

124  
How To Buy The Right Printer

# COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

**Using Printers  
With The TI-99/4A  
And The TRS-80  
Color Computer**

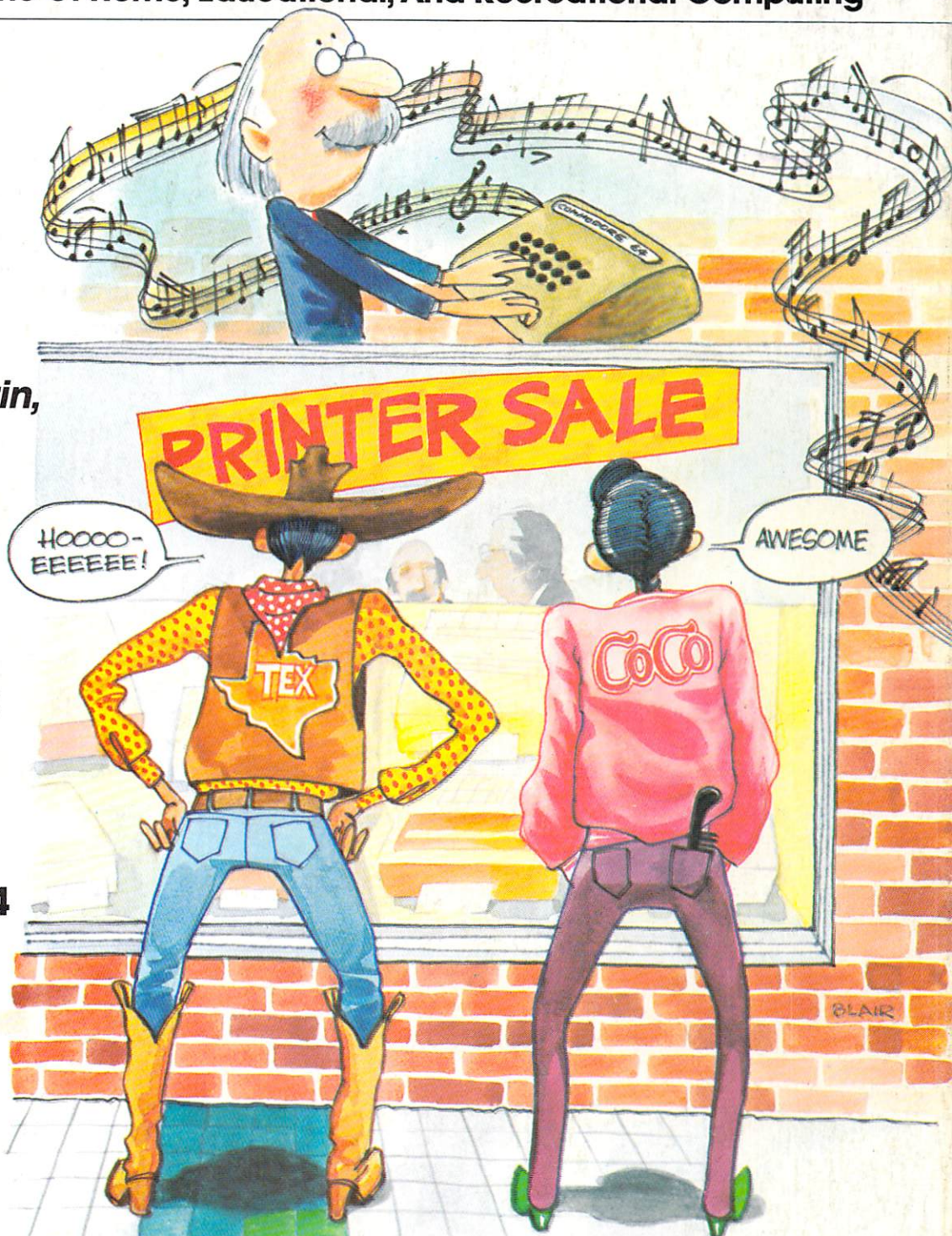
**Astrostorm,  
Hawkmen Of Dindrin,  
And More**

Ready To Run Game  
Programs For VIC-20,  
64, Atari, Apple, And  
TI-99/4A

**Atari Player  
Missiles Simplified:  
A Tutorial  
Approach**

**MusicMaster  
For Commodore 64**

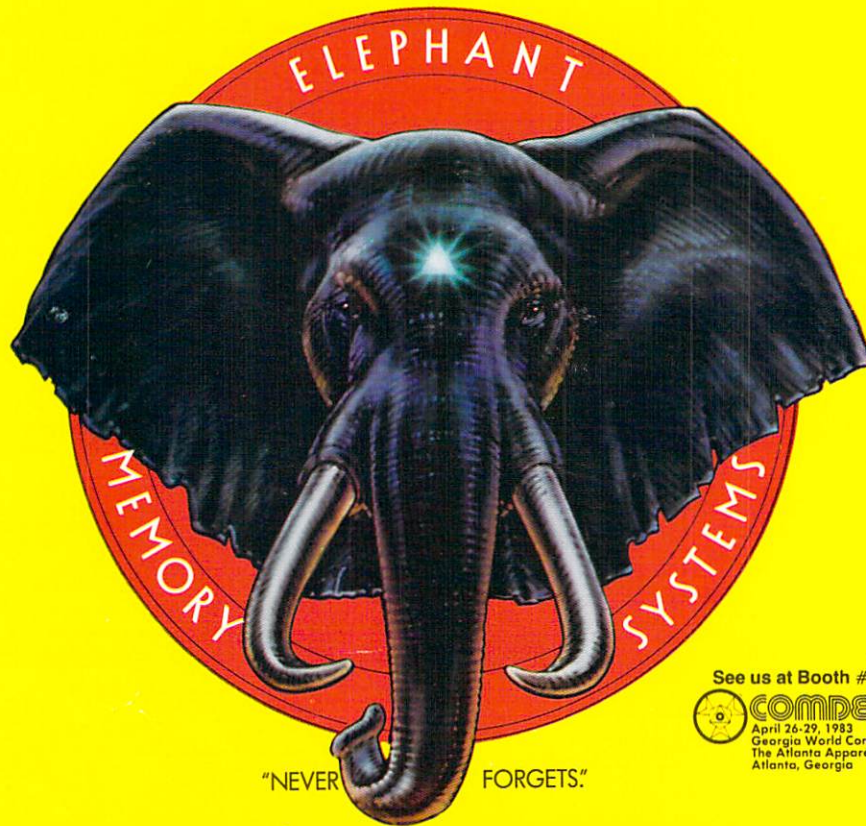
**Structured BASIC  
For The TI-99/4A**



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Exciting New Column On Computer Happenings:  
On The Road** With Noted Author Fred D'Ignazio



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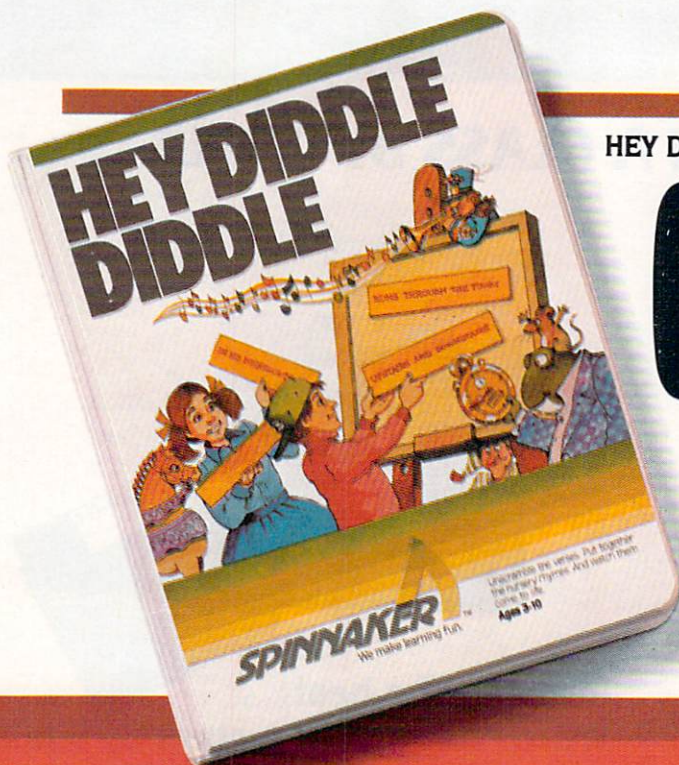
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So if you're looking for computer programs that do more than just "babysit" for your kids, read on. You'll find that our Early Learning Programs are not only compatible with Apple®, Atari®, IBM® and Commodore 64™ computers, but also with kids who like to have fun.



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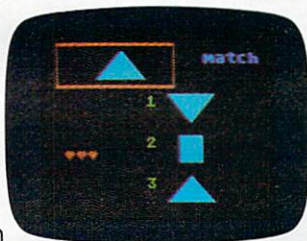
STORY MACHINE is like a storybook come to life. Using the keyboard, your children write their own fun little stories. The computer then takes what they've written and animates their story on the screen, com-



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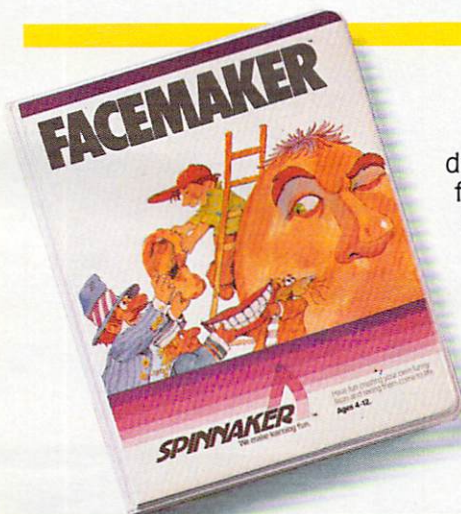
### KINDERCOMP™ Numbers, shapes, letters, words and drawings make fun. Ages 3 to 8.

KINDERCOMP is a game that allows very young children to start learning on the computer. It's a collection of learning exercises that ask your children to match shapes and letters, write their names, draw pictures, or fill in missing numbers. And KINDERCOMP will delight kids with color-



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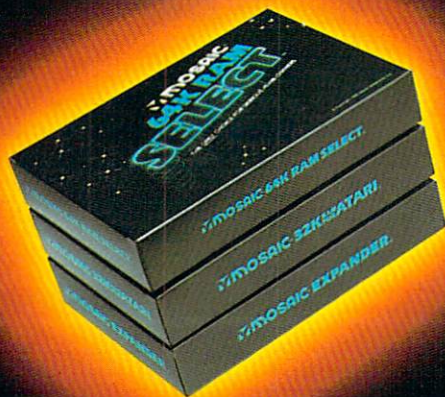
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*And*  
**800**



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## GUIDE TO ARTICLES AND PROGRAMS

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

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# EDITOR'S NOTES

**COMPUTE!**™ Publications   
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**A**s many of you are aware by now, we have become the eleventh operating division of ABC Publishing. What it means initially is that we'll have available resources and support that we've never enjoyed before as an independent company. In addition to the general strengths that our alliance with ABC provides, we'll have senior management expertise and skilled business support of a type that we've never had available. We're all quite pleased with this mutual blending of the styles and strengths of two healthy companies, one old, one young, but both very much committed to the future of our industry.

Best of all, **COMPUTE!** Publications will continue to operate as a separate division, without internal changes, and from exactly the same perspective of superior quality and leadership in personal, consumer publishing. I even expect to find more time for planning, research, and new product direction and development.

It seems appropriate, on the occasion of this announcement, to recount the current growth of **COMPUTE!** Publications. Our **COMPUTE! Books** Division will have over 16 titles in print by the end of July; *COMPUTE!'s First Book of VIC* is currently in its sixth printing. *COMPUTE!'s Gazette* for Commodore VIC-20

and 64 computers is premiering this month with an initial press run of 175,000 copies. An incredible feat given that **COMPUTE!** broke 100,000 in October of last year. Finally, our flagship, **COMPUTE!** Magazine, has achieved the significant 300,000 barrier. Our press run for this issue is 315,000. Need I add, "and growing...?"

The latest round of price cutting has reached a level defying the most aggressive predictions. Prices have dropped so fast that Texas Instruments was caught while delaying the planned introduction of the TI-99/2. By the time the /2 series was scheduled to be introduced at \$99, market moves had brought the price of the /4 down to \$99. The Atari 1200, recently announced at the \$1000 level, has rapidly dropped to the \$600-700 range; the 400 is now below \$150. And then there's Commodore, with the VIC-20 below \$90 in many areas, and the 64 at \$399, or \$299, if you're able to take advantage of the trade-in offer (where you trade in your old computer or video game computer and receive a \$100 rebate).

What's in the wind at Commodore? We've heard rumors of pending change with the new President of North American Operations bringing in selected new key personnel. We've also

heard that some existing, previously key personnel are looking around for other opportunities in the industry. Is another famous Commodore shake-up on the way? Stay tuned, we'll try to keep you posted.

In another vein, the acknowledgment that software is a critical factor in the marketplace seems to be gaining strength on all manufacturers' strategy planning calendars. TI seems to be making progress with their licensing program for in-house sale of out-of-house developed programs. Commodore has established a new division to develop and promote the sale of Commodore software. And through it all, both established and newly formed software houses are pursuing the growth of the industry.

Next month: A superior special theme issue, our third on Games.

*Robert Lock*



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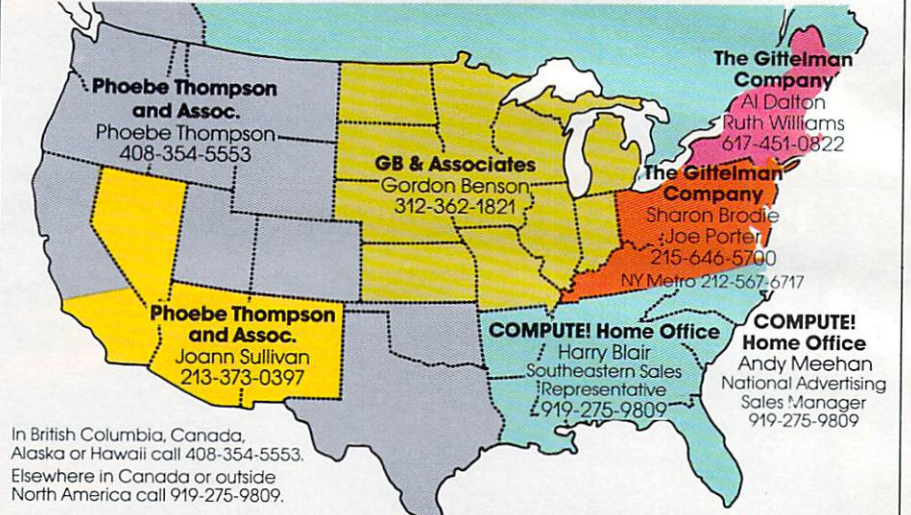
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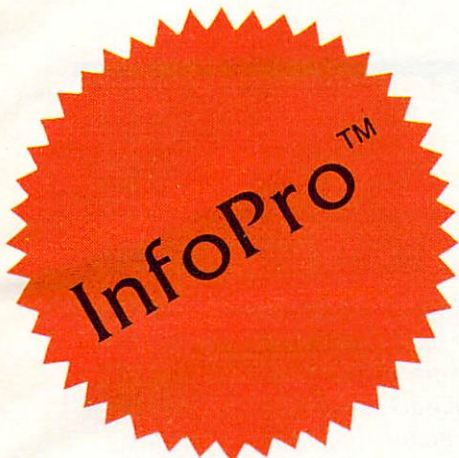
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# READERS' FEEDBACK

The Editors and Readers of COMPUTE!

## Copying VIC/64 DOS Wedge

I've tried to save the DOS support program from the test/demo diskette supplied with the VIC 1541 disk drive to one of my own. I also saved the loader. Both SAVE and VERIFY correctly, but when I run the loader my Commodore-64 spits back SYNTAX ERROR IN 52940!

Why does it do this, and if possible, how do I save it to another disk?

Erik Bard

You cannot SAVE or LOAD these programs as you would a BASIC program. This is the reason you are getting SYNTAX ERRORS. The DOS 5.1 program is in machine language, not BASIC.

Machine language programs have to be saved and loaded in a special way that specifies where they came from in memory. If you wish to copy this program to your own disk, here is the procedure:

1. First, you'll need a machine language monitor up and running in your 64. Supermon-64 (**COMPUTE!**, January 1983) is a good monitor to use for this purpose. Any monitor or assembler will do as long as it does not reside in the \$CC00 - \$CFFF range (decimal 52224 - 53247).
2. While running from within the monitor, LOAD the DOS 5.1 program into memory by entering L "DOS 5.1", 08.
3. Place the diskette you wish to save the program to into the disk drive, and save the program by entering S "DOS 5.1", 08, CC00, CF5A.
4. Place the Commodore test/demo diskette back into the disk drive, and from BASIC, LOAD the 64 Wedge loader into memory.
5. Place your new diskette back into the disk drive, and save the BASIC program in the normal manner (i.e.: SAVE "C-64 WEDGE", 8).
6. Now to run your new copy of the DOS 5.1 program, simply load the 64 WEDGE into your system, and RUN it as usual.

## Epson Printer's Grafrax

Several readers have inquired about the review of the Grafrax-80, published in the December 1982 issue of **COMPUTE!**. Specifically, they want to know if it is possible to redefine the MX-80 codes to approximate those of the Centronics 737. That way, software written

for the 737 could run without modification.

The Epson MX-80 with Grafrax-80 can redefine its escape codes. These are printer functions controlled by sending the escape character, CHR\$(27), and then a letter such as "E" for Enhanced printing. There are many other functions, however, that are controlled by sending an ASCII value less than 32 (a control character), such as CHR\$(14), which signals double-wide characters. These functions cannot be redefined.

Current MX-80 printers are being shipped with Grafrax Plus. While Grafrax Plus improves on Grafrax-80 by adding underlining, super- and subscripting, and faster graphics, some functions of Grafrax-80 were dropped to make room for the enhancements. Epson feels that those functions were not used very often anyway. Specifically, these functions do not carry over from Grafrax-80 to Grafrax Plus: TRS-80 graphics, Vertical Tab, and escape code redefinition.

You can find out which version you have by sending the printer a CHR\$(129) with something like LPRINT CHR\$(129). If you get a small graphic box, you've got Grafrax-80. If you don't know whether you have any kind of Grafrax, send the printer:

```
LPRINT CHR$(27);"4 Hello there!"
```

If you get italics, you've got Grafrax.

## Rounding Numbers

In using the simple program below, I encountered a (possible) bug in Applesoft's handling of variables. After the program is RUN, and an input of 3,4,5 is given (a known right triangle), I get an output of "NO". When I PRINT X and D, I get 5 and 5, respectively. But when I PRINT X=D, I get a response of zero, meaning "false." Is this a known error, or is this a bug in my program?

Ken Carpenter

```
1 PRINT"THIS PROGRAM WILL DETERMINE THE "  
2 PRINT"PYTHAGOREAN TRIPLE"  
3 PRINT"INPUT 3 NUMBERS"  
10 INPUT A,B,D  
40 X=SQR((A*A)+(B*B))  
50 IF D=X THEN INVERSE:PRINT"YES":GOTO 70  
55 INVERSE  
60 PRINT"NO"  
70 NORMAL:GOTO 1
```

The problem that you speak of here is common to most forms of BASIC and has to do with the manner in which



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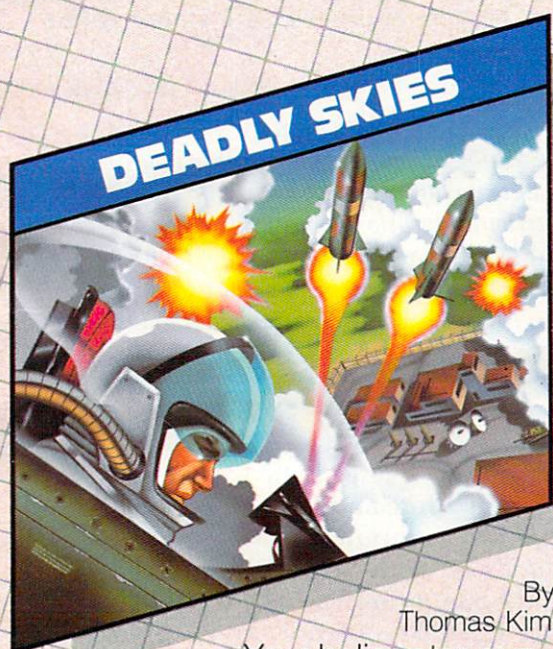
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computers handle real numbers. A very small calculation error will occur in some instances.

