for loans, press 2 for size of payments. Enter $65,000 for the loan, 360 monthly payments, and perhaps an interest rate of 12.5. I can find out immediately that the monthly payment is $693.72.

For physics and engineering students Texas Instruments has disk or cassette software called Electrical Engineering Library and Structural Engineering Library. Texas Instruments also has a Math Routine Library for advanced math students. Many times those tough equations that used to take hours or days to solve may now be solved easily and quickly with the computer.

The TI-99/4A keyboard has the letters in the same positions as those on a standard typewriter, and the shapes of the keys are similar, so the computer is ideal for touch-typing students. Students may use the Texas Instruments Touch Typing command module.

The Addison-Wesley Publishing Company has Computer Math Games, and Scott, Foresman has Math Action Games for grades one through eight or nine. What a way to practice math skills – by playing a video game! Milliken Math is also developing a math drill and practice series for grades one through eight.

The Minnesota Educational Computing Consortium (MECC) is renowned for its educational software for grades one through eight in a variety of math and science subjects. Their software is being developed for the TI computer on diskette.

Control Data Publishing Company is another pioneer in computer-aided instruction with their PLATO programs for all ages in all subjects. The first programs available for the TI (also for Atari 800 and Apple II Plus) are math, physics, French, German, and Spanish. For the TI you need the 32K memory expansion, disk controller, one disk drive, and the PLATO interpreter cartridge.

Math Competency Programs

Below are two short programs for secondary school students. These are called "Math Competency" because these types of problems are found in SRA, ACT, or other high school standardized competency tests. Younger students (third grade and up) should also be able to use the programs.

"Buying Items" gives a list of five items with their prices. The first question requires a total cost for all five items. The second question asks which two items may be purchased with a given amount of money. The question is in multiple-choice form.

"Earning Money" is a program using hourly or weekly wages to find a total earned for a given amount of time.

If you enter incorrect answers, you will be reminded how to get the right answer, and you will be given the same type of problem again. If you enter correct answers, you have the choice of solving another of the same kind of problem or continuing on to different sorts of questions.

Programming Techniques

"Buying Items"

There are three different categories for price lists. The number A is chosen randomly to be 1, 2, or 3. School supplies is number 1, a toy store is number 2, and a grocery store is number 3. The items I$ are read in as data in an array I$(A,C), where I$(2,4) would mean the name of an item in category 2 (toys), the fourth item listed.

The data for each item includes a minimum price I(A,C,1) and a maximum price I(A,C,2). For the actual price list for the problem, the price P is a random number from the minimum to the maximum:

```
D=I(A,C,2)-I(A,C,1)
P=I(A,C,1)+INT(RND*D+1)
```

A subroutine is used to convert the price calculated as a number of cents to a dollar value for printing in the problem. The price P is a whole number of cents. For example, 9 would be 9 cents; 59 would be 59 cents; and 135 would be 135 cents. To get the computer to print a decimal number that may include zeros for dollars, I use string manipulation. First let P$ be the string value of P.

If the length of P$ is 1, that means there is a single digit. In dollars we'll need a leading zero, so P$="0"&P$. Next I check to see if we have only cents – a length of 2 – because if there are only cents I want a space between the dollar sign and the decimal point. Therefore, if LEN (P$) is equal to 2, then P$=" "&P$. Now I put the right two characters to the right of a decimal point, and whatever is to the left are dollars. The subroutine is:

```
460 P$=STR$(P)
470 IF LEN(P$)>1 THEN 490
480 P$="0"&P$
490 IF LEN(P$)>2 THEN 510
500 P$=" "&P$
510 PR$=SEG$(P$,LEN(P$)-1,2)
520 PL$=SEG$(P$,1,LEN(P$)-2)
530 P$="$"&PL$&"."&PR$
540 RETURN
```

To combine string variables, an ampersand sign is used rather than a plus. In TI BASIC, IF-THEN-ELSE statements must contain statement numbers rather than commands. STR$ changes a number to a string. LEN(P$) finds the length or the number of characters in P$. SEG$(P$,A,B) yields the segment of the string P$ starting with the character in spot number A and containing the number B characters.

"Earning Money"

The names of the people in the problems are read in as N$(I) and T$(I) where I is a subscript from 0 to 5. The ways of earning money are read in as phrases J$(I).

The wage earned is P=100+25*INT(RND*10), which will translate from a dollar to as high as $3.25, in amounts divisible by 25¢. With this program, the amount earned, P, is known to be at least $1, so the subroutine for printing the dollar amount is:

```
340 P$=STR$(P)
350 P$="$"&SEG$(P$,1,LEN(P$)-2)&"."&SEG$(P$,
    LEN(P$)-1,2)
360 RETURN
```

A name is chosen with the random number N, and the number of hours in the first problem is a random number H=8+INT(RND*11). For the second type of problem, the number of weeks is a random number W=INT(RND*19)+2, which can be from two weeks to 20 weeks. The third type of problem chooses a random name, a random job, and a random number of weeks W=INT(RND*8)+2, which is from two weeks to nine weeks.

Program 1.

```
100 CALL CLEAR
110 PRINT TAB(6);"MATH COMPETENCY"
120 CALL CHAR(136,"080402FF020408")
130 PRINT :::TAB(7);"BUYING ITEMS"
140 CALL COLOR(14,9,16)
```

```
150 PRINT :::::TAB(9);"BY REGENA":::
    ::
160 DIM I$(3,5),I(3,5,2),N$(6),J(5),
    H$(3),S$(4)
170 FOR C=1 TO 6
180 READ N$(C)
190 NEXT C
200 FOR A=1 TO 3
210 FOR C=1 TO 5
220 READ I$(A,C),I(A,C,1),I(A,C,2)
230 NEXT C
240 NEXT A
250 DATA ANGIE,CINDY,CHERY,RICKY,BOB
    BY,RANDY,PENCIL,8,15
260 DATA ERASER,2,10,NOTEBOOK,35,99,
    RULER,29,49
270 DATA PAPER,59,90,DOLL,249,599,BA
    LL,49,89,TRUCK,100,150
280 DATA GAME,270,500,MODEL,300,700,
    CANDY,20,50
290 DATA MEAT,123,425,FRUIT,24,50,CH
    IPS,100,257,BREAD,100,179
300 H$(1)="PENCIL AND ERASER"
310 H$(2)="BALL AND TRUCK"
320 H$(3)="CANDY AND FRUIT"
330 GOTO 550
340 PRINT TAB(15);"PRESS <ENTER>";
350 CALL KEY(0,K,S)
360 IF K<>13 THEN 350
370 RETURN
380 CALL SOUND(100,330,2)
390 CALL SOUND(150,262,2)
400 RETURN
410 CALL SOUND(100,262,2)
420 CALL SOUND(100,330,2)
430 CALL SOUND(100,392,2)
440 CALL SOUND(200,523,2)
450 RETURN
460 P$=STR$(P)
470 IF LEN(P$)>1 THEN 490
480 P$="0"&P$
490 IF LEN(P$)>2 THEN 510
500 P$=" "&P$
510 PR$=SEG$(P$,LEN(P$)-1,2)
520 PL$=SEG$(P$,1,LEN(P$)-2)
530 P$="$"&PL$&"."&PR$
540 RETURN
550 RANDOMIZE
560 A=INT(RND*3+1)
570 TP=0
580 CALL CLEAR
590 PRINT "GIVEN THIS PRICE LIST:"::
600 FOR C=1 TO 5
610 D=I(A,C,2)-I(A,C,1)
620 P=I(A,C,1)+INT(RND*D+1)
630 GOSUB 460
640 TP=TP+P
650 PRINT TAB(6);I$(A,C);TAB(15);P$
660 NEXT C
670 R=INT(RND*13+4)
680 CALL COLOR(13,R,R)
690 CALL HCHAR(18,6,128,18)
700 CALL VCHAR(19,6,128,5)
710 CALL VCHAR(19,23,128,5)
720 CALL HCHAR(24,6,128,18)
730 F=INT(RND*2+1)
740 IF F=2 THEN 790
750 PRINT ::"HOW MUCH WILL IT COST"
760 PRINT "TO BUY ALL THE ITEMS"
770 PRINT "ON THE LIST?"
780 GOTO 830
790 N=INT(RND*6+1)
800 PRINT ::N$(N);" WANTS TO BUY"
810 PRINT "EVERYTHING ON THE LIST."
820 PRINT "WHAT WILL THE TOTAL COST
    BE?"
830 INPUT "$":X
840 IF ABS(X-TP/100)<.001 THEN 920
850 GOSUB 380
860 PRINT :"ADD ALL FIVE NUMBERS."
870 P=TP
880 GOSUB 460
890 PRINT "THE TOTAL IS ";P$:::
900 GOSUB 340
910 GOTO 550
920 GOSUB 410
930 CALL HCHAR(20,1,32,128)
940 IF F=2 THEN 970
950 PRINT "IF YOU COULD ONLY SPEND"
960 GOTO 980
970 PRINT "IF ";N$(N);" COULD ONLY S
    PEND"
980 IF A<>1 THEN 1010
990 M=INT(RND*5+25)
1000 GOTO 1050
1010 IF A<>2 THEN 1040
1020 M=INT(RND*36+239)
1030 GOTO 1050
1040 M=INT(RND*18+100)
1050 P=M
1060 GOSUB 460
1070 PRINT P$;", WHICH OF THESE PAIR
     S"
1080 PRINT "OF ITEMS COULD ";
1090 IF F<>1 THEN 1120
1100 PRINT "YOU BUY?"::
1110 GOTO 1160
1120 IF N>3 THEN 1150
1130 PRINT "SHE BUY?"::
1140 GOTO 1160
1150 PRINT "HE BUY?"::
1160 R=INT(RND*4+1)
1170 FOR V=1 TO 4
1180 IF V=R THEN 1280
1190 X=INT(RND*2+4)
1200 S$(V)=I$(A,X)
1210 X=INT(RND*3+1)
1220 S$(V)=S$(V)&" AND "&I$(A,X)
1230 IF V=1 THEN 1290
1240 FOR V1=1 TO V-1
1250 IF S$(V1)=S$(V)THEN 1190
1260 NEXT V1
1270 GOTO 1290
1280 S$(V)=H$(A)
1290 PRINT TAB(3);CHR$(64+V);" "&S$(
     V)
1300 NEXT V
1310 CALL SOUND(150,1397,2)
1320 CALL KEY(0,K,S)
1330 IF (K<65)+(K>68)THEN 1320
1340 CALL HCHAR(K-45,4,42)
1350 IF K<>64+R THEN 1410
1360 GOSUB 410
1370 PRINT :"TRY AGAIN? (Y/N)";
1380 CALL KEY(0,K,S)
1390 IF K=89 THEN 550
1400 IF K=78 THEN 1450 ELSE 1380
1410 GOSUB 380
1420 CALL HCHAR(19+R,3,136)
1430 PRINT :"THE TOTAL OF THE TWO IT
     EMS  MUST BE LESS THAN ";P$
1440 GOTO 1370
1450 CALL CLEAR
1460 END
```

Program 2.

```
100 CALL CLEAR
110 PRINT TAB(6);"MATH COMPETENCY"
120 PRINT :::TAB(7);"EARNING MONEY"
130 PRINT :::::TAB(9);"BY REGENA":::
    ::
140 DIM N$(5),J$(5),T$(5)
150 FOR I=0 TO 5
160 READ N$(I),J$(I),T$(I)
170 NEXT I
180 DATA SAM,DOING ODD JOBS,JOHN,JOE
    ,MOWING LAWNS,ANDY,BOB,TENDING C
    HILDREN,MARK,ANN
190 DATA RUNNING ERRANDS,LENA,SUE,DO
    ING HOUSEWORK,AURA,KAY,DELIVERIN
    G ADS,DAWN
200 GOTO 370
210 PRINT :TAB(15);"PRESS <ENTER>";
220 CALL KEY(0,K,S)
230 IF K<>13 THEN 220
240 RETURN
250 CALL SOUND(100,330,2)
260 CALL SOUND(150,262,2)
270 RETURN
280 CALL SOUND(100,262,2)
290 CALL SOUND(100,330,2)
300 CALL SOUND(100,392,2)
310 CALL SOUND(200,523,2)
320 RETURN
330 P=100+25*INT(RND*10)
340 P$=STR$(P)
350 P$="$"&SEG$(P$,1,LEN(P$)-2)&"."&
    SEG$(P$,LEN(P$)-1,2)
360 RETURN
370 CALL CLEAR
380 RANDOMIZE
390 N=INT(RND*6)
400 H=8+INT(RND*11)
410 GOSUB 330
420 PRINT N$(N);" WORKS";H;"HOURS PE
    R WEEK."
430 IF N<3 THEN 460
440 PRINT :"SHE EARNS ";
450 GOTO 470
460 PRINT :"HE EARNS ";
470 PRINT P$;" PER HOUR."
480 IF N<3 THEN 510
490 PRINT :"HOW MUCH DOES SHE EARN"
500 GOTO 520
510 PRINT :"HOW MUCH DOES HE EARN"
520 PRINT :"IN A WEEK?"::
530 INPUT "$":D
540 D1=P*H/100
550 IF ABS(D-D1)>.001 THEN 610
560 GOSUB 280
570 PRINT ::"TRY AGAIN? (Y/N)"
580 CALL KEY(0,K,S)
590 IF K=89 THEN 370
600 IF K=78 THEN 680 ELSE 580
610 GOSUB 250
620 PRINT :"MULTIPLY";H;"HOURS BY ";
    P$::"PER HOUR."
630 P=H*P
640 GOSUB 340
650 PRINT :"THE ANSWER IS ";P$
660 GOSUB 210
670 GOTO 370
680 CALL CLEAR
690 RANDOMIZE
700 N=INT(RND*6)
710 H=INT(RND*11)+8
720 GOSUB 330
730 PRINT N$(N);" EARNS ";P$;" PER H
    OUR."
740 IF N<3 THEN 770
750 PRINT :"SHE WORKS";
760 GOTO 780
770 PRINT :"HE WORKS";
780 PRINT H;"HOURS PER WEEK."
790 IF N<3 THEN 820
800 PRINT :"HOW MUCH WILL SHE EARN I
    N"
810 GOTO 830
820 PRINT :"HOW MUCH WILL HE EARN IN
    "
830 W=INT(RND*19)+2
840 PRINT :W;"WEEKS?"::
850 INPUT "$":D
860 D1=P*H*W/100
870 IF ABS(D-D1)>.001 THEN 930
880 GOSUB 280
890 PRINT ::"TRY AGAIN? (Y/N)"
900 CALL KEY(0,K,S)
910 IF K=89 THEN 680
920 IF K=78 THEN 1030 ELSE 900
930 GOSUB 250
940 PRINT :"MULTIPLY";H;"HOURS BY"
950 PRINT :P$;" PER HOUR."
960 PRINT :"THEN MULTIPLY BY";W;"WEE
    KS."
970 PRINT :"THE ANSWER IS ";
980 P=H*P*W
990 GOSUB 340
1000 PRINT P$:::
1010 GOSUB 210
1020 GOTO 680
1030 CALL CLEAR
1040 J=INT(RND*6)
1050 T=INT(RND*6)
1060 GOSUB 330
1070 W=INT(RND*8)+2
1080 PRINT T$(T);" EARNED ";P$;" LAS
     T WEEK"
1090 PRINT :J$(J);"."
1100 IF T<3 THEN 1130
1110 PRINT :"IF SHE EARNED THIS AMOU
     NT"
1120 GOTO 1140
1130 PRINT :"IF HE EARNED THIS AMOUN
     T"
1140 PRINT :"EVERY WEEK, WHAT WOULD
     THE"
1150 PRINT :"TOTAL INCOME BE FOR"
1160 PRINT :W;"WEEKS?"::
1170 INPUT "$":D
1180 D1=P*W/100
1190 IF ABS(D-D1)>.001 THEN 1250
1200 GOSUB 280
1210 PRINT ::"TRY AGAIN? (Y/N)";
1220 CALL KEY(0,K,S)
1230 IF K=89 THEN 1030
1240 IF K=78 THEN 1330 ELSE 1220
1250 GOSUB 250
1260 PRINT :"MULTIPLY ";P$;" PER WEE
     K"
1270 PRINT :"BY";W;"WEEKS."
1280 P=P*W
1290 GOSUB 340
1300 PRINT :"THE ANSWER IS ";P$::
1310 GOSUB 210
1320 GOTO 1030
1330 CALL CLEAR
1340 END
```

VICword

Mark Niggemann

Many programmers find that typing a question mark instead of having to type out the entire word "PRINT" is a great timesaver. How would you like to be able to use single-key entry for 52 BASIC commands? With VICword running in your VIC, you can hold down the SHIFT key and hit the letter "L" and the word "LOAD" will appear on screen. Hold down the COMMODORE key and hit "L" and "SAVE" writes itself on the screen. Especially helpful when typing in those long BASIC programs, VICword is a clever machine language program that puts itself into memory (expanded or not), protects itself from interference by BASIC, and then tells you how to turn it on or off whenever you want. Just type in the program (SAVE a copy of it) and then RUN it. It does the rest.

Before buying a Commodore VIC, I used my father's PET for most of my programming work. One nice utility programming aid that I had at my disposal was Charles Brannon's "Keyword" (**COMPUTE!**, August 1981, #15). After typing in a couple of long programs on the VIC, I set out to make a revision of Keyword for the VIC.

I was not content with only 26 defined keys. After all, the VIC has both the COMMODORE key and the SHIFT key. So, why not use both to get a total of 52 defined keys? This would prove to be a difficult task. The original Keyword program relied on the fact that the ASCII code values of the SHIFTed letters were in numeric order. On the VIC, the COMMODORE keyed letters are not in that order. This made things very tough.

After looking at Jim Butterfield's memory map (**COMPUTE!**, January 1982, #20), I noticed a curious link located at $028F and $0290, respectively, that I thought might help. After some further examination, I found that this link points to a routine in ROM that sets up the appropriate keyboard lookup table, depending on whether the SHIFT, COMMODORE, or CONTROL key is being depressed. The lights came on at this point. Since this routine in ROM is part of the interrupt scan for clock updating, cursor flash, and keyboard handling, it is possible to run "VICword" using this link and also to take care of the problem of the COMMODOREd letters.

When you SYS the ON/OFF address given by the loader program, VICword will set the link at $028F and $0290 to point to its scan portion. In scanning, VICword checks to see if the quote mode flag is set. The reason this is done is so that you can still get graphics characters when you need them. If this flag is set, VICword will promptly exit the scan. If it isn't, VICword then checks if the SHIFT or COMMODORE key is being pressed. If either is pressed, then the keyboard lookup table pointer, located at $F5 and $F6, is set to point at the SHIFT key lookup table.

By using this table, and not the COMMODORE key lookup table, the ASCII values are in numeric order. VICword will determine which table of token values it will use and will read the tokenized keyword for the particular key pressed. The rest of VICword is identical to Keyword in function.

Entering VICword

Some precaution should be observed when you type in VICword. Since this is a machine language program, a single mistake in the DATA statements

Keys into BASIC Commands.

KEY	SHIFT	COMMODORE
A	PRINT	PRINT#
B	AND	OR
C	CHR$	ASC
D	READ	DATA
E	GET	END
F	FOR	NEXT
G	GOSUB	RETURN
H	TO	STEP
I	INPUT	INPUT#
J	GOTO	ON
K	DIM	RESTORE
L	LOAD	SAVE
M	MID$	LEN
N	INT	RND
O	OPEN	CLOSE
P	POKE	PEEK
Q	TAB(	SPC(
R	RIGHT$	LEFT$
S	STR$	VAL
T	IF	THEN
U	TAN	SQR
V	VERIFY	CMD
W	DEF	FN
X	LIST	FRE
Y	SIN	COS
Z	RUN	SYS

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could cause VICword to crash. Generally, it is a good idea to SAVE any machine language program before you try to execute it. Then, if you do crash and you can't get out of it by using RESTORE, you can just load in the version that you saved and recheck the DATA for any erroneous entry.

When I defined the keyword tables used in VICword, I chose the most commonly used keywords in BASIC. I tried to make most of the SHIFT keys complementary to the COMMODORE keys. For example, SHIFT G is GOSUB and COMMODORE G is RETURN. Not all keys could be paired up like this. See the table to find out the key definition.

I have used VICword quite often to help out on those long programs. I hope that VICword is as useful a tool for you as it has been for me. If you don't want to take the trouble of typing in VICword, I'll provide you with a copy. Send a blank cassette, an SASE mailer, and $3 to:

Mark Niggemann
Pearson #2208
Friley Hall
Iowa St. University
Ames, IA 50012

```
100 REM** VICWORD LOADER
140 IF PEEK(PEEK(56)*256)<>120THENPOKE56,
    PEEK(56)-1:CLR
150 HI=PEEK(56):BASE=HI*256
160 PRINT"{CLEAR}PATIENCE..."
170 FOR AD=0 TO 211: READ BY
180 POKE BASE+AD,BY: NEXT AD
190 :
200 REM RELOCATION ADJUSTMENTS
210 POKE BASE+26,HI: POKE BASE+81,HI
220 POKE BASE+123,HI: POKE BASE+133,HI
230 :
240 PRINT"{CLEAR}*** VICWORD ***"
250 PRINT"ON/OFF:   SYS{REV}";BASE
260 END
270 DATA 120, 173, 143, 2, 201, 32
280 DATA 208, 12, 169, 220, 141, 143
290 DATA 2, 169, 235, 141, 144, 2
300 DATA 88, 96, 169, 32, 141, 143
310 DATA 2, 169,  0, 141, 144, 2
320 DATA 88, 96, 165, 212, 208, 117
330 DATA 173, 141, 2, 201, 3, 176
340 DATA 110, 201, 0, 240, 106, 169
350 DATA 159, 133, 245, 169, 236, 133
360 DATA 246, 165, 215, 201, 193, 144
370 DATA 95, 201, 219, 176, 91, 56
380 DATA 233, 193, 174, 141, 2, 224
390 DATA 2, 208, 3, 24, 105, 26
400 DATA 170, 189, 159,  0, 162, 0
410 DATA 134, 198, 170, 160, 158, 132
420 DATA 34, 160, 192, 132, 35, 160
430 DATA 0, 10, 240, 16, 202, 16
440 DATA 12, 230, 34, 208, 2, 230
450 DATA 35, 177, 34, 16, 246, 48
460 DATA 241, 200, 177, 34, 48, 17
470 DATA 8, 142, 211,  0, 230, 198
480 DATA 166, 198, 157, 119, 2, 174
490 DATA 211,  0, 40, 208, 234, 230
500 DATA 198, 166, 198, 41, 127, 157
510 DATA 119, 2, 230, 198, 169, 20
520 DATA 141, 119, 2, 76, 220, 235
530 DATA 76, 67, 236
540 :
550 REM *VICWORD TOKENS FOR SHIFT KEY
560 :
570 DATA 153, 175, 199, 135, 161, 129
580 DATA 141, 164, 133, 137, 134, 147
590 DATA 202, 181, 159, 151, 163, 201
600 DATA 196, 139, 192, 149, 150, 155
610 DATA 191, 138
620 :
630 REM *TOKENS FOR COMMODORE KEY
640 :
650 DATA 152, 176, 198, 131, 128, 130
660 DATA 142, 169, 132, 145, 140, 148
670 DATA 195, 187, 160, 194, 166, 200
680 DATA 197, 167, 186, 157, 165, 184
690 DATA 190, 158, 0
```

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CRAB

(Cross Reference For Atari BASIC)

Manny Juan

Remarkable for its brevity, this useful Atari utility will print out a list of the variables in a BASIC program and show in which lines they appear. It will work on any Atari using a disk drive and for any BASIC program stored with the SAVE command.

CRAB is probably the smallest and shortest cross reference program ever written for any computer (47 lines in less than 2K), and it is written entirely in BASIC.

This was made possible by taking advantage of two features of Atari BASIC: internal tokenization and a "dynamic keyboard" capability.

Internal Tokenization

When a program is SAVEd to disk, it is stored according to this scheme: 14 bytes from page zero are written out first. These seven, two-byte registers serve as pointers to the different tables and areas within the program. They are followed by the variable name table, which is delimited by a trailing zero byte. The variable value table comes next, where one entry is eight bytes long, and each corresponds to a variable in the previous table. Finally, the tokenized BASIC statements are written out in the internal format that they are stored in RAM.

Dynamic Keyboard Capability

"Dynamic Keyboard" allows a program, while running, to add or change statements into memory by displaying those statements on the screen, then invoking what Atari calls the "forced RETURN" routine through a set of POKE statements. This routine takes what is on the screen and processes it as if it were input through the keyboard and terminated with a RETURN key.

How CRAB Works

This utility will run on any disk-based Atari system and will cross reference programs stored with the SAVE command.

It starts by asking which program on disk to cross reference and determines whether it is indeed a BASIC program by checking to see if the first two bytes are equal to zero. These bytes normally contain the address of low memory when used in RAM, but they are normalized to zero when saved to disk or tape.

The subroutine GC (defined at line 60) is used throughout the program to obtain the next byte from disk.

Variable Name Table

The next 12 bytes are skipped because they are not used by this utility. The utility is now ready to process the Variable Name Table. This table is actually a string of characters which contains all the variable names used during the development of the program in the order that they were entered. The last byte of the variable name has its high bit turned on to serve as a delimiter.

Whenever a variable name is extracted by CRAB, its position in the table (relative to zero) is added to 128, and the sum is multiplied by 100 to create a line number. A REMark statement containing only the variable name, but using the previously computed line number, is displayed on the screen and gets added into memory using the "forced RETURN" or "dynamic keyboard" feature described above. (Screen display was "turned off" in this program, but you can restore it by REMarking the SETCOLOR statement in line 100.)

For example, if this utility itself were the target program for cross reference, the first few variables would be processed and added as REMark statements into memory like this:

```
12800 REM T8
12900 REM I
13000 REM T
13100 REM Z
.
.
etc.
```

The whole process of extracting the variables from the Variable Name Table is done by lines 100 through 160 in the listing.

After all variable names have been stored

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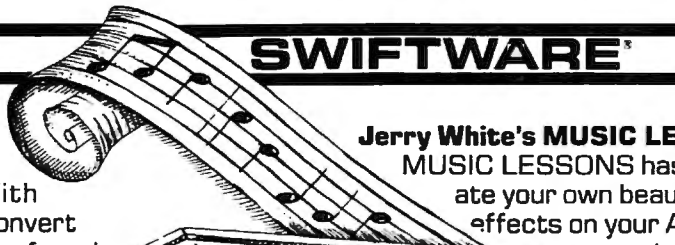

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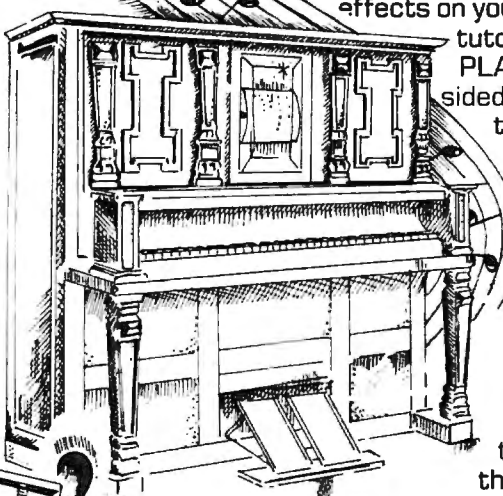

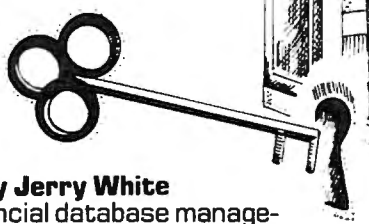

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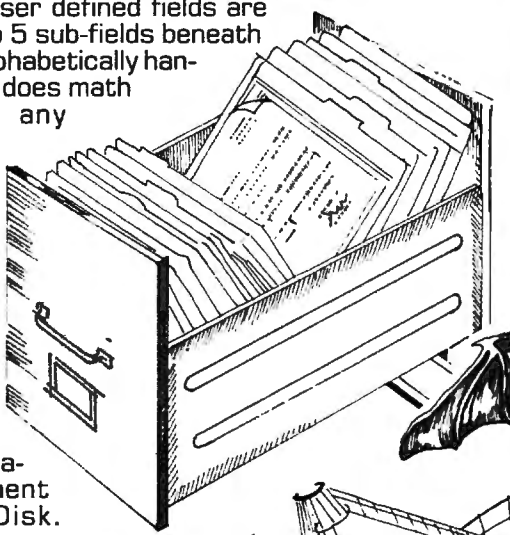

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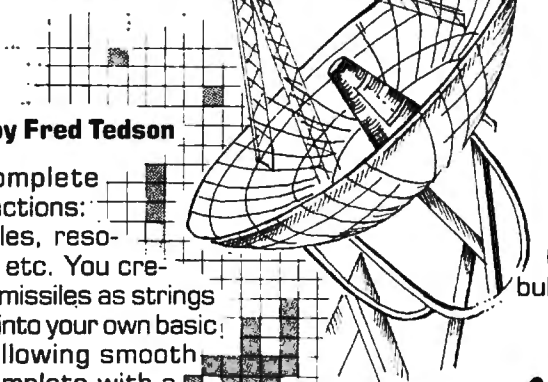

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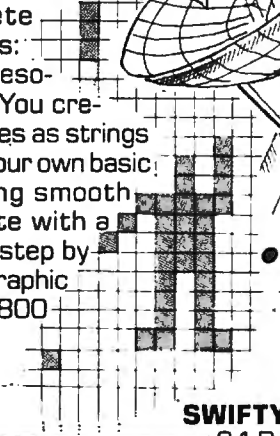

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into memory as BASIC REMark statements, the whole variable value table is also skipped (line 180) because the variables are not used by this utility.

CRAB is now ready to process the program statements.

Tokenized Variables

The first time a variable is used during program development, its name is added to the variable name table, and its position, plus 128, becomes its token "assignment." Using CRAB again as our example, the variable "T8" will always be tokenized into one byte as 128, the variable "I" as 129, "T" as 130, etc.

The token assignments are basically what CRAB uses to recognize variables when it is stepping through the tokenized program. A token whose value is 128 or greater is usually a representation for a variable. However, it is still conceivable that some tokens may contain such values. This is especially possible in line number tokens, BCD numbers, and character strings within REM or DATA statements. CRAB was written to recognize and skip these instances.

When CRAB encounters the line number, it saves it immediately (line 190). Lines 210 through 230 take care of recognizing and skipping REMark and DATA statements. The end-of-statement (token 20) and end-of-line (token 22) delimiters are caught at lines 240 and 250 to allow orderly processing of statements. Line 270 checks whether the token being processed is a number; if it is, the next six bytes are skipped. (Numbers start with token 14, followed by their BCD representation in six more bytes.) And, finally, line 270 checks whether the token being looked at is a variable.

When a variable is recognized, CRAB prepares a REMark statement whose value is the current line number being processed. Then it takes the token value of the variable, multiplies it by 100, and adds the usage count for that variable (stored in array N). The result becomes the line number of this REMark statement, which is again inserted into its proper place in memory through the use of the "dynamic keyboard" feature.

This procedure is best shown by an example. Suppose the line being processed is line 40 of the CRAB listing. In this case, the variables I, Z, and A$ have token assignments of 129, 131, and 136, respectively. At this point, both variables I and Z would have a usage count of one (when they are defined at line 10); while A$ has a usage count of two, since it is also used in line 20.

At line 40, these usage counts all get incremented by one, and the following BASIC REMark statements are generated:

```
12902 REM 40
13102 REM 40
13603 REM 40
```

You can see that, after all variables have been processed, the memory area after the CRAB utility will be filled with hundreds of REMark statements, starting with line 12800. Any line ending in 00 (evenly divisible by 100) would be carrying a variable name, and it would be immediately followed by scores of other REMark statements which list all the line numbers that reference it. (And they are sorted, too!)

It remains a simple matter for CRAB to skip itself (lines 400, 410), process the above REMark statements, and format them into a cross reference listing.

RUN Notes

You will notice that the cross reference listing produced does not show the variables in alphabetical sequence and that multiple references to a variable in the same line appear as repeated line numbers. This is the price we pay for a short (but unique) cross reference program like CRAB.

Because of the way variable names are stored in the variable name table (first come, first served, and no garbage collection), it may be a good idea to first LIST the target program to disk, reENTER it to RAM (to clear unused variables), and then SAVE it back in tokenized form. The resulting file may then be processed by CRAB.

```
10 REM CRAB - CROSS REFERENCE ATARI B
   ASIC, VERSION 1, BY MANNY JUAN
20 CLR :T8=256:I=1:T=2:Z=0:L=128:R=84
   2:H=100:DIM N(127),A$(16)
30 TRAP 330:? CHR$(125);"PROGRAM TO X
   REF";:INPUT A$
40 OPEN #I,4,Z,A$
50 GC=60:GOTO 70
60 GET #I,C:RETURN
70 GOSUB GC:D=C:GOSUB GC:D=D+C
80 IF D THEN ? A$;" IS NOT A BASIC PR
   OGRAM":END
90 FOR J=I TO 12:GOSUB GC:NEXT J
100 LN=L*H:SETCOLOR I,9,4
110 GOSUB GC:IF  NOT C THEN 170
120 ? CHR$(125):? CHR$(29):? LN;" REM
     ";
130 ? CHR$(C-L*(C>127));:IF  NOT (C>1
    27) THEN GOSUB GC:GOTO 130
140 SOUND Z,LN,10,8:? :? :? "CONT":PO
    SITION Z,Z:POKE R,13:STOP
150 POKE R,12
160 LN=LN+H:GOTO 110
170 FOR J=Z TO 127:N(J)=Z:NEXT J
180 FOR J=I TO 8*(LN/H-L):GOSUB GC:NE
    XT J
190 GOSUB GC:LN=C:GOSUB GC:LN=LN+C*T8
200 GOSUB GC:GOSUB GC
210 GOSUB GC:IF C>I THEN 240
220 GOSUB GC:IF C<>155 THEN 220
230 GOTO 190
240 GOSUB GC:IF C=20 THEN GOSUB GC:GO
    TO 210
250 IF C=22 THEN 190
260 IF C=14 THEN FOR J=Z TO 5:GOSUB G
    C:NEXT J:GOTO 240
```

```
270 IF C<L THEN 240
280 D=C-L:N(D)=N(D)+I:SOUND Z,LN,10,8
    :SOUND I,D+30,10,8
290 ? CHR$(125):? CHR$(29):? (L+D)*H+
    N(D);" REM ";LN
300 ? :? :? "CONT":POSITION Z,Z:POKE
    R,13:STOP
310 POKE R,12
320 GOTO 240
330 TRAP 33333:SOUND Z,Z,Z,Z:SOUND I,
    Z,Z,Z
340 SETCOLOR I,9,10:? CHR$(125)
350 X=PEEK(195):IF X<>136 THEN ? "ERR
     ";X;" AT LINE ";PEEK(186)+PEEK(1
    87)*T8:END
360 CLOSE #I:CLOSE #6:OPEN #6,4,Z,"K:
    "
370 ? "HIT ANY KEY WHEN PRINTER IS RE
    ADY(5 SPACES)(OR ESC TO QUIT)"
380 GET #6,X:IF X=27 THEN END
390 LPRINT "XREF LISTING FOR ";A$
400 X=PEEK(136)+PEEK(137)*T8
410 PL=PEEK(X+T):LN=PEEK(X)+PEEK(X+I)
    *T8:IF LN<L*H THEN X=X+PL:GOTO 41
    0
420 D=INT(LN/H):M=LN-H*D:IF  NOT M TH
    EN LPRINT :LPRINT
430 PL=PEEK(X+T):FOR J=5 TO PL-T:LPRI
    NT CHR$(PEEK(X+J));:NEXT J
440 LPRINT " ";:IF  NOT M THEN LPRINT

450 X=X+PL:LN=PEEK(X)+PEEK(X+I)*T8:IF
     LN<32768 THEN 420
460 LPRINT :LPRINT :LPRINT D-L+I;" VA
    RIABLES"
470 END                                  ©
```

Programming Characters On An Expanded VIC-20

Paul F Schatz

You can use programmable characters in VIC programs requiring more than 2.5K. The solution: move the start of BASIC beyond the screen and programmable character RAM.

One of the best features of the VIC-20 computer is its ability to define character sets. Besides allowing the design of custom characters, this feature can also be used for high resolution plotting. (These features are outlined in the *VIC-20 Programmer's Reference Guide* and will not be discussed in this article.) The versatility of the programmable characters is somewhat limited since the RAM used for displaying the screen and for defining the characters must be addressed in the memory from 4096 to 8192. Table 1 gives the locations and contents of the various possible character sets.

With an unexpanded (5K) VIC or a VIC expanded with the 3K RAM card, this limitation is of no consequence since the screen and character set are placed at the top of memory after the BASIC program. However, when an 8K RAM card is plugged into a VIC, the location of the screen RAM moves to extend from 4096 to 4607, and the start of BASIC moves to 4608. These changes eliminate, to all intents and purposes, using the programmable characters since any BASIC program requiring more than 2.5K tramples on the RAM area normally used for programmable characters.

There *is* a software solution, and a relatively simple one at that. In essence, the solution lies in moving the "start of BASIC" to a location beyond the screen and programmable character RAM. Here's a method for moving the start of BASIC, including several examples.

Moving The Screen

A simple method for moving the screen is to set the screen memory page register (location 648) and call the ROM routine which initializes the I/O. For example, to move the start of screen on an expanded VIC from 4096 to 7680 (the default location on the unexpanded VIC) enter the following statement:

```
POKE648,30:SYS58648
```

Moving The Start Of BASIC

In practice, the programmer has to be careful about where BASIC is located or the screen can be plopped right into the middle of the program with disastrous results. The simple method for avoiding conflicts of this sort is to move the start of BASIC to the start of the 8K expansion RAM. This frees up the internal RAM on the VIC (locations 4096 to 8191) for video operations such as multiple screens, custom characters, etc. The start of BASIC is moved with

```
POKE8192,0:POKE43,1:POKE44,32:NEW
```

Moreover, it is possible to use custom character files created with the Commodore Character Editor. The technique follows. Place the 8K (or more) expander in the expansion slot. Turn the VIC-20 on. Move the start of BASIC. Move the screen to 7680. Load the character set file. Enter NEW. It is important to NEW the computer to get the BASIC pointers straightened around. Not to NEW can lead to a crash. Now enter the program that uses the custom characters. Since the screen is located from 7680 to 8186 and the custom character definitions start at 7168, everything that the *Programmer's Reference Guide* says about them applies, e.g., to display the custom characters POKE36869,255.

An alternative, somewhat simpler method for moving BASIC is:

```
POKE 642,32: SYS 58232
```

Other Configurations

As mentioned earlier, moving the start of BASIC to 8192 chops 3.5K from the RAM area which can be used by BASIC. Two K of this area can be used for programmable character definitions, leaving only 1.5K of RAM which can be used for storage or for machine language routines. To retain as much RAM as possible for BASIC programs and still have programmable character capability, the start of BASIC can be moved to 6656, the screen located from 6144 to 6655, and the programmable character set (256 characters) located from 4096 to 6143.

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If needed, another .5K of programmable RAM can be recovered by overlapping the screen with the character set descriptions, i.e., start BASIC at 6144, locate screen from 5532 to 6143, and locate programmable characters from 4096 to 6143. Characters 191 to 255, whose definitions are located in the same area as the screen, are lost. This configuration leaves 10K of RAM open for BASIC programming.

The most concise method for pulling together all the loose threads for the various options is with Table 2. Substituting the appropriate values from the table into the following statements moves the screen and the start of BASIC to the designated locations. To move the start of BASIC, enter

```
POKE 44,SB:POKE BB,0:NEW
```

To move the screen, run the following program:

```
10 POKE 36866,CR2: POKE 36869,CR5: POKE
   648,SC
20 FOR J=217 TO 228: POKE J,LI: NEXT
30 FOR J=229 TO 250: POKE J,LI+1: NEXT
```

To use the programmable character set in a program, incorporate the following statement:

```
POKE 36869,CS
```

Table 1:
Location of character sets with screen at 4096

		Characters displayed			
POKE36869	Start of character set	0-63	64-127	128-191	191-255
192	32768	UC	GR	rev UC	rev GR
193	33792	rev UC	rev GR	LC	UC
194	34816	LC	UC	rev LC	rev UC
195	35840	rev LC	rev UC	NA	NA
196-203	Not useful – VIC, I/O, color RAM, zero page, etc.				
204	4096	SR	PG	PG	PG
205	5120	PG	PG	PG	PG
206	6144	PG	PG	PG	PG
207	7168	PG	PG	UC	GR

UC = uppercase
SR = screen RAM
NA = not accessible
LC = lowercase
PG = programmable
GR = graphics
rev = reverse

Table 2:
Relocating BASIC, screen RAM, and character sets

Start of BASIC	8192	8192	6656	6144
SB	32	32	26	24
BB	8192	8192	6656	6144
PRINT FRE(0)	8189	8189	9725	10237
Start of screen	4096	7680	6144	5632
CR2	22	150	22	150
CR5	192	240	224	208
SC	16	30	24	22
LI	144	158	152	150
Location of color RAM	37888	38400	37888	38400
Location of char. set	7168	7168	4096	4096
CS	207	255	236	220

Magic Commodore BASIC

David Sale

Reversed REMs, subroutine protection, a program with backward line numbers, invisible lines – all these and several other tricks are possible when you type SYS 4 and fall into the world below PET BASIC. For any PET/CBM model. These techniques can also be applied to the VIC-20 and Commodore 64 if you have a machine language monitor such as VICMON, TINYMON, or Supermon 64.

BASIC is a very civilized language. Machine code is more exacting, but it is capable of doing certain things that BASIC cannot do. Wouldn't it be nice to be able to force BASIC to break some of its rules some of the time?

If you are willing to tinker a bit, there is a way. First, though, you must thoroughly understand how BASIC code is stored in memory. Enter the following program carefully:

```
10 REM START
20 PRINT "20 ";
30 PRINT "30 ";
```

Save this on tape or disk since you may need to reLOAD it later.

For the PET/CBM, type SYS 4 to enter the monitor, then M 0400,0420 to display the relevant part of memory. Your screen should look like this:

```
0400 00 0D 04 0A 00 8F 20 53
0408 54 41 52 54 00 1A 04 14
0410 00 99 20 22 32 30 20 22
0418 3B 00 27 04 1E 00 99 20
0420 22 33 30 20 22 3B 00 00
```

The numbers in the first column represent the memory addresses of the next bytes; hence, the value found in 0418 is 3B (hex), while that in 041C is 1E (hex).

Each BASIC line consists of four parts. This can be illustrated by examining the values starting at 0401:

1. The first two bytes (0D 04) point in low-high order to the beginning of the next line, i.e., to address 040D.
2. The next two bytes (0A 00) give the line number, also in low-high order (000A hex = 10 decimal).
3. The following bytes give the contents of the line with tokens like 8F (REM) and 99 (PRINT) for BASIC words.
4. The 00 marks the end of the line.

For the VIC or 64, type the proper SYS to invoke whatever monitor version you are using. For the 64, display memory locations 0800-0820 (hex). The display should be the same as for the PET/CBM, except that all the locations which show 04 for this and all other examples will show 08 on the 64.

The VIC is slightly more complicated because the start of BASIC moves as memory is added. For the unexpanded VIC, display memory locations 1000-1020 (hex). The display should be the same as for the PET/CBM, except that all locations that show 04 in the examples will now show 10. For the VIC with 3K expansion, simply follow the instructions for the PET/CBM examples since the start of BASIC has now moved to 0400. If you add 8K or more, display memory locations 1200-1220 (hex). The display should be the same as for the PET/CBM, except that all locations which show 04 show 12 instead.

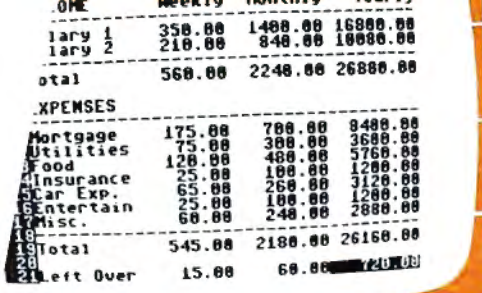
Highlighting REMarks

In a long program it might be useful to have the REMark statements highlighted to make them easier to find. Typing "RVS" will not produce the desired result, since that will place a 52 (hex) in memory, not the desired 12. Using quotes and RVS will place the 12 in memory; however, the RVS will print as a reversed R, but will not highlight the line!

The solution? Replace the value following the 8F (hex for REM) with 12 by putting it there in the monitor. In other words, line 0400 (after you type this in and hit RETURN) will look like this:

```
0400 00 0D 04 0A 00 8F 12 53
```

Exit from the monitor by typing X, then LIST the program. The REM statement will be highlighted. You can locate all the 8F's in a long program by hand, but this would be rather tedious. A better



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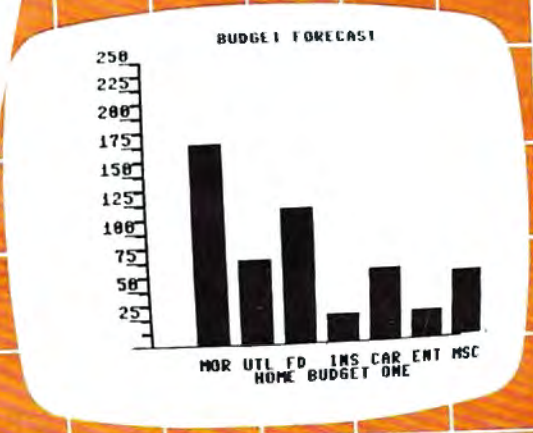

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solution would be to use a short machine language program (Program 1 or 2) to do this for you once the procedure is understood. The program will automatically check to make certain that the 8F is a REM, not part of a pointer or line number.

Editing in BASIC any highlighted line will, of course, remove the highlighting because BASIC will not accept the RVS command from the screen.

Protecting Line Numbers

BASIC will accept sequential numbers up to 63999 (F9FF hex). Entering two lines with the same number will delete the first. Entering line numbers like 64000 will create an error remark even though numbers up to FFFF hex should be available. But if we can manipulate BASIC by entering the monitor, we should now be able to create a program with extra large line numbers or with all lines the same number:

```
0400 00 0D 04 00 FA 8F 20 53
0408 54 41 52 54 00 1A 04 01
0410 FA 99 20 22 32 30 20 22
0418 3B 00 27 04 02 FA 99 20
0420 22 33 30 20 22 3B 00 00
```

Typing the changes above will create a program starting at line 64000. The lines cannot be edited or deleted using BASIC unless they are first renumbered.

Now You See It, Now You Don't

If you are really determined to protect a subroutine, one of the best ways involves fiddling with the pointers. Try making the following change in the original program:

```
0400 00 27 04 0A 00 8F 20 53
```

When you LIST it, only the first line will appear. The reason is that the pointer which is used in LISTing directs the computer to the end of the program, not to the second line. However, the program will RUN correctly.

A slightly more complicated method will produce all of the desired lines in a scrambled, renumbered sequence that is totally protected, yet appears to be quite normal when LISTed on the screen:

```
0400 00 1A 04 0A 00 8F 20 53
0408 54 41 52 54 00 27 04 1E
0410 00 99 20 22 32 30 20 22
0418 3B 00 0D 04 14 00 99 20
0420 22 33 30 20 22 3B 00 00
```

Try LISTing and then RUNning this program. You will notice that the lines LIST as 10, 20, 30, but RUN in the order 10, 30, 20. Now try to edit one of these lines using BASIC. When you press RETURN, be prepared for a beautiful screen display and a total crash!

What happened? We changed the pointers which the LIST command uses, but the RUN command does not. Line 10 actually points to line 30 (1A 04). Line 30 points to line 20 (0D 04), and line 20 points to the end of the program (27 04). Exchanging the line numbers for 20 and 30 made them appear to be listing in the correct order when, in fact, they were not.

As long as your subroutine does not use any lines called by GOTO or GOSUB (other than the first line), you can reverse the entire sequence of lines for total protection. Be sure, though, to make a note to yourself describing exactly what you have done, or in six months' time you may never be able to remember how to edit your protected program.

NEW And Re-NEW

Have you ever had the falling sensation, when typing NEW, of realizing that you had forgotten to SAVE your program first? Fortunately, BASIC only resets several pointers. All you have to do is enter the monitor and return these to their correct values.

Type NEW with our sample program in memory, then examine line 0400:

```
0400 00 00 00 0A 00 8F 20 53
```

You will see that only the second and third bytes have been changed. Since these should be the pointers to indicate the start of the second line, you simply look through memory for the next 00 and place the following address (040D) in low-high order (0D 04) in locations 0401 and 0402.

The program will now LIST, but it will not RUN correctly if any variables or arrays are used. To correct this, you must correct several pointers on page one of memory that control BASIC operations. Make a note of the address of the second 00 at the end of the program. Write it down in low-high sequence. In our sample program, the second 00 is at 0427, so we would write down 27 04.

For Upgrade and 4.0 ROMs, display M 002A,002F. For Original ROMs, display M 007C, 0081. For the VIC and 64, display M 002D,0031. In our example, these memory locations will now contain:

```
002A 03 04 03 04 03 04
```

Change each pair to the number you have written down. Press RETURN, then exit from the monitor with X. You have now restored the pointers for the beginning of variables and the end of variables and arrays to their correct values. It's a good idea also to type CLR before running the program again.

Monitor fiddling is a large topic, and this article only scratches the surface. Armed with a good memory map and a table of BASIC keyword codes, you should be able to discover many new possibilities for yourself.

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Program 1.

```
1                       *       =   $0360
2   0360 A2 03                  LDX #03     ; COUNTER FOR ZEROS
3   0362 A0 05                  LDY #05     ; POINTER FOR BYTE
4   0364 20 A2 03   MAIN        JSR GET     ; CHECK BYTE
5   0367 D0 1B                  BNE REM     ; IS IT 00
6   0369 CA         LINE        DEX         ; HOW MANY 00'S
7   036A F0 42                  BEQ END     ; END OF BASIC
8   036C 20 A6 03               JSR MOVE    ; CHECK NEXT BYTE
9   036F 20 A2 03               JSR GET
10  0372 F0 F5                  BEQ LINE    ; CHECK FOR END OF LINE
11  0374 8A                     TXA         ; BYPASS POINTERS
12  0375 18                     CLC
13  0376 69 05                  ADC #05
14  0378 AA                     TAX
15  0379 20 A6 03   LOOP        JSR MOVE
16  037C CA                     DEX
17  037D E0 04                  CPX #04
18  037F B0 F8                  BCS LOOP
19  0381 20 A2 03               JSR GET     ; CHECK NEXT BYTE
20  0384 C9 8F      REM         CMP #$8F    ; IS IT A REM
21  0386 F0 06                  BEQ REVRS   ; IF SO POKE REVERSE
22  0388 20 A6 03               JSR MOVE    ; CHECK NEXT BYTE
23  038B 4C 64 03               JMP MAIN
24  038E 20 A6 03   REVRS       JSR MOVE    ; MOVE TO NEXT BYTE
25  0391 AD A4 03               LDA $03A4   ; GET ADDRESS
26  0394 8D 9B 03               STA $039B   ; USE IT BELOW
27  0397 A9 12                  LDA #$12    ; FORCE REVERSE SYMBOL
28  0399 99 00 04               STA $0400,Y
29  039C 20 A6 03               JSR MOVE
30  039F 4C 64 03               JMP MAIN    ; CHECK NEXT BYTE
31  03A2 B9 00 04   GET         LDA $0400,Y; EXAMINE BYTE
32  03A5 60                     RTS
33  03A6 C8         MOVE        INY
34  03A7 F0 01                  BEQ PAGE    ; INCREMENT BASE FOR ADDRESS
35  03A9 60                     RTS
36  03AA EE A4 03   PAGE        INC $03A4   ; BASE FOR ADDRESS OFFSET
37  03AD 60                     RTS
38  03AE A9 04      END         LDA #04     ; RESTORE BASE ADDRESS
39  03B0 8D A4 03               STA $03A4
40  03B3 60                     RTS
```

Program 2.

```
50 PRINT"{CLEAR}HIGHLIGHT REMS"
60 PRINT "{DOWN}LOAD AND RUN THIS PROGRAM
   , THEN LOAD"
70 PRINT"PROGRAM TO HIGHLIGHT."
80 PRINT"{DOWN}TYPE {REV}SYS 864{OFF} TO
   ACTIVATE."
90 PRINT"{DOWN}ALL REMARK STATEMENTS WILL
    THEN APPEAR"
100 PRINT"IN REVERSE MODE WHEN LISTING."
110 FORA=864 TO 947
120 READ X:POKE A,X
130 NEXT
140 END
150 DATA  162,3,160,5,32,162,3,208,27
160 DATA  202,240,66,32,166,3,32,162,3
170 DATA  240,245,138,24,105,5,170,32,166
180 DATA  3,202,224,4,176,248,32,162,3
190 DATA  201,143,240,6,32,166,3,76,100
200 DATA  3,32,166,3,173,164,3,141,155
210 DATA  3,169,18,153,0,4,32,166,3
220 DATA  76,100,3,185,0,4,96,200,240
230 DATA  1,96,238,164,3,96,169,4,141
240 DATA  164,3,96
```

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Rainbow Atari Graphics

John R. Slaby

Try these variations and see if you can't make use of this new technique in games and graphics.

Here's how to print out any message in either Graphics 1 or 2 and get up to seven colors for each character at the same time. Each color is limited to one scan line. After typing in the program and running it, you will be prompted to choose a graphics mode (1 or 2). You will then be asked for the message you want to display.

Capital and lowercase letters will be displayed in their normal solid default colors of orange and light green. Inverse capital and lowercase letters will be displayed in multicolor and will rotate in a curtain effect in opposite directions. The maximum length of the message was set at 120 characters/spaces, but this can be altered by changing the MSS$ dimension number. The input of the message has margins set to simulate the Graphics 1 or 2 display so that you don't end up with unintentionally hyphenated words.

The REMs in the program describe what is done where, but I believe three sections deserve some amplification. First, look at the 400 line numbers. The two FOR/NEXT loops store the various color values into the page six table locations for use by the DLI and the vertical blank. Note that the color and luminance values increase for each location, thus giving a color and brightness change for each scan line.

If you want, you can easily change these values to give different effects. Choosing several colors and alternating them will give a barber pole effect. Keeping the same luminance value (make the I*2 just I) gives a sharper contrast between the colors. And to get a wider range of colors, change the color number by more than one for each scan line (i.e., I*16*1.2). There are a great number of possibilities you can play with to get the effect you want; and since there are two tables, the two effects can be drastically different.

The vertical blank routine is contained in the DATA statements of the 300 lines. Its function is to rotate the two color tables in different directions to give the rolling curtain effect. If you want a static color display, you can eliminate the vertical blank by removing line 520 and adding POKE 54286,192 to line 510.

Another easy variation is to change the rotation rate. The number 4 after the number 201 in line 320 controls the rate of change. Decrease this number to increase the rotation rate; increase it to slow it down. Please note that the maximum number is 255. If you exceed this number, you will register an error, which will be caught by the TRAP (line 50); this process will start the program over again and again if you don't correct the bad POKE value.

Multicolors With DLIs

The DLI is the key to the multicolors. In *Space Invaders* the DLIs are used to change the color of the invaders for each mode line. For Graphics 0 and 1, the mode line consists of eight scan lines, and for Graphics 2, 16 scan lines. Normally, if you want to change colors for a mode line, you load a color value into the A,X, or Y registers, wait for horizontal sync (WSYNC), and then load the registers into the desired color registers during the horizontal blank. The problem is that the DLI is for the entire eight or 16 scan lines, not each line.

Therefore, changing the color register after the horizontal blank results in your not knowing when the color change will take effect (i.e., halfway across the scan line). One method to get around this would be to accurately count the 6502's

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cycles. When I first looked at the problem, this seemed the only way out; but not feeling that ambitious, I put this project on hold until I came up with an easier way.

The key is the WSYNC. For a meaningful display to exist on the TV screen, the WSYNC must occur every scan line, not every mode line. Thus, once you get control via the DLI, you keep it for eight WSYNCs and change the color registers during each scan line's horizontal blank. In theory, you can get eight colors for each character; but since the first line is usually blank, seven colors is what you actually get. If you want to modify the DLI, you could get 14 colors for Graphics 2.

The one drawback of this method: if it is used for every mode line, it could tie up the 6502 processor for a good part of the available time. The majority of the remaining time would be during vertical blank. This would thus restrict the amount of additional calculations, etc., you might want to do. This doesn't mean the technique is useless; it can be used for an eye-catching title page or can be used sparingly for a graphics display. It can also be used in games.

I believe this method is used in *Demon Attack* by Imagic for the Atari VCS. This game appears to change even the color of the player. You can also do this with my program by loading the player color register instead of the playfield. Overall, greater study of this method should allow programmers more latitude in creating striking visual effects.

The DLI and the vertical blank are not directly relocatable, but if you have any machine language capabilities, you should be able to modify them with little effort.

```
30 REM Choose Graphics Mode
40 DIM MSS$(120)
50 TRAP 1000
60 ? "What Graphics Mode? 1 or 2";:IN
   PUT A:IF A<>1 AND A<>2 THEN 60
70 GOSUB 100:GRAPHICS A+16
80 DL=PEEK(560)+256*PEEK(561)+6
90 FOR I=0 TO 6:POKE DL+I,133+A:NEXT
   I:GOTO 200
100 REM Modify margins to make messag
    e(8 SPACES)readable
110 POKE 82,10:POKE 83,29:?
120 REM Input message
130 ? :? "What is message?":? "Use AT
    ARI inverse(3 SPACES)for color ef
    fect.(3 SPACES)CAPITAL or lower."
140 INPUT MSS$:RETURN
200 REM Locate DLI
210 FOR I=0 TO 42:READ B:POKE 1553+I,
    B:NEXT I
220 DATA 72,138,72,152,72,162,0,141,1
    0,212
230 DATA 189,1,6,188,9,6,141,24,208,1
    40,25,208
240 DATA 232,173,0,6,201,1,144,3,141,
    10,212
250 DATA 224,6,144,226,104,168,104,17
    0,104,64
300 REM Locate Defered Verticle Blank
310 FOR I=0 TO 73:READ C:POKE 1599+I,
    C:NEXT I:POKE 1596,0
320 DATA 72,138,72,173,60,6,201,4,144
    ,55,162,7
330 DATA 173,8,6,141,61,6,173,9,6,141
    ,62,6
340 DATA 202,189,1,6,157,2,6
350 DATA 224,0,208,245,173,61,6
360 DATA 141,1,6,162,0,189,10,6,157,9
    ,6,232,224,7,208,245,173,62,6,141
    ,16,6,169,0
370 DATA 141,60,6,238,60,6,104,170,10
    4,76,98,228
400 REM Color data & # lines for mode
410 FOR I=0 TO 7:POKE 1537+I,(8+I)*16
    +I*2:NEXT I
420 FOR I=0 TO 7:POKE 1545+I,(1+I)*16
    +I*2:NEXT I
430 POKE 1536,A
500 REM Enable DLI AND DVVBLK
510 POKE 512,17:POKE 513,6
520 POKE 548,63:POKE 549,6:POKE 54286
    ,192
600 POSITION 1,2:? #6;MSS$
610 GOTO 610
1000 TRAP 40000:GOTO 50
```

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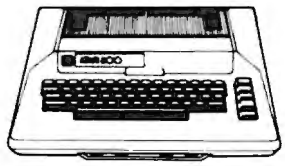

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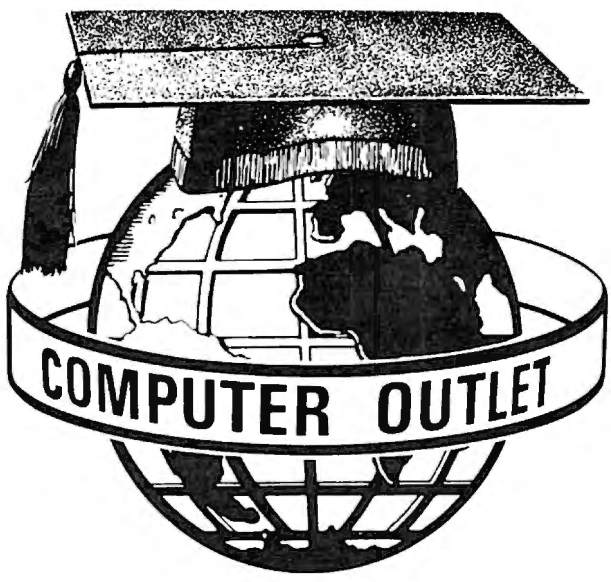

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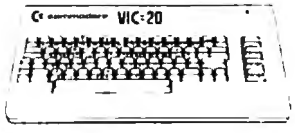

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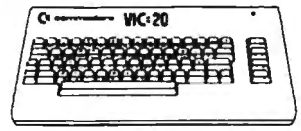

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VIC Automatic BASIC

Karl R Beach

Educators, adventure game writers – anyone who wants to create video displays in a BASIC program – will find this automatic screen generator easy to use and a real time saver. The author describes how to modify it to work on other Commodore computers as well.