In your example, the number that is calculated for X on the Apple is slightly more than 5 (5.000000002, actually). PRINT X-D to see this difference after RUNning the program.

Before the Apple prints a value for X, it rounds this number to 9 digits and drops trailing zeroes so that 5.00000000 appears on your screen as 5. Internally, the Apple stores this number with greater precision (Recall that X was not equal to D in your example).

A way to get around this problem is to convert numeric values to strings and then compare the strings. In this way, the small calculation error is not seen. In your program, line 50 would then read:

```
IF STR$(D) = STR$(X) THEN INVERSE:PRINT"YES":  
GOTO 70
```

---

## Promqueen Review: A Manufacturer's Reply

The following comments are excerpted from a letter received from Stephen Bolger, General Manager of Gloucester Computer Bus:

We read the review by Mr. Herman in January's **COMPUTE!** with disappointment. Mr. Herman evidently did not consider the Promqueen's merits as a development system; he merely considered it as an EPROM programmer. When a manufacturer places his product in the hands of a publication for review he places his trust as well that the product, if reviewed, be reviewed on the basis of its advertizing claims. Unfortunately, the review which eventuated does not appear to address, much less mention the product's claim to be a microprocessor development system. Such systems usually start at \$5000 and go up steeply from there. The Promqueen exists to give ultra low cost access to a microprocessor development system.

Stephen R. Bolger  
General Manager  
Gloucester Computer Bus

**COMPUTE!** endeavors to provide objective reviews. While we regret that Mr. Bolger feels that his product was not thoroughly described, the review was fundamentally positive and, we believe, balanced. Further, we cannot agree that the Promqueen is the equivalent of a \$5000 development system, and would have done our readers and the manufacturer a disservice if we had chosen to review it in that light.

---

## An Answer To The Restless Atari ROM

Referring to the letter from Joe Cocuzzo in the March 1983 issue about the "Restless Atari ROM," I have had a similar problem with my Atari 800. After many trips to my authorized service center

the problem was still present.

I believe I know what the problem is. Placing cartridges in and out of the machine flexes the mother board. As this board flexes, the chips on it work loose in their sockets. Eventually intermittent failures can occur.

When the machine starts to misbehave, I reseat all of the chips. This corrects the problem for about six months, depending on how often cartridges are inserted.

David Fehr

---

## Apple POKEs

On the Apple, POKE 1011,0 re-boots on your disk when CTRL-RESET is pushed. This can be very inconvenient later on when you are in the middle of a program. Is there another POKE statement to get out of that?

A. Welch

If a value of 157 is POKEd into location 1011, this feature will be disabled. This was determined by PEEKing the above location after powering up the Apple. PEEKing a particular location before and after a program is RUN would work on all computers which allow PEEKing and POKeing. This is a useful way to determine the default (normal) status of important addresses.

---

## The New Timex 2000

In your article on the "New Home Computers" (March 1983), you wrote about the upcoming Timex/Sinclair 2000 computer.

I own the ZX-81 with T/S 1000 software and ZX printer. If I bought the T/S 2000, would I be able to use my T/S 1000 software and ZX printer with it?

Adam Schaffer

Sources at both Timex and Sinclair say that software written for the T/S 1000 will, in most cases, run on the T/S 2000. However, there could be a problem when transferring software from the T/S 1000 to the T/S 2000. At this time, the Timex people intend to provide a stringy-floppy disk drive for the T/S 2000. They are not yet definite about whether there will be a cassette player.

Even if a cassette is marketed for the T/S 2000, there is still some question concerning the compatibility of the two units. It's possible that a cassette for the T/S 2000 would load at a different speed than the T/S 1000 cassette, thereby preventing software transfer. But these peripherals are still in the planning stage, and we'll need to wait to hear more from Timex/Sinclair.

However, the ZX printer is expected to be fully compatible with both machines.



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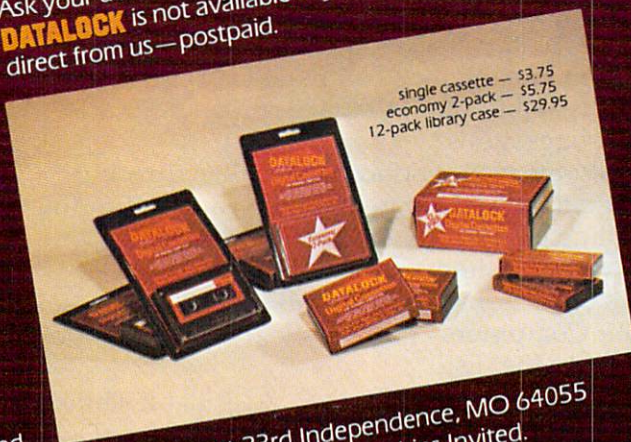
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## Printing Atari Character Sets

Many of your game programs use a redefined character set, but access it by means of a POKE. What a headache! Is there any way on the 800 to change the ATASCII character set so that it can be accessed by PRINT statements?

Howard Fishman

*It is possible to use strings to hold a redefined character set. We prefer the POKE method, however, because it is the easier one to type into the computer. Using strings would require the entry of quite long strings, filled with strange characters.*

## Genealogy

Recently I attended my first Computer Genealogy meeting and saw the program "Roots," used in building a family tree. Unfortunately, this program is not available for Commodore PETs.

I'm looking for a comparable program (price and capability-wise) that will run on a 32K PET. Any suggestions?

By the way, I noticed Genealogy (tracing your family back for generations) and Refunding (mailing in box tops and labels for cash, which I do) were two items not mentioned in the December '82 issue "How **COMPUTE!** Readers Use Their Computers" (pg. 30). So there's two more to add to that list!

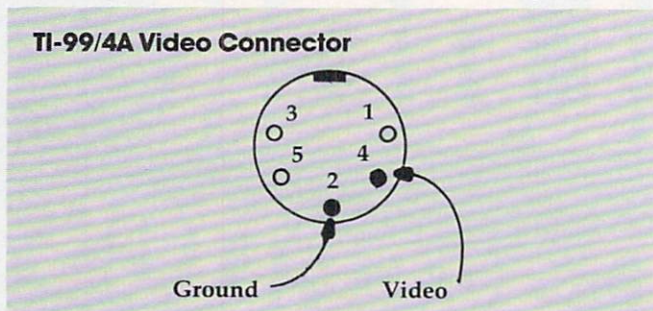
Rita M. Thrasher

## TI Monitor Connection

Can you help me? Our school has recently purchased 8 Texas Instruments TI-99/4A microcomputers. Among the 8 donated black and white television sets was a Hitachi monitor used with an Apple computer.

Can I hook up the Hitachi monitor to the TI? If so, how?

George S. Ruff



Although the TI video output is a color signal, an acceptable black and white monitor picture can be obtained by taking the two signals shown in the figure below to the monitor input. The figure shows the video connector as you would see it facing the back panel of the TI-99/4A,

or the back side of an easily-obtainable five-pin DIN plug which plugs into the connector. Use shielded cable with the shielding braid connected to the GROUND pin. For the other end of the cable use whatever type of plug mates with your monitor's input jack.

## Atari 400 Upgrade

In your December 1982, Issue 31, someone inquired about the flaws in the operating system of the 400/800 computers. I have an Atari 400 with the old operating system. Is there any way for me to get the new OS (revision B)? or is there any way to upgrade the existing ROM?

Rocky Boniello

*No officially supported OS upgrade is offered by Atari, but you might contact your local Atari Service Representative. The ROMs are not on a removable board in your 400, so it is even harder to upgrade.*

## Understandable POKES

I have only had my Commodore 64 for a month, and I'm already becoming a fanatic.

I have a problem which I'm sure others have, and I also would like to propose a solution.

Most BASIC language programs can be followed with little difficulty, except for the POKE and PEEK statements. Without knowledge of each computer, one cannot follow or use the programs submitted in your magazine.

My solution is to use REM statements with each POKE or PEEK. For example, if I submitted a Commodore 64 program and had a statement such as

```
110 POKE 53281,1
```

many would not understand it. However,

```
110 POKE 53281,1:REM**SET BACKGROUND  
COLOR TO WHITE**
```

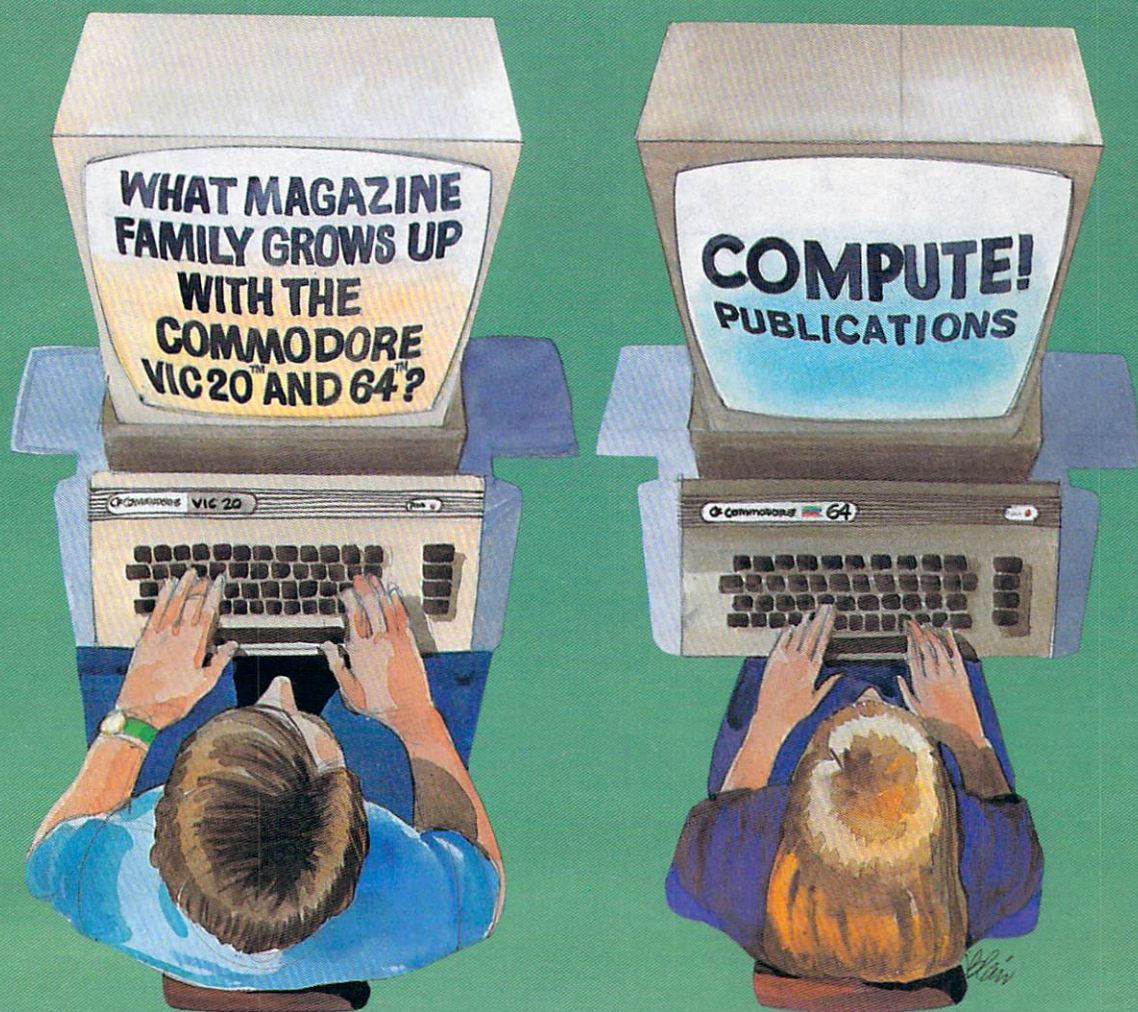
would assist people, since they could then use the appropriate commands or memory location to accomplish this on their computer!

Don Hollingsworth

*This sounds like an excellent idea. Some complicated programs use POKES and PEEKs too often for this to be practical. However, many programs PEEK or POKE only a few times and such REM statements would be of real value to owners of other computers.*

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

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# Computers And Society

David D Thornburg, Associate Editor

## Androids And Robots

*The rain stopped falling as soon as he pulled his car into the parking lot at Polaris Astronautics. He was an hour early for his appointment, but his host had told him to come early for a plant tour. As soon as he checked in with the receptionist, he was greeted by his "tour guide."*

*"Hello, Dr. Calder. We at Polaris are glad you could visit today. I will conduct you on a guided tour prior to your meeting with Dr. Clevis in the propulsion laboratory. My name is BO-3, but most people call me Bothrey. I have been trained to recognize your voice, so if you have any questions, please don't hesitate to ask me to help you."*

*Jon Calder looked at Bothrey as he (or it) wandered (or wobbled) down the hall. He knew of recent advances in android design, but he hadn't expected to find an android working as a tour guide. As the tour progressed, he thought about all the time he had wasted at his company by personally escorting dignitaries on a "dog and pony show." The more he thought about it, this was a perfect application for androids. What he didn't know was that Dr. Clevis had even greater applications in mind ....*

Is the preceding account fictional? As of this month it is, but I believe that by the end of 1983, androids like Bothrey will be serving us in capacities similar to the one mentioned. To understand why I can make this prediction, we need to first understand what an android is and how it differs from its robot cousins. Next, we will explore some of the advances that are needed to make creations like Bothrey possible.

Robots, the topic of last month's column, are mechanical devices that are controlled by external computers. For example, the Androbot robot, TOPO, is controlled by an external computer such as an Apple II using a language such as Logo. Androids, on the other hand, are totally self-contained. The distinction I make between robots and androids is that an android not only has a self-contained computer, but it is able to adapt its

programs on the basis of information it receives from its sensors. Because this field has only recently crossed the boundary from fiction to reality, there is no universally accepted definition of these terms. In this column, I will use the word *android* to refer to a mobile, self-adapting computer system.

### Adaptable Androids

Do commercially available androids exist today? The answer to this question is "Yes." Both the Heath HERO-1 and the Androbot B.O.B. (meaning Brains On Board) are androids by my definition. They both have sensors that convey information from the outside world and can be programmed to use this information to adapt to their environments.

What kinds of things can an android do today? Since I am most familiar with B.O.B., I will outline its characteristics. B.O.B. is equipped with five ultrasonic sensors (of the type found on Polaroid cameras) and two infrared sensors. The ultrasonic sensors allow the android to create a map of its environment and to note the location of objects such as chairs, tables, sofas, people, walls, etc. If B.O.B. had ultrasonic sensors alone, it wouldn't be able to distinguish between people and inanimate objects. The infrared sensors provide the extra data needed to help identify the existence and location of humans. Unfortunately, B.O.B.'s infrared sensors can also identify other warm objects such as fireplaces. While B.O.B.'s vision is quite limited at this time, one can expect androids to have more sophisticated image-processing equipment in the future.

Because of the complexity of its mapping and moving tasks, B.O.B. is controlled by three 16-bit microprocessors. One of B.O.B.'s early tasks was to seek out humans and engage them in conversation, tell jokes, and follow people as they moved. The nature of B.O.B.'s tasks is determined, of course, by the software it runs.

The software to control an android must be quite sophisticated. Rather than programming the device to perform specific well-defined tasks, the programmer must make the android exhibit



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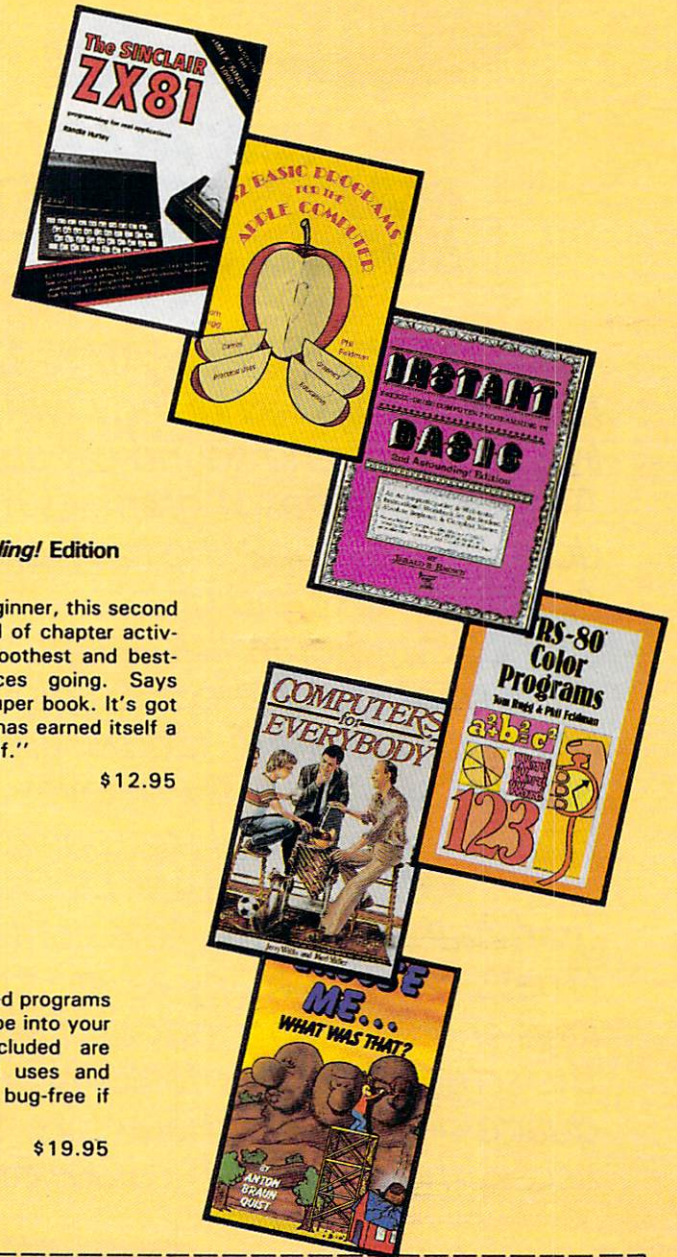
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certain behaviors when it encounters certain situations. To be truly flexible, an android should be able to pick and choose among several options, based on prior experience with a given situation. If it is provided with enough strategies, an android can make note of which strategies work in which situations, and dynamically adapt its programs to favor the use of these appropriate strategies. In humans we call this "learning from experience."

## Asimov's Three Laws

If we accept that such program environments can be built, what basic behaviors should an android exhibit? In the 1940's Isaac Asimov developed the famous "Three Laws." (He wrote a guest editorial on this topic that appeared in the November 1981 issue of **COMPUTE!**.) While Asimov uses the word *robot* to describe what I have been calling an android, these laws are useful for both types of devices:

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

(from *I, Robot*, 1950)

How can androids be programmed to obey these laws? Keeping in mind the relatively early state of development at this time, one can still see where these laws have been incorporated into android behavior.

First Law behavior can take many forms. In androids such as B.O.B., it requires that the device not run into people. When approaching a human being, B.O.B. automatically stops a foot or so away and can be programmed to keep its distance from someone, even if the person is moving.