This program allows you to compose a page of text, to create text animation exactly as it will later be seen on the screen, or to construct audience interaction programs. The screen display is then automatically converted into bug-free lines of BASIC that can be entered into memory as part of the program. When the programmer is ready, the core is quickly deleted, and the remaining finished program is SAVEd.

This program should be useful to educators who wish to prepare interactive instructional programs as quickly as possible. Other uses include writing "VIC letters" to friends, training children in word processing, and preparing text for interactive adventure games.

Although this program is set up for a VIC-20, it should work equally well on any Commodore PET/CBM/VIC computer if the POKEs are changed, the color commands are altered or eliminated, and the program lines pertaining to the length of text-lines are modified.

Writing The Text Block

Let's use this program to write a BASIC program block beginning at line 2000. You will first be asked to enter a starting line number (which could be any number between 1000 and 7000), and then you will be greeted with a screen display that represents a blank page of text. The red line is the right-hand margin, which limits text-line lengths to 21 characters.

As you begin typing, you'll see that the first line of a text page is indented two spaces. To avoid the indentation, press the "correction key" – the left arrow (←) – and begin typing from the left margin. If you make a mistake, you can correct it before entering the text line by pressing the "correction key" and retyping the entire line. If you discover a mistake after entering the text line, you can correct it at the end of the page when the conversion to BASIC is underway. If you run into the right margin while typing, you must press either the "correction key" or the RETURN key.

When you have completed a satisfactory text line, enter it by pressing the RETURN key. After your ninth line, you will be asked whether you want the reader to proceed to the next page or, before moving on to the next page, to answer a question which you may have written into the text. Let's assume you've typed the following page of text and a question for the reader:

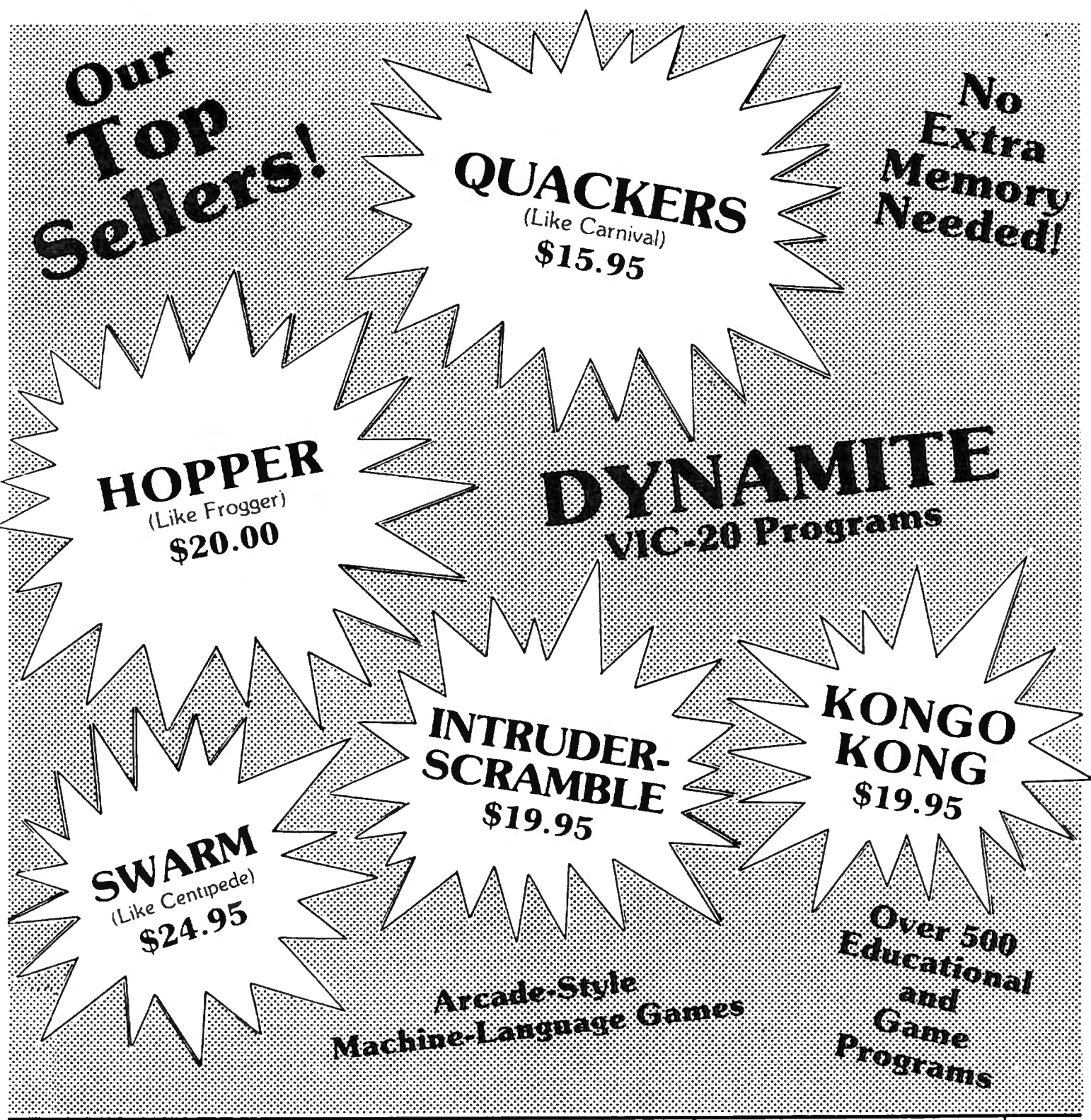
```
George Washington
was the first Presi-
dent of the United
States. What was his
wife's name?
(1) Alice
(2) Martha
(3) Melissa
```

At this point, you will be prompted to enter an answer string. The multiple-choice format is the quickest and most problem free for use with children, although this program can be easily modified to accommodate a number of different answer formats. If your text page consists of fewer than nine text lines, you need to press the British pound symbol (£) immediately to the left of the CLR/HOME key in order to terminate the page.

Your screen is instantly filled with what appears to be a part of a BASIC program listing beginning at line 2000 and containing the text you just typed. If you have no text line errors to correct, press the HOME key. If you have errors, drive the cursor to the top of the screen using the cursor control keys and correct your errors on the way. Now press the RETURN key until all the program lines have been entered. Note the last line number used in this sequence; then type in RUN again and begin the process anew, using a higher starting line number.

Adding Animation

If you want text animation, first type in up to three lines of static text as you did previously. After you've entered the final line of static text, press the up arrow (↑) between the asterisk and the RESTORE key. You'll first be prompted to enter a color for the animated text lines (default will be black, as are the static text lines), and then you'll see the first in a series of four input prompts that have been "bent" to allow you to type from the



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left margin. Remember not to exceed 21 characters in an animated text line. In this mode, the text lines cannot include commas or colons. When you are satisfied with each animated text line, press the RETURN key. Here is an example:

```
.  Computers  .
.   can help  .
.    students  .
.      learn!  .
```

The dots in each animated text line are used to maintain "space" within the string in which each line is stored. The time delay for this animation is set at line 855 and should be adjusted to fit the reading level of your users. A FOR/NEXT time delay can be inserted between the static and animated text lines and also could be used to emphasize an important point repeatedly. Use color and cursor controls carefully to insure the effect you want.

When you are out of memory or when you have finished writing text-pages, delete the core of this program by typing RUN 70. Then, when prompted, enter the number one. Numbers 1-20 will scroll onto the left side of the screen. Press the cursor HOME key and gently tap the RETURN key 20 times. A second RUN 70 will allow you to quickly delete lines 21-40, a third deletes lines 41-60, and a fourth deletes the deletion program block.

A handy tool to put into your computer when writing BASIC programs is the following block:

```
9000 INPUT Q9
9005 PRINT "{CLEAR}": FOR I = 1 TO 20:
     PRINT Q9: Q9 = Q9 + 1: NEXT I: END
```

This is especially useful if you renumber a program block and wish to delete the "old" block.

The last step before SAVEing your program is to delete line 7000. This line is a "safety net" that allows you to RUN portions of the program you are writing without triggering the LOAD command used in chaining at line 756. If you don't wish to chain, don't delete line 7000.

Good luck in using this program. If you come up with any improvements (SYS commands, etc.), I'd appreciate you letting me know. *Note:* If you'd like to try this program, but would rather not type it into your VIC-20 and debug your transcription, I will be happy to make you two VERIFYed copies. Send $3, an SASE mailer and a blank cassette to:

Karl R. Beach
3012 C Sierra Parkway
Hutchinson, KS 67501
(316)665-6504

Program 1.

```
1 POKE36869,242:PRINT"{CLEAR}{BLU}{DOWN}
    {04 RIGHT}AUTO-BASIC"
2 POKE36879,27:K2=7701:K3=38421:INPUT"{
    BLK}{03 DOWN}{03 RIGHT}BEGIN LINE
    #";P
3 PRINT"{CLEAR}":FORI=1TO23:POKEK3,2:POK
    EK2,92:K2=K2+22:K3=K3+22:NEXTI
4 A$="PRINT":B$=CHR$(34):Q$="{DOWN}":L$=
    "{02 RIGHT}"
5 FORZ=1TO9
6 IFZ=1THENPRINT"{HOME}  {REV}+{OFF}";:F
    $=F$+"{02 RIGHT}":GOTO12
7 Y=LEN(F$)+1:FORI=1TOY: PRINT"{LEFT}";:
    NEXTI:PRINT"{02 DOWN}{REV}+{OFF}"
    ;
9 Y=0:F$=""
12 GETE$:IFE$=""THEN12
13 IFE$=CHR$(95)THENY=LEN(F$):FORI=1TOY:P
    RINT"{LEFT}";:NEXTI:F$="":GOTO12
14 IFE$=CHR$(13)THENE$="":PRINT"{LEFT} ";
    :GOTO23
15 IFE$=CHR$(94)THENE$="":GOTO50
16 IFE$=CHR$(92)THENE$="":GOTO40
17 F$=F$+E$:PRINT"{LEFT} ";:PRINT"{LEFT}"
    ;E$;:PRINT"{REV}+{OFF}";
18 IFLEN(F$)>16THENPOKE36878,15:FORI=1TO1
    0:POKE36875,225:NEXTI:POKE36878,0
    :POKE36875,0
19 IFLEN(F$)<21THEN12
20 GET E$:IF E$=CHR$(13)THEN23
21 IFE$=CHR$(95)THEN13
22 GOTO 20
23 F2$=STR$(P)+A$+B$+Q$+F$+B$
24 IFZ=1THENZ$=STR$(P)+A$+B$+"{BLK}"+F$+B
    $
25 IFZ=2THENY$=F2$
26 IFZ=3THENX$=F2$
27 IFZ=4THENW$=F2$
28 IFZ=5THENV$=F2$
29 IFZ=6THENU$=F2$
30 IFZ=7THENT$=F2$
31 IFZ=8THENS$=F2$
32 IFZ=9THENR$=F2$
33 P=P+2
34 NEXTZ
40 PRINT"{HOME}{19 DOWN}1=PAGE 2=ANSWER"
41 GETH$:IFH$=""THEN41
42 P=P+2
43 IFH$="1"THENM3$=STR$(P)+"GOSUB900":GOT
    O46
44 K2=7701:FORI=1TO23:POKEK2,32:K2=K2+22:
    NEXTI:INPUT"ANSWER=";M5$
45 M4$=STR$(P)+"A$="+B$+M5$+B$+":GOSUB825
    "
46 PRINT"{CLEAR}":B=0
47 PRINTZ$:PRINTY$:PRINTX$:PRINTW$
48 PRINTV$:PRINTU$:PRINTT$:PRINTS$
49 PRINTR$:PRINTM3$:PRINTM4$:END
50 PRINT"{CLEAR}":INPUT"COLOR 3,5,6,7";B9

51 IFB9=3THENC9$="{RED}"
52 IFB9=5THENC9$="{PUR}"
53 IFB9=6THENC9$="{GRN}"
54 IFB9=7THENC9$="{BLU}"
55 C6$=":GOSUB850":E$=""
56 INPUT"{DOWN}{02 LEFT}";U2$
57 INPUT"{DOWN}{02 LEFT}";T2$
58 INPUT"{DOWN}{02 LEFT}";S2$
59 INPUT"{DOWN}{02 LEFT}";R2$
60 IFC9$=""THENC9$="{BLK}"
61 P=P+2:U$=STR$(P)+"GOSUB850:"+A$+B$+"{0
    2 DOWN}"+C9$+U2$+B$+C6$
62 P=P+2:T$=STR$(P)+A$+B$+"{UP}"+C9$+T2$+
```

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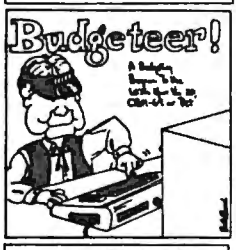
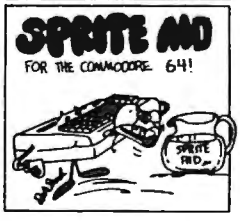
```
    B$+C6$
63 P=P+2:S$=STR$(P)+A$+B$+"{UP}"+C9$+S2$+
    B$+C6$
64 P=P+2:R$=STR$(P)+A$+B$+"{UP}"+C9$+R2$+
    B$+C6$
66 GOTO40
68 END
70 INPUT "1-21-41-61";A
71 FORI=1TO20
72 PRINTA
73 A=A+1
74 NEXTI
75 END
88 POKE36869,242:PRINT"{CLEAR}WHAT'S YOUR
    NAME?"
89 INPUT"{DOWN}";Z$
90 Z$=Z$+""
92 POKE36879,25
95 GOSUB900
100 GOTO 1000
750 PRINT"{CLEAR}{GRN}PLEASE WAIT WHILE"
752 PRINT"{DOWN}I LOAD MORE PAGES"
754 PRINT"{DOWN}FROM MY CASSETTE!"
756 LOAD
758 END
825 PRINT"{HOME}{20 DOWN}{PUR}{REV}TYPE NU
    MBER OF ANSWER!{OFF}"
826 GETB$:IFB$=""THEN826
827 IFA$<>B$THEN835
828 PRINT"{03 UP}{BLK}CORRECT, ";Z$;"!"
829 GOSUB890
830 FORI=1TO2000:NEXTI
832 PRINT"{CLEAR}":RETURN
835 PRINT"{03 UP}{BLK}THE ANSWER IS ";A$
837 FORI=1TO2000:NEXTI
840 PRINT"{CLEAR}":RETURN
850 GOSUB890
855 FORI=1TO1000:NEXTI
860 RETURN
890 POKE36878,15:FORI=1TO10:POKE36875,225:
    NEXTI:POKE36878,0:POKE36875,0:RET
    URN
900 PRINT"{HOME}{20 DOWN}{RED}{REV}PRESS K
    EY FOR NEW PAGE{OFF}"
901 GETO$:IFO$=""THEN901
902 PRINT"{CLEAR}{BLK}":RETURN
905 END
1000 REM
7000 END
7005 GOTO750
```

Program 2.

Make these changes to Program 1 when using 8K or 16K expander.

```
1 POKE36869,194:PRINT"{CLEAR}{BLU}{DOWN}
    {03 RIGHT}AUTO BASIC"
2 POKE36879,27:K2=4117:K3=37909:INPUT"{
    BLK}{03 DOWN}{03 RIGHT}BEGIN LINE
    #";P
44 K2=4117:FOR I=1 TO 23:POKE K2,32:K2=K2
    +22:NEXT I:INPUT"ANSWER=";M5$
88 POKE36869,194:PRINT"{CLEAR}{DOWN}WHAT'
    S YOUR NAME?"
```





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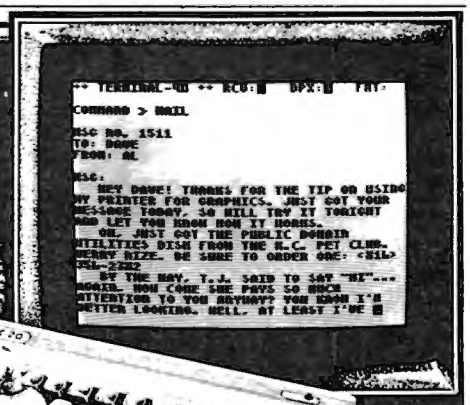

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"Tester"

Linton S Chastain

For the TRS-80 Color computer (extended BASIC optional), this program can be used to drill or quiz any student on practically any subject. If you dread tests or have difficulty recalling the details about a particular subject, this self-testing, computerized teacher might be just what you've been looking for.

Have you ever had to learn something and wished that you had some means by which you could drill yourself on that information? This program may be your answer. It requires only 929 bytes, plus DATA statements, to run. The DATA statements are added by the user after line 380. I used line number 400 as the start of my DATA statements. Lines 40 and 50 contain the title of the test.

The format for the DATA statement is "DATA N, "F$=QUESTION", "A$= CHOICE A", "B$=CHOICE B", "C$=CHOICE C", "D$=CHOICE D", "E$=CHOICE E", "G$= ANSWER". An example of the DATA statement is "DATAN, "WHAT IS THE CAPITAL OF N.C.? ","A. GREENSBORO","B. CHARLOTTE", "C.DURHAM","D. BURLINGTON","E. RALEIGH","E". If you can not think of five choices, you must still leave that position open. This is done as in the following example : "DATAN, "WHAT IS THE CAPITAL OF N.C. ?","A. GREENSBORO","B. CHARLOTTE","C. DURHAM","D. RALEIGH",,"D".

The program also has a control that will display a long question (a question of 50 characters or more) in two parts with a delay sufficient enough to be read by most people. This same control is used in answer choice "A". See lines 220-226 and lines 240-246. You can add this control to all the choices if you wish. I use these controls as is when I put Q+A data for the FCC Radio Telephone License into the program. The questions for this type of test are usually long, but the answers are generally numerical values.

```
10 'ADD YOUR DATA STATEMENTS AFTER LI
   NE 380
20 CLS:T=0
30 C=0:F=0
40 PRINT"NAME OF TEST"
50 PRINT"CONTINUATION OF NAME OF TEST
   "
60 PRINT
70 PRINT"COMMAND LIST # 1"
80 PRINT
90 PRINT"1- END TESTING"
100 PRINT"2- START TEST"
105 PRINT"3- DRILL"
110 INPUT" ENTER COMMAND BY NUMBER";R
120 IFR<0 OR R>3 THEN GOTO30
130 ON R GOSUB 150,160,155
140 GOTO40
150 END
155 F=1
160 FORN=1 TO 100:IF N > 100 THEN GOT
    O 370
170 CLS
200 READN,F$,A$,B$,C$,D$,E$,G$
210 PRINTN
220 PRINTF$
225 Y=LEN(F$):IFY>100 THEN 226 ELSE 2
    30
226 FORZ=1 TO 5000:NEXTZ
230 PRINT
240 PRINTA$
245 X=LEN(A$):IFX>50 THEN 246 ELSE 25
    0
246 FORZ=1 TO 5000:NEXTZ
250 PRINTB$
260 PRINTC$
270 PRINTD$
280 PRINTE$
290 PRINT
300 INPUT"ENTER ANSWER BY LETTER";R$
310 IFR$=G$ THEN 325
320 PRINT"YOU ARE WRONG"
321 IFF=1 THEN PRINT"ANSWER IS ";G$
322 GOTO330
325 PRINT"YOU ARE RIGHT":C=C+1
330 PRINT"PRESS <ENTER> WHEN READY"
340 INPUT"FOR ANOTHER QUESTION";X$
350 IFX$=INKEY$ THEN 360 ELSE 350
360 NEXTN
370 CLS:T=100:PRINT@0,"THIS IS":PRINT
    @32,C" OUT OF "T" CORRECT ANSWERS
    ":PRINT@64,C/T*100" % CORRECT"
380 RESTORE:RETURN
```

Estimating TI-99 Memory

Michael A Covington

You know the feeling – you're in the last stages of typing in some tremendously complex and subtle BASIC program that has been your brainchild for the last two or three months, you decide to run part of it for testing, and you get the dreaded message

```
* MEMORY FULL
```

telling you that your program is too big for the computer, and that all your work has been in vain.

At this point, you may be strongly tempted to go right to your dealer and buy another 32K of RAM. If you can afford to do so, more power to you; but many of us can't, at least not on a moment's notice. Alternatively, you may start going through your program and trimming it down. The first thing to do would be cut out the REM statements, especially if there are a lot of them; then make the PRINT statements less verbose, start combining short LET statements on one line (without the word LET, of course!) if your computer will let you, and so forth. But wouldn't it have been nice to know, earlier in the game, that you were running out of memory?

Some computers give you a command or pseudovariable that will tell you how much memory is free. Others, however, don't; you have to work blind. But I've developed a simple trick for finding out roughly how much memory is free even without a BASIC command for doing it.

The first thing you have to do is find out how large a numeric array your computer can accommodate. Try the one-line program:

```
1 DIM Q(5000)
```

If you can RUN this without getting a "memory full" message, try changing it to DIM Q(10000), and so on, until you hit the maximum. Alternatively, if you do get a "memory full" message, try reducing the size of the array until you don't. By this method I've found out that a 16K TI-99 will allow

```
1 DIM Q(1812)
```

as an upper limit.

But wait a minute, you say. On the TI-99, each element in a numeric array occupies eight bytes. The whole array therefore occupies 14,496 bytes, which equals just over 14K (remember that 1K = 1024 bytes). What happened to the rest of the 16K that the machine ostensibly has?

The answer is that a certain amount of memory – about 2K, it looks like – is occupied by essential control areas and by the DIM statement itself. This is why you can't use arrays to measure the size of memory exactly – but you can make quite useful approximate measurements.

What you do is simply add to your program a statement such as

```
1 DIM Q(1000)
```

(where Q is a variable not used in the program itself) and run the program; if you don't get a "memory full" message, then you have at least 1000 numeric storage locations left (equivalent to 8000 bytes on the TI-99). Similarly, a successful DIM Q(500) tells you that, on the TI-99, you have at least a quarter of the 16K RAM still available.

When you run the program, be sure to make it do a large variety of the things it will normally be used to do. Also, if you use string variables, do something to make them as long as they will ever normally be, since, on the TI-99, string variables are allocated dynamically (the amount of memory they occupy depends on their actual length).

Finally, *be sure* to remove the DIM statement after conducting the text; otherwise, your program will give you "memory full" messages later on and you won't know why. ©

Commodore Structure-BASIC

David Williams

This simulation of "structured programming" will give you a sense of why programmers take sides about it. Some can't stand it; some can't program without it. What's more, the special programming techniques explored in this article are both novel and powerful. It is designed to work on Upgrade or 4.0 PET/CBM BASIC; but can be translated to the VIC (with memory expansion) or Commodore 64 (see notes on translating at the end of the article).

This program helps to teach elementary computer programming to students, which is one of the things that I do for a living. Also, it uses some unusual programming techniques, such as recursively entered subroutines and BASIC lines which are modified by the rest of the program as it runs. Third, it was originally written in Waterloo Structured BASIC (WatBASIC), the version of BASIC available on the SuperPet.

For this article, I have modified the program so that it will run on PETs which are not equipped with the Waterloo ROM, but I have left much of the original structure intact (including some WatBASIC instructions in the form of REM statements or non-executed lines) in the hope that you may still be able to gather from it some of the flavor of the other version of BASIC.

The purpose of "Structure-BASIC" is to help and encourage students to plan their programs in the form of flowcharts. (In the context of Waterloo BASIC, flowcharts are often called "structure diagrams," which I shall also often call them in this article.) Using Structure-BASIC, a student can draw a simple structure diagram on the PET's screen, placing BASIC instructions on it where appropriate.

When the diagram is complete, he simply presses the X (for eXecute) key, and the machine proceeds to execute his program directly from the diagram, without requiring the normal BASIC format with line numbers, etc. The diagram can include loops and conditional branches, provided these are drawn in the required way, and can carry almost the full vocabulary of BASIC words in the instructions to be executed. Diagrams can be executed repeatedly, with modifications if the user so wishes, and are stored in high memory during execution, so that the screen can be used for output and user INPUT.

Before telling you exactly how to use this program, I should tell you how to get it into your PET. If you type it in from the listing, there are a couple of things you should bear in mind. First, unless you have the Waterloo chip in your machine, you probably won't be able to copy the line indentations which are there to emphasize the program's structure and improve its legibility. This is a trivial problem. You can simulate the indent spaces with colons, if you wish, or you can simply ignore them. The program will run perfectly well without them.

The second problem is much more serious. Near the beginning of the program there are five lines, numbered 2010, 2035, 2055, 2072, and 2082, each of which contains a string of 30 X's. These characters are there simply to reserve memory locations into which tokenized BASIC instructions are to be POKEd by the "changeline" routine later in the program. It is vital that "changeline" POKEs exactly the right memory locations (the ones occupied by the X's), but the addresses of these locations will be affected by any trivial differences – such as the absence of indent spaces – between the way you type in the program and the way I did.

Before you try running the program, I strongly suggest that you go through the following steps to make sure that the POKEs are correctly targeted. First, look at the values given to the variable TG in lines 3172, 3176, 3180, 3184, and 3188. These numbers should be the addresses in memory of the first X in each of the five lines listed earlier. Try PEEKing each of these addresses. You should get 88. This is the (decimal) ASCII number for the character "X".

If you don't get 88, try the address plus one, the one after that, and so on, until you do get 88. If you do get 88 from your first PEEK, try the previous address. If that also gives you 88, try the one before that, and so on. In this way you can locate the first X in each string. Then change lines 3172, etc., so that TG is given the correct address of the first X in each string in your version of the typed-in program. (If you know how to use the machine-language monitor, you can, of course, use it to find the first X in each string much more quickly than you could through the method above.)

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If you can't face all that typing, or if you've tried it and find that the program somehow won't work right, send me a blank tape (no disks please) and $3 plus however much it costs you to send the cassette to me. With luck, it will cost me about the same amount to send it back to you. Please don't send postage stamps unless they're Canadian ones. My address is at the end of this article. If you'd like a copy of the program in WatBASIC as well as the non-Waterloo version (you may like to look at a listing, even if you can't run it), request it and I'll include it for free.

Three Options

Now let's assume that you have loaded Structure-BASIC into your PET, which has at least 16K of RAM, Upgrade or subsequent ROMs, and a 40-column screen. When you RUN the program, you will get a menu with three choices: (1) draw and run a new diagram, (2) modify and run an existing diagram (already in high memory), and (3) read instructions. Read the instructions if you like. The program will take you back to the menu when you have finished reading. Since there is not yet a diagram in high memory, you should now make choice number one. The screen will clear, and at the top left corner there will appear a rapidly flashing square containing a downward-pointing arrowhead. This is the cursor with which you can draw the logic lines on the diagram.

To start with, try drawing a simple linear program. Press the asterisk key a few times, and you will see the cursor move down the screen (the direction indicated by the arrowhead), leaving a trail of asterisks behind it. The program uses this trail to indicate a logic line. After a few asterisks, press the "E" key. This indicates that you are about to write an instruction to be Executed as the diagram is interpreted. You will see a reverse-field asterisk added to the logic line, and a new cursor, without an arrowhead, will appear to the right of it.

Write a simple BASIC instruction, such as "A=1", using this cursor. If you make a mistake, you can backspace using the delete key and write over your error. When the instruction is finished, hit "return" and the line-drawing cursor will reappear. Add a few more asterisks, press "E" again, and write another instruction such as "PRINT A". (Using a question mark instead of "PRINT" or using other BASIC shorthand is perfectly okay.) Press "return" again; then, since the two instructions constitute a tiny program, press the X key to watch it execute. There will be a delay while the diagram is copied into high memory, and then the screen will clear.

After another short delay, the number one will be printed, followed by READY and the normal PET cursor. RUN Structure-BASIC again, and this time choose option number two from the menu. You will see your diagram reappear on the screen, copied there from high memory, which is used in a way which is not erased by the RUN command. The line-drawing cursor will reappear. You can then change the diagram however you wish, moving the line-drawing cursor with the normal cursor controls and writing instructions as before.

Almost any instructions can be used, the exceptions being ones which would require line numbers, such as GOTO and GOSUB; lines which are normally simply "pointed at" by BASIC, such as DATA, DEF FN, and simple literal definitions of strings (e.g., A$="STRING"), and FOR/NEXT loop structures. We'll come to the method for writing loops shortly. If you want to use strings in your diagrammed program, you can INPUT them or build them by concatenation (e.g., K$="KEY"+"WORD"). The INPUT method is certainly the best for beginning programmers. After it has been INPUT, a string can be manipulated using any of the normal string operator instructions.

Conditional Branches And Loops

Now let's write a simple program with a conditional branch. Start off as before, and make the first instruction INPUT "A WORD";W$. Then, after a few more asterisks, press the "I" key while still in line-drawing mode. The word IF will appear to the left, and the writing cursor will wait for you to enter the condition for the branch. Let's make it LEN(W$)>10. Continue the program mainline downward, and terminate it with some instruction like PRINT "END".