The first part of the Second Law is the goal of every programmer. Who among us hasn't wished for a computer command called DWIM (Do What I Mean)? Having an android obey its user's instructions is essential if these devices are to serve any practical purpose.

As for the first part of the Third Law, androids can be provided with an ultrasonic sensor that looks down towards the floor at a 45 degree angle. Through use of this sensor, the android can avoid open elevator shafts, staircases, and other dangerous situations that would gum up the drive mechanism.

While it is easy to see how android designers can incorporate at least parts of the Three Laws into their device's behavior, there are portions of the Second and Third Law that will prove to be

quite challenging. These parts require that one law be obeyed unless the resultant behavior causes it to come into conflict with an earlier law. It is interesting to note that many of Asimov's robot stories center on conflicts arising from this hierarchical structure of the Three Laws. For those of us working with the nonfiction aspects of these devices, these laws give us much to think about.

## Robot Personality

It is quite important that a programmer choose an appropriate language when modeling robot behavior. Fortunately, languages such as Logo and LISP provide an excellent linguistic environment for this application. These languages are extensible list-processing environments that can be used to create adaptive programs.

Rather than work with an android directly, it is easier for a designer to develop android-control programs using a remotely controlled robot driven by a separate computer. In fact, much work in this field can be done with no robot at all! Powerful versions of Logo (such as those for the Apple II and DR Logo for the IBM PC) provide the list-processing environment as well as a "screen robot" called the turtle. Various obstacles can be programmed to appear on the screen, and the turtle can be made to move in response to an adaptive control program. One can monitor the robot's behavior just by watching what happens on the display.

Of course, the real fun comes when a set of programmed behaviors is tried on a real robot. Some of the funniest things I have seen have come from watching an android behave "strangely." How do you respond, for example, to an android that moves partway down an otherwise empty hallway, stops, turns to face a blank wall, and starts talking to it? Androbot founder Nolan Bushnell has suggested that robot personality is actually a collection of program bugs.

While androids for the consumer market are just now a reality, one might well ask how they will be used. Fortunately, we have over 40 years of science fiction stories to help answer these questions. Androids can be used for tasks as diverse as helping with the grocery shopping, "watching" the children for a few hours, greeting guests, patrolling the house at night – the list is endless.

It is important that we all become sufficiently familiar with the capabilities and limitations of androids and robots to be able to use them effectively. Far from being menacing machines that deprive people of their livelihood, domestic robots and androids have the potential to enhance our lives in many ways. The extent to which they do rests largely with us, for *we* will write the programs that will shape the "behavior" and "personalities" of these creations. ©



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# THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

*This month we'll continue with our overview of the major categories of personal computer programs.*

## Artificial Worlds

A *simulation* is a dynamic model of something, a special kind of imitation of reality. Movies imitate images and sounds, but they aren't really simulations because the events are laid out in a pre-determined sequence. No matter how many times you see *Star Wars*, the princess is always captured and taken to the Deathstar. If you had a *Star Wars* simulation, events would be unpredictable – you might be able to rescue her and even lead the Rebel Alliance to a final victory.

Simulations, then, are full of *variables*, events that can change. And computers are ideal tools for constructing webs of interrelated, fast-acting variables.

"Spreadsheet" programs, like the popular *VisiCalc* financial simulator, allow you to make up lists of related items and then create interrelationships between the items. For example, you could enter all your normal expenses and link them to your income (as a percent of it). Then you could give yourself a simulated "raise" in the model by just typing over the previous income figure. All of the related items would then adjust, changing to respond to the new amount of income. It's like a spider web hit by a drop of water: some items change, some stay put. But by touching one part of the web, you can send vibrations throughout the whole structure. Like reality, a single action can cause multiple effects, and then these new changes can, in turn, cause further changes.

As the price of computer memory continues to fall, we will be able to create or buy simulations of ever-increasing delicacy. When you have enough interrelated events, you've built a *world*. In fact, many of the popular computer "adventure" games (where you explore a forest, a castle, or a cave, looking for treasure) are just such world simulations. Modelling will likely be a major computer application in the future. A simulation of sufficient complexity would be indistinguishable from reality.

## Languages

Languages are another major category of personal computer programs, but many people don't realize that languages are, themselves, programs.

They're large, but they *are* programs.

Most versions of BASIC use up about 8K (roughly 8,000 bytes) of the computer's memory. Another 8K is devoted to the "Operating System" which looks after such things as communication with peripherals like printers, video management, and so forth.

You use a *computer language* whenever you need to communicate with a computer (this communicating is usually called *programming*). Languages like BASIC are programs to help you write other programs. There are dozens of languages you could try, but BASIC is by far the most popular and is available on almost every home computer. In fact, it's usually built into the computer so that when you turn it on, BASIC is waiting for your instructions.

There are other languages, though, and each has its own attributes and uses. Languages do differ: some are better suited to specific tasks than others. For example, *Pascal* is often favored by teachers because it emphasizes certain standardized rules of program writing. *Machine language* is the fastest-running language. *BASIC* is probably the easiest to learn. *Forth* is faster than BASIC and can be the language of choice for certain game, graphics, or music programming. *PILOT* and *Logo* are popular introductory languages for children, but *Logo* can also be a powerful tool in the hands of advanced programmers. Languages like *FORTRAN* and *COBOL* have been popular in the larger machines called *mainframe* or *minicomputers*.

## Special Interests

Many programmers begin to specialize after a while. You might focus on writing games or graphics programs, and find that BASIC doesn't serve your needs as well as another language would.

Once you know BASIC fairly well, moving on to learn a new language is simplified. There are some underlying concepts such as loops, variables, and IF/THEN structures which are common to all computer languages. After you've grasped several of these main ideas, you'll quickly pick them up when you come upon them in a new language.

*The Beginner's Page*  
**COMPUTE!** Magazine  
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# PRESENTING THE REMARKABLE SV-318.



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COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	16K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	32K	15K
BUILT-IN EXTENDED MICROSOFT® BASIC	YES	YES	ADDITIONAL COST	NO	YES	ADDITIONAL COST
BUILT-IN RAM	32K*	48K	16K	64K	16K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	15	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	4
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 I/O	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY (LOW PROFILE)	256K	143K	96K	170K	N/A	170K
	YES	NO	NO	NO	NO	NO
CP/M® COMPATIBILITY (80 column programs)						
CP/M® 2.2	YES	NO***	NO	NO****	NO	NO
CP/M® 3.0	YES	NO	NO	NO	NO	NO

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.

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# Questions Beginners Ask

Tom R. Halfhill, Features Editor

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

**Q** When the new Atari 1200XL computer was announced a few months ago, Atari said it would be "software compatible" with the older Atari 400 and 800 models. Doesn't this mean that software which worked on the 400/800 should also work on the 1200XL? Then why won't certain cartridges for the 400/800 fit into the 1200XL's cartridge slot?

**A** To be fair, this isn't Atari's fault. But before we get to the cartridge question, let's define exactly what is meant by "software compatible," since this question is coming up frequently, too. And this definition applies to all computers, not just Ataris.

Atari 400/800 software is *upward compatible* with the new 1200XL. This means that programs written *properly* for the 400/800 also will run on the 1200XL – although the reverse is not necessarily true. If a program is specifically written to take advantage of the 1200XL's special features (such as the HELP or special function keys, or the 64K of memory), it probably won't work on the 400/800 unless adjustments are made.

But note that we said "properly written" software. Some programmers take shortcuts which can cause compatibility problems. Usually these shortcuts involve what are known as "illegal calls" to the computer's *operating system*. The operating system is a built-in program in all computers which does routine "housekeeping" tasks necessary to a computer's operation. Machine language programmers sometimes "call" routines built into the operating system to save themselves the trouble of writing similar routines. This is perfectly okay, except that these calls must adhere to certain rules to insure that the program will work on all future versions of the operating system. Atari's operating system manuals state that if these rules are obeyed, future compatibility is assured.

That's why some machine language programs won't run on all versions of Ataris – the programmer took an unauthorized shortcut. Several popular commercial games were affected in this way when Atari revised the 400/800 operating system about a year ago. Late-model 400/800s have a "Revision B" operating system which fixes a few bugs in the old one. The changes were subtle, but some programs which depended on the old operating system were rendered unworkable.

The 1200XL has a somewhat different operating system than the 400/800. Among other things, it includes the 1200XL's built-in diagnostics. Machine language programs for the 400/800 which call the operating system properly should have no trouble running on the new computer.

Now, as for the cartridges: it's true that some Atari 400/800 cartridges made by independent software companies will not fit the 1200XL's slot. However, all cartridges made by Atari *do* fit. The slots are identical, except that the 1200XL has less room around the opening (the 1200XL's slot is external, while the 400/800 slot is beneath the front hatch). Some independent software companies made their cartridges oversized, which is why they won't fit a new slot.

Probably these companies will issue new versions to fit the 1200XL. If you recently bought an oversized cartridge for a 1200XL, you may be able to exchange it. If you can't, the only solution is to take apart the cartridge. The "cartridge" is really just a protective plastic housing around a small circuit board. One screw or some glue usually holds it together. When the housing is removed, the board can be plugged into the slot. But do this only as a last resort, because it involves two dangers: (1) Exposed circuit boards are delicate and easily damaged by mishandling, and (2) if you accidentally manage to plug in the board upside-down, the board can be ruined. If you take apart a cartridge, we recommend clearly marking which side goes up (or forward in a 400/800), and fashioning some sort of protective cover out of cardboard or a flexible plastic cassette tape box.

**Q** I heard that Commodore recently introduced a new model computer called the "VIC-21," and that it is already being sold in

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some cities. What is the VIC-21? Why didn't we read about it ahead of time?

**A** Not to worry, we didn't let you down. There is really no such thing as a VIC-21 - even though a store in Boston started selling them a few months ago.

Confused? So were a lot of Bostonians. What happened is that a store began advertising a sale on the "VIC-21," which was really just an ordinary VIC-20 with a 16K memory expansion cartridge included. The package sold for about \$200. As a promotion, the store pasted stickers on the boxes which said "VIC-21" - apparently derived from the sum of 16K plus the VIC's built-in 5K of memory. When people started calling competing stores and Commodore about the "new computer," Commodore immediately disavowed any connection with the promotion. Although it has been hinted that someday Commodore may upgrade the standard VIC, possibly with 16K, no such plans have been announced.

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## TWILIGHT OF THE COMPUTER HACKER

*Fred D'Ignazio, author of the popular **COMPUTE!** column, "The World Inside The Computer," begins a second column this month called "On The Road." He will travel around the country visiting user groups, workshops, seminars, conventions, or anywhere else computers are having an impact on everyday life.*

---

This month I begin a new column.

My assignment: To go on the road, living the life of a carefree wanderer; to seek out computers and people; to write about the good things or the bad things – whatever I find.

### The Twilight Of The Hacker

My first journeys as a gypsy computer reporter were brief and confined to my home city of Roanoke.

The first place I visited was the monthly meeting of the Roanoke Area Computer Enthusiasts (RACE). The meeting was held on a weekday evening in the Roanoke Valley Science Museum. I went to the meeting with great enthusiasm because several members planned to demonstrate a full-blown VIC-20 system (it occupied almost half the table). I especially wanted to see the demonstration because I will soon be writing a "kids and computers" column on the VIC-20 (and Commodore 64) in the new *COMPUTE!'s Gazette* for Commodore magazine.

The VIC-20 demonstration went fine. And we were also treated to a detailed description of RACE's current project – a homebrew computer modem. But what really impressed me was the club itself and the people who formed it. The club was small, old, almost exclusively male, and made up of computer hackers, people who enjoy rolling up their sleeves and diving into the bits, bytes, chips, and circuit boards that make up the average computer.

The evening was solid technically, and the people were all very nice, but I left the meeting feeling a little drained and lethargic. The club members called themselves "enthusiasts," but where was their enthusiasm?

Computer "hackers" were the pioneers of microcomputing. They were the enthusiasts – the zealots, even – who got this industry started, in the 1960s and the 1970s. Now we're in the mid-1980s, and what has happened to the hackers? They're the computer elders who are being shoved aside by a stampeding horde of new personal computer users who seem to share none of their characteristics.

### Enter The Computer Humanists

What are these new personal computer users like?

To find out, I went to two recent events – the Computer Faire the following Saturday and Sunday at the science museum; and the "Computers in the Schools" conference at Hollins College, just outside Roanoke.

The best way to describe the new personal computer users is to say that they are the kind of crowd you'd find at a Roanoke bowling alley on a Friday night – only more diverse. There are a lot of them. And they are young, old, and in between. There are lots of women and lots of kids.

The new personal computer users talk funny, almost like regular people. You don't hear a lot about bits and bytes. Instead, you hear about computer model numbers. And computer components. And computer software. Most of the discussion centers on who has what piece of new software for which machine, and how it's the "neatest thing you've ever seen."

Another thing that distinguishes this new group from the old-line hackers is their energy. Everyone is so excited. Parents are excited about bringing all the new educational programs into their homes. Kids are excited about the games.



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To score, you have to  
burrow deep. Deep  
into the caverns.

You craftily cop a dozen  
jewels. Then, jump to the ledge  
below. Then down to another. And  
another. But, STOP!

There's nothing but an abyss  
below. Nothing for you there except  
a bad fall—and even worse, delay!

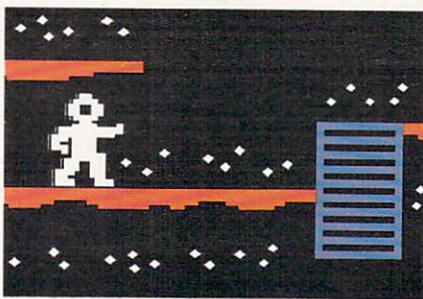
No, don't  
go there.  
You've already  
stripped that  
vein of diamonds.  
Go where no one  
has ever dared  
venture before.

Follow the caverns.  
Deeper and deeper.

Down the ladders. Over to  
the right—more jewels...and  
CURSES!...you've fallen.  
And you're losing time.

Grab those diamonds.  
Ah ha! You've reached 1000!  
The Flame Spirit has been set free.

Now you must capture it.



Quick—down another ladder.  
Listen!

Ghostly music  
floating  
through the  
black tunnels.  
That means  
the Flame Spirit  
is hiding nearby.



The music grows louder as you  
draw closer.

Now softer (quick, go back the  
other way). Louder again. Shine your

flashlight.  
The Flame Spirit  
is very near.  
A flicker. Out of  
the corner of your eye.  
Shine that light!

There  
it is. Now,  
kneel  
before the  
Spirit and  
grab it.  
Gotcha! Run!  
Run to the  
Temple. Watch out! Behind you!

A vampire bat trying to  
steal the Flame Spirit. Climb down,  
below the ledge. Another bat!

Down. To the very bottom of the  
mountain.

To the pit. And the darkness.

Lit only by the shimmer of  
diamonds. Suddenly there's a rush of  
movement... a giant spider—after you.



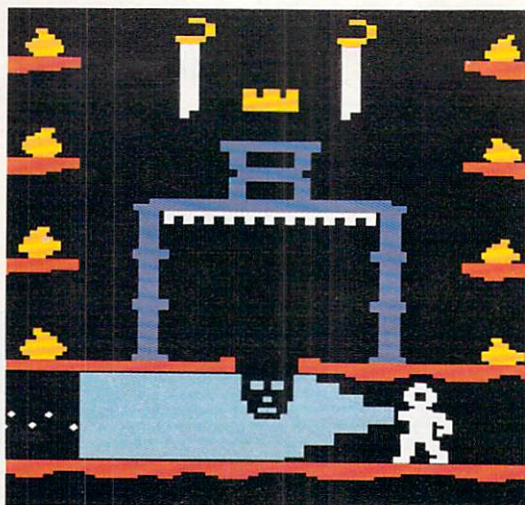
Run. Jump. Up to the ledge. Hurry!  
Jump again!

Aarrrrggggghhhh! You're caught.

Woven in a tangled web. Hurry,  
break loose before he returns and  
you're devoured.

Ah! You've freed yourself. You've  
lost time, but you've gained character.

Now, on to the Temple.  
But beware of the guardian flames—one  
false move and you'll end up charred  
...and out of the game! Get to the  
Temple Portal, the Spirit in your  
grasp. Shine your light on the giant  
guardian skull. You kneel. (Not out of  
respect, but out of need—for without



kneeling,  
entering the  
Temple is forbidden.)

The entrance yawns  
open. And you leap in. There,  
enshrined deep within the

sacred Temple,  
emblazoned  
with gold, is the  
sovereign  
crown. You must  
get that crown.  
Without it, you  
cannot become

Mountain King. With it, you'll rule.

But now comes the tough part.  
Can you make the treacherous climb  
back to the surface? Can you  
avoid the relentless bats and  
spreading cave fires on the  
way? Can you even find the way?

Get Mountain King.™ Plug it  
into your home computer. It will  
plunge you into the depths, and lift  
you to the heights.

#### ANOTHER GAME TO DIG INTO.

It's Boulders and Bombs.™  
One to four can play. And with  
99 levels of terrific tunneling  
adventure, it's every bit as involving  
as Mountain King.

Your challenge is to tunnel to  
safety beneath the surface of an  
unknown planet as hostile, alien  
vultures seek to turn you into a  
buried fossil, entombed in an alien  
life form.

While day turns to night above  
ground, you use your trusty roto-  
auger to claw a path to safety  
below ground—through tons  
of earth, boulders, and the  
ever-spreading green  
cave fungus.

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available soon for  
Commodore 64™  
and VIC-20™)

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"Commodore 64" and "VIC-20" are  
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Machines, Inc.

Fortunately,  
you can unearth  
time bombs along  
the way to blast away  
the hazards the vultures  
toss at you.

But the crawling fungus  
spreads as time runs out.

Now that you know the names of  
these challenging new games, and  
you know what it's like to play them,  
there's one other thing you should  
know:

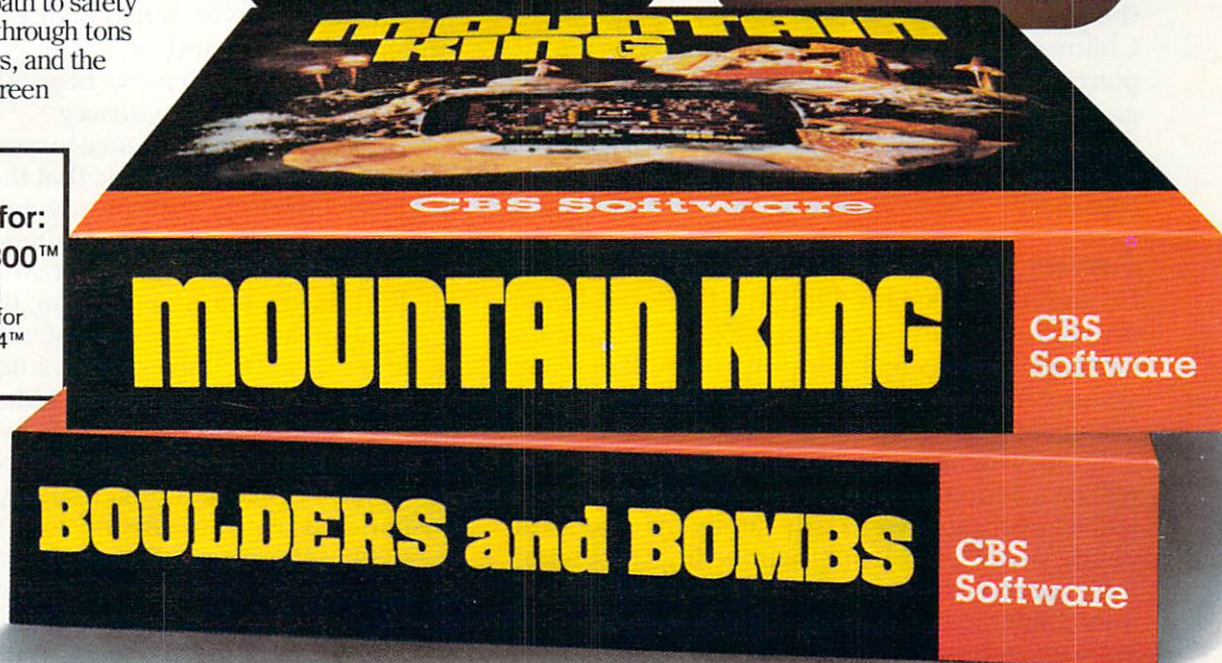
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about quality entertainment,  
we haven't mentioned it until now.

Because  
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we believe our  
computer programs should  
speak for themselves.

#### NEW! MOUNTAIN KING



#### NEW! BOULDERS AND BOMBS



**CBS Software. You know what you're getting.**

Teachers are excited about the ways they can use the computers in their classrooms. I sensed some fear and anxiety in this group, too – a certain tentativeness about really moving into this strange new world. But mostly I sensed excitement – a lot of it.

And the questions. Here is where the computer hackers and humanists diverged completely. The hackers asked how soldering on certain boards is done and about which section of memory is switch selectable. The humanists asked how computers for very young kids would alter the way kids develop their fine motor skills and the way that they get along with other people.

For example, I conducted a workshop at Hollins College on "Computer Literature." During the workshop a man raised his hand and said, "I am an artist and a teacher. I teach elementary school children how to paint and draw. If little children learn to paint beautiful pictures on a computer just by pressing a couple of buttons, how will they ever learn to draw on paper?"

How do you answer a question like that? I didn't try, but other people in my workshop did. One woman, an elementary school teacher, said, "Who cares if they draw on paper? In the future, no one will be using paper. They will be using TV screens for everything. They are the new medium for creative expression, not paper. Kids have to learn how to do this to be prepared."

Another teacher disagreed. "If kids only learn how to push buttons," she said, "they'll never develop their bodies. Their gross and fine motor skills will never be developed. These skills are crucial to a child's becoming an adult."

Another teacher added, "And what about the pleasure children have using art materials? Children who only work with TV screens and plastic buttons will never know the joy of using gooey fingerpaints, and clay, and paste, and making cutouts out of construction paper. It doesn't sound modern to me, it sounds deprived."

### **Jiminy Cricket The Computer**

During the workshop, I told the teachers about my concept of the "Computer Friend." I said that I thought all personal computers would one day assume human-like qualities and become intimate friends of their human masters.

One teacher applauded this prospect. "This will be a boon for human relations," she said. "It will let everyone, especially family members and young people, work out their feelings first with their computer. If something is troubling them, they don't have to keep it bottled up inside them. They can tell their computer friend. Then, after the matter is aired, they understand it more clearly, and they feel better about it and can ap-

proach members of their families and other human beings. A lot of situations are like powder kegs, ready to go off. Maybe the computer friend will help defuse them."

This point of view was echoed by another member of the workshop, who said she thought the computer friend might be like Pinocchio's friend Jiminy Cricket. The friend could be a person's conscience. The friend would hear a person's deepest secrets, his darkest and most whimsical fantasies and wishes.

At this point, two teenage girls raised their hands. "All this sounds dangerous to me," one of the girls said. "If computers are so friendly, they might lure people away from interacting with each other."

"She's right," said the other girl. "How can a human being be as patient as a computer friend? How can a person give another person their undivided attention the way a computer friend can?"

"And what about babies and toddlers?" added a woman teacher. "They may learn early in their lives to relate to a computer friend. But the friend may become a substitute for other people. This could stunt a child's ability to get along with people around her. Her earliest model for socialization wouldn't be a person, it would be a computer."

### **Computer Intimacy Vs. Computer Literacy**

In one of our workshop discussions, I questioned the big focus on computer literacy. I said that computer literacy was fine now while we were still in an age of transition from a non-computerized society to a completely computerized society. In the future, however, when people have fully accepted computers and when computer technology has matured, we will move beyond computer literacy into computer *intimacy*.

I compared my audience to computer hackers, and said that it was obvious that the change from literacy to intimacy was already occurring. People were worrying less how computers worked and more how to "drive" computers the way they might drive an automobile. Also, they were showing concern about the impact of such a powerful technology on their lives, their students' lives, and the lives of their children. I likened introducing a computer into people's lives to sitting behind the wheel of a powerful race car. The car can take you places at breathtaking speeds, but, if mishandled, it can maim and ruin.

Computers are not a technology of the body but a technology of the mind. As carriers, amplifiers, and multipliers of symbols, concepts, and ideas, they are far more powerful than automobiles. Whether they cause us to benefit or suffer depends on how we use them. ©



# IS GRIDRUNNER™ UNBEATABLE?

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

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

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

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# HOW TO BUY THE RIGHT PRINTER

Charles Brannon, Program Editor

You discover bugs (errors) in your 50-line BASIC program. If you could only see more than 20 lines at a time! You use your computer to keep track of your record collection, but realize that the valuable information on your TV screen is transient – erased when you “Press RETURN to Continue.” You subscribe to a telecommunications network and despair when your hard-earned 300-baud text scrolls off the screen into oblivion. You may feel that you need a permanent record of your text, want to write (word process), or hang your artistic efforts on the wall.

Even though prices are falling, a printer *is* an investment. Your printer could cost more than your computer. After you’ve realized you need a printer, you need to decide how much printer power you require.

## Applications

First you should identify your application. Do you need only paper listings of your programs? Simple “printouts” from your home financial program? Will you want to use your computer for word processing? Do you need to print on plain paper, on special forms, or to produce extra-wide accounting reports? Consider also the fact that as you expand your computer system, your needs could change. Does a certain printer have enough features to be satisfactory in the long run? Remember that most printers cannot be expanded as easily as computers can.

## Printing Techniques

Printer manufacturers have come up with many ways to solve the problem of getting words onto paper. The most obvious method is similar to the way that typewriters print. A formed character “stamp,” usually made of metal, is struck against a ribbon that leaves an impression on paper. On a typewriter, a series of levers controls which character hits the paper. IBM invented the “type ball,” a hemisphere containing all the characters in various rows. To print a letter, the ball turns and tilts to select the right letter, then the whole ball strikes the ribbon.

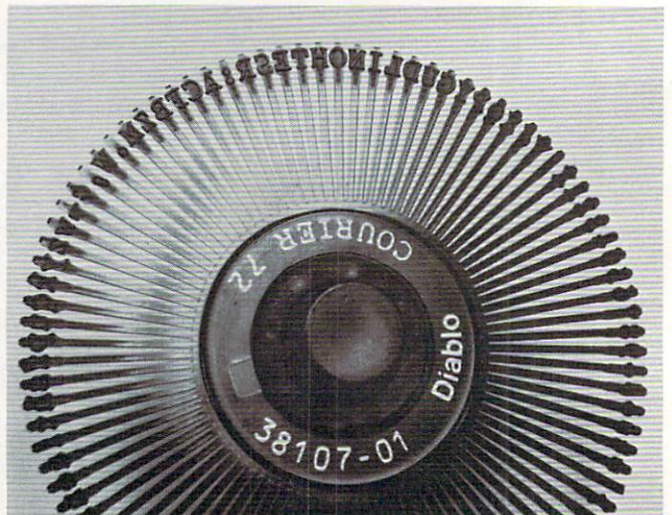
It is not easy to interface a computer with a typewriter. First, typewriters are not built to tolerate continuous operation. Second, some of the



Close-up of an IBM Selectric ball. Some electronic typewriters can also function as computer printers with the proper interface.

interfaces are cumbersome and expensive, usually a series of solenoids that push the levers around, or a keyboard overlay with a separate solenoid for each key to mimic a human typist. The third problem is speed; you still can't drive the typewriter faster than about ten characters a second.

The old-fashioned typewriter layout is prone to jamming; the type ball is too slow. Printer technology diverged to solve the problem. *Dot-matrix* printing was developed as an appropriately digital way of producing text. The *daisy wheel* was developed as a high-speed, reliable way of printing formed characters.



Some letter-quality printers are called “daisy wheel” printers because they use a print head shaped like a daisy with letters on the ends of the petals.

# GROW WITH US.

VIC 20™ and Commodore 64™ expansion products from Micro Systems Development.

**A** The Interbus Series. Three interfaces for the VIC 20 and Commodore 64: one for IEEE 488, one for RS 232 and one for Parallel.

The VIE and CIE are IEEE 488 interfaces for the VIC 20. When plugged into the expansion port, the cartridge is "transparent," that is, the user can still attach other peripherals without any interference. Devices such as 4040, 8050, 2031, 2032, 4022 and 8023 can be controlled. The IEEE software can be called by using the 'SYS' command, even in the middle of a BASIC program.

The V232 and C232 are serial interface cartridges which allow connection of various input/output devices such as printers, modems, plotters, etc. to VIC 20 or Commodore 64 computers. Features include: positive and negative voltage swings to meet full EIA standards, straps and jumpers to allow reconfiguration to meet pinouts for any RS232 device, and software selectable reconfiguration such as baud rate, parity, and duplex mode.

The VPI and CPI are parallel interfaces for the VIC 20 and Commodore 64. These interfaces provide direct BASIC use of the parallel printer bus and give "invisible" access to the bus. The VPI can be used only on the VIC 20 and uses the expansion port. The CPI will work with both the VIC 20 and Commodore 64 and does not use the expansion port. The CPI also has switches for setting insertion or deletion of line feed, conversion of Commodore ASCII into standard ASCII or visa versa, addresses printer to device 4, 5, 6 or 7, and allows normally unprintable Commodore characters to be printed in a recognizable form.

**B** Expandoport Series. Expandoport 3 and Expandoport 6 are three- and six-slot expansion boards for the VIC 20. Each slot on the Expandoport 6 has a switch for controlling power to that connector. The switch allows the use of cartridges which respond to the same memory space. The Expandoport 6 also has a fuse and reset switch. The fuse prevents excessive current drain from the VIC 20 and protects it from 'shorts'. The reset switch allows the user to 'Restart' the VIC 20 without turning power off. This feature allows RAM, which is located in the ROM expansion area, to be protected during 'Restart'.

Expandoport 4 is a four port expansion board for the Commodore 64. It has the same features as the Expandoport 6 and even allows for the use of varying width cartridges.

**C** Terminal Pak Series. The VTE 40 Terminal Emulator (VTE 40) is a hardware and software package which converts the VIC 20 into a 40-column communications terminal. The VTE 40 cartridge is complete. Various set-up parameters such as baud rate, parity, duplex, and bits per character can be selected through a 'menu' format. VTE 40 features are: 40 x 25 text display, user definable communication specs, smooth or normal scroll, print information to printer or disk, generation of control codes, selective omission of data, continuous status line.

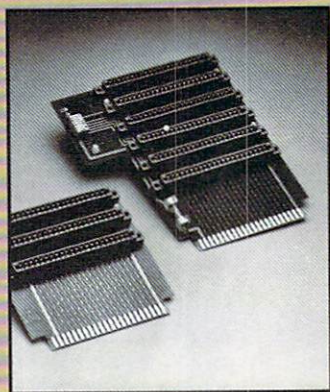
The CTE/VTE Terminal Emulator (CTE/VTE) is a software program which converts the VIC 20 or Commodore 64 into a terminal. The user can 'software select' the baud rate compatible with the modem used. Full upper and lower case characters are supported.

**D** Audio Link. An audio cassette adapter interface for the VIC 20. Features include: use of regular cassette recorders, conversion of VIC 20 digital data to audio and visa versa, normal and inverted cassette signal, remote on/off control and control of external devices.

**E** VRAM. These memory expansion modules are designed to provide additional user programming space for the VIC 20 system. VRAM plugs into the memory expansion port and requires no additional power or modification to the VIC 20 system. The units are packaged as 3K, 8K, 16K and 24K modules. Strapping is provided for mapping 8K blocks of memory into the various available memory blocks.



**A** Interbus Series.



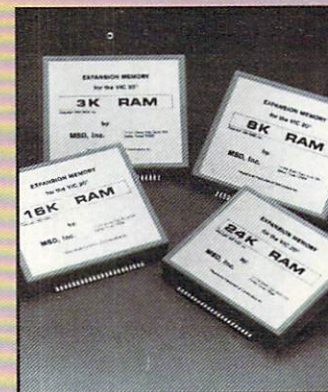
**B** Expandoport Series.



**C** Terminal Pak Series.



**D** Audio Link.



**E** VRAM.

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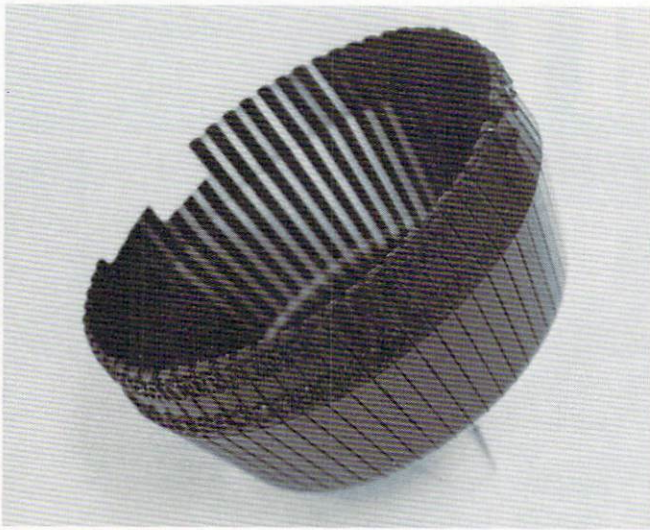
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Some letter-quality printers use a "thimble," a variation of the daisy wheel.

## Dot Matrix

Take a look at the characters your computer displays on your TV screen. Each one is made of tiny dots, usually within an 8 x 8 box. Figure 1 shows a typical *dot matrix* representation of the letter "A". The dots are formed by a sweeping electron beam in your TV tube. Dot-matrix printers also use a series of dots to form characters.

The heart of a dot-matrix printer is the *print head*. Imagine it as a series of vertically stacked pins (see Figure 2). Each pin can be "fired" independently. To print a line of text, the print head sweeps across the paper. Characters are not formed "all at once," but one vertical line at a time.

There are several ways to print on the paper. *Impact* printers strike the pins against a ribbon to leave an impression on paper. *Thermal* printers use a column of tiny "spark plugs" to electrically vaporize (burn off) a special aluminum coating on thermal paper so that a black surface under the



A print head from a dot-matrix printer. The ends of the tiny wires which form the characters are barely visible at the front-center of the print-head.

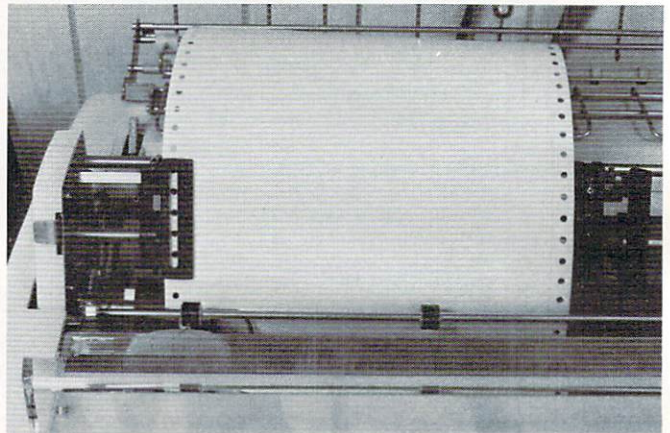
aluminum will show through. *Ink-jet* printers spray ink through tiny holes.

Each dot-matrix method has its advantages and disadvantages. Thermal printing is much quieter (and cheaper) than impact printing. Some thermal printers are virtually silent. Ink-jet printers are even quieter, but their price places them outside the home computer

market for now. Impact printers, despite their sound and higher price, do not require special thermal paper. Another disadvantage of thermal paper is that it does not age well. It oxidizes over time and darkens appreciably.

## Friction Vs. Tractor

Also borrowed from typewriter technology, a *platen* is found in most friction-feed printers. The pressure of the rotating cylinder feeds single-sheet or roll paper. Unfortunately, friction-fed paper is subject to slippage and skewing. After ten forms, your printer may no longer be lined up with the paper. Skewing varies; some printers have excellent friction feed. However, the reliability of a tractor feed mechanism is generally superior for processing multiple forms. The "teeth" of a tractor feed mechanism fit into small holes on each side of the paper and pull it through the printer. Tractor feed is more expensive and requires continuous special pinfeed paper. However, the strips of holes can be detached and the paper separated into 8½" x 11" sheets.



A tractor-feed printer with its toothed wheels and perforated paper. (The right-hand tractor is unlatched.)

## Print Quality

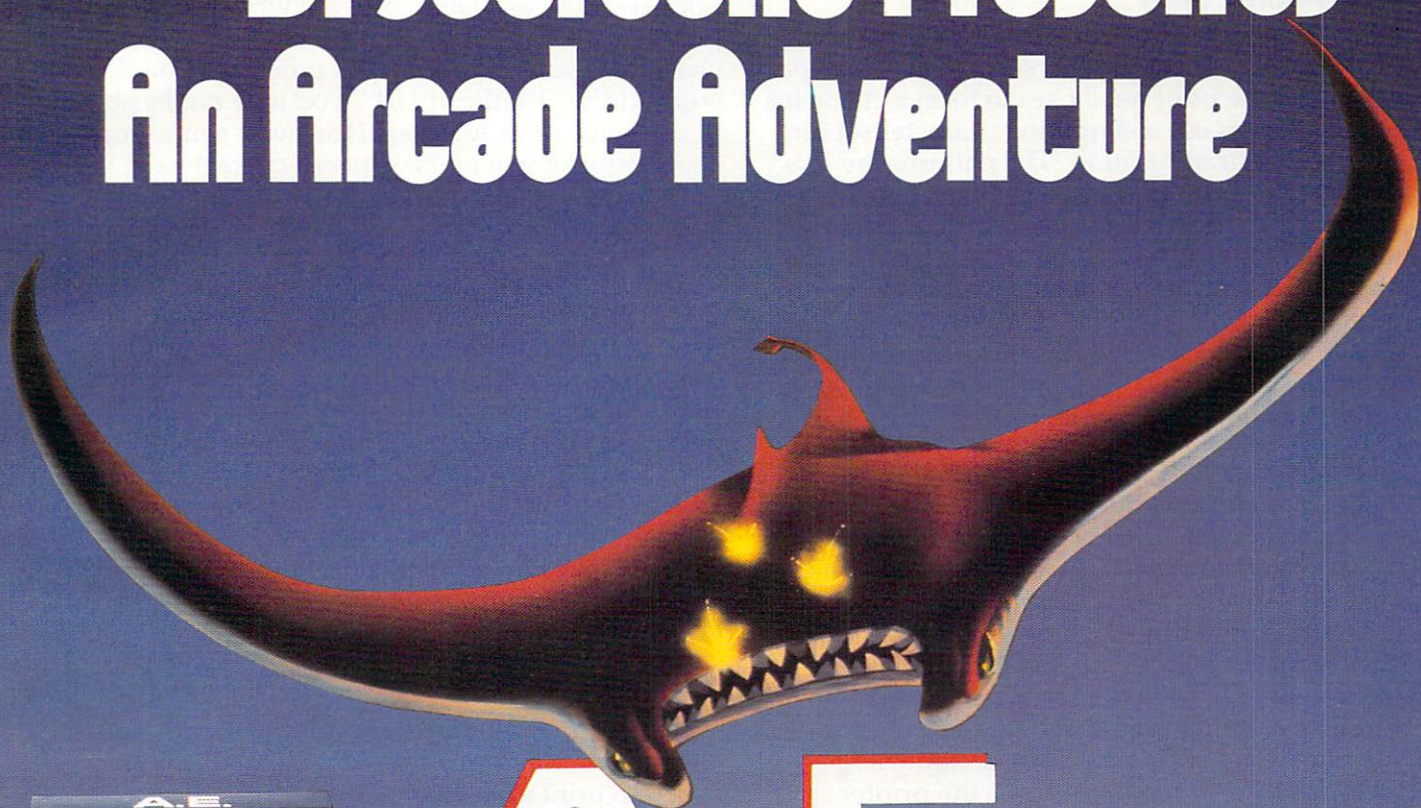
Obviously, formed character printers (daisy wheels) produce the best-looking text, indistinguishable from a typewriter. This is important for business, where the "computery" style of dot matrix is often unacceptable for letters. Some dot matrix printers, however, have exceedingly fine print quality. This is called *correspondence quality*, and can approach a typewriter's quality.