Now move the line-drawing cursor, with the regular cursor controls, until it is immediately to the right of the "I" in the line. Press the "C" key; you will see the arrowhead in the cursor point to the right. Now the cursor will move in that direction as a line is drawn. Put a few asterisks in this line; then press "E" and write in the instruction PRINT "LONG WORD". Press RETURN and then "X" to execute the little program. Of course it will print out "long word" only if you enter more than ten characters in response to the INPUT instruction.

The method of drawing a conditional branch suggests that any number of instructions can be made contingent on a single "if" condition. This is, in fact, the case in Waterloo BASIC. In regular BASIC, an indirect strategy has to be used to achieve this result, unless the condition and all its consequences can be written on a single line.

Writing a loop with Structure-BASIC is very similar to the method for a conditional branch. A loop is just a branch executed repeatedly until its condition is no longer satisfied. When drawing a

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logic line, press the "L" key. The word "while" will appear; then you should write in the loop condition. Continue in exactly the same way you used for a branch. The condition can refer to anything which is altered by the execution of the loop, so that ultimately it will no longer be satisfied and execution of the loop will cease.

Limitations And Possibilities

There are a few other features, and some limitations, to Structure-BASIC which I should mention. An easy way to make changes to an instruction label is to move the line-drawing cursor to the desired position, press C if necessary so that the arrowhead points in the same direction as the one in which the label is written, then press W. You will then be able to rewrite the label as you wish. Press RETURN when you have finished.

If you wish to nest loops or conditional branches, you can do so. However, no more than two loops and/or two branches can be put into a nest. The program recognizes the end of an instruction label by the presence of at least two blank spaces after it (single spaces are allowed within a label). Therefore, you must be careful always to allow enough space at the end of a label.

Similarly, always make sure there is at least one blank space at the end of a logic line, branch, or loop. You must also make sure that no label crosses, and thus interrupts, the string of asterisks in a logic line. In order not to slow down program execution, I have not included any checks to prevent you from drawing or writing past the edge of the screen. You just have to be careful not to do so, and also to leave enough space between the end of a line or label and the screen's edge.

With a little practice you should find, as I have, that Structure-BASIC allows you to draw structure diagrams of a wide variety of simple programs on the screen and then execute them. The speed of execution is, of course, much slower than for programs written in the normal way; but this is of little importance if the main objective is to teach simple programming techniques to students.

You may still be a bit curious about how Structure-BASIC functions as a program. I intend to leave much of the figuring out of its workings to you in the hope that, as you look through the listing, you will also realize how it can be easier to read and understand a structured program than an unstructured one. Even though I have had to disrupt the structure to some extent (even to the point of including some GOTOs) in order to make it run on an unmodified PET, I think it is still quite legible.

The line indentations are intended to be helpful in this respect. They set aside the contents of loops and conditional branches from the program mainline, which can be imagined as running down the left-hand edge of the listing. Nested loops and branches are progressively more indented as the depth of the nest increases. Another aid to legibility is the division of the program into a number of named paragraphs or PROCedures. These should permit the program reader to be able to study in isolation the functional building-blocks from which the program is made. However, because of the peculiar problems of writing a self-modifying BASIC program, I have been forced to place some PROCs at the beginning of the program which would otherwise have been better placed later.

Some stylists may also object to the fact that the program functions recursively, so that some PROCs can be nested within themselves. However, this seems to me to be a perfectly logical consequence of the task which this program has to carry out. The recursion happens when the diagram contains a loop or branch. This is executed as a little program nested within the main program. The interpretation of the branch uses the same PROCs used to interpret the main program, so they end up nested within themselves. Indeed, if the diagram contains a nest of loops and/or branches, the PROCs can be recursively nested several times over. This type of program organization does require some care.

The other unusual feature about this program's organization is that it is self-modifying. During execution of a diagram, instruction labels are read and converted into tokenized BASIC form using the PET's internal ROM routines. (It uses these ROM routines for making this conversion when you enter an instruction in direct mode.) Finally, the tokens are POKEd into target lines in the program. A full explanation of this technique would be an article in itself. Here I will just say that the "tricky" step in the process, the conversion to token form, is carried out in the PROC named "compile." With this hint, and the aid of a memory map to help you understand the POKEs, perhaps you can figure out for yourself how it works.

There are some tantalizing possibilities associated with this program which I have so far been unable to explore because of lack of time and/or equipment. One simple one would be to modify it to run on the 80-column PET. This would greatly increase the amount of information which could be included in a diagram. A similar result could be achieved by allowing a diagram to span several "pages," each a full screen in size. Perhaps the pages could be made to call each other as PROCs or subroutines.

Another possibility – which would destroy the structured nature of the program, but would

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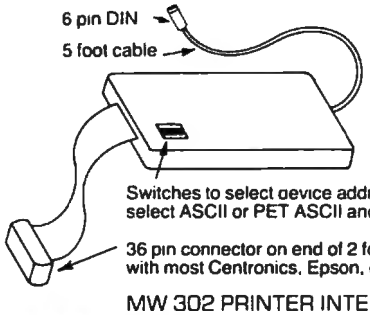

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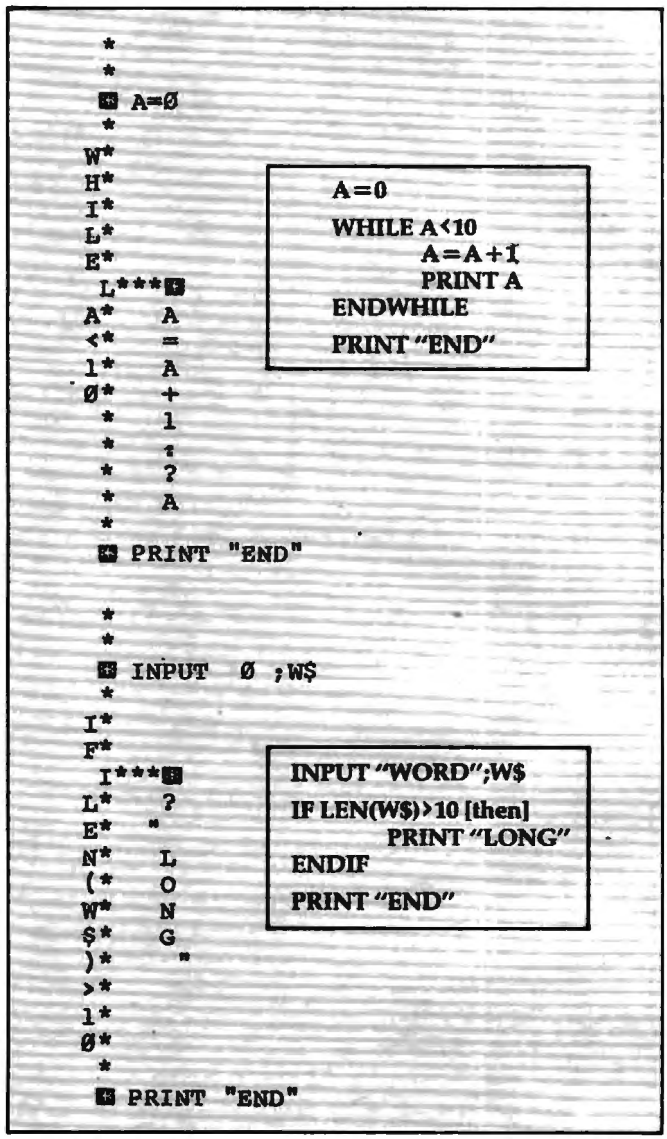
make it run much faster – would be to translate some of the routines into machine language. An even more radical rewrite of the program should enable it to run as a diagram-to-BASIC compiler. An "engine" like that would not interpretively run the diagram as the present program does. Instead, it would write into the PET's memory a conventional BASIC program which could later be executed at normal BASIC speed or which could be SAVEd as a normal program on tape or disk. That might make "son-of-Structure-BASIC" a really useful tool in the writing of long and complex programs. However, it would then need better technology than the present program uses to draw the diagram. Perhaps something based on the use of a light pen for the actual drafting and a large disk file to store the diagram.

I would be interested in knowing if any readers follow up on the above possibilities or any others. If you do, or if you have any questions or problems regarding the program in its present form, please write to:

David Williams
Box 174
Postal Station "Z"
Toronto, Ontario, Canada M5N 2Z4

```
1000 GOTO 16010:CALL MAINLINE
1020 :
2000 PROC CHANGEABLE
2010  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2020 RETURN
2025 :
2030 PROC CHANGELP1
2035  IF NOT (XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     XX) THEN RETURN
2040   GOSUB 15010:REM CALL TRACK
2045  GOTO 2035
2046 RETURN
2047 :
2050 PROC CHANGELP2
2055  IF NOT (XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     XX) THEN RETURN
2060   GOSUB 15010:REM CALL TRACK
2065  GOTO 2055
2066 RETURN
2067 :
2070 PROC CHANGEIF1
2072  IF NOT (XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     XX) THEN RETURN
2074   GOSUB 15010:REM CALL TRACK
2077 RETURN
2078 :
2080 PROC CHANGEIF2
2082  IF NOT (XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     XX) THEN RETURN
2084   GOSUB 15010:REM CALL TRACK
2087 RETURN
2088 :
3000 PROC COMPILE
3010  CL$="::::::::::::::::GOTO 3100:"+CL$+
     CHR$(13)
3020  FOR I=1 TO LEN(CL$)
3030   POKE 828+I,ASC(MID$(CL$,I,1))
3040  NEXT I
3050  POKE 212,2
3060  POKE 59408,(PEEK(59408) AND NOT 32)
```

Two example structured programs. The structure diagram, which can actually be RUN like a BASIC program, is shown at the left. Follow the asterisks to see the program flow. A "listed out" version of the structure is shown in a box to the right of the diagram.




```
3070  POKE 175,2
3080  POKE 188,0
3085  POKE 176,2
3090  END
3100  POKE 175,0
3110  POKE 176,3
3120  CL$=""
3130  I=528
3140  REM LOOP
3145   J=PEEK(I)
3150   IF J=0 THEN 3163
3155   CL$=CL$+CHR$(J)
3160   I=I+1
3162  GOTO 3140
3163  GOSUB 3170:REM CALL CHANGELINE
3164 RETURN
3166 :
3168 PROC CHANGELINE
3170  IF TG$<>"CL" THEN 3174
3172 TG=1082
```

VIC And 64 Notes

This is one of the most intriguing Commodore programs we've seen. As a converted Waterloo (structured) BASIC program, it uses *modular PROCedures*. Don't worry about the unfamiliar PROC's and ENDIF's. These lines are never executed anyway (no GOTOs ever land on them). They're like REM statements documenting the program's flow.

Mostly Machine Specific

While this is a structured program, it's very machine-specific. Some very tricky techniques are used. First, it uses POKEs to screen RAM when building the program diagram. Change any references to 32768 or 32769 to 1024 for the 64. You'll need to make other changes to get PROCedure DRAW to work on the VIC, such as replacing references to 40 (PM=PN-40) to 22, and using the appropriate screen memory address for your VIC's memory size: 3K expansion=7680, 8K or greater expansion=4096.

When you execute a screen program, Structure BASIC "creates" statement lines by modifying itself. It grabs a line from the screen, "tokenizes" (condenses) it with a *very* strange method (explained later), and POKEs the tokens into program RAM. The variable TG (target) holds the memory location of the program line being modified. It should be changed to reflect the host machine's start of BASIC. For the 64, just add 1024 to the value of TG. There isn't enough memory in a 5K VIC to run Structure BASIC. With 8K or more added RAM, you should add 3584 to the value of TG.

PROCedure INITIALIZE reserves RAM at the top of memory to hold the screen diagram between RUNs. Change references to 52 and 53 to 55 and 56 for the VIC or 64. PROCedure COMPILE is the trickiest. It builds a program line in CL$. This cannot be directly placed into memory, since it is in ASCII form. (The command PRINT is not stored as the letters "PRINT" in memory, but rather with a single character *token*.) So CL$ is copied to the second cassette buffer, and then a series of POKEs makes the computer think it is getting input from the second tape drive. It doesn't try to read the tape, it just looks at the second cassette buffer.

The newly tokenized line is found in the BASIC input buffer (at $0200 and up). The program then PEEKs the tokenized line into CL$ and later POKEs this directly into some program lines. Yes, it's confusing at first, but very powerful. The technique permits BASIC to easily modify itself. It could be used for program-defined DEF FN statements (for graphs or math programs). It could also serve as the kernel of a MERGE command to add lines of BASIC read in from an ASCII file on tape or disk. Don't overlook the potential of this technique.

It's not simple to convert it to the VIC or C-64. First, the machines don't have a second cassette or second cassette buffer. Instead of POKEing a "2" (lines 3050, 3070, 3085), use "1". The POKE addresses 212, 175, 188, and 176 should be changed to 186, 153, 166, and 154, respectively. These are merely suggestions. Translating such an exquisitely machine-specific program as this will require additional conversions.

When you succeed in making a VIC or 64 version, send it in and we'll share it with everyone. In the meantime, studying the techniques explained in this article will improve anyone's understanding of their computer's BASIC.

```
3173   GOTO 3196
3174  IF TG$<>"CLP 1" THEN 3178
3176 TG=1154
3177   GOTO 3196
3178  IF TG$<>"CLP 2" THEN 3182
3180 TG=1270
3181   GOTO 3196
3182  IF TG$<>"CLI 1" THEN 3186
3184 TG=1385
3185   GOTO 3196
3186  IF TG$<>"CLI 2" THEN 3190
3188 TG=1488
3189   GOTO 3196
3190  REM:ELSE
3192   PRINT "TOO DEEP STACK"
3193   END
3194  ENDIF
3196  IF LEN(CL$)>=30 THEN 3208
3198   CL$=CL$+" "
3200  GOTO 3196
3208  I=0
3210  REM:LOOP
3215   AS=ASC(MID$(CL$,I+1,1))
3220   POKE TG+I,AS
3225   I=I+1
3230  IF I<30 THEN 3210
3400 RETURN
5000 :
5010 PROC INITIALIZE
5015  A0=256*PEEK(53)
5020  IF PEEK(A0+1000)=204 THEN 5080
5030   POKE 52,0
5040   POKE 53,PEEK(53)-4
5050   A0=256*PEEK(53)
```

```
5052   FOR I=1001 TO 1023
5054    POKE A0+I,32
5056   NEXT I
5060   POKE A0+1000,204
5062   PRINT "{03 UP}{02 DOWN}RUN{02 UP}";

5064   POKE 623,13
5065   POKE 158,1
5067   END
5070  ENDIF
5080  A1=32768
5120  FOR I=0 TO 2
5130   POKE 826+I,32
5140  NEXT I
5170  FOR I=1 TO 6
5180   READ WH(I)
5190  NEXT I
5200  FOR I=1 TO3
5210   READ I1(I)
5220  NEXT I
5480 RETURN
5490 :
5510 DATA 87,72,73,76,69,32
5520 DATA 73,70,32
5600 :
6000 PROC DRAW
6010  PN=32769
6020  FM=40
6030  CS=150
6100  REM:LOOP
6110   REM:LOOP
6120    GET G$
6121     PK=PEEK(PN)
6122     POKE PN,CS
6124     FOR I=1 TO 20: NEXT
6126     POKE PN,PK
6128     FOR I=1 TO 20: NEXT
6130   IF G$="" THEN 6110
6140   IF G$<>"*" THEN 6470
6450    POKE PN,42
6460    PN=PN+FM
6470   IF G$<>"L" THEN 6492
6471    POKE PN,12

6472    FW=FM
6474    PM=PN-41-5*FW
6476    FOR I=1 TO 6
6478     POKE 622+I,WH(I)
6480    NEXT I
6482    POKE 158,6
6484    GOSUB 8010:REM CALL WRITELABEL
6490    PN=PN+FM
6492   IF G$<>" " THEN 6500
6494    POKE PN,32
6496    PN=PN+FM
6500   IF G$<>"I" THEN 6530
6501    POKE PN,9
6502    FW=FM
6504    PM=PN-41-2*FW
6506    FOR I=1 TO 3
6508     POKE 622+I,I1(I)
6510    NEXT I
6512    POKE 158,3
6514    GOSUB 8010:REM CALL WRITELABEL
6520    PN=PN+FM
6530   IF G$<>"E" THEN 6560
6540    POKE PN,170
6542    FW=41-FM
6544    PM=PN+2*FW
6545    GOSUB 8010:REM CALL WRITELABEL
6550    PN=PN+FM
6560   IF G$<>"{DOWN}" THEN 6580
6570    PN=PN+40
6580   IF G$<>"{UP}" THEN 6600
6590    PN=PN-40
6600   IF G$<>"{RIGHT}" THEN 6620
6610    PN=PN+1
6620   IF G$<>"{LEFT}" THEN 6640
6630    PN=PN-1
6640   IF G$<>"C" THEN 6660
6650    FM=41-FM
6655    CS=340-CS
6660   IF G$<>"W" THEN 6680
6662    FW=FM
6664    PM=PN
6665    GOSUB 8010:REM CALL WRITELABEL
6670   REM:ENDIF
6680  IF G$<>"X" THEN 6100
6900 RETURN
6999 :
8000 PROC WRITELABEL
8010  REM:LOOP
8020   REM:LOOP
8030    GET G$
8032    PK=PEEK(PM)
8034    POKE PM,(127 AND PK)+128-(128 AND ~
     PK)
8036    FOR I=1 TO 10: NEXT
8037    POKE PM,PK
8038    FOR I=1 TO 10: NEXT
8040   IF G$="" THEN 8020
8050   IF G$=CHR$(13) THEN RETURN
8060   AS=ASC(G$)
8065   IF AS<>20 THEN 8069
8067    PM=PM-FW
8068    GOTO 8090
8069   REM:ELSE
8070    POKE PM,(128 AND AS)/2+(63 AND AS)

8080    PM=PM+FW
8090  GOTO 8010
8100 ENDPROC
8999 :
9000 PROC COPY
9010  FOR I=0 TO 999
9020   POKE A0+I,PEEK(A1+I)
9030  NEXT I
9040 RETURN
9999 :
10000 PROC RECOPY
10020  FOR I=0 TO 999
10030   POKE A1+I,PEEK(A0+I)
10040  NEXT I
10050 RETURN
10999 :
11000 PROC READLABEL
11010  CL$=" "
11020  PR=SR
11030  REM:LOOP
11040   PK=PEEK(PR)
11050   AS=(63 AND PK)+2*(64 AND PK)+2*((NO
     T PK) AND 32)
11060   CL$=CL$+CHR$(AS)
11070   PR=PR+FR
11080  IF RIGHT$(CL$,2)<>"  " THEN 11030
11090  CL$=MID$(CL$,2,LEN(CL$)-3)
11100 RETURN
11999 :
12000 PROC DOLINE
12010  FR=41-FT
12020  SR=PT+2*FR
12030  GOSUB 11010:REM CALL READLABEL
12040  TG$="CL"
12050  GOSUB 3010:REM CALL COMPILE
12060  GOSUB 2010:REM CALL CHANGEABLE
12070  PT=PT+FT
12080 RETURN
```

```
12999 :
13000 PROC DOLOOP
13010  FR=FT
13020  SR=PT-41+FT
13030  GOSUB 11010:REM CALL READLABEL
13040  NL=1+NL
13050  TG$="CLP"+STR$(NL)
13060  GOSUB 3010:REM CALL COMPILE
13150  LS(NL)=TS
13160  LP(NL)=PT
13170  FT=41-FT
13180  TS=PT+FT
13200  IF NL<>1 THEN 13220
13210   GOSUB 2035:REM CALL CHANGELP1
13215  GOTO 13240
13220  REM:ELSE

13230   GOSUB 2055:REM CALL CHANGELP2
13240  REM:ENDIF
13250  FT=41-FT
13260  PT=LP(NL)+FT
13270  TS=LS(NL)
13280  NL=NL-1
13300 RETURN
13999 :
14000 PROC DOIF
14010  FR=FT
14020  SR=PT-41+FT
14030  GOSUB 11010:REM CALL READLABEL
14040  NI=1+NI
14050  TG$="CLI"+STR$(NI)
14060  GOSUB 3010:REM CALL COMPILE
14150  IS(NI)=TS
14160  IP(NI)=PT
14170  FT=41-FT
14180  TS=PT+FT
14200  IF NI<>1 THEN 14220
14210   GOSUB 2072:REM CALL CHANGEIF1
14215   GOTO 14240
14220  REM:ELSE
14230   GOSUB 2082:REM CALL CHANGEIF2
14240  REM:ENDIF
14250  FT=41-FT
14260  PT=IP(NI)+FT
14270  TS=IS(NI)
14280  NI=NI-1
14300 RETURN
14999 :
15000 PROC TRACK
15010  PT=TS
15015  REM:LOOP
15020   PJ=PEEK(PT)
15025   IF PJ=32 THEN RETURN
15030   IF PJ<>42 THEN 15050
15040    PT=PT+FT
15045    GOTO 15108
15050   IF PJ<>170 THEN 15070
15060    GOSUB 12010:REM CALL DOLINE
15065    GOTO 15108
15070   IF PJ<>12 THEN 15090
15080    GOSUB 13010:REM CALL DOLOOP
15085    GOTO 15108
15090   IF PJ<>9 THEN 15105
15100    GOSUB 14010:REM CALL DOIF
15102    GOTO 15108
15105   REM:ELSE
15106    PRINT "TRACKING ERROR"
15107    END
15108   REM:ENDIF
15110  GOTO 15015
15200 ENDPROC
15999 :
16000 PROC MAINLINE
16010  GOSUB 5015:REM CALL INITIALIZE
16015  REM:LOOP
16020   PRINT "{CLEAR}{07 DOWN}WHICH OF THE
      FOLLOWING DO YOU WANT TO DO"
16030   PRINT "{DOWN}1. DRAW THEN RUN PROGR
     AM DIAGRAM"
16040   PRINT "{DOWN}2. MODIFY THEN RUN EXI
     STING DIAGRAM"
16050   PRINT "{DOWN}3. READ INSTRUCTIONS"
16170   PRINT "{02 DOWN}{02 RIGHT}ENTER NUM
     BER AT LEFT"
16200   REM:LOOP
16210    GET G$
16220   IF G$<"1" OR G$>"3" THEN 16200
16230   IF G$<>"3" THEN 16250
16240    GOSUB 17010:REM CALL INSTRUCTIONS
16250   REM:ENDIF
16260  IF G$>="3" THEN 16015
16300  PRINT "{CLEAR}";
16310  IF G$<>"2" THEN 16325
16320   GOSUB 10020:REM CALL RECOPY
16325  REM:ENDIF
16330  GOSUB 6010:REM CALL DRAW
16340  GOSUB 9010:REM CALL COPY
16350  PRINT "{CLEAR}";
16360  TS=A0+1
16370  FT=40
16380  GOSUB 15010:REM CALL TRACK
16400  POKE 53,4+PEEK(53)
16900 END
16999 :
17000 PROC INSTRUCTIONS
17010  PRINT "{CLEAR}USE '*' TO DRAW LOGIC ~
     LINES. CHANGE"
17020  PRINT "DIRECTION BY ENTERING 'C'.  F
     OR AN"
17030  PRINT "EXECUTABLE LINE, ENTER 'E'. F
     OR A LOOP,"
17040  PRINT "ENTER 'L'.  FOR AN IF, ENTER ~
      'I'."
17042  PRINT "CURSOR IN DRAWING MODE SHOWS ~
     DIRECTION"
17044  PRINT "OF MOTION.  PROGRAM SWITCHES ~
     TO LABEL-"
17046  PRINT "LING MODE WHEN 'L','I' OR 'E'
      ARE"
17048  PRINT "ENTERED, OR WHEN 'W' IS ENTER
     ED."
17050  PRINT "AFTER WRITING A LABEL, PRESS ~
      'RETURN'."
17060  PRINT "THE CURSOR CONTROLS CAN BE US
     ED IN"
17070  PRINT "DRAWING MODE.  A BLANK CAN BE
      USED TO"
17080  PRINT "OVER-WRITE UNWANTED MATERIAL.
     "
17090  PRINT "WHEN A DIAGRAM IS FINISHED, E
     NTER"
17100  PRINT "'X' TO EXECUTE IT.  USE SINGL
     E LETTERS"
17110  PRINT "FROM 'A' TO 'H' FOR VARIABLES
     , TO"
17120  PRINT "AVOID INTERACTION WITH VARIAB
     LES IN"
17130  PRINT "THE MAIN PROGRAM.  LOOPS CANN
     OT BE"
17140  PRINT "NESTED MORE THAN TWO DEEP; NE
     ITHER"
17150  PRINT "CAN IFS."
17500  PRINT"{02 DOWN}{02 RIGHT}PRESS {REV}
     SPACE{OFF} TO CONTINUE"
17510  REM:LOOP
17520   GET G1$
17530  IF G1$<>" " THEN 17510
17900 RETURN
```

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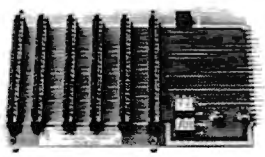

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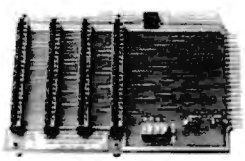

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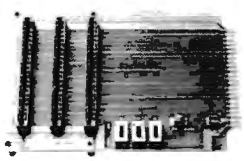

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OUTASIGHT: ATARI
April Meanderings From Bill Wilkinson

There is so much to discuss this month, what with all the new announcements from Atari and others, that I won't waste your time with one of my cutesy little introductions, wherein I summarize — usually in one, long, run-on sentence (with many parenthesized asides) or one or two highly conjunctive paragraphs – all the things I might talk about this month, give away the punch line to various program listings, and apologize for mistakes made three or four months in the past, including mistakes that most readers never notice because (luckily) they just read the text and don't try to type in the program (or are clever enough to wait a month or two and see what mistakes I turn up in subsequent issues).

I *will* note that I will break from tradition a little this month and discuss some new software releases. I know that I have said before that I would not review software, but I feel that I must make an exception when it comes to new languages, especially those that come directly from Atari.

Atari COBOL

Unbelievable! After claiming for months (years?) that they were *not* after the business market, Atari did a complete about-face and produced an interpreter for that most popular business language: COBOL.

Although versions of COBOL have been available for a number of years in the CP/M market, as far as I know this marks the first attempt to implement it on a 6502. The implementation itself is revolutionary, also.

Most of my regular readers will no doubt recall that I have repeatedly stated that the 6502 is a lousy machine to write a compiler for. Several groups have attempted to solve this problem by producing code for an arbitrary "p-machine" and then writing a p-code interpreter which emulates the (possibly imaginary) p-machine. Examples of this type of compiler include Atari Pascal, UCSD Pascal for the Apple, and (in a similar but not identical vein) Forth.

Now, p-code is small, and the p-code interpreter can be fairly compact and efficient. But a COBOL p-code interpreter (should we call it C-code?) would be fairly large, because of the great variety of data types, etc., that COBOL supports. So why bother with the compiler stage? Why not tokenize the user's input, à la Atari BASIC, and directly interpret the tokens? You save a lot of space and sacrifice only a little bit of speed. Voilà.

Anyway, I recognize that not too many **COMPUTE!** readers are COBOL aficionados, so let's do a very short exploration of COBOL in general and Atari COBOL in particular. Insofar as possible, I will try to relate COBOL features to BASIC features.

COBOL programs are always divided into four major *divisions*: the identification division, the environment division, the data division, and the procedure division.

There really is nothing in BASIC to correspond to either the identification or environment divisions. The identification division is a kind of forced REMark section; its contents are usually installation and/or compiler specific. Under Atari COBOL, this division is used to specify programmer name, date of compile, and auto-boot procedures (if any). The environment division is used by the COBOL programmer to tell the compiler about the hardware configuration that the compiled code is *destined* for. Atari COBOL allows the user to specify whether he or she is running on a 400, 800, or 1200 computer and describe the memory configuration. One can also specify whether a

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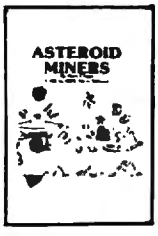

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color TV or a black and white monitor is in use, using either the American NTSC system or the European PAL scheme. Naturally, one can describe the kind of printer to be used (daisy wheel, dot matrix, etc.).

COBOL's data division is at best poorly translatable to BASIC. With COBOL, one must declare all variables, while BASIC users declare only strings and arrays. Also, with COBOL, each variable has a "PICTURE" associated with it which specifies what the data the variable represents will look like when it is displayed or printed (kind of like having a built-in "PRINT USING" format for each variable). Of course, some variables are never printed or displayed, so they can be declared "COMPUTATIONAL," without a picture associated.

Wisely, Atari chose to disallow all use of the procedure division, ...

Atari COBOL expands on the "PICTURE" concept by allowing the user to specify graphic modes and pictures, including the capability of declaring a variable to be a "player" or "missile" which will be automatically animated (moved both horizontally and vertically) during the VBLANK interrupt period. Of course, there is a price to pay for this flexibility: just setting up a player can require as many as 48 lines of code!

The final division (and, yes, the divisions must be kept in proper order in a COBOL program) is the procedure division. It is here that COBOL looks the most like other languages, including BASIC. There are COBOL equivalents to many BASIC statements, including GOSUB ("PERFORM"), LET ("MOVE"), IF...THEN ("IF"), and several more. Obviously, all the useful "work" of COBOL is done in the procedure division.

While COBOL does not use line numbers, it suffers some of BASIC's problems; and the user must work to write properly structured COBOL programs. Perhaps the real beauty of COBOL is its ability to be extremely self-documenting. How much more readable it is to say "IF SALES GREATER THAN QUOTA MOVE BONUS-AMOUNT TO BONUS IN SALARYRECORD". And that really *is* legitimate COBOL code!

The most fantastic aspect to Atari COBOL is that somehow Atari managed to fit the whole thing into an 8K byte cartridge. Rumor has it that they have developed a 16-bit virtual machine that does the brunt of the work. (I don't believe the rumor that Atari wrote COBOL in BASIC and is going to call the manual "An Introduction to BASBOL." On the other hand, who can say?)