Correspondence quality printers space the dots closer together. A 5 x 7 character matrix is standard on average dot-matrix printers, but correspondence quality printers use 9 x 9, 9 x 14 (or 9 x n, where n can vary), or even higher densities.

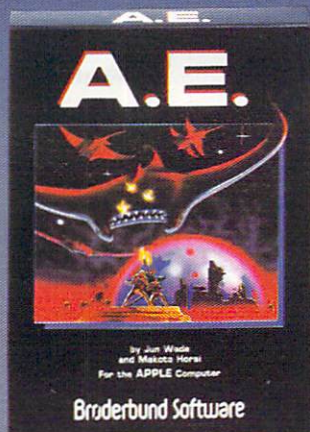
Related to dot density are lowercase descenders, the "tails" on the letters g, j, p, q, and y. A 5 x 7 matrix is not really adequate for good descenders, which should extend at least two dots below normal letters. See Figure 3 for an example.



# Broderbund Presents An Arcade Adventure

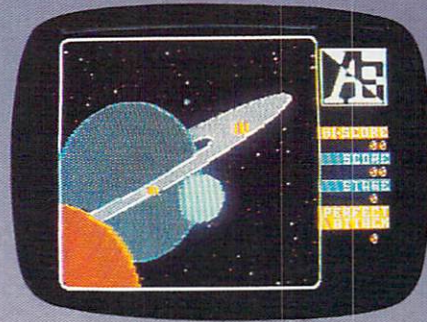
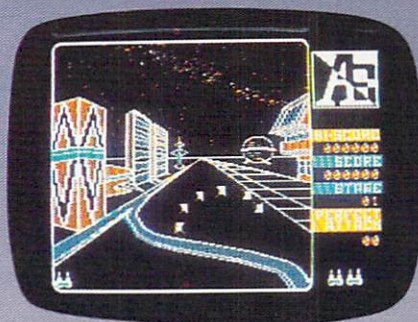


# A.E.



A.E.'s, produced by an industrial giant to control pollution on Earth have slipped quality control. They attack relentlessly in waves from the sky. Your mission: to drive them farther and farther into space. With each successful defense, you are transported to another, then another more distant 3-D environment. With these progressively difficult scenes, A.E. delivers the ultimate challenge.

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Descenders can make text easier to read, and if you do a lot of proofreading or copy-editing, this can make a difference.

## Character Sets

Every printer has a slightly different typeface, or character set. The character set is the various patterns that the print head uses to form a character. Some printers use a simplified character set for high-speed draft printing. The patterns are less dense. However, that same printer might also offer high-quality dot-matrix printing, but at a lower speed. A printer should have upper- and lowercase, and all the normal symbols found on your keyboard. Some printers have special line-drawing graphics characters or foreign language symbols. Compare sample printouts from several printers when making your choice.

## Variations

Dot matrix printers can also perform special tricks with the characters. They can elongate (print twice as wide) and condense (twice as small). Some printers can automatically underline text, others have horizontal or vertical tabs, or can double-strike or print in boldface. Printers can also vary the height of a printed line. Most printers are able to *form feed* (automatically advance to the top of the next page). This is done by sending a special message from your computer to the printer.

## Graphics

In addition to printing predetermined patterns (ordinary numbers, letters, etc.), some printers also let you control the print head directly to create your own custom graphics. You can create special symbols. And you can "dump" (copy) graphics from your computer, if it has a high-resolution screen. High-resolution is measured in dots-per-inch or dots-per-line. You may not need more resolution than your computer has. If your computer can display 320 dots per line, you won't necessarily need a printer's capability to print 960 dots per line. One caveat of high resolution is speed; the more tiny dots you have to control, the more data needs to be sent. You may require a special machine language routine to effectively

use dot graphics, so check what's available before buying.

## Printer Software

Look over the available software which is compatible with the printer you're considering purchasing. If your favorite word processor doesn't support the "FastPrint 110," you may not be able to use some of its features. However, some word processors let you embed special characters in your text to control any printer.

## Speed

Generally, dot-matrix printers are fast – 60 to 80 characters per second (CPS). Letter quality printers (daisywheels) run from 25 to 50 CPS. Some low cost daisywheels print at around 10-14 characters per second, so consider your patience threshold before you buy. Several tricks are used to increase *throughput*. Time normally wasted during the carriage return, when the print head has to travel from the end of a line back to the beginning for the next line, can be used by printing backwards on the return. This is *bidirectional* printing, and can speed up overall output significantly.

Another trick used in conjunction with bidirectional printing is *logic-seeking*. A logic-seeking printer attempts to print the shortest line. If necessary, the print head may return at high speed to print a short line. Some printers, especially daisy wheels, also boast space skipping. This is most useful when the printer fills in blanks on a pre-printed form. Instead of advancing at a uniform rate, the printer counts all spaces received, and then quickly jumps directly to the next non-space printing location.

## Random Access Printer

To free up the computer while the printer is zipping away, some printers contain an internal *buffer*. A buffer is just RAM memory, like your computer's RAM, but is inside the printer. The buffer accepts characters from your computer as fast as the computer can send them. It then feeds the characters to the printer at a more leisurely pace. If the buffer is large enough, your computer will be available almost instantly for other non-printer

Figure 1: Dot Matrix

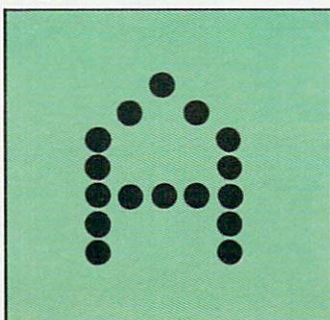


Figure 2: Print Head

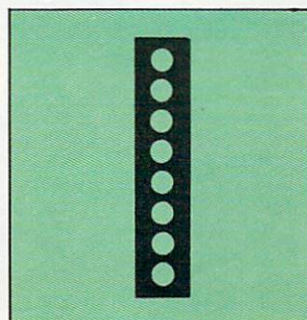
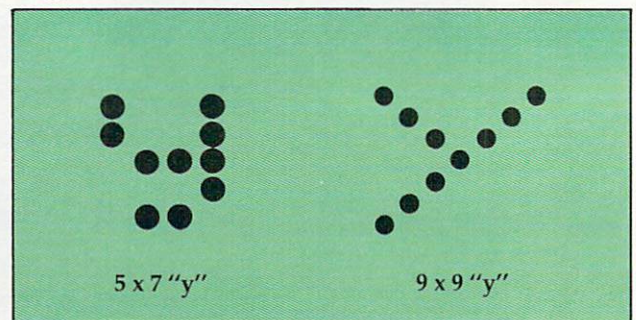
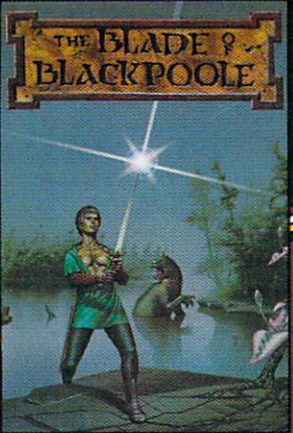


Figure 3: Descenders



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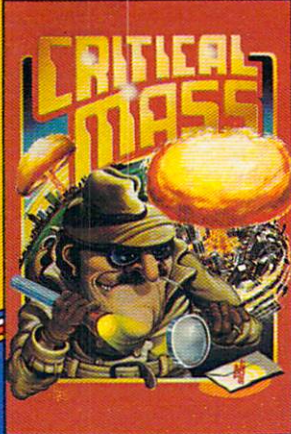
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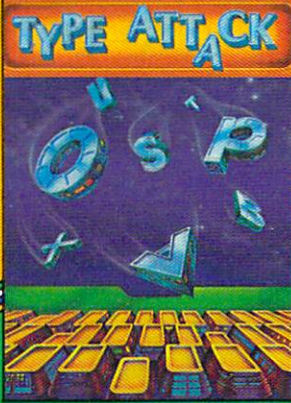
AN ILLUSTRATED ADVENTURE

## Critical Mass

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

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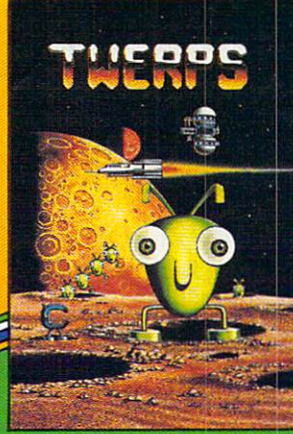
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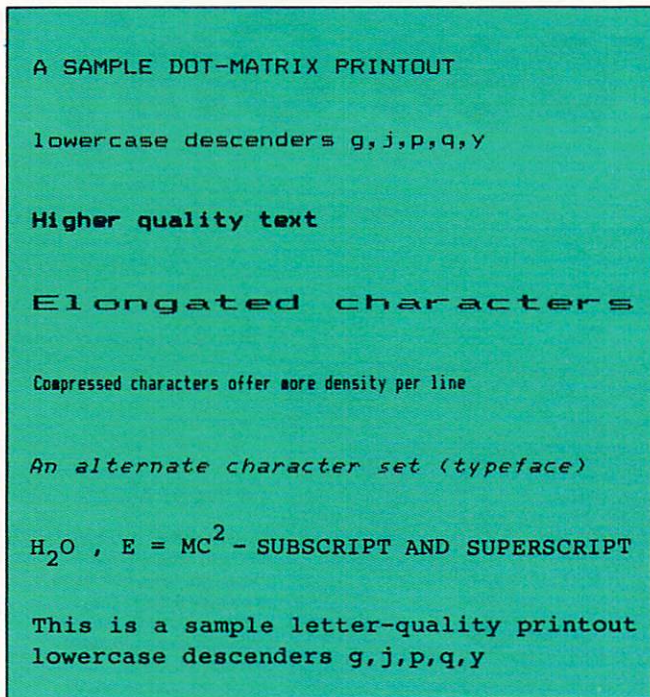
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**Figure 4: Sample Type Styles**



tasks while the printer is printing. Almost all printers have a one-line buffer, but some printers have 4K, 16K, or even 64K buffers! Also, some manufacturers market add-on buffers that attach between your computer and the printer.

## The Interface

Most computer manufacturers have a line of "official" printers. These are usually relabeled versions of other commonly available printers. Sometimes, the company that made your computer customizes the printer to add extra functions, or just a built-in interface. If you are buying a printer from a third party vendor, you may need a special cable or interface.

The two most common printer interfaces are Centronics parallel and RS232C serial. Many home computers use a proprietary (non-standard) input/output port and special cables. This does not lock you out from other printers if an "interface box" is available. You plug your computer's special cable into this "black box" and run a cable from the interface to the printer. Some interfaces also perform intelligent tasks, such as code translation, if your computer does not use the standard ASCII code (a convention for sending text as numbers).

## Print Width

Most printers can print 80 columns per line, although some can squeeze in condensed characters in 132 character lines. Some printers have an extra-wide carriage. There are also 40-column and 32-column printers. If you plan to do word processing, you'll need an 80-column printer, since it matches normal 8½" x 11" paper. Forty-column printers aren't as common as they once were,

since 80-column printers have become less expensive. If you are interested in screen dumps and program listings, you need a width equal to your computer's display width (22, 32, or 40 columns).

## More On Daisy Wheels

A daisy wheel printer prints by rotating a small metal or plastic disk with characters on long spokes, or petals. A hammer strikes the petal against the ribbon and paper. A variation on the daisy is the "thimble," where the petals are curved up into a cup, with the hammer in the middle of the cup. There are more moving parts and more metal and plastic in a letter quality printer than in a dot matrix or thermal printer.

When you're shopping for a letter quality printer, see how many type styles are available. Also compare ribbon prices. Some daisy wheels can even superscript and subscript (roll the paper up or down half a line), type in boldface or "shadow," or even plot graphics using a period as a dot. Some lower price daisy wheels can mimic the features of their "big brothers," using the same daisy wheel elements and ribbons.

If you want to add the valuable features of word processing, or want convenient hard copy at any time, a relatively small investment in a printer can change your whole outlook on your computer system. ©

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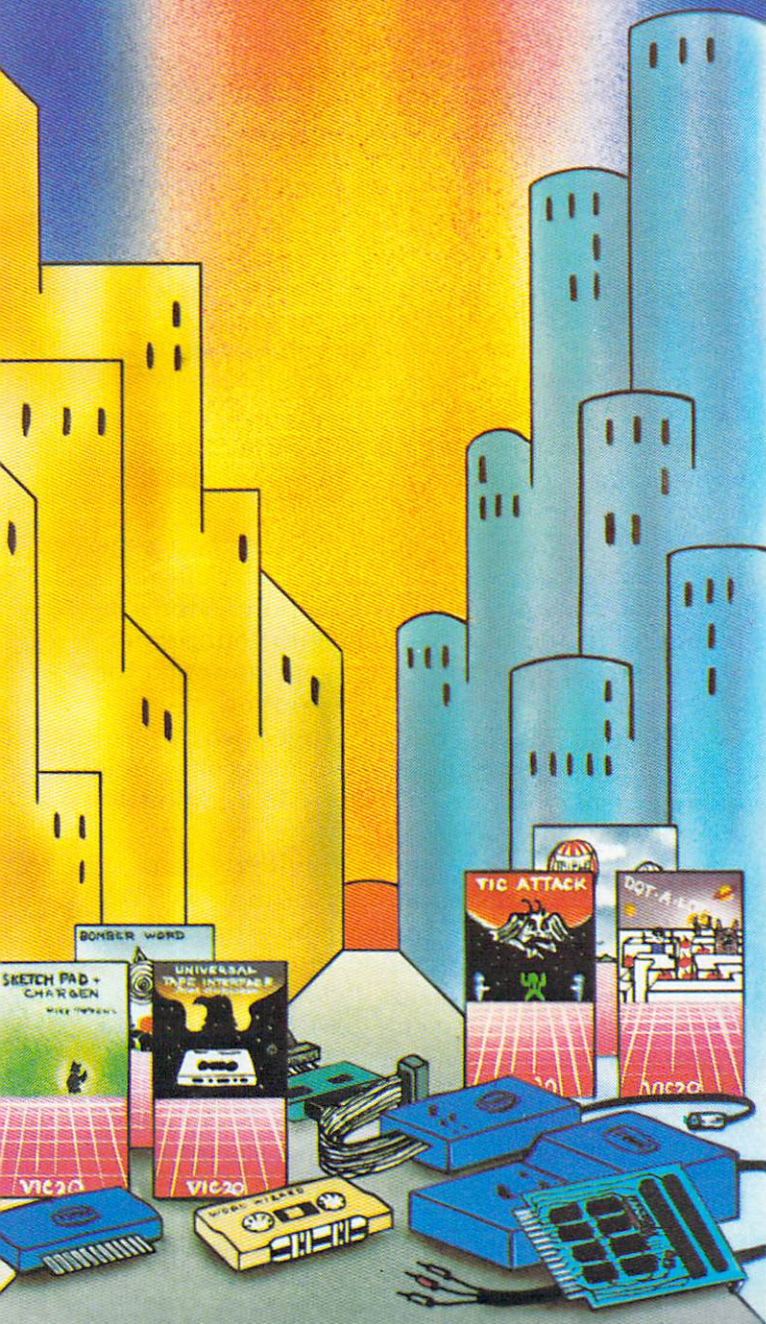
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# The New, Low-Cost Printers

Kathy Yakal, Editorial Assistant

*You no longer have to pay more for your printer than you did for your computer. There are now a number of good, low-cost printers that offer many of the features found in more expensive models.*

---

If you've been putting off buying a printer because they're too expensive or they're too big, ugly, and noisy or there aren't very many to choose from — it could be that you just ran out of excuses.

Your best approach might be to ask yourself a few questions first so you don't find yourself buying a printer that goes beyond your needs or, worse yet, one that you'll outgrow in six months. If you're not sure what questions to ask, or if you want to familiarize yourself with the mechanics of these machines, see Charles Brannon's article in this issue on choosing the right printer.

## The \$500 Cutoff

In this article, we'll be dealing with a group of printers in the under-\$500 price range. A year ago, that would have been a pretty short list. Many of these printers are new; the others have recently come down in price enough to be included.

What can you reasonably expect from a printer in this price range? More than you might think. You wouldn't necessarily want to use one of these models for business correspondence, but they would certainly suffice for personal correspondence, record-keeping, printing your own programs, and other personal uses.

As for features, there's no need to think that you can't expect a reasonable number of features found on more expensive printers. You just won't find as many. But several printers in this price range offer bidirectional printing, upper- and lowercase characters, some graphics capabilities, and at least one good interface. Also, most of these printers will accommodate full-size paper and offer a choice of friction or tractor feed.

## Peripherals For Your Peripherals

When you bought your home computer, you might never have dreamed that you would need more than 8K RAM. If you found, a few months down the road, that you really did need it, you bought additional memory.

Likewise, it is possible to expand the capabilities of many printer models *after* you've bought them and used them awhile. You might find that a one-line buffer is so limiting that it's tying up valuable computer time or that your friction feed printer does not allow you to print long documents continuously without stopping to feed more paper into it. Or you might buy a new computer that does not have the appropriate interface. Such situations can be resolved. You'll have several options.

As for an additional buffer, this can be accomplished with a *data buffer*. A data buffer pulls the stored information from your computer, stores it within itself, and feeds the data into your printer at a measured pace, freeing up your computer for other uses while your printer is printing.

The Quadram Microfazer is one such device. The Microfazer plugs into a Centronics-compatible interface, and will give you up to 64K additional memory for under \$300.

Another is the Microbuffer from Practical Peripherals. The Microbuffer comes in three models. One fits the Apple II and can be expanded up to a 64K buffer. Another model interfaces with Epson printers and contains up to 16K, although it reportedly will soon go up to 64K. The third is a stand-alone model, which fits virtually any printer/computer combination that has the correct interfaces; this model contains 256K buffer. Microbuffers come with RS-232 and Centronics parallel interfaces and retail for under \$300. All of these units are stackable.

Adding tractor feed to your friction feed printer

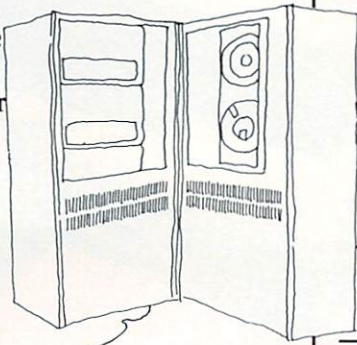
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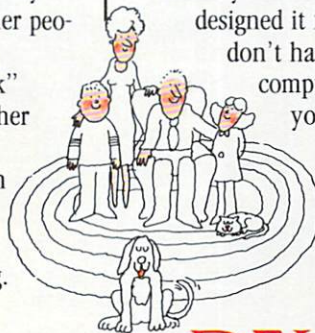
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# What the home computer was really meant for.

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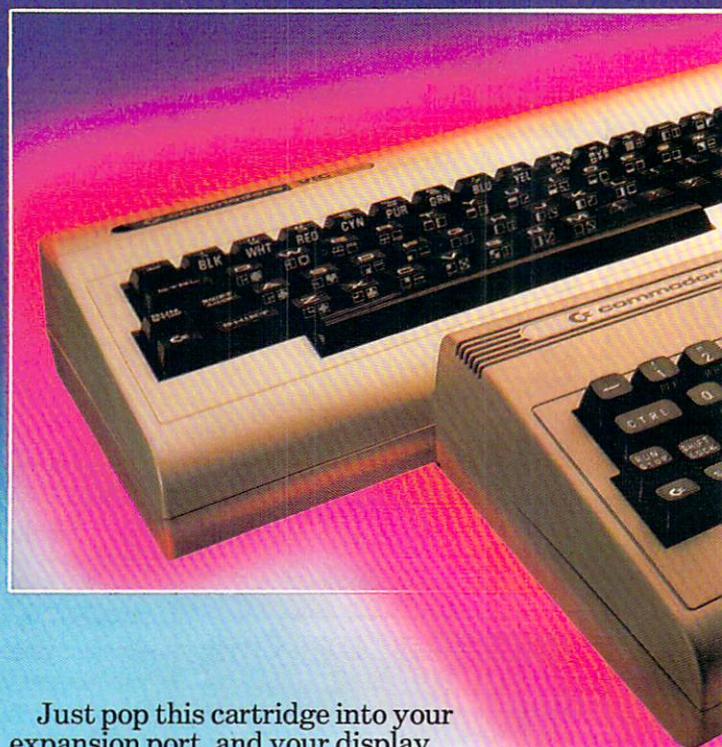
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**New! Our lowest priced VIC 20 VIDEO PAK ever.**

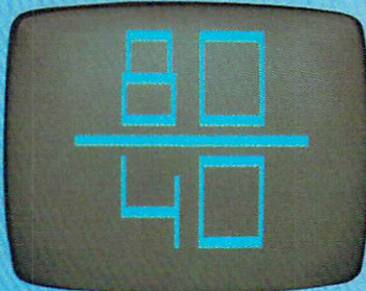
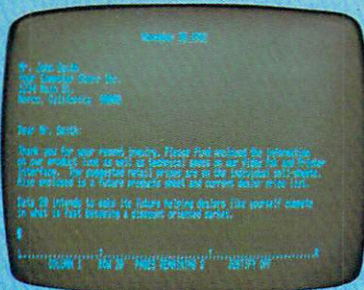
We've just introduced a highly cost-effective 8K version. Price it out!



Just pop this cartridge into your expansion port, and your display instantly goes to the industry-standard 24 lines, with a choice of 40 or 80 characters. Displayed this way, you'll know exactly what you're going to get on the printout. And you really increase the amount of data you can see on the screen.

You also increase memory in the process—to 12K to handle more sophisticated functions. Our package includes a terminal emulator and screen print feature. Plus the free WORD MANAGER software package!

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





# FOR BOTH COMMODORES



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

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

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



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

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

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



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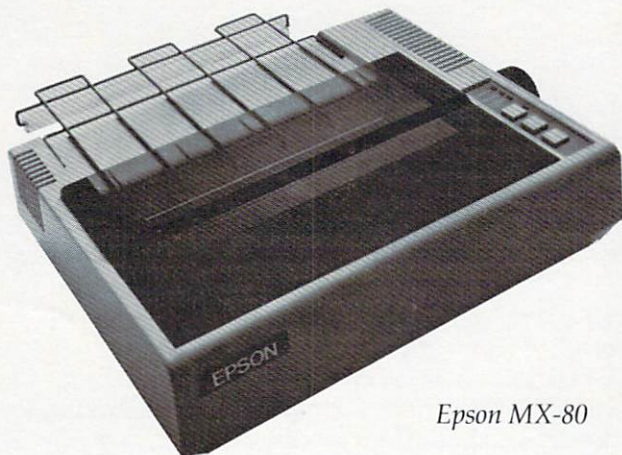
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is not a problem in most cases; several computer manufacturers offer snap-on tractors at a fairly low cost. Nor is altering your interface capability generally much of a problem.

## Many Choices

In the following printer descriptions, we will describe the specifications and special features of each machine. This should help you to compare these models to your needs and budget.



*Epson MX-80*

## Epson MX-80

Of the Epson models in the MX Series, the MX-80 falls in our price category, retailing at \$494.

One standard feature of the MX Series is Graftrax Plus. Epson has upgraded this graphics chip from the original Graftrax included in earlier Epsons; the chip can be added to an older model. Graftrax Plus provides a considerable variety of graphics capabilities. It allows graphics configurations of up to 120 dots per inch horizontally and 72 dots per inch vertically. It also has an italics set and 66 possible variations of print characters, if you count all of the script variations.

The MX-80 can print a full 96-character ASCII set in upper- and lowercase. Characters are formed in its standard 9 x 9 matrix, though that can be emphasized and even double emphasized in a 9 x 18 or 18 x 18 matrix. Characters per inch (cpi) range from 5 to 17.16, depending on which mode you're using, and characters per line (cpl) run from 40 to 132. The print head operates bidirectionally at a speed of 80 characters per second (cps).

You can hook up an Epson MX-80 to several different models of home computers via its Centronics parallel interface. A one-line buffer is standard, but the optional RS-232 interface comes with a 2K buffer. An IEEE488 interface is also available. The adjustable, tractor-type pin feed will accommodate up to 10-inch fanfold paper.

*Epson America, Inc.  
3415 Kashiwa Street  
Torrance, CA 90505*

## Radio Shack TRS-80 DMP-100 Dot-Matrix Printer

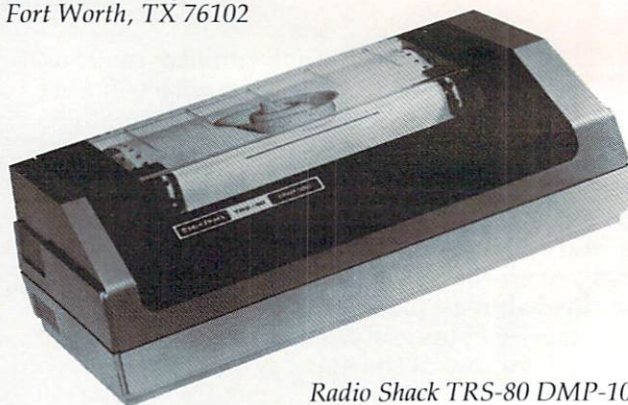
In December 1982, Radio Shack added a low-cost, dot-matrix printer to the growing list of TRS-80 microcomputer peripherals. Though Radio Shack has manufactured several printers for use with its personal computers, this is its first entry in the under-\$500 bracket.

The DMP-100's ability to print high-density, dot-addressable graphics is valuable for anyone interested in producing graphics on paper. Also, using an optional screen print program, the DMP-100 can produce detailed black and white graphics printouts similar to those on the TRS-80 Color Computer screen display. Its main character set can be expanded from 10 cpi to 5 cpi to create more readable copy.

The DMP-100's 80 upper- and lowercase 5 x 7 dot-matrix characters can be printed at a speed of 50 cpi. It has underline capacity and will take paper up to 9.5 inches wide. A buffer of 480 bytes is included with the printer, as is one ribbon cartridge. Selectable serial and parallel interfaces may be used to connect the DMP-100 to your Radio Shack computer.

The DMP-100 retails for \$499.

*Tandy Corporation  
1800 One Tandy Center  
Fort Worth, TX 76102*



*Radio Shack TRS-80 DMP-100*

## Printellex

About 2 inches high, 4 inches wide, and 8 inches long, the Printellex manages to pack many features into that small space. It retails for \$145.

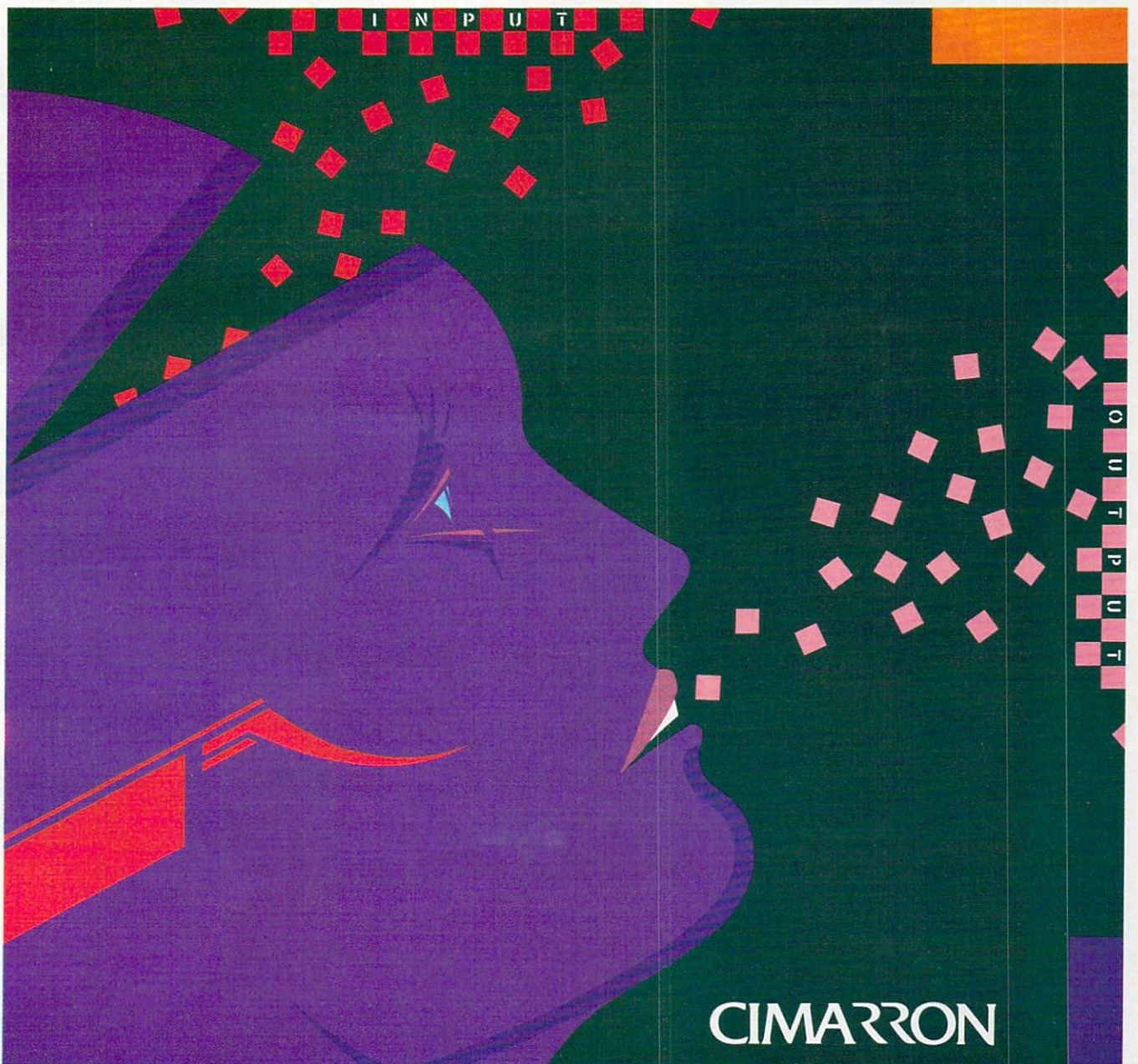
The Printellex will not print on full-size paper. Its maximum paper width is 4.3 inches. And it's not an impact printer – it's *thermal*, so, although you won't have the noise of an impact printer, your paper costs will be higher.

The Printellex prints characters in a 5 x 7 dot matrix at the rate of 160 cps. It prints a standard 10 cpi for a maximum of 40 cpl. It prints graphics. It prints upper- and lowercase characters. It is not logic-seeking, but it does have a one-line buffer. Both right and left margins can be justified.

The Printellex has both a Centronics parallel

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Introducing the **Insta-Series** from Cimarron—**Instant Productivity Software** for the **Commodore 64** Personal Computer. **The Software System:** Insta-Writer, Insta-Mail, Insta-Calc, Insta-Check, Insta-Ledger, Insta-Sched, Insta-File, and proven Word Craft Ultra 64, DTL Compiler 64, and CMAR 64 are all available on **Diskette, Casette, or Cartridge**. This is a software system specifically designed for **Your Productivity**; manage information—**Instantly!** Call 714 662-2801 or contact the **Commodore Dealer** nearest you. **Insta-Series**—you're communicating with the future—**Now!**



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# Inside Apple

Apple Computer Inc., 20525 Mariani Avenue, Cupertino, California 95014

Vol. 1 No. 2

For the authorized Apple dealer nearest you, call 800-538-9696 (800-662-9238 in California.)

## 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.

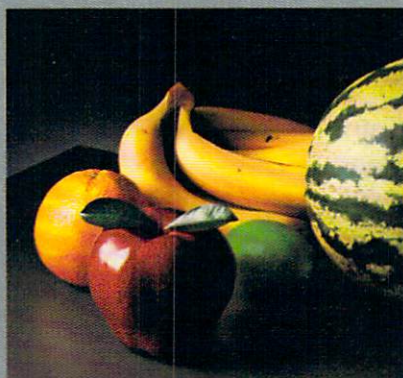
Thanks to those people — in hundreds of independent companies — you can make the humblest 1978 Apple II turn tricks that are still on IBM's Wish List for 1984.

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

For two very good reasons.

First, compatibility. We've created a totally kluge-free family of products designed to take full advantage of all the advantages built into every Apple.

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.

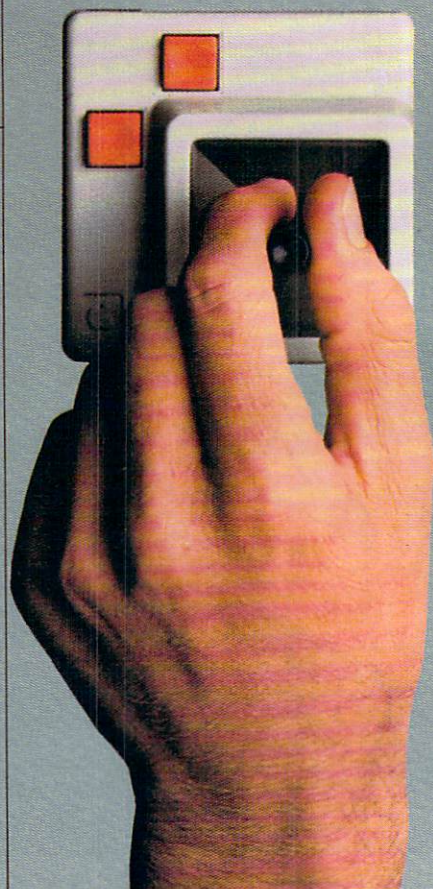
Why is it such a joy to use?

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.

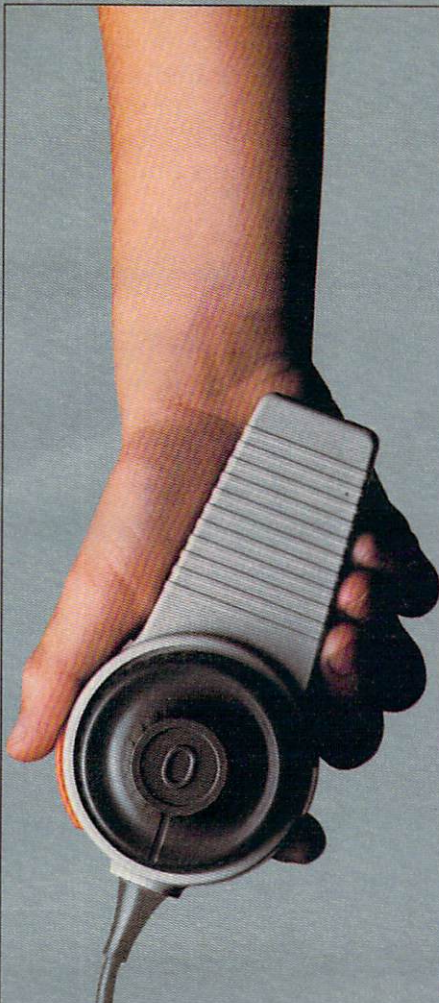
So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

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.

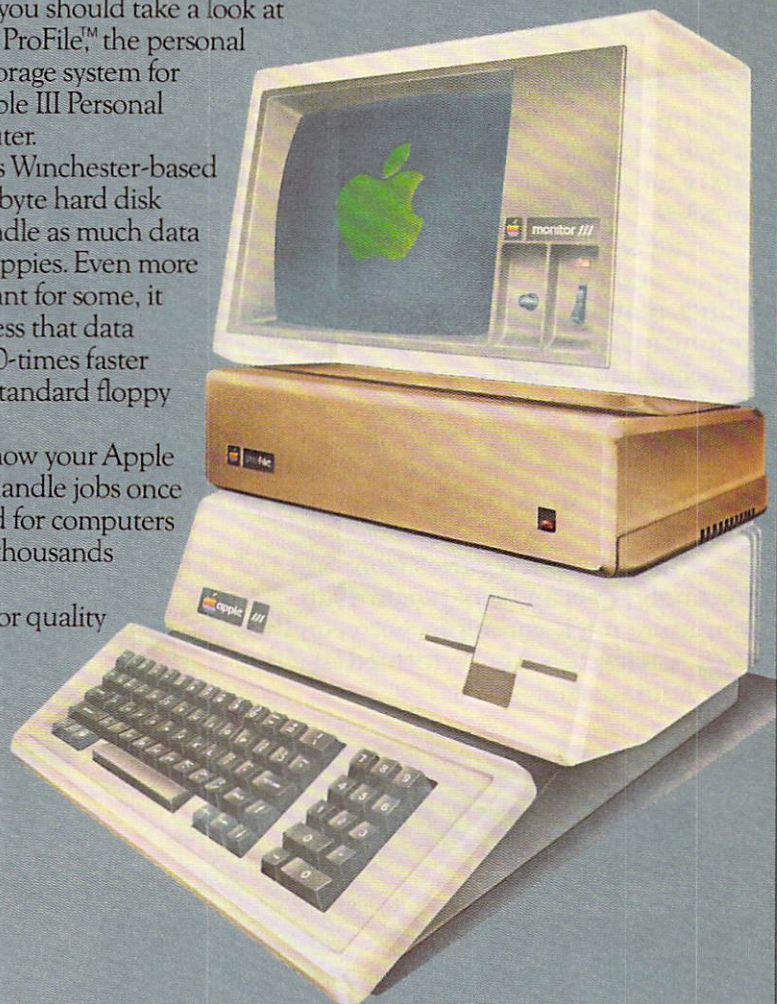
If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile™, the personal mass storage system for the Apple III Personal Computer.

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:

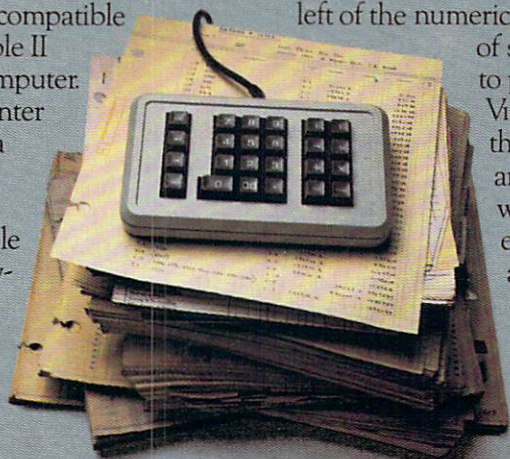
Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

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.



interface and an RS-232. Computer Peripherals, which manufactures the Printex, says that it is ideal for use with Sharp, Epson HX20, Atari, Texas Instruments, and Commodore computers.