The one unfortunate aspect to Atari COBOL is that, in order to cram it all into the cartridge, they had to omit one of the four major divisions. Wisely, Atari chose to disallow all use of the procedure division, since they felt that all but the most experienced COBOL programmers would not miss it.

Is Something Unclear?

I received a letter from Y. D. Obon, of Erehwon, Nebraska, regarding a comment I had made many months ago about suppressing the screen clear when changing graphics modes. I had said at the time that there seemed little use in such a capability. Well, once again, I have been proved wrong.

Since my comment appeared a long time ago, and since it was written in connection with my assembly language graphics library, I will restate it in terms of Atari BASIC. If the GRAPHICS statement had been omitted from Atari BASIC, the user would have been able to perform the equivalent function by typing in the following equivalent statements:

```
CLOSE #6
OPEN #6, 12+n,m, "S:"
```

In that second line, "m" is the graphics mode (e.g., m=7 is equivalent to GRAPHICS 7). Also, "n" is 0 if full screen graphics are desired, and 16 if you want four text lines at the bottom of the screen. BASIC generates "n" for you based on the GRAPHICS mode you select; note that BASIC inverts the sense of the "+16" before performing the OPEN. (Note that the "12" is simply to tell CIO that we can do both input and output on this channel. It is not used by "S:".)

However, "n" as shown above can take on at least one other meaning besides selecting full screen or text mode graphics. If "n" equals 32 (or 48), the screen clear which usually takes place upon changing of graphics modes is suppressed. Now I hadn't thought this feature of much use. After all, if I had a mode 5 graphics display and attempted to change to mode 6 without clearing the memory, I would get some sort of meaningless jumble on the screen.

The program demonstrates several points, including that made in the previous paragraph. I was sorely tempted to simply dump this listing on you, without explanation, and let you try it out. But I will take pity. At the very end of this

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month's column, there is an explanation of the various points made by this program. *Please, please* don't read it yet! Please type the program in and run it first. One clue: not only is the program a lesson in and of itself, but it also reveals the main point of this month's column up to this point.

Caution: Double and triple check the program before you RUN it. The effect could be disastrously scrambled if you make a mistake. On the other hand, the listing is short enough that you should be able to type it in error-free.

Confusion Is Good For A Sole

Actually, maybe I'm a heel instead of a sole. But I had to have a *little* fun with this column, and April is obviously the month for it.

I have had a few people pre-read this month's column, and the consensus is that I should explain some of my jokes. Now, I have always felt that a joke that has to be explained isn't funny, but maybe practical jokes are exceptions.

I would first like to point out that even while I was pulling your assorted limbs, I was trying to give you good and valid information. In the discussions of COBOL, everything I told you was accurate and truthful, *except*, of course, anything that referred to Atari. For instance, COBOL really does have four major divisions, and it really does support a PICTURE capability in the data division. But I think you will find Atari buying IBM (the whole company, not just the computers) before you will find them producing a COBOL for any of their current crop of machines.

Finally, the "kicker" in the description of Atari COBOL (the giveaway that it was all a joke) was the statement that the procedure division was not supported. That is roughly equivalent to leaving *all* statements out of Atari BASIC other than REM, DATA, and DIM!

A Slight Hand

If you have not yet typed in and RUN the BASIC program at the end of this article, you are cheating if you start reading this part. Shame, shame, on you. Actually, the program is a kind of puzzle. How and why does it act as it does? Well, the easiest way to explain is to discuss it, line by line.

Line 10: There's nothing special about the name of the string, DIM$. I chose that name just to show that keywords are *not* generally reserved names in Atari BASIC. GRAPHICS 23 is actually GRAPHICS 7+16, full screen mode 7 graphics. Note that this statement will clear all screen memory used in mode 7.

Line 20: We're going to do a loop 40 times. We READ a character from the DATA statements and use its ATASCII value as a COLOR. Trick: only the two least significant bits of a color number are used in mode 7. Thus COLOR 3 is the same as COLOR 7 is the same as COLOR ASC("G"), because ASC("G") is 71.

Line 30: We draw some nice vertical lines, each in a color determined via the READ in line 20. Remember, plotting points on an Atari really means we are turning on or off certain bits in the computer's screen memory. Isn't this a peculiar set of bit patterns?

Line 40: Naughty, naughty, Bill. You used an XIO 12 instead of a CLOSE! Yes, but the point is that doing a CLOSE from BASIC really is the same as an XIO 12. So we closed IOCB #6, the screen device. And what about the rest of the stuff, the '237,91,"*=LABEL"' ? Junk. Pure junk. It is totally ignored by CLOSE, and is meant only to mislead you.

Line 50: More of the same foolishness. XIO 3 is exactly the same as an OPEN command. We are opening the screen ("S..." is the screen, the "..." are ignored, natch) on IOCB #6 (which is where GRAPHICS would open it). We choose graphics mode 1 (the second parameter), and the 44 may be thought of as 32+8+4. The 32 says *don't* clear the screen memory, 8 says we can write to the device (the screen), and 4 says we can read from it (though we don't in this program).

Line 60: So that we can leave the full screen graphics active.

Lines 70, 80, and 90: As explained above, only the two lower bits of each of these characters are used. We could have used 2,2,4,5, etc., instead, but I worked to get these in alphabetical order, to confuse you further!

And why does it work like it does? Because we are actually seeing the stuff we plotted in mode 7 in a different way. Those same bits which were used in pairs as colors are now interpreted as bytes of eight bits each which are seen as characters.

So now you know the secrets. But you still can't see the surprising result unless you take the time to type in and run the program. Which you already did. Unless you cheated.

Well, Henny Youngman I'm not, but I hope you enjoyed this month's foolishness. Next month, on to more serious things. Finally, we will start showing how to write self-relocatable assembly language. Until then, best wishes from the Lo Of Lirpa.

```
10 DIM DIM$(1):GRAPHICS 23
20 FOR X=20 TO 59:READ DIM$:COLOR ASC(DIM$)
30 PLOT X,0:DRAWTO X,91:NEXT X
40 XIO 12,#6,237,91,"*= LABEL"
50 XIO 3,#6,44,1,"SAVE D:TEST"
60 GOTO 60
70 DATA B,B,D,E,H,K,L,L,N,O,P,R,T
80 DATA B,B,E,J,J,K,L,L,L,L,N,N
90 DATA A,B,D,F,G,G,J,J,K,K,L,N,O,P
```

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HEXEDIT

A BASIC Hex Editor For The VIC

Bill Yee

"Hexedit" lets you handle hexadecimal-decimal conversions and create and save machine language on your VIC. It works on any VIC, expanded or not.

Are you tired of POKEs, PEEKs, and constant conversion from hexadecimal to decimal and back again? Here's an editor that allows you to roam around VIC memory entirely in hexadecimal. In addition, by changing a BASIC pointer, binary data or machine code entered into VIC RAM via the editor can be saved and loaded on VIC cassette. The normal VIC cassette commands SAVE, LOAD, and VERIFY are used.

The editor is written in BASIC in order to avoid the chicken and egg problem (only an unexpanded VIC is required to create "Hexedit" but it will work without modification on any VIC). Because the unexpanded VIC has only 3500-odd bytes of RAM available, Hexedit contains no REM statements, and GOSUBs are used extensively. Hexadecimal to decimal conversion is done by a subroutine at line 11, and decimal to hexadecimal conversion is done by a subroutine at line 14. This allows you to do conversions outside of Hexedit via direct BASIC statements. For example, entering H$ = "ABCD" : GOSUB11 : ?D displays 43981, and entering D = 43981 : GOSUB14 : ?H$ displays ABCD.

Hexedit occupies 615 bytes of memory, and on an unexpanded VIC the end of the program would be at 4713 ($1269). A PEEK of the BASIC pointer for the "end of BASIC program start of BASIC variable area" at locations 45 and 46 ($2D and $2E) should show 106 and 18 ($6A and $12) after you have created Hexedit.

Modifying Memory

If you plan to use Hexedit just to look at VIC memory, there is nothing more to do. If you want to create and save data, you need to reserve some space in the RAM following Hexedit. This is done by modifying the BASIC pointer at locations 45 and 46 so that the "end of BASIC program start of BASIC variable area" is much higher than it is for Hexedit proper. If you do a POKE45,0 and a POKE46,28 followed by a CLR (to clean up the other BASIC pointers), you would now have the memory space from 4714 to 7167 ($126A to $1BFF) at your disposal.

However, once you have changed the pointer, do not add or delete any BASIC statement. If you do, the BASIC line editor in the VIC will move data around in memory up to the "end of BASIC program" location defined by the pointer as well as relinking the data to form linked BASIC statements.

Hexedit is executed with a RUN command. You are prompted for a starting memory location by Hexedit. The address is taken to be hexadecimal if prefixed by $. Otherwise, it is seen as decimal. After the location prompt, all output and input is taken to be hexadecimal. Hexedit displays the current location address followed by the contents. Keying the up CRSR causes a byte walk towards lower memory. The down CRSR is used to byte walk towards higher memory. Depressing the SPACE bar with no other input re-displays the current location. This is useful for looking at the VIC VIA timers or input ports. If the value in the location has not changed, hitting the SPACE bar will appear to have no effect.

A RETURN causes a prompt for a new starting location. If you respond to the prompt with just another RETURN, Hexedit will END.

Data can be entered into memory at the current location whose address and contents are displayed by Hexedit. The digits 0-9 and A-F are accepted for input. Only the last two digits entered are written into memory. So if you make a mistake, just keep on entering digits until it is right. After digit input, write of memory occurs on either up or down CRSR, SPACE bar, or RETURN.

The location pointer is modified after a successful write of memory, as described previously, except for the SPACE bar. In this case, with data entered, the SPACE bar causes the current location to increment. I found this method of data entry with the SPACE bar to be the fastest way. If the

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current location cannot be written by the data specified, the response will in all cases be the message "R/O" followed by re-display of the same location.

Once you have finished entering data into reserved memory, you can exit Hexedit by hitting RETURN twice. The VIC cassette commands can then be used to SAVE the new data (along with Hexedit) to tape. A subsequent LOAD will retrieve the data as well as Hexedit from tape.

I have used Hexedit for entering up to 2 Kbytes of assembly code on the VIC. For example, it is a way to create "TINYMON1" directly on the VIC rather than doing it via a PET. For those with limited resources, Hexedit provides a way for doing more with what you already have at no further cost.

```
1 GOSUB8:L=D:C=99
2 GOSUB7:L=D
3 GOSUB13:L$=H$:D=PEEK(L):GOSUB14:PRINTL
    $": "H$" ";:GOSUB18
4 IF H$=""ANDC=32THENPRINT"{UP}":GOTO3
5 IFH$<>""THENH$=RIGHT$(H$,2):GOSUB11:PO
    KEL,D:IFPEEK(L)<>DTHENPRINT" R/O"
    :GOTO3
6 GOTO2
7 PRINT:IFC<>13THEND=L+SGN(99-C):RETURN
8 H$="":INPUT"LOC";H$:IFH$=""THENEND
9 IFLEFT$(H$,1)<>"$"THEND=VAL(H$):RETURN

10 H$=MID$(H$,2,LEN(H$)-1):H$=RIGHT$(H$,4
    )
11 N=LEN(H$):D=0:FORM=0TON-1:C$=MID$(H$,N
    -M,1):H=ASC(C$)-48:IFH>9THENH=H-7

12 D=D+H*16^M:NEXT:RETURN
13 D=L
14 IFD<0ORD>65535THENPRINTD"OOR":END
15 H$="":M=4096:N=3:IFD<256THENM=16:N=1
16 FORH=0TON:C=INT(D/M):D=D-C*M:M=M/16:C=
    C+48:IFC>57THENC=C+7
17 H$=H$+CHR$(C):NEXT:RETURN
18 H$=""
19 GETC$:IFC$=""THEN19
20 C=ASC(C$):IFC=13ORC=17ORC=32ORC=145THE
    NRETURN
21 IF C<48OR(C>57ANDC<65)ORC>70THEN19
22 PRINTC$;:H$=H$+C$:GOTO19
```

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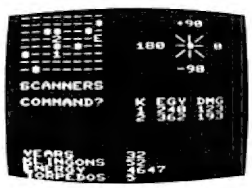

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PET Searcher

Ronald A Blattel

A machine language routine can reduce the search time of random access files. The program given here searches for a given input string and matches it with an array string. For CBM computers, Upgrade and BASIC 4.0, with disk.

Random access or relative files require a keyfile to hold the record number from which is derived the record location on disk. If the keyfile is long, a sequential BASIC search for the desired record can take many seconds and eliminate the time advantage of a random access file.

One solution to this problem is to sort the keylist and then do a binary search. This requires saving the record number with the keyword. Another solution is to maintain an unsorted list and equate the list position of the keyword with the record number. The search time could be reduced with a machine language routine.

The following program searches a one-dimensional array for a given input string. The position in the array is accessed directly with the USR function. It is fast and reliable provided certain rules are observed. The input string variable must be declared in the program before any other strings. The array must be DIMensioned before any other arrays. Any variables used during the search process must be declared before the search.

Before the search, the USR jump locations, 0-2, must be POKEd with the appropriate values. These will be generated in the loader (Program 1). The search returns to BASIC on a match. If the search is to continue for multiple matches, a different jump location must be POKEd. This also is given in the loader program.

The search will match an input string with the exact array string or a longer array string. For instance, an input string of "hello" would match with "hello" and "hello there." A "*" in the input string matches anything. So, "***** there" will match with "hello there."

The last element in the array to be searched must be "#" to stop the search.

The loader program allows a choice of storing the routine at any location or protecting it in high memory. It is deliberately short. Any modifications such as browsing backwards can be implemented in BASIC by storing the matches in another array.

The routine setup is exemplified in the demonstrator (Program 2). Also, the search time is calculated and may be compared to the same search in BASIC.

The USR function transfers program control from BASIC to machine code, starting at the address at 0001 and 0002. By POKEing the appropriate addresses at these locations, the program will either initialize (start at the beginning of the search) or continue where it left off.

The only ROM-dependent subroutine used in the program is the one which converts two-byte integer numbers to floating point. The program was written on a machine with Upgrade ROMs, in which this subroutine begins at location $D26D. (See the last number in line 910 and the first in lines 920, 109 and 210 respectively. This is the subroutine address in the usual low byte/high byte order – 109 = $6D and 210 = $D2.) In BASIC 4.0 the conversion subroutine begins at location $C4BC, thus the 109 and 210 must be changed to 188 and 196 to use the program with these ROMs.

Program 1.

```
100 PRINT"{CLEAR}LOADER AND RELOCATER FOR ~
    SEARCH 2.0"
110 :
120 DEFFNH(X)=INT(X/256)
130 DEFFNL(X)=INT(X-256*FNH(X))
140 DEFFNN(X)=PEEK(X)+256*PEEK(X+1)
150 NU=142  :REM LENGTH OF PROGRAM
160 :
170 INPUT"{DOWN}START AT {REV}A{OFF}DDRESS
     OR {REV}T{OFF}OP OF MEMORY  T{Ø3
     LEFT}";IN$
180 IF IN$="T" THEN 290
190 INPUT"{DOWN}START AT WHICH ADDRESS";XX

200 GOSUB 220:GOTO380
210 :
```

```
220 FOR I= Ø TO NU-1
230 READ A
240 POKE XX+I,A
250 NEXT
260 RETURN
270 :
280 REM CALCULATE NEW TOP OF MEMORY
290 HIMEM=FNN(52)-NU-1
300 XX=HIMEM+1
310 :
320 GOSUB 220
330 :
340 REM ADJUST TOP OF MEMORY
350 POKE(52),FNL(HIMEM)
360 POKE(53),FNH(HIMEM)
370 :
380 REM ADJUST 'FLIP' SUBROUTINE ADDRESS
390 REM (CURRENTLY 2ND AND 3RD NUMBERS IN
     LINE 710)
400 O1=106
410 POKE XX+1,FNL(XX+O1)
420 POKE XX+2,FNH(XX+O1)
430 :
440 REM ADJUST 'CONTINUE' SUBROUTINE ADDRE
    SS
450 REM (CURRENTLY 1ST AND 4TH NUMBERS IN
     LINE 960)
460 O2=77
470 O3=124
480 POKE XX+O3+1,FNH(XX+O2)
490 POKE XX+O3+4,FNL(XX+O2)
500 :
510 REM ADJUST 'STORE' SUBROUTINE ADDRESS
520 REM (CURRENTLY 5TH NUMBER IN LINE 920,
     1ST IN 930)
530 REM (AND 1ST AND 2ND NUMBERS IN LINE 9
    40)
540 O4=109
550 O5=115
560 O6=132
570 POKE XX+O4,FNL(XX+O6)
580 POKE XX+O4+1,FNH(XX+O6)
590 POKE XX+O5,FNL(XX+O6)
600 POKE XX+O5+1,FNH(XX+O6)
610 :
620 PRINT"{Ø2 DOWN}SET UP BY:
630 PRINT"{DOWN}POKE Ø,76"
640 PRINT"{DOWN}POKE 1,"FNL(XX)
650 PRINT"{DOWN}POKE 2,"FNH(XX)
660 PRINT"{Ø2 DOWN}FOR CONTINUATION:"
670 PRINT"{DOWN}POKE Ø,76"
680 PRINT"{DOWN}POKE 1,"FNL(XX+O3)
690 PRINT"{DOWN}POKE 2,"FNH(XX+O3)
700 END
710 DATA  32 , 164 , 3 , 160 , 2
720 DATA  177 , 42 , 133 , 4 , 200
730 DATA  177 , 42 , 133 , 5 , 200
740 DATA  177 , 42 , 133 , 6 , 169
750 DATA  Ø , 133 , 8 , 133 , 9
760 DATA  24 , 165 , 44 , 105 , 8
770 DATA  133 , Ø , 165 , 45 , 133
780 DATA  1 , 144 , 2 , 230 , 1
790 DATA  160 , Ø , 177 , Ø , 133
800 DATA  2 , 200 , 177 , Ø , 133
810 DATA  3 , 165 , 4 , 170 , 160
820 DATA  Ø , 169 , 35 , 209 , 2
830 DATA  240 , 35 , 177 , 5 , 201
840 DATA  42 , 240 , 7 , 209 , 2
850 DATA  208 , 6 , 202 , 240 , 22
860 DATA  200 , 208 , 240 , 24 , 165
870 DATA  Ø , 105 , 3 , 133 , Ø
880 DATA  144 , 2 , 230 , 1 , 230
890 DATA  8 , 208 , 203 , 230 , 9
900 DATA  208 , 199 , 216 , 165 , 8
910 DATA  168 , 165 , 9 , 32 , 109
920 DATA  210 , 162 , 9 , 189 , 190
930 DATA  3 , 72 , 181 , Ø , 157
940 DATA  190 , 3 , 104 , 149 , Ø
950 DATA  202 , 16 , 241 , 96 , 169
960 DATA  3 , 72 , 169 , 135 , 72
970 DATA  208 , 230 , Ø , Ø  , Ø
980 DATA  Ø , Ø , Ø , Ø , Ø  , Ø , Ø
```

Program 2.

```
100 REM DEMO FOR SEARCH 2.Ø
110 REM DEFINE INPUT VARIABLE BEFORE OTHER
     VARIABLES
120 REM AND DIM SEARCHED ARRAY BEFORE OTHE
    R ARRAYS
130 REM "**LLO" OR "**LL*" ARE ALLOWED
140 REM LAST ELEMENT IN LIST MUST BE "#"
150 :
160 A$="HELLO"  :REM DEFINE INPUT VARIABLE
     FIRST
170 :
180 CR=Ø:T=Ø:Z$=" " :REM DEFINE Z$ BEFORE ~
    USING IN SEARCH LOOP
190 :
200 GOSUB 500
210 :
220 DIM B$(3ØØØ) : REM SEARCHED ARRAY DIM'
    D BEFORE OTHER ARRAYS
230 :
240 FOR I=ØTO3ØØØ: REM SET UP DEMO ARRAY
250 B$(I)="BBBBBB"
260 NEXT
270 B$(3)="HELLO"
280 B$(4)="HELLO"
290 B$(5)="HELLO"
300 B$(15ØØ)="HELLO"
310 B$(25ØØ)="HELLO"
320 B$(3ØØØ)="#"
330 :
340 REM USE POKE VALUES FOR SET UP FROM LO
    ADER PROGRAM
350 POKEØ,76:POKE1,58:POKE2,3
360 PRINT"{CLEAR}ARRAY ELEMENT    TIME REQ
    UIRED"
370 PRINT"   MATCHED           TO MATCH"
380 T=TI
390 CR=USR(Ø)
400 PRINTTAB(3);CR;TAB(18);(TI-T)/60
410 GETZ$:IFZ$=""THEN 410
420 T=TI
430 REM USE POKE VALUES FOR CONTINUATION F
    ROM LOADER PROGRAM
440 POKEØ,76:POKE1,182:POKE2,3
450 CR=USR(Ø)
460 PRINTTAB(3);CR;TAB(18);(TI-T)/60
470 IF B$(CR)="#" THEN END
480 GOTO 410
490 :
500 PRINT"{CLEAR}         SEARCH"
510 PRINT"{Ø2 DOWN}THIS PROGRAM CALCULATES
     THE RECORD NUMBER OF A GIVEN REC
    ORD IN A "
520 PRINT"{DOWN}SEQUENTIAL LIST.  DEFINE T
    HE SEARCH STRING BEFORE OTHER VAR
    IABLES"
530 PRINT"{DOWN}AND DIMENSION THE SEARCH M
    ATRIX BEFORE ANY OTHER ARRAYS."
```

```
540 PRINT"{DOWN}AS LONG AS ALL VARIABLES H
    AVE BEEN INITIALIZED, IT WILL YIE
    LD"
550 PRINT"{DOWN}MULTIPLE MATCHES IN SEQUEN
    CE."
560 PRINT"{DOWN}THE LAST ARRAY ELEMENT MUS
    T BE #."
570 PRINT"{Ø2 DOWN}PRESS ANY KEY TO CONTIN
    UE"
580 PRINT"{DOWN} AND PRESS KEY FOR SUBSEQU
    ENT MATCHES."
590 GETZ$:IF Z$=""THEN 590
600 PRINT"{DOWN}{REV}PLEASE WAIT"
610 RETURN
```

The Atari Return Key Mode

James Luczak

Atari's Return Key Mode can be a very powerful programming tool. Not only can you write a program that adds or deletes program lines from itself, but you can also change the contents of a program line – all of this while the program is running.

Have you ever wanted a game program to store the all-time high score? Have you ever wished that a program could *modify itself*? Atari's Return Key Mode makes this and many other things possible.

Data statements can be updated. Strings can be created and inserted into a program. It might even be possible to simulate disk file operations by creating, deleting and updating files set within the program.

This article has two purposes: first, to introduce the Return Key Mode to readers who don't know it exists, and second, to show how to use the Return Key Mode. Once you know how it works, it's very easy to use. The three demo programs below will demonstrate the use of the Return Key Mode to add, delete, and edit program lines (and also give you something to experiment with). Program 1 illustrates how lines can be added to a program. Program 2 illustrates how lines can be removed from a program, and Program 3 shows how to edit lines and then reinsert them into the program.

Before we discuss how to use the Return Key Mode, run Program 1. The screen should look like Example 1. Now run Program 1 again. The screen should then look like Example 2. If you list Program 1, you'll notice that lines 55 and 130 have been added to the program. I'll explain how this was done in a minute.

Enter Program 2 and try running it. Your screen should look like Example 3. Now run Program 2 a second time; your screen should now look like Example 4. List Program 2. As you can see, we have added line 80 and removed lines 30, 40, 50, 60, and 70 from the program. Before running Program 3, let's see how this was accomplished.

In general, the format used in Program 1 to add lines must be used to delete lines and to edit lines.

Adding Lines

To add lines to a program, follow these steps:

- **Step One:** Print the lines that are to be added with a line number, and as valid lines. Notice the POSITION commands in lines 60 and 70 in Program 1. The position of the cursor is very important when using the Return Key Mode. Any lines that are going to be added, removed, or listed must be positioned between STOP (line 100) and CONT (line 90). This is probably quite confusing right now, but things should start to clear up. Remember, when adding lines, to position the line to be added. Include a line number, and the line must appear on the screen when printed as a valid line (lines 60 and 70 are examples of lines printed as valid program lines).
- **Step Two:** POSITION 0,0 : POKE 842,13 (line 80).

The POSITION command insures that the cursor is correctly placed. The POKE command puts the Atari into the Return Key Mode.

- **Step Three:** POSITION 2,8 : PRINT "CONT" (line 90).

The POSITION command places the CONTinue (CONT) command below the last line to be added to the program. You can position the CONTinue command (type "CONT") as far below the last added line as you wish. However, there are three rules to observe when positioning the CONTinue command. *Rule One:* There should be clear screen between the last line that is going to be added to the program and the CONTinue command. *Rule Two:* Do not position the CONTinue command beyond line 23. *Rule Three:* The CONTinue command must be printed on a clear line (a line with nothing else printed on it).

Breaking Rules

Let's disregard a couple of the rules and see what happens. You can get the program back by hitting SYSTEM RESET. Remember: always start with the original program (remove lines 55 and 130). Add the following line to the program: 75 POSITION 2,8 : PRINT "THIS IS JUNK". After you get the program back (remove lines 55 and 130), change line 90 as follows: 90 POSITION 2,24 : PRINT "CONT". The program scrolls right off the top again.

All in all, if you observe these three rules you won't have any problems. The line that the CONTinue command is positioned on sets the lower limit of the Return Key Mode. Anything below the CONTinue command will not be affected by the Return Key Mode.

- **Step Four:** POSITION 2,4 : STOP (line 100).

The POSITION command places the STOP command above the first line to be added to the program. There is one rule to observe when positioning the STOP command. The STOP command must be positioned two lines above the first line to be added to the program. The reason for this rule is that, when the Atari sees a STOP command, it will print "STOPPED AT LINE XXX" on the next line below the STOP command. And it will print it no matter what happens to be there. By positioning our first line addition two lines below the STOP command, we make sure that "STOPPED AT LINE XXX" does not overprint our line additions. The line that the STOP command is positioned on sets the upper limit of the Return Key Mode. Anything above the STOP command will not be affected by the Return Key Mode.

- **Step Five:** POKE 842,12 (line 110).

This POKE removes the Atari from the Return Key Mode and returns it to normal operations.

Here's a short recap of the steps to follow when using the Return Key Mode:

1. Print the lines that are going to be added with a line number, and as a valid program line
2. POSITION 0,0 : POKE 842,13 turns Return Key Mode on
3. POSITION 2,X : PRINT "CONT" sets lower limit of Return Key Mode
4. POSITION 2,X : STOP sets upper limit of Return Key Mode
5. POKE 842,12 removes the Atari from the Return Key Mode

Taking Lines Out

To remove lines from a program, follow the same steps as you would to add lines. Then print the line number to be removed. Lines 90 through 110 in Program 2 show how it's done. That's it.

Example 1.

```
LINE 0
LINE 1
LINE 2
LINE 3

STOPPED AT LINE 100
55 GOTO 130
130 PRINT "THIS IS HOW IT WORKS"
CONT

READY
```

Example 2.

```
LINE 0
LINE 1
LINE 2
LINE 3
THIS IS HOW IT WORKS
```

Example 3.

```
LINE 0
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5

STOPPED AT LINE 140
80 GOTO 170
30
40
50
60
70
CONT

READY
```

Example 4.

```
LINE 0
LINES 30 THRU 70 ARE REMOVED

READY
```

Example 5.

```
TODAY IS MONDAY

USE THE CURSOR CONTROLS TO POSITION
THE CURSOR THEN TYPE TUESDAY OVER
MONDAY
?

140 DATA TODAY
150 DATA IS
160 DATA MONDAY

HIT RETURN WHEN DONE
```

Editing Programs

Before we explore how to edit, enter Program 3 and run it. Your screen should look like Example 5. Use the cursor and change one or all of the words in the data statements. Hit RETURN after you have made all changes. The Atari will print a line at the center of the screen with your changes. List Program 3. The data statements in lines 140 through 160 will contain any changes you have made.

Program 3 edits program lines, then reinserts them. Again, follow the same steps as you would to add lines, except, instead of printing program lines, list the lines that you want to edit (line 40). In order to edit the line, we must first suspend program operation. This is quite easy to do. Use an INPUT command (line 60).

Since the computer is now waiting for an input from the user, we can make any changes we wish. To make a change, use the cursor controls (control arrows) to position the cursor over the item to be changed. Then type in the change. To remove a word, follow the same routine, but type spaces over the word to be deleted. There is one rule to observe concerning the position of the INPUT command: the INPUT command must be positioned one line below the STOP command.

If the INPUT command is not positioned one line below the STOP command, the word READY will be printed three lines below the INPUT command. Try changing line 60 as follows: POSITION 2,7 : INPUT T$ and add the following line: 105 END. Now run the program and hit the RETURN key. Look what happened to the data lines that are listed. Everything is OK except the last data line listed. The word READY is printed over part of the data line. Remove line 105 and run the program again. Make a change, then hit RETURN. You'll notice that your change has not been implemented. If you observe the position rule for the INPUT command, you won't have any trouble with editing. Remember: don't hit RETURN until all changes are made.

Using Atari's Return Key Mode is not very difficult. Experiment with the demo programs, and you'll get the hang of it.

Program 1.

```
10 ? CHR$(125)
20 POSITION 2,0:? "LINE 0"
30 ? "LINE 1"
40 ? "LINE 2"
50 ? "LINE 3"
60 POSITION 2,6:? "55 GOTO 130"
70 ? "130 PRINT ";CHR$(34);"THIS IS
   HOW IT WORKS";CHR$(34)
80 POSITION 0,0:POKE 842,13
90 POSITION 2,8:? "CONT"
100 POSITION 2,4:STOP
110 POKE 842,12
120 END
```

Program 2.

```
10 ? CHR$(125)
20 POSITION 2,0:? "LINE 0"
30 ? "LINE 1"
40 ? "LINE 2"
50 ? "LINE 3"
60 ? "LINE 4"
70 ? "LINE 5"
85 POSITION 2,8:? "80 GOTO 170"
90 ? 30:? 40:? 50
100 ? 60
110 ? 70
120 POSITION 0,0:POKE 842,13
130 POSITION 2,14:? "CONT"
140 POSITION 2,6:STOP
150 POKE 842,12
160 END
170 ? "LINES 30 THRU 70 ARE REMOVED"
```

Program 3.

```
5 DIM T$(1),C$(10):RESTORE
10 ? CHR$(125)
20 FOR X=1 TO 3:READ C$:? C$;" ";:NE
   XT X
30 ? :? :? "USE THE CURSOR CONTROLS
   TO POSITION{3 SPACES}THE CURSOR T
   HEN TYPE TUESDAY OVER{5 SPACES}MO
   NDAY"
40 POSITION 2,7:LIST 140,160
50 POSITION 2,15:? "HIT RETURN WHEN
   DONE"
60 POSITION 2,6:INPUT T$
70 POSITION 0,0:POKE 842,13
80 POSITION 2,12:? "CONT"
90 POSITION 2,5:STOP
100 POKE 842,12
110 ? CHR$(125):RESTORE
120 POKE 84,10:POKE 85,10:FOR X=1 TO
     3:READ C$:? C$;" ";:NEXT X:? :?

130 END
140 DATA TODAY
150 DATA IS
160 DATA MONDAY
```

Apple II Bar Charts

Bernard L Webb

Reports for school, business, or other purposes can frequently be made more interesting and more understandable by the use of charts and graphs of various types. Such charts can be prepared on the Apple II using a graphics pad or by keyboard control. This fast and convenient program draws bar charts under program control, with only a minimum of effort by the operator.

This program is interactive, with the operator providing on request the necessary information as to the number of bars and so forth. The information requested is quite simple and requires no advance calculations. Error trapping routines have been included to catch most operator errors and prevent premature termination of the program.

Completed charts can be stored as binary files, and other charts can be recalled from disk if desired. The latter function is useful if you want to superimpose a bar chart on a line graph or other illustration previously prepared.

Designing The Chart

The program will draw up to 30 bars in its present form. A larger number of bars can be accommodated by changing the dimension statements at the beginning of the program. However, the limitations of the Apple hi-res screen would cause the bars on even a 30-bar chart to be rather narrow.

In order to provide variety, several types of bar charts can be prepared by the program. The bars can be all positive, as shown in Charts 1 and 4, or they can be both positive and negative, as shown in Charts 2 and 3. The bars can be vertical, as shown in Charts 1 and 2, or horizontal, as shown in Charts 3 and 4. The bars can be contiguous, as shown in Chart 1; or spaces can be inserted between them, as shown in Chart 2. The number of spaces, if any, to be inserted between bars is determined by the operator at runtime.

Generally, it is better to use vertical bars if there are many bars. Horizontal bars are best if the bars need to be long, especially if there are not many of them. Of course esthetics may also be a factor in selecting between them. The minimum value on the bars need not be zero if all bars are positive. If negative bars are included, the chart is centered at zero in order to avoid misleading comparisons.

This program does not provide any means for lettering the charts. The charts shown here were lettered with a VersaWriter digitizer board and the associated software. I sometimes use the *Higher Text Plus* software from Call-A.P.P.L.E. for the lettering, and there are several other software packages that can serve the same purpose.

Printing Options

I print the charts on either my Epson MX-80 dot matrix printer or my NEC Spinwriter letter-quality printer. Chart 1 was printed on the Epson, and Chart 2 was printed on the Spinwriter.

I use the *Grafpak* screen-dump package from Smartware to print charts on the Epson, and the *Spinwriter Graphics* dump program from Computer Station on the NEC. Both have been highly satisfactory, but several other publishers have similar software. Computer Station's software will not work with the serial port of the Mountain Computer CPS MultiFunction Board. The menu says it will work only with the Apple Serial Board, the Apple Communications Card and the California Computer Serial Card. However, I have found that it will also work with the serial port of my SSM AIO card, provided I choose the Apple Communications Card option from the menu.

Figure 1.

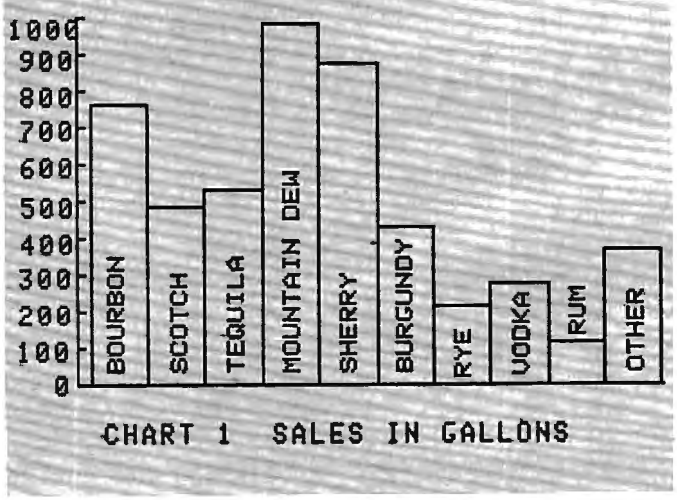

Figure 2.

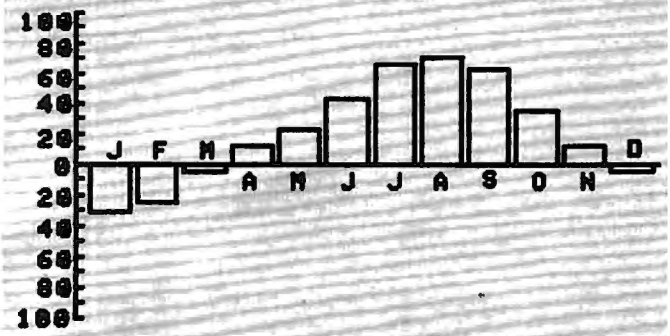

CHART 2-LOWEST TEMPERATURE-MONTHLY

Figure 3.

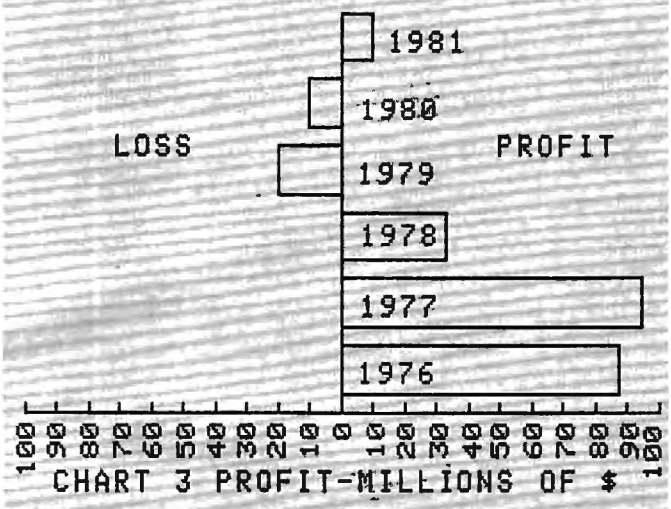

CHART 3 PROFIT-MILLIONS OF $

Figure 4.

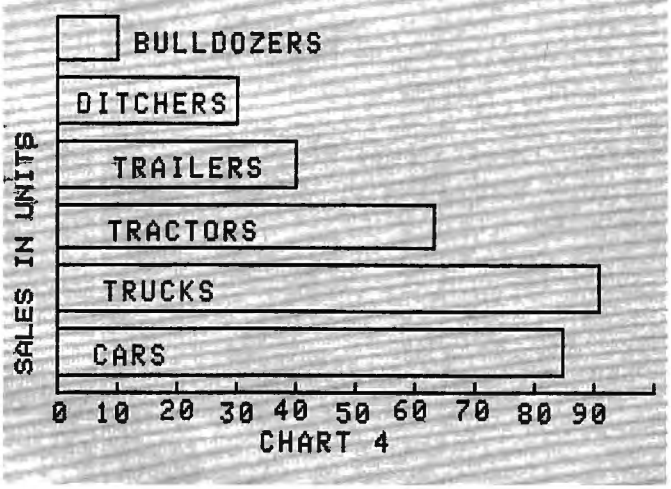

CHART 4

```
10  DIM YV(30),YP(30),YQ(30)
20  DIM XP(30),XQ(30)
30  HCOLOR= 7
40 D$ =  CHR$ (4):F9 = 0
50  HGR
60 X = 29:Y = 130
70 H = 130:L = 250
80  INPUT "WANT TO RECALL PICTURE
      FROM DISK?(Y/N)  ";Y$
90  IF Y$ = "N" THEN 130
100  IF Y$ <  > "Y" AND Y$ <  > "
     N" THEN 80
110  INPUT "INPUT FILENAME  ";P$
120  PRINT D$;"BLOAD";P$
130  PRINT "DO YOU WANT HORIZONTA
     L OR VERTICAL BARS?(H/V) "
140  INPUT H$
150  IF H$ <  > "H" AND H$ <  > "
     V" THEN 130
160  INPUT "WILL THERE BE NEGATIV
     E BARS?(Y/N)  ";NB$
170  IF H$ = "V" AND NB$ = "N" THEN
     210
180  IF H$ = "V" AND NB$ = "Y" THEN
     940
190  IF NB$ <  > "N" AND NB$ <  >
     "Y" THEN 160
200  GOTO 1150
210  IF NB$ = "Y" THEN 270
220 XY$ = "Y"
230  HPLOT (X + L),Y
240  HPLOT  TO X,Y
250  HPLOT  TO X,(Y - H)
260  GOTO 310
270  HPLOT (X + L),(Y - (H / 2))
280  HPLOT  TO X,(Y - (H / 2))
290  HPLOT X,Y

300  HPLOT  TO X,(Y - H)
310  INPUT "NUMBER OF BARS ON X A
     XIS? ";N2
320  INPUT "NUMBER OF SPACES BETW
     EEN BARS?  ";SP
330  IF NB$ = "Y" THEN 350
340  INPUT "NUMBER OF DIVISIONS O
     N Y AXIS? ";N1
350  IF NB$ = "Y" THEN Z3 = 2
360  IF NB$ = "Y" THEN Z3 = 2
370  IF NB$ = "N" THEN Z3 = 1
380 Y1 = H / (Z3 * N1)
390 X1 = (L - 6 - (SP * N2)) / N2

400 Y2 = Y:X2 = X
410  IF NB$ = "Y" THEN Z6 = (N1 *
     2)
420  IF NB$ = "N" THEN Z6 = N1
430  IF NB$ = "N" THEN 460
440  HPLOT X,Y
450  HPLOT  TO (X + 3),Y
460  FOR I = 1 TO Z6
470 Y2 = Y2 - Y1
480  IF NB$ = "N" THEN 500
490  IF I = N1 THEN 550
500  IF Y2 < 0 THEN Y2 = 0
510  HPLOT X,Y2
520  HPLOT  TO (X + 3),Y2
530 XP(1) = X + 6
540 XQ(1) = XP(1) + X1
```

```
550  NEXT I
560  FOR I = 2 TO N2
570 XP(I) = XQ(I - 1) + SP
580 XQ(I) = XP(I) + X1
590  IF XQ(I) > 279 THEN XQ(I) =
     279
600 X2 = X2 + X1 + SP
610  NEXT I
620  INPUT "MAXIMUM VALUE SHOWN O
     N Y AXIS? ";Y3
630  IF NB$ = "Y" THEN 660
640  INPUT "MINIMUM VALUE SHOWN O
     N Y AXIS? ";Y4
650  IF Y3 <  = Y4 THEN  GOSUB 16
     30: GOTO 620
660  FOR I = 1 TO N2
670  PRINT "INPUT THE Y-VALUE FOR
      BAR NUMBER  ";I
680  INPUT YV(I)
690  IF YV(I) > Y3 THEN  GOSUB 97
     0: GOTO 670
700  IF Y4 > 0 AND YV(I) < Y4 THEN
      GOSUB 1030: GOTO 670
710  IF Y4 = 0 AND  ABS (YV(I)) >
     Y3 THEN  GOSUB 1090: GOTO 67
     0
720  IF NB$ = "Y" THEN Z7 = H / 2

730  IF NB$ = "N" THEN Z7 = H
740 YQ = ((YV(I) - Y4) / (Y3 - Y4
     )) * Z7
750  IF NB$ = "N" THEN 780
760  HPLOT XP(I),(Y - (H / 2))
770  GOTO 790
780  HPLOT XP(I),Y
790  IF NB$ = "Y" THEN Z8 = H / 2

800  IF NB$ = "N" THEN Z8 = 0
810  HPLOT  TO XP(I),(Y - YQ - Z8
     )
820  HPLOT  TO XQ(I),(Y - YQ - Z8
     )
830  IF NB$ = "N" THEN 860
840  HPLOT  TO XQ(I),(Y - (H / 2)
     )
850  GOTO 870
860  HPLOT  TO XQ(I),Y
870  NEXT I
880  INPUT "WANT TO SAVE PICTURE
     TO DISK?(Y/N)  ";Y$
890  IF Y$ = "N" THEN  END
900  IF Y$ <  > "Y" THEN 880
910  INPUT "INPUT FILENAME  ";X$
920  PRINT D$;"BSAVE ";X$;",A8192
     ,L8192"
930  GOTO 1650
940  INPUT "NUMBER OF DIVISIONS O
     N THE POSITIVE Y AXIS?  ";N1
950 Y4 = 0
960  GOTO 210
970  PRINT "INPUT VALUE EXCEEDS M
     AXIMUM VALUE ON ";XY$;" AXIS
     . WANT TO INPUT NEW VALUE (N
     ) OR TERMINATE (T)?"
980  INPUT T$
990  IF T$ = "N" THEN 1020
1000  IF T$ = "T" THEN  END
1010  GOTO 970
1020  RETURN
1030  PRINT "INPUT VALUE IS LESS
     THAN MINIMUM ";XY$;" VALUE.
     WANT TO INPUT NEW VALUE (N)
     OR TERMINATE (T)?"
1040  INPUT T$
1050  IF T$ = "N" THEN 1080
1060  IF T$ = "T" THEN  END
1070  GOTO 1030
1080  RETURN
1090  PRINT "INPUT NEGATIVE VALUE
      WILL PLOT OFF CHART. WANT T
     O INPUT NEW VALUE (N) OR TEM
     INATE (T)?"
1100  INPUT T$
1110  IF T$ = "N" THEN 1140
1120  IF T$ = "T" THEN  END
1130  GOTO 1090
1140  RETURN
1150  INPUT "HOW MANY BARS ON THE
      Y AXIS?";YB
1160  INPUT "HOW MANY SPACES BETW
     EEN BARS?";NS
1170 XY$ = "Y"
1180  IF NB$ = "Y" THEN 1210
1190  INPUT "HOW MANY DIVISIONS O
     N X AXIS?";XD
1200  GOTO 1230
1210  INPUT "HOW MANY DIVISIONS O
     N POSITIVE X AXIS?";XD
1220 XD = XD * 2
1230  HPLOT (X + L),Y
1240  HPLOT  TO X,Y
1250  IF NB$ = "N" THEN  HPLOT  TO
     X,(Y - H)
1260  IF NB$ = "Y" THEN  HPLOT (X
      + (L / 2)),Y: HPLOT  TO (X +
     (L / 2)),(Y - H)
1270  HPLOT X,Y: HPLOT  TO X,(Y -
     3)
1280 Z = X
1290  FOR I = 1 TO XD
1300 Z = Z + (L / XD)
1310  IF I = XD AND NB$ = "Y" THEN
     1340
1320  IF I = (XD / 2) AND NB$ = "
     Y" THEN 1340
1330  HPLOT Z,Y: HPLOT  TO Z,(Y -
     3)
```

```
1340  NEXT I
1350  HPLOT (X + L),Y: HPLOT  TO
     (X + L),(Y - 3)
1360 ZQ = H - (NS * YB)
1370  IF NB$ = "Y" THEN 1420
1380  INPUT "INPUT MAXIMUM VALUE
     ON X AXIS";MX
1390  INPUT "INPUT MINIMUM VALUE
     ON X AXIS";LX
1400  IF MX <  = LX THEN  GOSUB 1
     630: GOTO 1380
1410  GOTO 1430
1420  INPUT "INPUT MAXIMUM VALUE
     ON POSITIVE X AXIS";MX
1430 ZZ = ZQ / YB
1440 YP(1) = Y - 6
1450 YQ(1) = Y - 6 - ZZ
1460  FOR I = 2 TO YB
1470 YP(I) = YQ(I - 1) - NS
1480 YQ(I) = YP(I) - ZZ
1490  IF YQ(I) < 0 THEN YQ(I) = 0

1500  NEXT I
1510  IF NB$ = "Y" THEN ZV = X +
     (L / 2):ZY = L / 2
1520  IF NB$ = "N" THEN ZV = X:ZY
      = L
1530  FOR I = 1 TO YB
1540  PRINT "INPUT X VALUE FOR BA
     R NO. ";I
1550  INPUT BI
1560  IF BI > MX THEN  GOSUB 970:
      GOTO 1540
1570  IF NB$ = "N" AND BI < LX THEN
      GOSUB 1030: GOTO 1540
1580  IF NB$ = "Y" AND  ABS (BI) >
     MX THEN  GOSUB 1090: GOTO 15
     40
1590 ZW = ZV + ((BI - LX) / (MX -
     LX)) * ZY
1600  HPLOT ZV,YP(I): HPLOT  TO Z
     W,YP(I): HPLOT  TO ZW,YQ(I):
      HPLOT  TO ZV,YQ(I)
1610  NEXT I
1620  GOTO 880
1630  PRINT "MINIMUM VALUE IS EQU
     AL TO OR GREATER THAN MAXIMU
     M. PLEASE TRY AGAIN."
1640  RETURN
1650  END                          ©
```

Major & Minor: VIC Music Theory

M. J. Winter

You can learn some of the essentials of musicianship on your VIC while it coaches you on keys, signatures, and scales. This program can serve as a model for writing other computer-assisted-education routines for the VIC. It also illustrates a nice memory-saving technique: the computer displays the instructions and then removes them from the program after they are no longer needed.

"This piece has six sharps. What key is that?"

"What's the key signature for B minor?"

Questions like these are asked of every music student. Music teachers feel that the answers should be almost automatic – not hopeful guesses or the result of lengthy calculations.

Major and minor keys is a "natural" topic for computer-assisted instruction. In order to identify a key, the signature must be seen and the scale heard. (With practice, hearing the scale may be enough.) The program "Major and Minor Scales and Keys" combines instruction and practice on musical keys with ear-training.

Until I saw the "Electric Eraser" technique by Louis Sander (**COMPUTE!**, August 1982), the instructions in my program were a separate program by themselves. Now the rules for determining keys are given in lines 79-96. These lines are erased before the arrays are dimensioned, so be sure to SAVE the program before you RUN it. The program fits in an unexpanded, 5K-VIC. When typing in line 91, be sure to use the "?" for each PRINT; otherwise, it won't fit.

After reading the rules for determining major and relative minor keys, the user sees a menu of three options:

1. Study signatures – a review of randomly selected keys
2. Give signature when told key
3. Tell key from scale and signature

In each option, ten examples are given, and for every example a scale is played. Options 2 and 3 correct errors and keep a score. At the end of the ten examples, the user may quit or return to the menu. To see the beginning instructions again, however, it is necessary to reload the program. If you quit the program, then wish to RUN it again you must delete line 2.

```
2 GOTO79
3 GOSUB68:POKE36879,31:DEFFNR(X)=INT(RND
    (1)*X)+1:C=36876:VR=C+2:D=C-1
4 DIM N%(25),MJ%(16,2),S$(13),N$(13,2),T
    %(13,2),SP%(7),FP%(5):E=C-2
5 SH$="FCGDAEB":FL$="BEADG":D$="{HOME}{1
    1 DOWN}"
6 SP$="{DOWN}{Ø6 RIGHT}#{Ø3 DOWN}#{Ø4 UP
    UP}#{Ø3 DOWN}#{Ø3 DOWN}#{Ø4 UP}#{
    Ø4 DOWN}#"
7 FP$="{Ø5 RIGHT}{Ø5 DOWN}Z{Ø3 UP}Z{Ø4 D
    DOWN}Z{Ø3 UP}Z{Ø4 DOWN}Z"
8 SP%(1)=7:SP%(2)=11:SP%(3)=16:SP%(4)=2Ø
    :SP%(5)=24:SP%(6)=29:SP%(7)=33
9 FP%(1)=9:FP%(2)=13:FP%(3)=19:FP%(4)=24
    :FP%(5)=29
10 FORI=1TO25:READN%(I):NEXT:B$="
          "
11 DATA191,195,199,2Ø1,2Ø3,2Ø7,2Ø9,212,21
    5,217,219,221,223,225
12 DATA227,228,23Ø,231,232,234,235,236,23
    7,238,239
13 FORI=1TO16:READMJ%(I,1):NEXT:FORI=1TO1
    6:READMJ%(I,2):NEXT
14 DATAØ,2,4,5,7,9,11,12,12,11,9,7,5,4,2,
    Ø,Ø,2,3,5,7,9,11,12,12,1Ø,8,7,5,3
    ,2,Ø
15 FORI=1TO13:READS$(I),N$(I,1),T%(I,1),N
    $(I,2),T%(I,2):NEXT
17 DATANONE,C MAJOR,2,A MINOR,11,1 SHARP,
    G MAJOR,9,E MINOR,6
18 DATA2 SHARPS,D MAJOR,4,B MINOR,1
19 DATA3 SHARPS,A MAJOR,11,F-SHARP MINOR,
    8
2Ø DATA4 SHARPS,E MAJOR,6,C-SHARP MINOR,3

21 DATA5 SHARPS,B MAJOR,1,G-SHARP MINOR,1
    Ø
22 DATA6 SHARPS,F-SHARP MAJOR,8,D-SHARP M
    INOR,5
23 DATA7 SHARPS,C-SHARP MAJOR,3,A-SHARP M
    INOR,12
25 DATA1 FLAT,F MAJOR,7,D MINOR,4,2 FLATS
    ,B-FLAT MAJOR,12,G MINOR,9
26 DATA3 FLATS,E-FLAT MAJOR,5,C MINOR,2
27 DATA4 FLATS,A-FLAT MAJOR,1Ø,F MINOR,7
28 DATA5 FLATS,D-FLAT MAJOR,3,B-FLAT MINO
    R,12
29 FORQ=1TO1Ø:K=FNR(13):MD=FNR(2):PRINT"{
    CLEAR}"Q:IFOP<>1THENPRINTTAB(16)"
    {UP}SC"SC
3Ø IFOP<>3THENPRINT"{RED}{REV}KEY{OFF}{
    BLU} ";N$(K,MD)
31 IFOP<>2THENPRINT"{DOWN}{RED}{REV}SIGNA
    TURE{OFF}{BLU}  ";S$(K)
32 PRINTTAB(11);:V=VAL(S$(K))
33 KS$=LEFT$(SH$,V):IFMID$(S$(K),3,1)="F"
```

```
   THENKS$=LEFT$(FL$,V)
34 IFK=1THENKS$="NONE"
35 IFOP=1THENPRINTKS$
36 IFOP=2THENNP=3:GOSUB60
37 GOSUB50:IFMID$(S$(K),3,1)="S"THEN PRIN
   TD$;LEFT$(SP$,SP%(V)+2)
38 IFMID$(S$(K),3,1)="F"THENPRINTD$;LEFT$
   (FP$,FP%(V)+2)
39 GOSUB78:PRINT"{HOME}"LEFT$(D$,10)"{
   RED}PRESS {REV}S{OFF}"
40 IFPEEK(197)<>41THEN40
41 FORJ=1TO16:POKEC,N%(T%(K,MD)+MJ%(J,MD)
   ):POKEVR,15:GOSUB78
42 IFJ=8THENPOKEC,0:GOSUB78
43 NEXT:POKEC,0:POKEVR,0:GOSUB78:IFOP=3TH
   ENNP=3:GOSUB74
44 PRINT"{HOME}"LEFT$(D$,10)"PRESS {BLU}{
   REV}C{OFF}                "
45 IFPEEK(197)<>34THEN45
46 NEXTQ:PRINT"{04 UP}CONTINUE?":PRINT"{
   DOWN}PRESS {REV}Y{OFF} OR {REV}N{
   OFF}"
47 IFPEEK(197)<>11ANDPEEK(197)<>28THEN47
48 IFPEEK(197)=28THENEND
49 RUN3
50 PRINTD$;:PRINT"{BLU}"
51 PRINT"@@@@'M@@@@@@@@@@@@@@"
52 PRINT"]    'N
53 PRINT"+@@@N@@@@@@@@@@@@@@@"
54 PRINT"]   N'
55 PRINT"+@N@'@@@@@@@@@@@@@@@"
56 PRINT"]G
57 PRINT"+H@@@M@@@@@@@@@@@@@@"
58 PRINT"] M$$N
59 PRINT"-@@@@%@@@@@@@@@@@@@@":RETURN
60 POKE198,0:PRINT:PRINT"{BLU}SIGNATURE{
   RED}":INPUTA$
61 IFA$=S$(K)THENPRINT"RIGHT":GOTO64
62 NP=NP-1:IFNP=2THENPRINT"{UP}"B$:PRINT"
   {03 UP}{BLU}";:GOTO60
63 PRINT"{02 UP}{BLK}"S$(K)"       "
64 IFS$(K)="NONE"THENSC=SC+NP:RETURN
65 POKE198,0:A$="":PRINT"{BLU}WHICH?    {
   RED}":INPUTA$
66 IFA$=KS$THENPRINT"{DOWN}RIGHT":SC=SC+N
   P:RETURN
67 NP=NP-1:PRINT"{UP}{BLK}"KS$"{BLU}"B$:G
   OSUB78:RETURN
68 PRINT"{CLEAR}SELECT ONE":PRINT"{DOWN}{
   RED}{REV}1{OFF}{BLU} STUDY SIGNAT
   URES"
69 PRINT"{DOWN}{RED}{REV}2{OFF}{BLU} GIVE
    SIGNATURE WHEN    TOLD KEY"
70 PRINT"{DOWN}{RED}{REV}3{OFF}{BLU} TELL
    KEY FROM SCALE    & SIGNATURE"
71 PRINT"{02 DOWN}PRESS {RED}{REV}1{OFF}
   {REV}2{OFF}{BLU} OR{RED} {REV}3{
   OFF}":PRINT"{DOWN}{BLU}YOU'LL GET
    10 EXAMPLES"
72 GET RP$:IFVAL(RP$)<1OR VAL(RP$)>3THEN7
   2
73 OP=VAL(RP$):RETURN
74 POKE198,0:PRINT"{UP}{REV}KEY{OFF}"B$:P
   RINT"{UP}{04 RIGHT}";:INPUTA$
75 IFA$=N$(K,MD)THENPRINT"{02 DOWN}RIGHT"
   :SC=SC+NP:RETURN
76 NP=NP-1:IFNP=2THEN74
77 PRINT"{02 UP}{BLK}"N$(K,MD)"{RED}":GOS
   UB78:RETURN
78 FORKK=1TO499:NEXT:RETURN
79 A=PEEK(61)+256*PEEK(62)+3:POKE2,INT(A/
   256):POKE1,A-256*PEEK(2)
80 IFERTHENPOKEA-2,0:POKEA-1,0:POKE45,PEE
   K(1):POKE46,PEEK(2):RUN3
81 POKE36879,26:PRINT"{CLEAR}{05 DOWN}"TA
   B(4)"{BLU}MAJOR AND MINOR"
82 PRINTTAB(5)"{DOWN}SCALES & KEYS":PRINT
   TAB(7)"{05 DOWN}PRESS {REV}S{OFF}
   "
83 IFPEEK(197)<>41THEN83
84 PRINT"{CLEAR}A SIGNATURE INDICATES":PR
   INT"{DOWN}BOTH A MAJOR & MINOR":P
   RINT"{DOWN}KEY.";
85 PRINT"THE MINOR IS":PRINT"{DOWN}ALWAYS
    A THIRD LOWER.{DOWN}"
86 GOSUB51:PRINT"{RED}{DOWN}C MAJOR/A MIN
   OR":PRINT"{02 DOWN}{BLU}PRESS {
   RED}{REV}C{OFF}";:PRINT"{08 UP}Q{
   LEFT}{02 UP}W"
87 IFPEEK(197)<>34THEN87
88 PRINT"{BLU}{CLEAR}":GOSUB51:PRINTTAB(6
   )"{RED}{05 UP}Z{02 RIGHT}{03 DOWN
   DOWN}W{02 DOWN}{LEFT}Q":PRINT"{DO
   DOWN}F MAJOR/D MINOR{DOWN}"
89 PRINT"{BLU}PRESS {RED}{REV}D{UP}":IFPE
   EK(197)<>18THEN89
90 PRINT"{BLK}FOR 2 OR MORE FLATS":PRINT"
   {DOWN}THE MAJOR KEYNOTE IS":PRINT
   "{DOWN}THE NEXT-TO-LAST FLAT{BLU}
   "
91 PRINT"{02 DOWN}PRESS {REV}B{OFF}":PRIN
   T"{HOME}{RED}"TAB(7)"{03 DOWN}Z{0
   2 DOWN}{RIGHT}W{LEFT}{02 DOWN}Q{
   DOWN}{LEFT} {02 DOWN}{LEFT} ":PRI
   NT"{DOWN}B-FLAT MAJOR/G MINOR"
92 IFPEEK(197)<>35THEN92
93 PRINT"{BLU}{CLEAR}":GOSUB51:PRINT"{
   HOME}{DOWN}"TAB(6)"#{03 DOWN}#{
   RED}{RIGHT}{UP}W{02 DOWN}{LEFT}Q"
   :PRINT"{04 DOWN}D MAJOR/B MINOR"
94 PRINT"{02 DOWN}{BLU}LOOK ABOVE AND BEL
   OW":PRINT"{DOWN}THE LAST SHARP":P
   RINT"{02 DOWN}PRESS {REV}X"
95 IFPEEK(197)<>26THEN95
96 ER=1:GOTO79                              ©
```

Atari Digitizer

Robert E Miller

Much computerized mathematical and graphics work requires the entry of many DATA statements. One way around this is with a peripheral called a digitizer *with which you "draw" on an electronic sketchpad. The program below, however, is quite easy to use, achieves the desired result, and requires only the TV screen and the joysticks.*

When you are writing graphics display programs, or are performing mathematical computations involving curves not describable in closed form, you must frequently input coordinates as data lines. This task may involve measuring coordinates from a scale drawing and then entering the coordinates from the keyboard. This tedious and time-consuming effort can be circumvented by employing digitizing equipment, but such equipment is too expensive for many home applications.