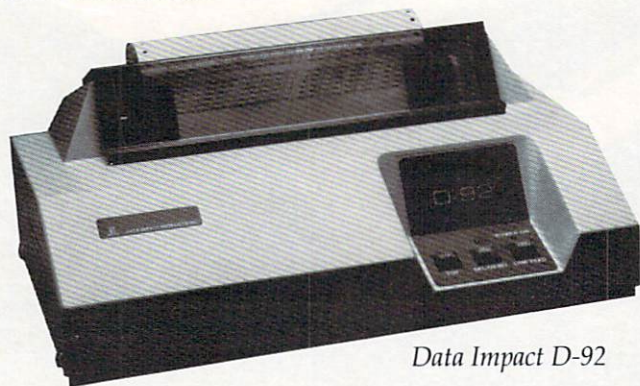
*Computer Peripherals*  
1117 Venice Boulevard  
Los Angeles, CA 90015

## Data Impact D-92

Data Impact Products offers several add-ons, all of which can be purchased separately for under \$100 each. The printer itself, the D-92, retails for \$399.

The D-92 is 100 cps, bidirectional. It can print upper- and lowercase, but has no graphics capabilities built in. A chip allowing dot-addressable graphics is available for \$30, and is easily installed. Another add-on will expand the standard 800-character buffer to 2K. The D-92 comes with a standard friction feed that will accommodate up to 8.5-inch paper. You may also purchase a tractor feed for up to 10-inch paper or a single sheet feeder as options.

Character pitch varies from 5 to 16.5 cpi; accordingly, cpl can be between 40 to 132. There are four more pitch variations between those boundaries. Characters can be formed in either a 7 x 9 or 11 x 9 dot matrix.



*Data Impact D-92*

The Data Impact D-92 can be interfaced with a number of popular personal computers via its Centronics parallel interface. An RS-232 serial interface is also available as an option for \$40.

*Data Impact Products*  
745 Atlantic Avenue  
Boston, MA 02111

## Okidata Microline 80

Okidata manufactures a number of printers that cost more than \$500, but has recently come out with a machine that retails for \$449 – the Microline 80. The ML80 can be interfaced with the Radio Shack TRS-80, Apple, IBM, and several other popular home computers through its Centronics-compatible interface.

The ML80 can print its 7 x 9 dot matrix characters at 80 cpl for standard size print and 132 cpl

for condensed print. It can produce double-width characters at the rate of 5 cpi. Depending on the type of feed used (friction and pin are standard, a snap-on tractor is optional), up to 9.5-inch paper can be used. Up to 64 block shapes can be printed for graphics printing.



*Okidata Microline 80*

The manufacturer claims that the ML80's print head, operating at a speed of 80 cps unidirectional, will have a life of more than 200 million characters. Short, low-mass pins are used which are made of an extremely hard alloy.

The ML80 uses a spool ribbon. No buffer is included, but it is available through an interface.

*Okidata*  
111 Gaither Drive  
Mt. Laurel, NJ 08054

## Timex/Sinclair 2040 Thermal Printer

In the first quarter of 1983, Timex Computer Corporation entered the personal computer printer market with its TS2040. This 32-column thermal printer is compatible only with Timex/Sinclair's two low-cost computers, the TS1000 and TS2000, and it retails for \$99.95.

Measuring 4.2 x 14.7 x 12 inches and weighing not much more than this magazine, the TS2040 can be hooked right up to your TS home computer by means of its Z-80 I/O port. It has graphics and text capabilities in two different modes: full-



*Timex/Sinclair 2040*

screen printing with single-key command, and a program-controlled printing mode which allows custom control of the printing format.

6 x 6 dot-matrix characters are printed at a rate of 64 cps; at a pitch of 10 cpi, a total of 32 cpl

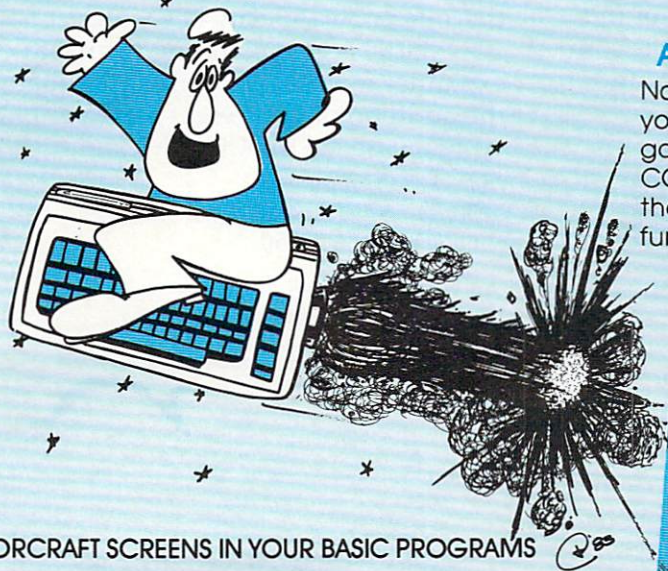
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MEDICAL	50	150	100
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can be printed on up to 4.3-inch wide paper. There is one character set that can be printed in upper-case only.

The TS2040 features a specially designed housing to achieve quiet operation.

*Timex Computer Corporation  
Waterbury, CT 06720*

## Commodore 1525P

Commodore offers two under-\$500 printers. Three, if you count the new four-color printer/plotter that retails for \$199.95 (see last month's **COMPUTE!**). The other printer, the 4022, is compatible with the Commodore CBM Series and retails for \$495.



*Commodore 1525P*

The VIC 1525P is compatible only with the VIC-20 and the Commodore 64 via a serial bus. It retails for \$395 and runs at a speed of 30 cps.

The 1525P can print ten 6 x 7 dot-matrix cpi, up to a maximum of 80 cpl. It is capable of printing upper- and lowercase characters, and graphics. The print head is unidirectional.

A one-line buffer is standard on the 1525P. The built-in tractor feed will take up to 9.5-inch wide paper.

*Commodore Business Machines  
Consumer Products Division  
487 Devon Park Drive  
Wayne, PA 19087*

## Mattel Aquarius Thermal Printer

One of the many peripherals designed for use with the new Mattel Aquarius home computer



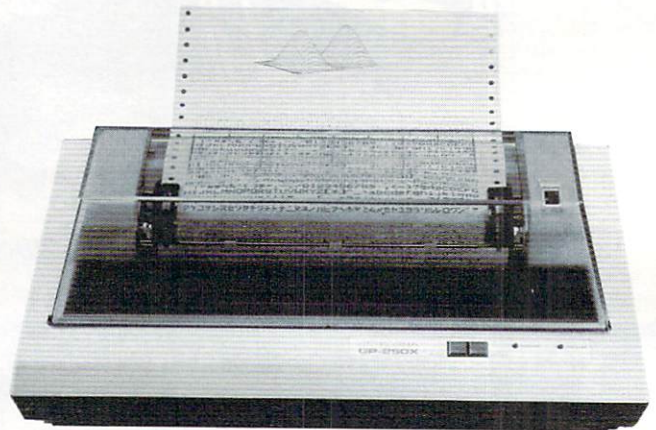
*Mattel Aquarius Printer*

system is its thermal printer. This is strictly a one-system printer; it connects directly to the Aquarius console without additional interfaces, as do the other Aquarius peripherals.

The Aquarius printer offers 40, 5 x 7 characters per line (10 cpi) at the rate of 80 cps. It is capable of printing 256 characters including upper- and lowercase letters, numerals, and special graphics characters. It also allows reproduction of graphics in the same configuration that appears on the computer screen. The printer will accept special thermal paper 4-3/8 inches wide.

Mattel is also planning to introduce a "master expander module" later this year that will allow the addition of up to eight more peripherals to the system (subject to FCC rules and certification).

*Mattel Electronics  
5150 Rosecrans Avenue  
Hawthorne, CA 90250*



*Seikosha GP-250X*

## Seikosha GP Series

The Axiom Corporation manufactures a large line of low-cost printers. The IMP-4 offers Quad Density Graphics Resolution, which allows up to 19,008 individual dots to be printed bidirectionally within a square inch.

The GP-100A and 250X, retailing at \$389 and \$499 respectively, both have dot-addressable graphics, though the 250X has a more advanced graphics mode. Both print 10 cpi, 80 cpl, and they both have tractor feeds that can work with up to 10-inch wide paper. The 250X can print double-height characters in addition to the standard and double-width characters available on both, and character modes can be mixed on the same line. Multiple copies are possible on both machines, one additional on the 100A, two on the 250X Graphics.

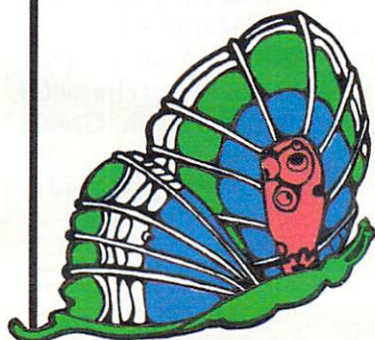
The 250X is faster than the 100A - 50 cps compared to 30. Two interfaces are standard, Centronics parallel and RS-232, and several more are available. There are 64 user-definable characters (384 bytes) which may be stored in the



# HAVE A PICNIC WITH THE VIC-NIC

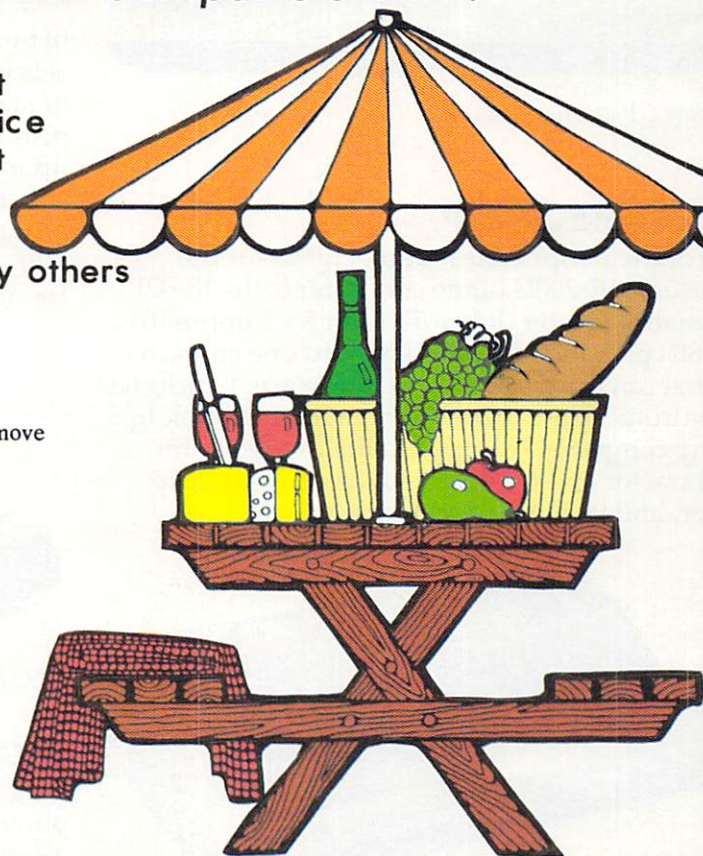


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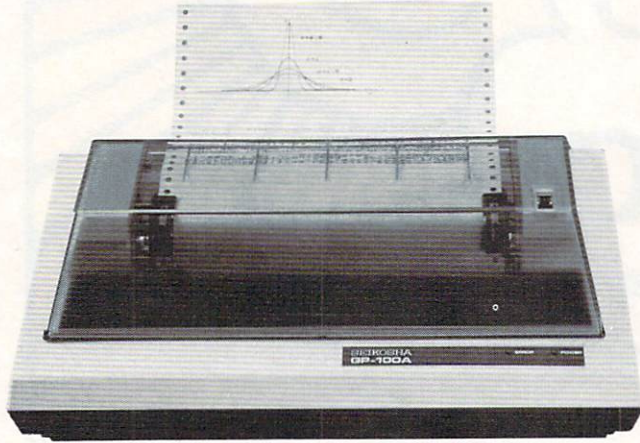
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printer's memory. That's in addition to the 80-byte standard buffer.

Both the GP100A and 250X will interface with several home computers, including the Apple, Atari, and Radio Shack.

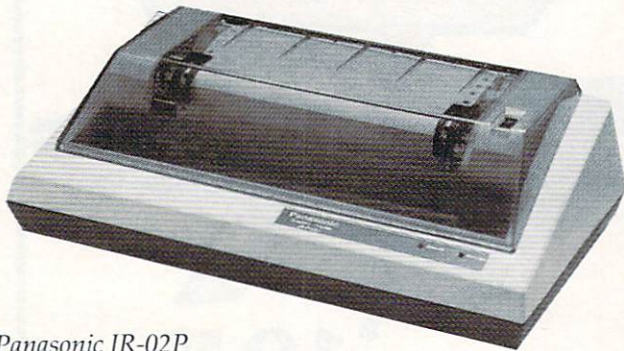
*Axiom Corporation  
1014 Griswold Avenue  
San Fernando, CA 91340*



*Seikosha GP-100A*

### **Panasonic JR-02P**

One of the peripherals manufactured for the Panasonic JR-200U home computer is the JR-02P dot-matrix printer. It features ten 5 x 7 dot-matrix cpi, 80 cpl at the rate of 30 cps; and one character set that can print upper- and lowercase. It includes a Centronics parallel interface, allowing hook-ups to any compatible computer, the capability for both tractor and friction feed for up to 10-inch paper, and 90 bytes of memory.



*Panasonic JR-02P*

There are also user-definable characters; the ability to repeat graphics or data patterns at the touch of a single button; same-line mix of characters, graphics, and double-width characters; and dot-addressable graphics.

The Panasonic JR-02P retails for \$369.

*Panasonic Company  
One Panasonic Way  
Secaucus, NJ 07094*



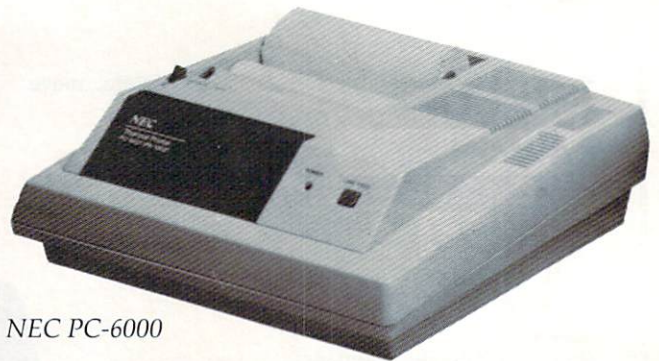
*Prowriter 8510-AP*

### **Prowriter 8510-AP**

Retailing at \$495, the Prowriter offers a standard pitch of 10 cpi for a total of 80 cpl. Its dot-matrix characters measure 7 x 9 and can be printed in upper- and lowercase. The printhead is bidirectional, and its standard friction and tractor feeds will accommodate up to 10-inch wide paper; paper can be cut off less than 1 inch from the print line. A Centronics parallel interface is standard.

The Prowriter prints at 120 cps. A full kilobyte of buffer is included. It boasts a variety of character sets including Japanese, German, Swedish, Greek, or standard English. High resolution graphic printing is possible; each 1 square inch can hold up to 144 x 160 dots. There are eight different character sizes.

*C. Itoh Electronics  
5301 Beethoven Street  
Los Angeles, CA 90066*



*NEC PC-6000*

### **NEC PC-6021 Thermal Printer**

Built to interface with NEC's PC-6000 home computer (though it does have a Centronics parallel interface), the NEC PC-6021 Thermal Printer provides printed copy of your programs and graphics. Its 5 x 7 dot matrix characters print at a speed of 40 cps; the maximum 4.5-inch thermal paper will accommodate 20 or 40 cpl. Upper- and lowercase printing is standard. It does have graphics capabilities, and has only one character set.

The NEC PC-6021 ("NEC TREK") is available at a retail price of \$249.95.

*NEC Home Electronics, Inc.  
1401 Estes Avenue  
Elk Grove Village, IL 60007*

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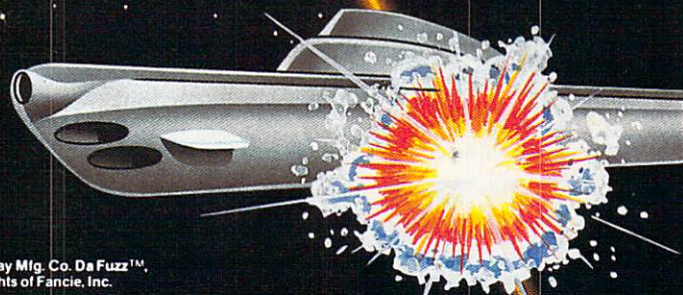
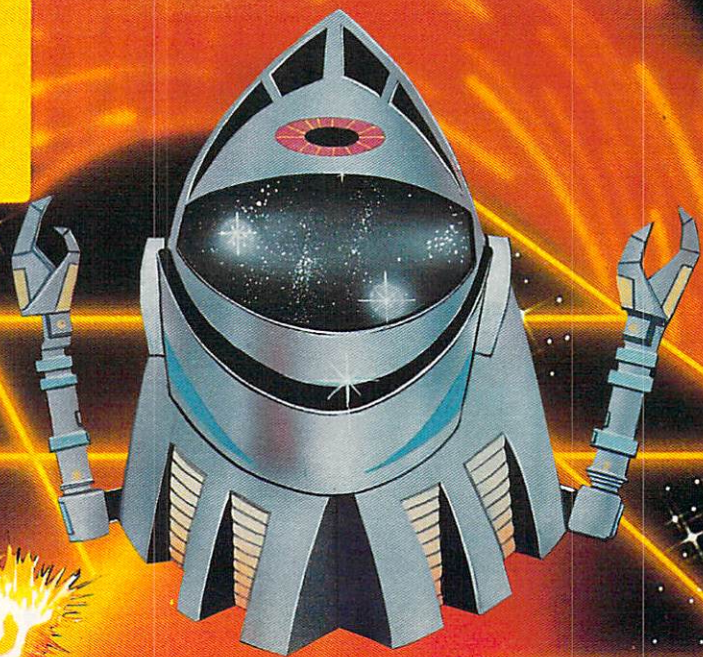
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## Alphacom 42 Thermal Printer

The Alphacom 42 Thermal Printer is a recent upgrade of Alphacom's VP42 printer. Two features have been expanded: interface capability and graphics. Where the VP42 worked only with the Commodore VIC-20, this new model will be able to interface with the VIC-20 and the Commodore 64, Atari 400, 800, and 1200XL, and Texas Instruments 99/2 and 99/4A. Cartridge cables, sold separately, will be required to attach the printer to each manufacturer's line of microcomputer. The Alphacom 42 also has higher resolution graphics than its predecessor.

At a speed of 80 cps, the Alphacom 42 prints forty 5 x 8 characters per line on 4.5-inch paper. One set of upper- and lowercase characters is included, as is a one-line buffer.

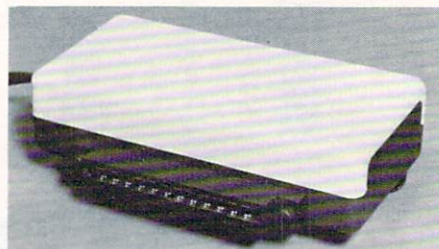
The printer and one cable will retail for slightly over \$200.