However, by combining the "Fluid Brush" program by Al Baker (**COMPUTE!**, January 1981) with the line generation/deletion techniques described by Bruce Frumker (**COMPUTE!**, August 1981), I developed an inexpensive but practical digitizer employing the screen and the joysticks.

Basically, this program allows you to store the coordinates of selected points around a pattern taped to the screen, simply by moving the cursor to each desired point with the joystick and pressing the trigger. The coordinates are stored in two arrays, X(I) and Y(I). Alternatively, you can make a free-hand drawing on the screen with the joystick, and digitize selected points during the drawing or return to the points after the drawing is completed.

As you can see in the Menu portion of the program (line 11000), various operations can be accomplished once the X(I), Y(I) arrays are formed.

Using The Menu

1. Enables the digitizing mode. Color treatment for drawing is the same as in "Fluid Brush." When the cursor is at a point (I) to be digitized, STRIG (1) is pressed, and X(I), Y(I) values are stored and also displayed as a check. (Note that a velocity for the cursor can be input, with "1" being needed for close control and erasing capability. Pressing the trigger button on joystick 2 erases or speeds up cursor movement.) The program is set up to handle 200 points. This number can be altered by changing the dimensions of X(I), Y(I).

... you can make a free-hand drawing on the screen with the joystick, and digitize selected points during the drawing.

At the graphics selection prompt, only Graphics 7 can be accommodated unless more than 16K of RAM is available. If 32K RAM is available, digitizing (and plotting) can be done in modes 7 and 8. If data stored in Graphics 8 is to be plotted directly in Graphics 7, stay within the field outlined in the upper left quadrant of the display during coordinate storing.

Use BREAK, RUN, RETURN to return to MENU.

2. Produces a listing of array values, X(I), Y(I). After BREAK, altered values can be entered from the keyboard with "X(N)=20, etc." if negative values, for example, have been stored.

3. Causes a selected number of values in the arrays to be plotted for viewing. (Note ability to scale size and to shift location.)

4. Automatically writes data lines containing the coordinates in the current arrays. These lines can be transferred to cassette, for example, for use in other programs with the LIST "C" starting line number, ending line number command. Zeros are inserted where no coordinates are input. (It's best to allow this subroutine to run to completion.) A sample figure is included in data lines 20000, 20001, 20002. The remaining data lines may be omitted when typing in the program.

5. Clears the arrays for a new problem.

6. Automatically clears data lines. (Be sure that the program is correct, or at least saved, before employing this subroutine because some circumstances can lead to lockup, which requires turning off the power.) It's best to let this subroutine run to completion also.

7. Causes a selected number of values in the data lines to be plotted.

Obvious program extensions are: storing color data as a third point-variable, using an option key to specify that the color is to match the background so that breaks in drawings can be accommodated, and digitizing automatically at selected time or distance intervals.

```
4 REM ATARI DIGITIZER
6 DIM X(201),Y(201),P$(1),Q$(3),T$(3)
8 GOSUB 11000
10 P$=","
15 GRAPHICS 0
20 ? "INPUT VELOCITY OF DOT":INPUT V
60 GOSUB 1000
150 COLOR 4:PLOT X,Y
160 S=100*STRIG(1)
170 FOR I=1 TO S:NEXT I
180 COLOR R:PLOT X,Y
200 IF S=0 THEN COLOR 4:PLOT X,Y:COLO
    R R
250 J=STICK(0)
260 Y=V*YD(J)+Y
270 X=V*XD(J)+X
272 ? X,Y
273 IF STRIG(0)=0 THEN CTR=CTR+1
274 IF STRIG(0)=0 THEN X(CTR)=X:Y(CTR
    )=Y:? "X(";CTR;")=";X(CTR),"Y(";C
    TR;")=";Y(CTR)
276 IF STRIG(0)=0 THEN GOSUB 5500
280 TRAP 3000
290 DRAWTO X,Y
300 IF PEEK(764)<>255 THEN GOSUB 4000
310 GOTO 150
1000 ? "GRAPHICS 7 OR 8?":INPUT G
1004 COLOR 1
1005 GRAPHICS G
1007 PLOT 0,0:DRAWTO 159,0:DRAWTO 159
     ,78:DRAWTO 0,78:DRAWTO 0,0
1010 X=90
1020 Y=48
1030 C=0:L=10:R=1
1060 SETCOLOR R-1,C,L
1070 COLOR 1
1080 PLOT X,Y
1090 OPEN #1,4,0,"K:"
1100 DIM XD(15),YD(15)
1105 RESTORE
1110 FOR I=1 TO 15
1120 READ N:XD(I)=N
1121 NEXT I
1122 FOR I=1 TO 15
1130 READ N:YD(I)=N
1140 NEXT I
1150 RETURN
2000 DATA 0,0,0,0,.707,.707,1,0,-.707
     ,-.707,-1,0,0,0,0
2010 DATA 0,0,0,0,.707,-.707,0,0,.707
     ,-.707,0,0,1,-1,0
3000 Y=Y+(Y<0)-(Y>79)
3010 X=X+(X<0)-(X>159)
3020 GOTO 280
4000 GET #1,R
4010 IF (R<49)+(R>51) THEN 4000
4020 R=R-48
```

```
4030 COLOR R
4040 POKE 656,2
4050 PRINT "COLOR(4 SPACES)(4 LEFT)";
4060 INPUT C
4070 SETCOLOR R-1,C,L
4080 RETURN
5000 CTR=CTR+1
5002 ? CRT
5004 FOR WAIT=0 TO 500:NEXT WAIT
5010 X(CTR)=X
5012 ? X(CTR)
5020 Y(CTR)=Y
5022 ? Y(CTR)
5030 FOR WAIT=0 TO 500:NEXT WAIT
5040 ? X(CTR),Y(CTR),CTR
5050 FOR WAIT=0 TO 500:NEXT WAIT
5060 RETURN
5500 FOR WAIT=0 TO 150:NEXT WAIT
5510 RETURN
6000 FOR I=1 TO 201:REM TO LIST X(I),
     Y(I)
6050 ? "X(";I;")=";X(I),"Y(";I;")=";Y
     (I)
6060 NEXT I
6070 FOR WAIT=0 TO 500:NEXT WAIT
6080 RETURN
7000 GRAPHICS 0:REM TO PLOT X(I),Y(I)
7001 ? "GRAPHICS 7 OR 8?":INPUT G
7002 GRAPHICS G
7004 ? " INPUT SCALE FACTOR":INPUT SC
     F
7006 ? "INPUT AXIS SHIFT CONSTANTS":I
     NPUT AX,AY
7008 ? "NUMBER OF POINTS TO PLOT?":IN
     PUT NBR
7010 COLOR 1
7020 PLOT SCF*X(1)+AX,SCF*Y(1)+AY
7025 FOR I=1 TO NBR
7060 X=SCF*X(I)+AX:Y=SCF*Y(I)+AY
7100 DRAWTO X,Y
7150 NEXT I
7200 ? "ANOTHER PLOT?":INPUT Q$
7400 IF Q$="Y" THEN 7000
7600 RETURN
8000 REM TO STORE X(I),Y(I) IN DATA L
     INES
8002 LN=20000
8004 FOR J=1 TO 200 STEP 3
8006 GOSUB 30001
8008 LN=LN+1
8010 NEXT J
8020 RETURN
9000 REM TO CLEAR X(I),Y(I) ARRAYS
9002 FOR K=1 TO 201
9004 X(K)=0:Y(K)=0
9006 NEXT K
9008 RETURN
10000 REM TO DELETE DATA LINES
10002 STLIN=20000:ENLINE=20067
10004 GOSUB 30020
10006 RETURN
11000 REM MENU
11005 GRAPHICS 0
11006 ? "(3 SPACES)**** DIGITIZING AN
      D PLOTTING ****"
11008 ? :?
11010 ? "(1) DIGITIZE/DRAW(KEYS 1,2,3
       FOR COLOR CHANGE. USE ATARI CO
      LORS"
11013 ?
11015 ? "(2) LIST X(I),Y(I)"
11018 ?
11020 ? "(3) PLOT X(I),Y(I)"
11023 ?
11025 ? "(4) STORE X(I),Y(I) IN DATA
      LINES FOR TRANSFER TO TAPE"
11028 ?
11030 ? "(5) CLEAR X(I),Y(I) ARRAYS"
11033 ?
11035 ? "(6) CLEAR OUT DATA LINES"
11038 ?
11040 ? "(7) PLOT X,Y FROM DATA LINES
      "
11045 INPUT SEL
11050 ON SEL GOSUB 15,6000,7000,8000,
      9000,10000,15000
11055 GOTO 11000
15000 GRAPHICS 0:REM TO PLOT X,Y USIN
      G DATA LINES
15001 ? "GRAPHICS 7 OR 8?":INPUT G
15002 GRAPHICS G
15004 ? " INPUT SCALE FACTOR":INPUT S
      CF
15006 ? "INPUT AXIS SHIFT CONSTANTS":
      INPUT AX,AY
15008 ? "NUMBER OF POINTS TO PLOT?":I
      NPUT NBR
15010 COLOR 1
15012 RESTORE 20000
15013 TRAP 15000
15014 READ X,Y
15020 PLOT SCF*X+AX,SCF*Y+AY
15022 RESTORE 20000
15025 FOR I=1 TO NBR
15030 READ X,Y
15060 X=SCF*X+AX:Y=SCF*Y+AY
15100 DRAWTO X,Y
15150 NEXT I
15200 ? "ANOTHER PLOT?":INPUT Q$
15400 IF Q$="Y" THEN 15000
15600 RETURN
20000 DATA 90,48,69,48,69,30
20001 DATA 90,30,90,48,69.153,30.153
20002 DATA 89.153,30.153,68.478,47.82
      8,0,0
20003 DATA 0,0,0,0,0,0
20004 DATA 0,0,0,0,0,0
20005 DATA 0,0,0,0,0,0
20006 DATA 0,0,0,0,0,0
20007 DATA 0,0,0,0,0,0
20008 DATA 0,0,0,0,0,0
20009 DATA 0,0,0,0,0,0
20010 DATA 0,0,0,0,0,0
20011 DATA 0,0,0,0,0,0
20012 DATA 0,0,0,0,0,0
20013 DATA 0,0,0,0,0,0
20014 DATA 0,0,0,0,0,0
20015 DATA 0,0,0,0,0,0
20016 DATA 0,0,0,0,0,0
20017 DATA 0,0,0,0,0,0
20018 DATA 0,0,0,0,0,0
20019 DATA 0,0,0,0,0,0
20020 DATA 0,0,0,0,0,0
20021 DATA 0,0,0,0,0,0
20022 DATA 0,0,0,0,0,0
20023 DATA 0,0,0,0,0,0
20024 DATA 0,0,0,0,0,0
20025 DATA 0,0,0,0,0,0
20026 DATA 0,0,0,0,0,0
20027 DATA 0,0,0,0,0,0
20028 DATA 0,0,0,0,0,0
20029 DATA 0,0,0,0,0,0
20030 DATA 0,0,0,0,0,0
20031 DATA 0,0,0,0,0,0
20032 DATA 0,0,0,0,0,0
20033 DATA 0,0,0,0,0,0
20034 DATA 0,0,0,0,0,0
20035 DATA 0,0,0,0,0,0
```

```
20036 DATA 0,0,0,0,0,0
20037 DATA 0,0,0,0,0,0
20038 DATA 0,0,0,0,0,0
20039 DATA 0,0,0,0,0,0
20040 DATA 0,0,0,0,0,0
20041 DATA 0,0,0,0,0,0
20042 DATA 0,0,0,0,0,0
20043 DATA 0,0,0,0,0,0
20044 DATA 0,0,0,0,0,0
20045 DATA 0,0,0,0,0,0
20046 DATA 0,0,0,0,0,0
20047 DATA 0,0,0,0,0,0
20048 DATA 0,0,0,0,0,0
20049 DATA 0,0,0,0,0,0
20050 DATA 0,0,0,0,0,0
20051 DATA 0,0,0,0,0,0
20052 DATA 0,0,0,0,0,0
20053 DATA 0,0,0,0,0,0
20054 DATA 0,0,0,0,0,0
20055 DATA 0,0,0,0,0,0
20056 DATA 0,0,0,0,0,0
20057 DATA 0,0,0,0,0,0
20058 DATA 0,0,0,0,0,0
20059 DATA 0,0,0,0,0,0
20060 DATA 0,0,0,0,0,0
20061 DATA 0,0,0,0,0,0
20062 DATA 0,0,0,0,0,0
20063 DATA 0,0,0,0,0,0
20064 DATA 0,0,0,0,0,0
20065 DATA 0,0,0,0,0,0
20066 DATA 0,0,0,0,0,0
30000 REM AUTO LINE GEN=30001,DELETIO
      N=30020,VARIABLE LIST=30060
30001 REM AUTO DATA LINE GENERATION
30002 P$=","
30003 ? CHR$(125)
30005 ? "{DOWN}";LN;"DATA";X(J);P$;Y(
      J);P$;X(J+1);P$;Y(J+1);P$;X(J+2
      );P$;Y(J+2)
30007 ? :? :? :?
30009 ? "CONT"
30010 ? :? :?
30013 POSITION 0,0
30015 POKE 842,13:STOP
30017 POKE 842,12
30019 RETURN
30020 REM AUTO LINE DELETION
30022 IF STLIN>=30000 THEN 30000
30024 IF ENLINE>=30000 THEN 30000
30026 REM
30028 FOR ERASE=STLIN TO ENLINE STEP
      1
30030 ? CHR$(125)
30032 ? "{DOWN}";ERASE
30034 ? :? :? "CONT"
30036 POSITION 0,0
30038 POKE 842,13:STOP
30040 POKE 842,12
30042 NEXT ERASE
30044 GRAPHICS 0
30052 RETURN
30060 REM LISTS NAMES OF ALL VARIABLE
      S USED
30062 I=0:FOR J=PEEK(130)+256*PEEK(13
      1) TO PEEK(132)+256*PEEK(133)-1
30064 IF PEEK(J)<128 THEN PRINT CHR$(
      PEEK(J));:GOTO 30068
30066 PRINT CHR$(PEEK(J)-128):I=I+1
30068 NEXT J:PRINT :PRINT I;" VARIABL
      ES IN USE":STOP
```

EXTRAPOLATIONS

Keith Falkner

Load Commodore BASIC Tapes Into Apple II

This month's column includes an extraordinary program which will let Apple users load PET/CBM programs directly off tape into the Apple. *This opens up a world of new software. The column is also of interest to Commodore users because it includes numerous explanations of the differences between the two computers' BASICs and software.*

Between microcomputers, compatibility is rare. **COMPUTE!** sets a good example by publishing BASIC listings of programs for several different machines. But why not go further and teach one computer to load programs which already exist in a different computer? This approach instantly gives access to some of the other computer's software base. Two years ago I wrote a program to load PET BASIC programs into the Apple, and made it available to readers of **COMPUTE!**. Now there are new computers from Commodore, so it's time to replace that program with one which can read any Commodore BASIC tape. Commodore seems to be retaining the current tape format, so this program may stay current.

Briefly, here is how to use it. The Commodore BASIC Tape Loader appears to be an Applesoft program, and can be loaded, saved, and run as an Applesoft program, although it is written entirely in Assembly Language. When run, it prints simple instructions and messages in English. It loads a Commodore BASIC program from tape into memory, and converts most of it into Applesoft. Then it ends, and you can do what you wish with the loaded program. You will likely choose to save it to disk, with the hope of completing the conversion at your leisure. In any case, the Commodore Loader will not again be needed for that program. The Commodore Loader can be rerun without being reloaded.

Tape Only

The Commodore Loader handles tape input only, because Commodore disk formats are very complex, and some of them are beyond the ability of an Apple Disk II to read. If you have disks of Commodore programs to convert, use a disk-to-tape program on the Commodore computer to copy many programs to one cassette; tape positioning is not critical.

You can even use the Commodore Loader if there isn't a tape drive or a cassette in sight. Just wire the cassette output line of the Commodore to the cassette input port of the Apple, ground the "sense" line to indicate a recorder is present and operating; then run the Commodore Loader, and issue a SAVE instruction on the Commodore machine. Honest, it works! And if you have a Franklin Ace instead of an Apple, the Ace lacks tape hardware and support for tape in the ROMs. You can use pin four of your Ace game I/O socket, after changing all references in the program from $C060 (cassette input) to $C063 (switch three). Some voltage amplification may be needed, but the lack of tape I/O routines in the ROMs will not matter.

What Can Go Wrong?

Three things can go wrong, all self-explanatory. The program prints a sentence announcing the error, then quits. "Tape is unreadable" means that 128 or more bytes could not be read correctly from tape. Each incorrect byte provoked a click from the speaker, so you can hear this message coming before it finally appears. "End-of-tape was found" means that the computer which wrote the tape put a "Type-5" label here to mark the end of the recorded part of the tape. You are free to rerun and try to load programs beyond that label if you think any are there. "The program is

too big" means that the incoming Commodore program will not fit between location 4096 ($1000) and the current HIMEM. Perhaps you can adjust HIMEM or MAXFILES if this occurs, and try again.

The Commodore Loader does not quit if a few (dozen) tape errors occur, because, first, there is no program to recover a tape it can't read, and, second, any bytes read incorrectly from tape are stored as the Applesoft token for ERROR (BEEP), and will actually cause the beep when you LIST the loaded program. If you find what seems like too many of these, consider adjusting the tape volume; it should be high enough to irritate, but not enough to hurt. In practice, even a solitary error of this type is rare, because there are two copies of the program on tape, and the Commodore Loader uses the second copy, if necessary, to correct bytes read erroneously from the first.

Incompatibilities

There are some fundamental differences between Apple and Commodore computers, but fortunately few programs exploit these differences. Adventure programs and scientific calculations need almost no changes. Business programs will need their disk and printer I/O routines largely rewritten. In general, a few changes will be needed for screen formatting, but these are obvious and will soon become routine. Here are specific areas where differences between the computers will necessitate changes in the programs.

1. No equivalent verb in the Apple.

OPEN, CLOSE, VERIFY, and CMD are commands in Commodore BASIC, and are translated to STOP. Machines with Version 4 BASIC have many more I/O commands such as DOPEN, COLLECT, and CATALOG. These are all translated to "UNDEF'D FUNCTION", and you will need to decipher the programmer's intent to program the equivalent for the Apple. Refer to Commodore's fine manuals for descriptions of these commands.

2. Specific device reference.

Programs containing OPEN and CLOSE will contain PRINT# and INPUT# commands, which are simply translated to PR# and IN# respectively, and will require substantial rework. The devices, by number, are conventionally these:

```
# 0  Keyboard
#1   Cassette Recorder
#2   Serial I/O Port
#3   Screen
#4   Printer
#8   Disk Drive
```

The numbers above are hardware addresses, and are the second numeric operand in the OPEN statement (translated to STOP), so STOP 6,4,128 addressed the printer (address 4) and defined file number 6 (the first operand of OPEN).

3. Reference to actual memory locations.

PEEK, POKE, CALL (SYS in Commodore BASIC), WAIT, and USR refer to specific locations in memory, and you will need more help than I can offer here.

4. Keys to move the cursor.

Commodore computers have keys to control the position, color, or action of the cursor. These are translated as follows:

Two functional equivalents:

CURSOR-LEFT becomes BACKSPACE, and appears as GR in the program.

CURSOR-DOWN becomes LINE-FEED, and appears as PR# in the program.

(Odd as they appear, these actually move the cursor exactly as stated.)

One destructive approximation:

CURSOR-RIGHT becomes SPACE, which obliterates what it should space past. This appears as COLOR= in the program.

Seven nonfunctional comments:

These keys are translated into Applesoft tokens selected to indicate what key was pressed by the programmer: 'RVS' -> INVERSE, 'OFF' -> NORMAL, 'HOME' -> HOME, 'CLR' -> CLEAR, 'CRSR UP' -> VLIN, 'DEL' -> DEL, and 'INST' -> IN#.

When the program is listed, these are visible, looking like genuine verbs, and it looks as if the name of the key will be printed. For example,

```
100 PRINT " CLEAR "
110 INPUT " INVERSE INSTRUCTIONS NORMAL
    ";Z$
```

In fact, line 100 will neither clear the screen nor print "CLEAR". It will merely print an equal sign (=). Line 110 will print "INSTRUCTIONS", and no trace will be seen of the INVERSE and NORMAL commands shown in the listing. This behavior can be perplexing, because, usually with Applesoft, what you see is what you get. The purpose of these translations is to disclose the programmer's intent, so when you list the program and discover:

```
300 INPUT " HOME PLAY INVERSE AGAIN
    NORMAL " ; X$
```

substitute the equivalent Apple code, which in this case is:

```
300 VTAB 1: PRINT "PLAY ";: INVERSE: PRINT
"AGAIN";: NORMAL: INPUT "? ";X$
```

For all those keys except INST and DEL, the equivalent in Applesoft is easy to devise, but simulating the Commodore computer's INSERT and DELETE keys is extremely difficult, and Apple's convoluted screen addressing makes this task truly difficult. Fortunately, very few Commodore BASIC programs print INSERT or DELETE characters.

5. Printing of numbers is slightly different.

```
290 X=4 : Y= -6
300 PRINT "X IS" ; X ; "Y IS" ; Y ; "."

Commodore BASIC:    X IS 4 Y IS-6 .
The Apple prints:   X IS4Y IS-6.
```

Commodore computers print a blank before positive numbers, and a CURSOR-RIGHT after all numbers; the Apple does neither. By the way, all four semicolons (;) in line number 300 above are optional in Apple and Commodore computers.

6. A side effect of TAB.

Commodore computers TAB over data already on the screen; the Apple wipes it out, so substitute an HTAB verb for a TAB phrase if the problem occurs.

```
CBM:   40 PRINT TAB(12) "XYZ"
Apple: 40 HTAB 12 : PRINT "XYZ"
```

7. Computations in Boolean arithmetic.

In the following lines,

```
400 X=11 : Y=6 : Z=X > Y
410 PRINT Z : IF Z THEN 500
```

Z is -1 in Commodore BASIC, so line 410 will print this result and go to 500. The Apple will set Z to +1, and print this different result, then go to 500. In the above example, the difference may not be crucial, but it often can be. Commodore BASIC does bit-by-bit evaluation of the operators OR and AND, so in

```
700 X=11 : Y=6 : Z=X AND Y
```

Commodore BASIC sets Z=2 because the bit pattern of 11 is 0000 1011 and the bit pattern of 6 is 0000 0110, and these two patterns, ANDed, give 0000 0010, arithmetically 2. Apple, on the other hand, merely sees that neither X nor Y is FALSE (zero), calls the result TRUE, and sets Z equal to 1. This can be a very subtle pitfall.

8. Random numbers.

RND (0) gives a genuine random number each time in Commodore BASIC, but in an Apple it repeats the previous random number. Simply replace the 0 with a 1.

9. The GET command.

Commodore BASIC's GET does not wait for a key to be struck, so the sequence

```
333 GET P$ : IF P$ = "" THEN 333
```

is the customary way to wait for a key to be typed. This same sequence is completely appropriate in the Apple, because if the key struck is CTRL-@, then P$ will be the null string. Ignorance of this is an obscure bug in some Applesoft programs. When the program is testing for a key, but not waiting when no key has been struck, a different approach is needed. For example,

```
CBM:   60 GET A$ : IF A$ = "" THEN 100
Apple: 60 ON PEEK (-16384) < 128 GOTO 100 : GET
       A$ : IF A$="" THEN 60
```

10. Graphics characters and lowercase.

Commodore computers can display lowercase letters and many symbols which the Apple cannot, and there are two display modes: Text and Graphic. $C1 is "a" (old machine), "A" (any other), or the symbol for the Spade suit (any PET). The Loader looks for $CF, probably a lowercase "o," in the program. If $CF is found, all letters are translated to uppercase; if not, graphic symbols are translated into a similar character the Apple can produce.

11. Direct screen addressing.

In many computers, the video screen occupies a part of memory, and a POKE to a storage location in the screen memory will produce a character on the screen. The relationship between memory location and screen position in Commodore computers is straightforward, but it is complex in the Apple, hence not often used. Nevertheless, it is worth mastering, because there are hordes of programs which use this technique, and a lot of them are attractive games.

The PET has 25 lines of 40 columns, and the memory location of each byte of the screen can be computed thus (the expression is not written in BASIC):

```
LOCATION=32768+40 * LINE+COLUMN
```

where the upper left corner is LINE 0, COLUMN 0.

The 80-column SuperPET and CBM computers can use similar addressing to POKE data onto the screen; just change the 40 to 80. The VIC-20 has 23 lines of 22 columns each, but the address of the screen depends on what expansion memory units are installed. The Commodore 64 has again 25 lines of 40 columns, but this machine can decide where in memory the screen is. The default address is 1024 (same as Apple's), so change 32768 to 1024 and the formula shown above applies to the 64 in its default state.

The Apple has 24 lines of 40 columns, and the memory location of each byte can be calculated by:

```
LOCATION=XL% ( LINE ) +COLUMN
```

where the array XL% has been initialized thus:

```
1000 DIM XL% (23) : FOR I=0 TO 7 :
       XL% (I)     =1024+128 * I :
       XL% (I+ 8)  =1064+128 * I :
       XL% (I+16)  =1104+128 * I : NEXT
```

As before, the upper left corner is LINE 0, COLUMN 0. In applying this tactic, take care not to let COLUMN exceed 39, or you will cause destruction of some important values in memory. For example, a POKE to valid LINE 23, and invalid COLUMN 49, will likely cause loss of your BASIC program.

12. Numeric keypad.

Programs which use screen-POKEs to move pieces of a game around the screen use the keys 1-9 to indicate the direction of motion. This is satisfactory on the PET, because these keys form a square, with 7, 8, 9 above 4, 5, 6 above 1, 2, 3, and it is natural that, if the 5-key means "stop," the 8-key means "up," and the 3-key means "down and right." Apple's numeric keys do not form a square, so some substitute must be devised. None is immediately obvious, but perhaps the parallelogram formed by R, T, Y above F, G, H above V, B, N would serve, since the BELL on the G-key can be easily remembered as being a home position. Often the game can be improved by substituting use of the game paddles or joystick. This is where you can improve on the original program.

13. Sound.

Stock Commodore computers are silent or have a rudimentary speaker. The various types of computers have their own ways of making noise, typically with a trio of POKE commands to 59464, 59466, and 59467. The VIC-20 uses similar methods, but the addresses are different. The 64 has a powerful sound chip which you won't try to simulate. Except for the VIC-20, the various POKE commands associated with production of sound address the Apple's Read-Only-Memory, which is unaffected by POKE.

14. Realtime clock.

Commodore computers have a realtime clock, which programs can read and set. TI increases by 60 every second, and can be read but not written; string TI$ is six numeric characters, in the format HHMMSS, and can be read and written.

```
100 INPUT "WHAT TIME IS IT" ; U$ : TI$ = U$
```

When this is executed, TI is set consistent with the value put in TI$.

```
400 PRINT "THE TIME IS " ; TI$
```

TI$ is computed from the instantaneous value of TI, and formatted as six digits. If you try running a PET program in your APPLE, and it just stalls, doing nothing at all, press CTRL-C to stop it, and you may find lines like

```
700 X = TI + 60
710 IF TI < X THEN 710
```

Line 710 is merely waiting for a second to elapse, and in the timeless Apple, it never will. Substitute a FOR/NEXT loop of the appropriate duration.

15. PI.

A single key on the PET provides the number PI, 3.14159265. No such facility exists in the Apple, so PI is translated into a character which prints as "UNDEF'D FUNCTION". This causes "?SYNTAX ERROR", and is simple to correct.

16. The INPUT statement has subtle differences.

Commodore BASIC supplies a question mark after the prompt; and, for neatness, you should supply one. In some Commodore computers, if an INPUT statement is issued, and the user accidentally or deliberately gives a null response by just pressing RETURN, execution of the program ceases at once. This is such a nuisance that programs with any elegance guard against it in a variety of ways, for example:

```
50 INPUT "WHAT NOW > > + < < < ";X$
```

where ">" and "<" stand for keys to move the cursor right and left. You can tidy this up as you supply the question mark for the prompt.

Does It Work?

The above list of incompatibilities is not exhaustive, but it is lengthy. Thus, you may wonder if the Commodore Loader is of much use. In practice, only a very small proportion of the statements in a program require conversion, and the conversion is usually noncritical.

The Commodore BASIC Tape Loader is a useful tool, and permanently gives you access to the expanding world of public-domain Commodore Software. In short, it's worth keying into your Apple.

Operating Instructions

1. Before loading the Commodore BASIC Tape Loader, insure that Applesoft's memory pointers are normal, by issuing "FP" or by booting the System Master. This is necessary because the machine language program cannot operate at any address except the one it was assembled into.
2. Load and run the Commodore BASIC Tape Loader. It asks you to either ready a cassette and press PLAY or to press ESC to exit. Take your choice.
3. Soon after the tape starts moving, the message "OK. SEARCHING ..." is displayed. Clicks from the speaker indicate unreadable data on the tape, and that is a normal condition before or between programs on that tape.
4. If a Data File (not a program) is detected, the program will display the File's name, bypass the data file, and keep searching for a program.
5. When a program is detected, its name is displayed, and the program is loaded into memory, and simultaneously displayed in a little window on the screen. Some of it will be legible. This can take several minutes.
6. If any bytes are unreadable, the Commodore Loader will need to process the second image of the program on tape, so your wait will be doubled.

7. When the Apple beeps, stop the tape. You now have a Commodore BASIC program in your Apple. Decide what to do with it.
8. To load another program, just type "&" (ampersand) and press RETURN. Unless something drastic has occurred, you needn't reload the Loader.

Making It Work

You can key in all the hex digits using the machine language monitor, or better yet, the MINI-ASSM described in this column last December.

So, now you've gotten it correctly assembled and saved; here is how to package it as an Applesoft program so that it can be used with the usual RUN and LOAD and SAVE commands:

```
Get the object program into memory.
CALL -151
67:01 08 FF 0F FF 0F FF 0F
AF:FF 0F N E003G
SAVE COMMODORE LOADER
```

A LIST command now should show only one line: 6502 CALL 2061.

PET To Apple Loader.

```
0800- 00 0B 08 66 19 8C 32 30 09D0- 08 86 AF A4 09 84 B0 E8 0BA0- 4C 4F 41 44 45 52 2E 20
0808- 36 31 00 00 00 20 2F FB 09D8- D0 01 C8 E8 D0 01 C8 86 0BA8- 20 20 20 20 20 56 20 33
0810- 20 58 FC 20 84 FE 78 A9 09E0- 69 84 6A 86 6B 84 6C 86 0BB0- 2E 30 20 28 43 29 20 4B
0818- 4C 8D F5 03 A9 0D 8D F6 09E8- 6D 84 6E A5 67 85 06 A5 0BB8- 45 49 54 48 20 46 41 4C
0820- 03 A9 08 8D F7 03 A9 00 09F0- 68 85 07 A0 01 B1 06 F0 0BC0- 4B 4E 45 52 2C 20 54 4F
0828- 8D 00 10 A9 01 85 67 A9 09F8- 1F A0 04 B1 06 F0 03 C8 0BC8- 52 4F 4E 54 4F 20 43 41
0830- 10 85 68 20 4B D6 A9 25 0A00- D0 F9 98 A0 00 38 65 06 0BD0- 4E 41 44 41 2C 20 31 39
0838- 85 1B A9 19 85 1C A0 00 0A08- 91 06 AA A9 00 65 07 C8 0BD8- 38 33 2E 0D 0D 0D 20 52
0840- 20 AE 0A BC 10 C0 AD 60 0A10- 91 06 86 06 85 07 D0 DB 0BE0- 45 41 44 59 20 41 20 43
0848- C0 85 2F A0 00 AD 60 C0 0A18- A5 67 85 06 A5 68 85 07 0BE8- 41 53 53 45 54 54 45 20
0850- 45 2F 10 16 45 2F 85 2F 0A20- A0 00 B1 06 AA C8 B1 06 0BF0- 41 4E 44 20 50 52 45 53
0858- A9 AE 20 F6 FD C8 C0 50 0A28- F0 78 88 84 A6 86 08 85 0BF8- 53 20 27 50 4C 41 59 27
0860- 90 08 A9 8D 20 F6 FD 4C 0A30- 09 18 A5 06 69 04 85 06 0C00- 20 4F 52 0D 0D 20 50 52
0868- B9 08 AD 00 C0 C9 9B D0 0A38- A5 07 69 00 85 07 B1 06 0C08- 45 53 53 20 27 45 53 43
0870- DC A9 04 20 5B FB 20 42 0A40- C9 22 F0 43 24 A6 30 16 0C10- 27 20 54 4F 20 45 58 49
0878- FC A0 C8 20 AE 0A A9 01 0A48- C9 FC F0 41 C9 CB B0 08 0C18- 54 2E 0D 0D 00 4F 4B 2E
0880- 85 67 A9 08 85 68 4C A7 0A50- AA 10 3A BD A0 0C D0 02 0C20- 20 53 45 41 52 43 48 49
0888- 0A A9 04 20 5B FB 20 42 0A58- A9 FB 91 06 D0 2F A2 18 0C28- 4E 47 20 2E 2E 2E 0D 0D
0890- FC A0 92 20 AE 0A A9 00 0A60- CA DD C7 0C F0 19 CA D0 0C30- 00 46 4F 55 4E 44 20 44
0898- 85 1D 20 BC 0A A0 00 20 0A68- F7 A6 A8 D0 0E C9 E0 B0 0C38- 41 54 41 20 46 49 4C 45
08A0- 15 0B 99 30 02 C8 C0 16 0A70- 0A C9 A0 90 06 E9 A0 AA 0C40- 3A 20 00 4C 4F 41 44 49
08A8- 90 F5 A5 A5 F0 0D A5 1D 0A78- BD E0 0C 29 7F 10 03 BD 0C48- 4E 47 3A 20 00 4F 4B 21
08B0- 30 04 A9 80 30 E2 A9 02 0A80- C8 0C 91 06 4C 8D 0A A5 0C50- 0D 0D 00 54 4F 20 52 45
08B8- 4C 61 0B 85 1D AD 30 02 0A88- A6 49 80 85 A6 E6 06 D0 0C58- 53 54 41 52 54 2C 20 50
08C0- C9 01 F0 32 C9 03 F0 2E 0A90- 02 E6 07 A5 06 C5 08 D0 0C60- 52 45 53 53 20 27 26 27
08C8- C9 04 F0 06 C9 05 F0 21 0A98- A5 A5 07 C5 09 D0 9F 4C 0C68- 20 41 4E 44 20 27 52 45
08D0- D0 C4 A0 A6 20 AE 0A A0 0AA0- 20 0A A0 C2 20 AE 0A 58 0C70- 54 55 52 4E 27 2E 0D 0D
08D8- 00 B9 35 02 09 80 20 F6 0AA8- 8D 10 C0 4C 03 E0 B9 8B 0C78- 00 45 52 52 4F 52 3A 20
08E0- FD C8 C0 10 90 F3 A9 8D 0AB0- 0B F0 08 09 80 20 F6 FD 0C80- 07 00 54 41 50 45 20 49
08E8- 20 F6 FD 20 F6 FD 4C 96 0AB8- C8 D0 F3 60 A9 00 85 A5 0C88- 53 20 55 4E 52 45 41 44
08F0- 08 A9 17 4C 61 0B A9 04 0AC0- 8D 10 C0 A0 0D 20 51 0B 0C90- 41 42 4C 45 2E 0D 00 45
08F8- 20 5B FB 20 42 FC A0 B8 0AC8- E4 1B B0 10 88 10 F6 AD 0C98- 4E 44 2D 4F 46 2D 54 41
0900- 20 AE 0A A0 00 B9 35 02 0AD0- 56 0B 8D 5C 0B 49 20 8D 0CA0- 50 45 20 57 41 53 20 46
0908- 09 80 20 F6 FD C8 C0 10 0AD8- 56 0B D0 E7 20 15 0B C9 0CA8- 4F 55 4E 44 2E 0D 00 54
0910- 90 F3 A9 8D 20 F6 FD 20 0AE0- FC D0 0A AD 00 C0 C9 9B 0CB0- 48 45 20 50 52 4F 47 52
0918- F6 FD 20 F6 FD 20 F6 FD 0AE8- D0 03 4C 71 08 45 1D C9 0CB8- 41 4D 20 49 53 20 54 4F
0920- A9 01 85 06 A9 10 85 07 0AF0- 84 F0 09 24 A5 10 E5 A9 0CC0- 4F 20 42 49 47 2E 0D 00
0928- 38 AD 33 02 ED 31 02 AA 0AF8- 02 4C 61 0B 85 1E A9 00 0CC8- 11 8A 12 9E 13 97 14 85
0930- AD 34 02 ED 32 02 A8 18 0B00- 85 A5 C6 1E A9 80 C5 1E 0CD0- 1D A0 91 8F 92 9D 93 BD
0938- 8A 69 01 85 08 AA 98 69 0B08- F0 46 20 15 0B 45 1D C5 0CD8- 94 8B 9D 88 FC FC A2 27
0940- 10 85 09 C5 74 90 0F D0 0B10- 1E F0 EF D0 C7 20 51 0B 0CE0- 20 5B 3D 2D 5F 28 2A 29
0948- 04 E4 73 90 05 A9 2F 4C 0B18- E4 1B 90 F9 20 51 0B A9 0CE8- 3D 2F 5D 21 2E 2E 2E 3D
0950- 61 0B A9 00 85 1D A9 00 0B20- 80 85 19 85 1A 20 51 0B 0CF0- 2E 2D 2D 21 5B 5B 5D 3D
0958- 85 A8 A8 91 06 85 A7 20 0B28- 90 02 E6 1A 66 18 20 51 0CF8- 3D 3D 5D 2E 2E 2E 2E 3F
0960- BC 0A 20 15 0B D0 0B A5 0B30- 0B 66 19 90 F0 20 51 0B 0D00- 2D 53 21 2D 2D 2D 2D 28
0968- 08 D0 02 C6 09 C6 08 20 0B38- 90 02 E6 1A A5 19 49 FF 0D08- 29 2E 2E 2E 5B 5C 2F 5B
0970- 15 0B 24 1D 10 04 C9 FC 0B40- C5 18 D0 04 66 1A B0 07 0D10- 5D 2A 5F 48 28 2E 58 2B
0978- F0 04 A0 00 91 06 48 A5 0B48- E6 A5 A9 FC 8D 30 C0 AA 0D18- 43 29 44 2B 5B 21 23 5C
0980- 06 29 1F AA 68 48 09 80 0B50- 60 A2 00 2C 60 C0 10 FB 0D20- B0 B1 B2 B3 B8 B4 B6 B7
0988- 9D 04 07 E6 A7 A9 05 C5 0B58- E8 2C 60 C0 30 FA E4 1C 0D28- AA AB AC AD AE B0 B1 B2
0990- A7 90 0D 68 AA D0 02 85 0B60- 60 48 A9 08 20 5B FB 20 0D30- B3 B4 B5 B6 B7 B3 B8 B9
0998- A7 C9 CF D0 04 85 A8 48 0B68- 42 FC A0 00 B9 79 0C F0 0D38- BA BA BB BC BD B3 BC B3
09A0- 68 A5 07 C5 09 D0 06 A5 0B70- 08 09 80 20 F6 FD C8 D0 0D40- B3 BE BF C0 C1 C2 C3 C4
09A8- 06 C5 08 F0 08 E6 06 D0 0B78- F3 68 A8 B9 80 0C F0 08 0D48- C6 C7 C8 C9 CA CB CC CD
09B0- BE E6 07 D0 BA A5 A5 F0 0B80- 09 80 20 F6 FD C8 D0 F3 0D50- CE CF D0 D1 D2 D3 D4 D5
09B8- 0B A5 1D 30 07 A9 80 85 0B88- 4C A7 0A 43 4F 4D 4D 4F 0D58- D6 D9 DA DB DC DD DE DF
09C0- 1D 4C 56 09 20 E2 FB A9 0B90- 44 4F 52 45 20 42 41 53 0D60- E0 E1 E2 E3 E4 E5 E6 E7
09C8- 01 85 67 A9 10 85 68 A6 0B98- 49 43 20 54 41 50 45 20 0D68- E8 E9 EA                 C
```

COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

February 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever- expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, The Voracious Butterfly on OSI.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, Vic Color Tips, VIC Memory Map, ZAP: A VIC Game.

February 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Atari P/M Graphics Made Easy, Atari PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April 1982: Track Down Those Memory Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple's Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

June 1982: Outpost Game (multiple computers), Apple Pascal Lister, Income Property (multiple computers), VIC Intelligent Videodisc System, Atari Disk Operating Systems, PET/Apple Search, A Self-modifying Atari P/M Utility, Use Atari Joysticks with VIC, VIC/PET Program Transfers.

July 1982: Gold Miner Game (Atari and VIC), IRA Planner (multiple computers), Atari Video Graphics, Apple DOS Changer, Super QuadraPET, VIC Overview, Maze Race (multiple computers), Direct Access File Editor (PET and Atari), VIC Super Expander Memory Map, Using The 6560 Video Interface Chip, PET Compactor, Headless FORTH Metacompilation, Test RAM Nondestructively (multiple computers).

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, Intelligent Apple Filing Cabinet, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of *TRON*, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Color Computer Graphics, The Apple Pilot Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Editing Atari BASIC With the Assembler Cartridge, Process Any Apple Disk File.

Home and Educational COMPUTING! (Fall 1981 and Summer 1981 – count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters, Alternate Screens, Automatic Line Numbers, Using The Joystick (Spacewar Game), Fast Tape Locater, Window, VIC Memory Map.

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Modifications Or Corrections To Previous Articles

A Day At The Races For VIC

To improve the "stride" of the horses in the VIC version of this game from the February issue (p. 44), the following change needs to be made to line 60 of Program 1:

```
60 DATA0,6,7,252,252,72,72,72
```

To give proper odds for a race with muddy track conditions, make the following change to line 120 of Program 2:

```
120 U1=RND(1)/12:U2=RND(1)/12:U3=RND(1)/12
    :U4=RND(1)/12
```

Slalom For PET

For a proper display, line 500 of Program 1 (the PET/CBM version, page 76 of the February issue) should read:

```
500 C1$=' {UP}{LEFT} {UP}{LEFT} {UP}{LEFT}
     {UP}{04 LEFT}     {UP}{04 LEFT}   ~
      {08 RIGHT}     {DOWN}{04 LEFT}   ~
      {DOWN}{LEFT} {DOWN}{LEFT} {
    DOWN}{LEFT} {DOWN}{LEFT} "
```

MASTERMAZE

Although the Atari maze generator program presented on page 107 of the February issue works correctly as printed, the two lines below were referred to in the article but were absent from the program listing:

```
330 A=USR(58484)
420 POKE 53279,8:POKE 77,124
```

Also, the "line 31" referred to on page 104 should be line 30.

In the sidebar "Mazemaking On The VIC, 64, and PET/CBM" which appeared on page 106, to use Program 1 on that page with the Commodore 64, the proper value of screen memory for line 120 is SC=1024. For the VIC-20, line 140 should read

```
140 FOR I=1 TO 21
```

For any of the machines, the REM statement in line 150 should read

```
REM 21, 39, OR 79 SPACES
```

Making Change For VIC

The Commodore version (Program 1, page 110) of this educational program from the February issue requires a slight modification for use on the VIC-20. A quirk of the VIC's operating system limits the length of "prompt" messages used with INPUT statements to one screen line, 23 characters. Thus, line 2180 must be changed to

```
2180 PRINT: PRINT "HOW MUCH CHANGE DO I": I
     NPUT "HAVE"; TC: PRINT: PRINT
```

Supermon 64

Commodore 64 owners who use video monitors instead of televisions may find that a grey background provides a more readable display than the standard blue. This can be obtained by POKEing 11 into location 53281, but reader Robert Knight suggests embedding the equivalent machine code in the monitor. Adding the required five bytes for

```
LDA #$0B        A9 0B
STA $D021       8D 21 D0
(in decimal: 169,11,141,33,208)
```

to the beginning of the relocated Supermon results in an easy-to-remember SYS address of 38888 for reentering the monitor.

A New, Even Better Thunderbird For Atari

COMPUTE! author David Plotkin suggests the following improvements to the Atari version (Program 2, p. 76) of Thunderbird which appeared in the January issue. First, to avoid ball "wrap-around," replace line 480 with the following:

```
480 IF TX<0 THEN TX=0:DX=-DX
485 IF TX>39 THEN TX=39:DX=-DX
```

When you advance beyond the first level, the Thunderbird shrinks in height as well as width. As a result, the ball can sometimes pass through its wings without registering a hit. The bird can be thickened by modifying line 350 to read as follows:

```
350 FOR I=0 TO 7*(3-2*(DIFF=2))STEP 3-2*(D
    IFF=2):READ A:FOR J=0 TO 3-2*(DIF
    F=2):POKE PADR+I+J,A:NEXT J:NEXT ~
    I
```

Alternately, you can make the ball larger by modifying line 1500, which defines the shape of the ball.

```
1500 DATA 5,0,40,40,169,169,40,40,0
```

Finally, for the smaller birds in the advanced levels, the lightning bolt comes from somewhere to the right of center. To adjust this, modify line 800 to read as follows:

```
800 XPOS=(PEEK(1664)-48)/4+4-2*(DIFF=1)-3*
    (DIFF=2):FLIP=0
```


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

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NEWS&PRODUCTS

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- General Ledger

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The product will be marketed through Commodore dealers. For more information, call a local Commodore regional office or contact:

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Football Game For Atari

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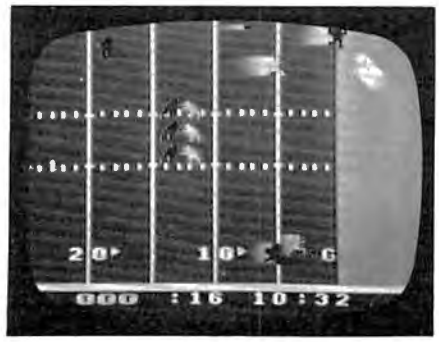

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Interfaces For PET And VIC

RAK Electronics has introduced two new products for the PET and VIC-20.

CW Morse allows your computer to become a Morse terminal for your amateur radio station. It is capable of sending and receiving Morse code at speeds of 25 wpm or more. Includes multiple 255 character message buffers, numerous special function keys, type-ahead keyboard buffering, and automatic speed control on receive.

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The 1982 edition of Ksoft's *Tax Return Helper* is available. A set of seven ZX-81/Timex programs (16K RAM) to help with Form 1040 and Schedules A, B, C, C1/C2, D and E. Data is interactively entered / examined / modified, and the results can be immediately seen. The programs perform all computations and even detect some of your errors. As in an electronic spreadsheet, when you make a change, all the lines affected by it are updated on the spot. The forms can be printed and/or saved on tape for future use. The cost ($14) is tax deductible. (Only $7 for the buyers of the 1981 edition.)

Ksoft
845 Wellner Rd.
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Two Books For VisiCalc Users

SYBEX has published two books for VisiCalc users. *Mastering VisiCalc*, by Douglas Hergert, is

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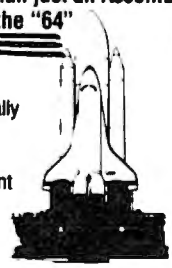

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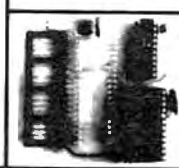

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New Products For Atari

Optimized Systems Software recently released several products for the Atari.

C/65 is a C compiler for both Apple and Atari. The compiler is based on Ron Cain's "Small C" compiler, which appeared in *Dr. Dobb's Journal*, but it has been restructured to enable it to run on and produce code for 6502-based machines. C/65 supports integer and character types (and arrays), pointers, fully recursive functions, and more. Requires a macro assembler. Two disk drives recommended but not required. The cost is $80.

MAC/65 is compatible with both EASMD and the Atari cartridge. It is an integrated assembly language development system suitable for both small subroutines and complex assembly language source files. The cost is $80 and includes BUG/65. (Both C/65 and MAC/65 include standard OS/A+ at no extra charge.)

BUG/65 includes all the traditional debugging operations. Also includes a breakpoint capability and a single step and trace mode. It is a stand-alone program which allows you to read files into memory, write files, and read or write single sectors. Cost: $34.95, separately.

Owners of OS/A+ with EASMD who purchased the package *after* August 15, 1982, may upgrade to MAC/65 by returning their master system diskette or by simply sending a "new diskette" fee of $5.

Owners who purchased the system *before* August 15, 1982, may purchase MAC/65 at half price ($40, plus $5 for charge card or C.O.D. orders).

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Arcade Math Game For The VIC

M-R Information Systems announces a new learning game for the VIC-20: *MicRo Math Blaster*.

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Memory Expansion For The VIC

Century Micro has announced memory expansion for the VIC-20. The CM 16, a 16K expansion for the VIC, retails at $69.90, and the CM 8, an 8K expansion, retails for $47.70. Both cartridges come with a 90-day warranty.

For more information contact:

Century Micro
7881 La Riviera Drive
Sacramento, CA 95826
(916)386-0711

Medical Adventure For The Apple

Synergistic Software has released a new educational game for the Apple II. *Microbe: The Anatomical Adventure* combines fantasy adventure, arcade action, and medical science. The entertaining and educational aspects of this game will appeal to parents, educators, medical students, and kids of all ages.

The game involves a miniaturized submarine injected into the human body. The mission of the sub Microbe is to rid the body of disease and repair damage to the brain. If corrective surgery is necessary, the crew of the Microbe must perform it.

The Microbe's crew consists of a captain, navigator, technician, and physician, each with specific job functions. The captain steers the sub through the veins and arteries of the human body, following the advice of the navigator. The technician performs repairs both inside and outside the sub. The physician must identify any attacking organisms (fungii, bacteria, viruses, parasites, etc.), prescribe the appropriate treatment, monitor the patient's condition, and insure that the result is a well person. If any crew member is injured or killed during the game, it becomes more difficult to complete the mission.

As the game progresses, players must keep track of damage to the sub, the fuel and air supplies, the compass and sonar readings, and the status of the laser (used to zap the germs). Players must plan their strategies carefully as they journey through the body.

Microbe: The Anatomical Adventure has three different levels. On the first level, the game can be played as a classic adventure, the goal being to explore the maze-like human body and overcome obstacles while solving the medical problem. On the second level, players can learn facts about health care, personal safety, anatomy, and medicine.

The third level is for college-level science students, premeds, and medical students. Players must know what drugs to prescribe and what immunity levels, blood pressure, heart rates, etc., are healthy or dangerous. The

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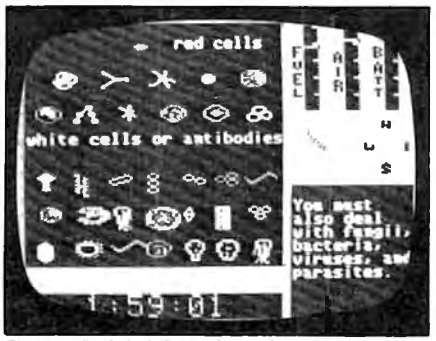

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development seminars, professional advancement courses, a business communications symposium, and 20 problem-solving sessions. The keynote address is "Information Resources – Strategic Direction for the Eighties," by Dr. Leonard Liu, Vice President, Office Systems and Programmable Workstations, IBM Communications Products Division, White Plains, New York. Among the topics to be covered in the problem-solving sessions are: computer feasibility and selection, word processing equipment selection, software applications, skills and performance assessments, productivity, supervisory techniques, office networks, and more. For additional information, contact the organizer, Cahners Exposition Group, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60018, (312)299-9311.

April 6-8, Raleigh, NC; April 28-30, Cambridge, MA; June 9-11, Watertown, CT. Microcomputers in Education, a series of hands-on workshops sponsored by Technical Education Research Centers (TERC). The workshops are designed for teachers and administrators at all levels; hands-on experience with the computer is emphasized, and a variety of microcomputers are used. Topics include: overview of educational uses of microcomputers; microcomputers in science, and math, instruction; administrative uses of microcomputers; Logo, Pascal, and BASIC; machine language; microcomputers as laboratory instruments; and microcomputers and the education of special needs students. For information on these workshops, contact Ms. Sharon Woodruff, Director of Training Services, TERC, 8 Eliot Street, Cambridge, MA 02138, (617)547-3890.

April 8-9, New Hampshire Hotel, Concord, New Hampshire. The Second Annual Microcomputers in Education Conference, sponsored by the New Hampshire Association for Computer Education Statewide (NHACES), New Hampshire State Department of Education, and New Hampshire Facilitator Center. The conference is open to the public. It offers computer-related presentations, vendors displays and demonstrations, a hands-on-lab for reviewing software, software swap sessions, and over 20 common interest sessions. The registration fee is $12/day. For registration information, contact Clint Cogswell, Kimball School, Concord, NH 03301, (603)225-9681, or Anne Knight, Computer Services, Stoke Hall, University of New Hampshire, Durham, NH 03824, (603)862-3527.

April 9, Hampshire Educational Collaborative, Northampton, Massachusetts. The first conference of Massachusetts Computer-Using Educators (MASS-CUE). The day's activities will include Software Expo '83, a program of software sharing, demonstration, and review. An organizational meeting will also be held. For further information, contact Leonard Huber, Project Director, Hampshire Educational Collaborative, 58 Pleasant Street, Northampton, MA 01060, (413)586-4590.

April 22-23, New Trier High School-West, 7 Happ Road, Northfield, Illinois. The third annual Role of the Computer in Education Conference, sponsored by Micro-Ideas. Keynote speaker: Arthur Luehrmann. Sessions cover literacy, BASIC, Logo, word processing, graphics, subject specific topics, and many others. Registration deadline: April 4. For further information, contact the conference director, Richard F. Nelson, Micro-Ideas, 1335 N. Waukegan Rd., Glenview, IL 60025, (312)998-5065.

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April 22-24, Hanalei Hotel, San Diego, CA. The semi-annual national meeting of the UCSD Pascal User's Society. The meeting will feature technical presentations, hardware and software demonstrations, language tutorials, special interest group meetings and software library exchange. Non-members are welcome. Pre-registration ($25, before April 8) should be mailed to: USUS Meeting Committee, P.O. Box 1148, La Jolla, CA 92038. Registration at the door ($35), beginning at 10 a.m., Friday, April 22.

April 27, 9 a.m. to 4 p.m., Ballroom of the Holmes Student Center, Northern Illinois University, DeKalb. Software Fair, sponsored by the University School of Education. Purpose of the Fair: to introduce teacher educators, teachers, and administrators to the software currently available for instructional purposes. For additional information, contact Louise E. Dieterle, Associate Dean of the College of Education, Northern Illinois University, DeKalb, IL 60115, (815)753-1949, or Howard Swan and Pete West, Learning Center, Northern Illinois Univ., (815) 753-1241.

April 28-30, Washington, DC. Ed·Com/Spring '83, a national computer conference and exposition for educators of all levels. More than 300 session hours featuring demonstrations, seminars, hands-on sessions, panels, and MicroCourses. For further information, contact Carol Houts, Judco Computer Expos, Inc., 2629 North Scottsdale Road, Suite 201, Scottsdale, AZ 85257, toll free outside Arizona (800)528-2355; in Arizona (602)990-1715.

April 29-30, Mesa Community College, San Diego. "Computers and Learning: Something for Everyone," the third annual CUE (Computer-Using Educators of San Diego) spring conference, designed for teachers and administrators in both public and private schools. Applications of computers from kindergarten through the two-year college will be presented. On-site registration, or pre-registration (by April 1) with: Darlene Tydlaska, 11419 Menkar Place, San Diego, CA 92126, (619)556-0043. The conference director is Barbara Chumbley, National School District, 637 Euclid Lane, El Cajon, CA 92021.

May 14, Penn State University, Hazleton Campus, Hazleton, PA. Second annual NEPACC (Northeastern PA Computer Club) Compufair '83. Features workshops, vendor booths, displays, etc. For information, call (717)454-8731.

May 14-15, George Brown College – Casa Loma Campus, Toronto, Ontario. The second annual TPUG (Toronto PET User's Group) Conference. Activities include: disk copy sessions of Club library (1500+ programs); Butterfield Machine Language Workshop; exhibits of hardware, software, accessories; a trader's corner for used equipment. For further information, contact Chris Bennett, TPUG Corresponding Secretary, 381 Lawrence Ave. West, Toronto, Ontario, M5M 1B9, (416)782-9252.

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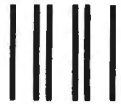

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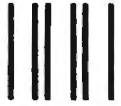

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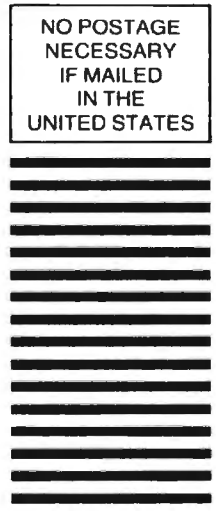

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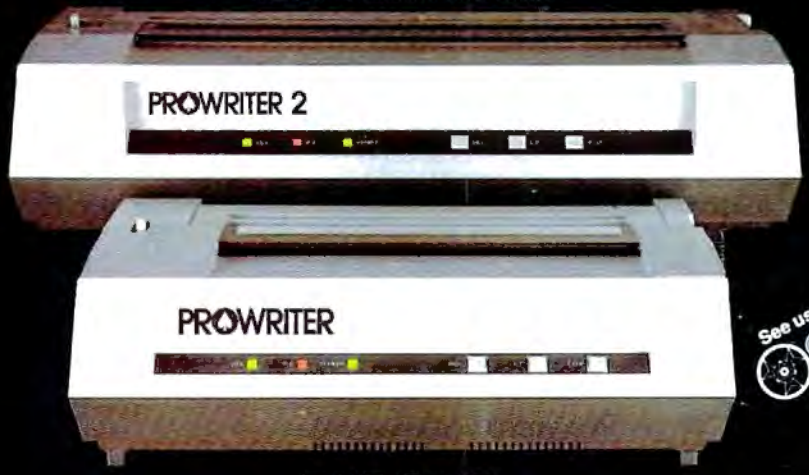

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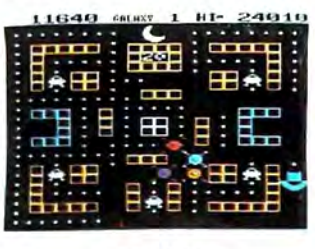

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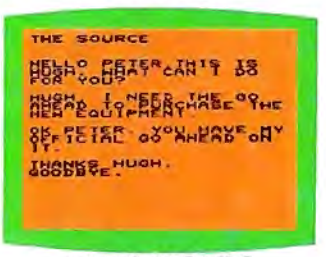

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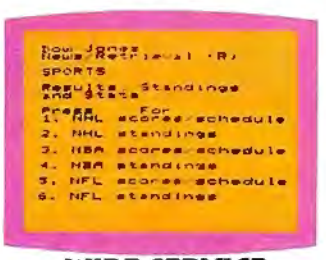

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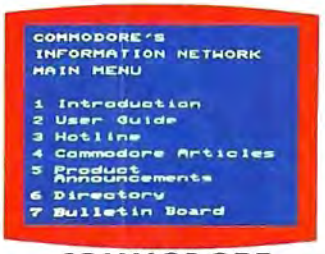

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