Alphacom  
2323 South Bascom Avenue  
Campbell, CA 95008

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02 110 PRINT"(DN)(C)1983
03 120 PRINT"(DN)SMART ASCII
04 130 PRINT"PRINTER INTERFACE."
05 140 PRINT"NOW CONNECT PRINTER."
06 150 PRINT"AND PRESS RETURN."
07 160 REM
08 170 PRINT"(RVS)READY?(rvs)"
09 180 REM
10 190 WAIT198,1:GETC%
11 200 IFC%(CHR$(13))GOTO190
12 210 REM
13 220 PRINT"TEST"
14 230 SYS 253+4096/34 red
15 240 PRINT"(HM)(RED)OK"
16 250 PRINT**,"PRINTER
17 260 CLOSE4
18 270 :
19 280 FORX=1TO1
20 290 IF2*2(
21 300 PRIN
22 310 P
23 320

```

**PRINT**  
the Unprintable

## with Smart ASCII

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## PRINT SPECIFICATIONS

## MECHANICAL SPECIFICATIONS

## ADDITIONAL CONSIDERATIONS

Name	Type Density	CPI*	CPL*	CPS*	Graphics	No. of Char. Sets	Upper/Lower Case	Interface	Ribbon	Bidirectional	Buffer	Retail Price †	Max Paper Width, in.	Add-Ons Available
Alphacom 42	5 x 8	10	40	80	Yes	One	Yes	Cartridge cable	—	No	One line	Under \$250	4.5	—
Commodore 1525P	6 x 7	10	80	30	Yes	One	Yes	Commodore serial bus	Spool	No	One Line	\$395	9.5	—
Data Impact D-92	7 x 9 11 x 9	10	80	100	(optional)	One	Yes	Centronics parallel	Cartridge	Yes	800 characters	\$399	8.5	RS-232 interface, 2K buffer, tractor feed, dot-addressable graphics chip
Epson MX-80	9 x 9	10	80	80	Yes	Two	Yes	Centronics parallel	Cartridge	Yes	One line	\$494	10	RS-232 interface with 2K buffer, IEEE488 interface
Mattel Aquarius Thermal Printer	5 x 7	10	40	80	Yes	One	Yes	None required	—	No	None	Under \$200	4 3/4	—
NEC PC-6021 Thermal Printer	5 x 7	10	40	40	Yes	One	Yes	Centronics parallel	—	No	No	\$249.95	4.5	—
Okidata Microline 80	7 x 9	10	80	80	Yes	One	No	Centronics parallel	Spool	No	None	\$449	9.5	Snap-on tractor
Panasonic JR-02P	5 x 7	10	80	30	Yes	One	Yes	Centronics parallel	Spool	No	90 bytes	\$369	10	—
Printexlex	5 x 7	10	40	160	Yes	One	Yes	Centronics parallel RS-232	—	No	One line	\$145	4.3	—
Prowriter (8510-AP)	7 x 9	10	80	120	Yes	Five	Yes	Centronics parallel	Cartridge	Yes	1K	\$495	10	—
Radio Shack TRS-80 DMP-100	5 x 7	10	80	50	Yes	One	Yes	Selectable serial and parallel	Cartridge	No	480 bytes	\$399	9.5	—
Seikosha GP-250X	5 x 8	10	80	50	Yes	One	Yes	Centronics parallel RS-232	Cartridge	No	80 bytes	\$499	10	Interfaces: external RS-232 with 2K buffer, cables for TRS-80, Atari, IBM, Apple (with Graphax software)
Seikosha GP-100A	5 x 7	10	80	30	Yes	One	Yes	Centronics parallel	Cartridge	No	None	\$389	10	Same as 250X
Timex/Sinclair 2040	6 x 6	10	32	64	Yes	One	No	None required	—	Yes	None	\$99.95	4.33	—

\* CPI = characters per inch;

CPL = characters per line;

CPS = characters per second

† Manufacturers' suggested list prices.

We have tried to be as comprehensive as possible. If any manufacturer has been left out, we regret the omission.

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# Using A Printer With The TI-99/4A

C. Regena

*These tips will give you a good start on adding a printer to the TI-99/4A. Here are the fundamentals from the RS-232 Interface to PRINT # statements.*

Texas Instruments has a thermal printer which attaches to the side of the TI. It is a small unit which uses a special thermal printer paper and can print a 30-column line. A number of other printers may also be used with your TI. Prices range from about \$500 on up. The cost depends on whether the printing is dot-matrix or letter quality, on various options available, and on how the printer is built. (For definitions of these terms, see other articles in this issue.)

To connect your printer to your TI-99/4A, you will need the RS-232 Interface. You may use either the "old-style" individual RS-232 Interface peripheral or the RS-232 Interface Card which fits in the TI Peripheral Expansion Box. You will also need a cable to go from the interface to the printer, and the cable should be sold with the printer. If you want to wire your own cable, the plug is a standard DB-25, and the pin connections are given in the manual that comes with the RS-232 Interface.

## Configurations

Manuals are important. The manual that comes with the RS-232 Interface describes how you list parameters for your "printer configuration" so you can give instructions to your computer to access the printer through the RS-232. The manual that comes with the printer should describe how to achieve various type styles (fonts) and how to set margins, line lengths, and the top of the form. Be prepared to spend some time experimenting with the different switches and features of your printer.

When you use the printer configuration in a command, it is set off in quotes. Parameters may be chosen for baud rate, stop bits, and number of nulls. Some examples are:

```
"RS232.TW.BA = 110" (teletype)
"RS232.BA = 600" (TI 825 or TI 840 printer)
"RS232.BA = 9600.DA = 8" (Epson MX 80)
```

One of the primary uses of a printer is to obtain a "hard copy" listing of a program. Using your own printer configuration in the quotes, the following commands may be used:

```
LIST "RS232.BA = 600"
    Lists whole program
LIST "RS232.BA = 600":-250
    Lists program lines up to line 250
LIST "RS232.BA = 600":300-330
    Lists program lines 300 to 330
LIST "RS232.BA = 600":700-
    Lists program from line 700 to end
```

Another valuable use for a printer is to print a report from your program. Before you print, an OPEN statement is necessary. The OPEN statement designates a device number and your printer configuration. You may have several devices, and you may number your devices in any order. An example statement is:

```
120 OPEN #1:"RS232.BA = 600"
```

After the OPEN statement, you may print to the printer by a statement such as:

```
130 PRINT #1:"MY NAME IS REGENA."
```

When you've finished printing or you're at the end of the program, you should close all devices. This can be done with the following statement:

```
550 CLOSE #1
```

Here is a short sample program that illustrates printing to a printer:

```
100 OPEN #1:"RS232.BA = 600"
    Opens device #1 for printer.
110 OPEN #2:"SPEECH",OUTPUT
    Opens device #2 for speech (Terminal Emulator
    II required)
120 PRINT "HERE IS A SAMPLE."
    Prints message on screen.
130 PRINT #1:"TEST REPORT"
    Prints on printer.
```

140 PRINT #2:"HELLO"  
 Speaks the word using synthesizer.  
 150 CLOSE #1  
 Closes device #1.  
 160 CLOSE #2  
 Closes device #2.  
 170 END

The print list following the colon in a PRINT # statement follows the same rules as regular printing to the screen. Since the length of lines may be longer on the printer (the screen has 28 columns in a print line), you may use the TAB function to arrange your printing:

100 OPEN #1:"RS232.BA = 600"  
 110 PRINT #1:TAB(25):"MONTHLY PAYMENTS"

You may use a variable in the TAB function:

200 PRINT #1:TAB(T + A);MONTH\$;X

You may also use colons to print blank lines:

220 PRINT #1::

If you have adjusted your printer properly for vertical tabs, you may go to the top of the next page by using:

300 PRINT #1:CHR\$(12)

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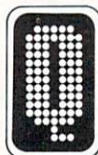
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# Commodore To ASCII For Printers

Thomas Henry

*Here's a utility program that will convert certain types of print programs to standard ASCII code format. It will work on all Commodore computers. The program is 109 bytes long. And even if you don't need this utility for your printer, you may want to examine the program anyway. It provides some insight into how a BASIC program is stored and how it may be changed by a machine language routine. On the other hand, you don't need to understand machine language to make use of it.*

---

Before describing the program, I should point out what sort of print programs it may be used for. A good example is instruction printouts. For instance, not long ago I joined the Toronto PET Users Group, and thus was able to draw on their program library. One of the disks I got had "Micro-mon" and "Basic Aid" programs on it, along with some programs to print out instructions for both of these. When I sent the instructions to the screen, everything was fine. However, sending the output to the printer resulted in a mess. Lowercase became uppercase, and uppercase became Epson graphic symbols. I really wanted a hard copy. That need provided the inspiration to write this program.

## Automatic Rewrite

This utility will automatically rewrite programs filled with PRINT statements (such as the ones mentioned above), so that anything between quotes will print out in standard ASCII. The total conversion time for a large program is less than one blink of the cursor. Note that this is not really a general-purpose program, but instead works only on programs of the sort just described. However, between this program and those in Brian Niessen's "PETASCII to ASCII Conversion" article (**COMPUTE!**, April 1982, pp. 126, 128), just about every type of program is covered.

Let's examine the program. Only two machine dependent locations are used, BASIC and POINTR. BASIC is the zero page pointer to the start of a BASIC program. This is at \$28 for all

PETs and CBMs and generally points to \$0401. For the VIC-20 and Commodore 64, the proper location is \$2B. Where it points to depends on the amount of extra memory added. The location called POINTR is the "start of variables" pointer, or, considered another way, it points to the end of a BASIC program. POINTR is used throughout the program, but will be restored to its initial value eventually, thus preserving the BASIC operating environment. POINTR is location \$2A for PETs and CBMs, and location \$2D for the VIC and 64.

At the entry of the program, POINTR is loaded with the start of BASIC. For a PET or CBM it points to \$0401. Next the accumulator is loaded with the first byte past the link addresses and line numbers. Indexing POINTR by Y, when Y equals \$04, will accomplish this. If a zero is found, then we must be at the end of a line. If the accumulator contains \$22, we have found a first quote and know that the conversion must start on the next character. To convert the string inside the quotes, we branch down to the label STRING.

Refer to that subroutine now. First we check if the end of a line has been found yet. If it hasn't, we check for an endquote. If that isn't found either, the character is ready to be converted. This conversion routine is very "hard-core" in the sense that it covers all 256 possible characters. This may be a bit more powerful than is actually needed here, but it's nice to be safe.

If the accumulator contains anything less than \$20, it is replaced with a \$01 which is a null character on my printer. It would be nice to use a \$00 as a null, but this upsets the program in general by confusing the BASIC operating system into thinking it has found an end of the line. Use any number you want, as long as your printer ignores it.

If the accumulator is less than \$41, the character must be punctuation or a numeral and can be printed as is. Next, if it lies between \$41 and \$5B, then \$20 must be added. This will change the lowercase from the PET to true ASCII lowercase.

If the character is less than or equal to \$61,

it's safe to print again. However, if it's less than \$81 but greater than \$61, it's an "artificial" punctuation, and hex \$40 must be subtracted to compensate.

The next test gets rid of all characters between \$81 and \$A0 by replacing them with a null symbol. Most of the characters in this range are cursor control symbols or system control symbols (like RUN and REVERSE OFF). We definitely don't want *these* going to the printer.

Next, graphic characters are replaced by blanks (as opposed to nulls), and finally capital letters are converted to true ASCII capitals by subtracting \$80.

This is a pretty hefty "compare and convert" routine, but it is foolproof in that your printer will never get a weird code and become confused. You may have to review the routine several times to really understand how it works, but it might help to keep in mind that some characters need no conversion, some (such as cursor control symbols) should be replaced by null symbols, and graphic characters should be replaced by blanks. Finally, upper- and lowercase letters must be accounted for. To confirm that the routine covers all cases, you can get a chart of true ASCII and compare it with a chart of PETASCII.

I've mentioned that at various times some numbers must be added or subtracted to perform the necessary conversion. Actually, since the numbers fall within a certain range, it is simpler and more efficient to use AND instead of subtraction, and OR instead of addition. The results are the same, and a few bytes may be saved.

## A Popular Shortcut

If you look at locations 705A through 7069 in Program 3, you will see a trick commonly employed by 6502 software designers. The various conversion subroutines, such as BAD1, BAD2 and so on, are all separated by a \$2C. This is the BIT instruction which will have no effect on the operation of the program. Thus one master subroutine can have several entry points, all leading up to a common ending. For example, suppose the routine is entered at GOOD1 at address \$7060. The accumulator will be ORed with \$20. Next a BIT test is executed, but this has no effect other than setting some flags in the status register. Then another BIT is performed, and finally the routine concludes by storing the accumulator back in memory.

You may have to sit and stare at this a while to see why this works and why it saves some memory. Nevertheless, this technique of creating harmless op codes allows multiple entry points.

Resuming the analysis of the assembler listing, the STRING routine keeps looping around and around until every character has been con-

verted. Either an endquote byte or a zero indicates that the string is done. If an endquote is found, then the next string is searched for. If, however, a zero is found, the end of a line is indicated, and the program goes to ENDLIN. ENDLIN will direct POINTR to the start of the next line in memory by examining the forward link address of the previous line. If the forward link points to a zero byte, then the end of the program has been found, otherwise control is directed back up to the label LINE, and the next line is converted.

EXIT tidies things up before returning to BASIC. As you probably know, the end of a BASIC program is marked by three consecutive zeros. POINTR is left pointing at the second of these three zeros. Next, the number \$02 is added to it, so that it points to the start of variables. It is then safe to return to BASIC.

While back in BASIC, LIST the program and you will see a collection of nonsense between all the quote marks. It will look odd on the screen, but will turn out a perfectly printed hard copy on your ASCII printer. Depending on your needs, you may want to save the converted copy of your program, but in general this isn't necessary.

## How To Load And Use The Program

For convenience, BASIC versions (Programs 1 and 2) will load the necessary machine language routine for you. Use Program 1 for all PET/CBM models. It locates the machine code at locations 28672 up. Use Program 2 for the VIC-20 and Commodore 64. It loads the code at the top of memory, protects it from BASIC, and indicates the proper SYS address to initiate the conversion. Once you have run the BASIC loader, you may want to save the machine language routine directly to tape or disk. This will enable you to use it in the future without having to run the BASIC loader program again. To save the machine code from memory on the PET/CBM, invoke the monitor (SYS 4), then type

```
S "CONVERT",01,7000,706d
```

to save to tape, or

```
S "CONVERT",08,7000,706d
```

to save to disk. For the VIC or 64, you will need VICMON, Supermon, Micromon, or one of the other available machine language monitors. Follow the directions for the PET/CBM, except that the beginning and ending addresses for the save will need to be adjusted depending on where in memory the routine is located.

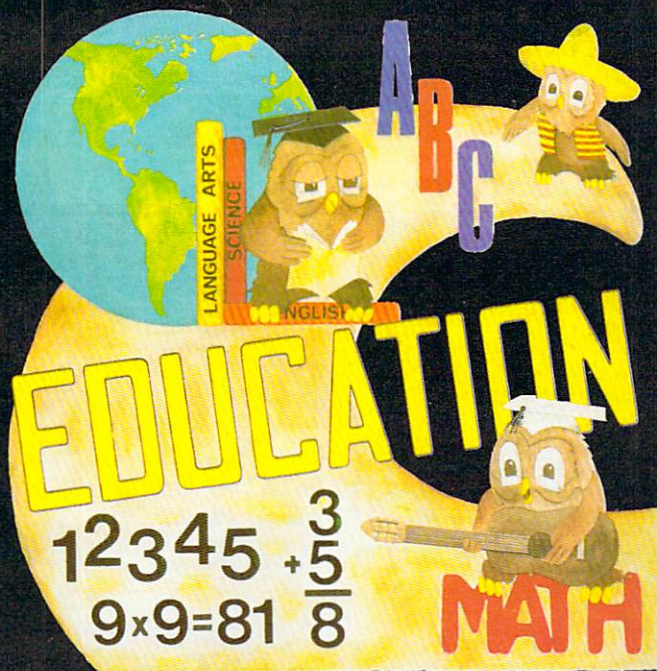
Here's how to use the program. First, load in the PETASCII to standard ASCII converter. Next type NEW. This will clear up some of the pointers in zero page. Now load in the program to be converted. At this point, type SYS 7\*4096 (or whatever address the loader indicates). The program will

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be "instantly" rewritten. LIST it. See how odd it looks? But now RUN the program, and direct all output to the printer. The result will be perfect hard copy.

This isn't the sort of program you're likely to need on a daily basis. But, when you need it, you really need it. So type it in, save it, and play with it a little. Then, when you get some program documentation on disk, you can create a hard copy at a moment's notice.

One final note: if you have some old programs written for the original model PET, you probably have noticed that upper- and lowercase are reversed. You could go back and rewrite the program, but why not let the machine do it? Make a few alterations in the utility presented above, and you can have instant conversion of your old-style programs.

### Program 1: BASIC Loader For All PET/CBM Models

```
100 REM BASIC LOADER FOR PETASCII TO ASCII
    CONVERTER
110 REM PET/CBM VERSION
120 HERE=7*4096
130 FOR ADRS=HERE TO HERE+108
140 READ DTA:POKE ADRS,DTA:CK=CK+DTA:NEXT
150 IF CK<>12485 THEN PRINT"CHECK FOR ERRO
    R IN DATA STATEMENTS":STOP
160 PRINT"TYPE 'SYS";HERE;"{LEFT}' TO ACTI
    VATE."
170 END
200 DATA 165,40,166,41,133,42,134,43
210 DATA 160,4,177,42,240,7,201,34
220 DATA 240,31,200,208,245,160,0,177
```

```
230 DATA 42,170,200,177,42,240,6,134
240 DATA 42,133,43,208,227,24,165,42
250 DATA 105,2,133,42,144,2,230,43
260 DATA 96,200,177,42,240,223,201,34
270 DATA 240,216,201,32,144,31,201,65
280 DATA 144,38,201,91,144,26,201,97
290 DATA 144,30,201,129,144,21,201,160
300 DATA 144,11,201,193,144,4,201,219
310 DATA 144,12,169,32,44,169,1,44
320 DATA 9,32,44,41,63,44,41,127
330 DATA 145,42,24,144,196
```

### Program 2: BASIC Loader For VIC-20 And Commodore 64

```
100 REM BASIC LOADER FOR PETASCII TO ASCII
    CONVERTER
110 REM VIC-20/C-64 VERSION
120 HERE=PEEK(56)-1:POKE 56,HERE:POKE 52,H
    ERE:HERE=HERE*256
130 FOR ADRS=HERE TO HERE+108
140 READ DTA:POKE ADRS,DTA:CK=CK+DTA:NEXT
150 IF CK<>12533 THEN PRINT"CHECK FOR ERRO
    R IN DATA STATEMENTS":STOP
160 PRINT"TYPE 'SYS";HERE;"{LEFT}' TO ACTI
    VATE."
170 END
200 DATA 165,43,166,44,133,45,134,46
210 DATA 160,4,177,45,240,7,201,34
220 DATA 240,31,200,208,245,160,0,177
230 DATA 45,170,200,177,45,240,6,134
240 DATA 45,133,46,208,227,24,165,45
250 DATA 105,2,133,45,144,2,230,46
260 DATA 96,200,177,45,240,223,201,34
270 DATA 240,216,201,32,144,31,201,65
280 DATA 144,38,201,91,144,26,201,97
290 DATA 144,30,201,129,144,21,201,160
300 DATA 144,11,201,193,144,4,201,219
310 DATA 144,12,169,32,44,169,1,44
320 DATA 9,32,44,44,63,44,44,127
330 DATA 145,45,24,144,196
```

### Program 3: PETASCII To ASCII Converter For Print Programs

```
0000          BASIC = $28          ;START OF BASIC
0000          POINTR = $2A        ;START OF VARIABLES

0000          *=$7000

7000 A5 28     ENTRY LDA BASIC      ;INITIALIZE POINTR TO
7002 A6 29     LDX BASIC+1         ;COINCIDE WITH THE START
7004 85 2A     STA POINTR          ;OF BASIC.
7006 86 2B     STX POINTR+1

7008 A0 04     LINE LDY #$04        ;GO PAST LINK & LINE#.
700A B1 2A     CHECK LDA (POINTR),Y ;GET A PROGRAM CHARACTER.
700C F0 07     BEQ ENDLIN          ;ZERO MEANS END OF LINE.
700E C9 22     CMP #$22            ;LOOK FOR FIRST QUOTE.
7010 F0 1F     BEQ STRING          ;GO CONVERT THE STRING.
7012 C8        NEXT INY            ;NO STRING FOUND YET.
7013 D0 F5     BNE CHECK           ;BRANCH ALWAYS.
```

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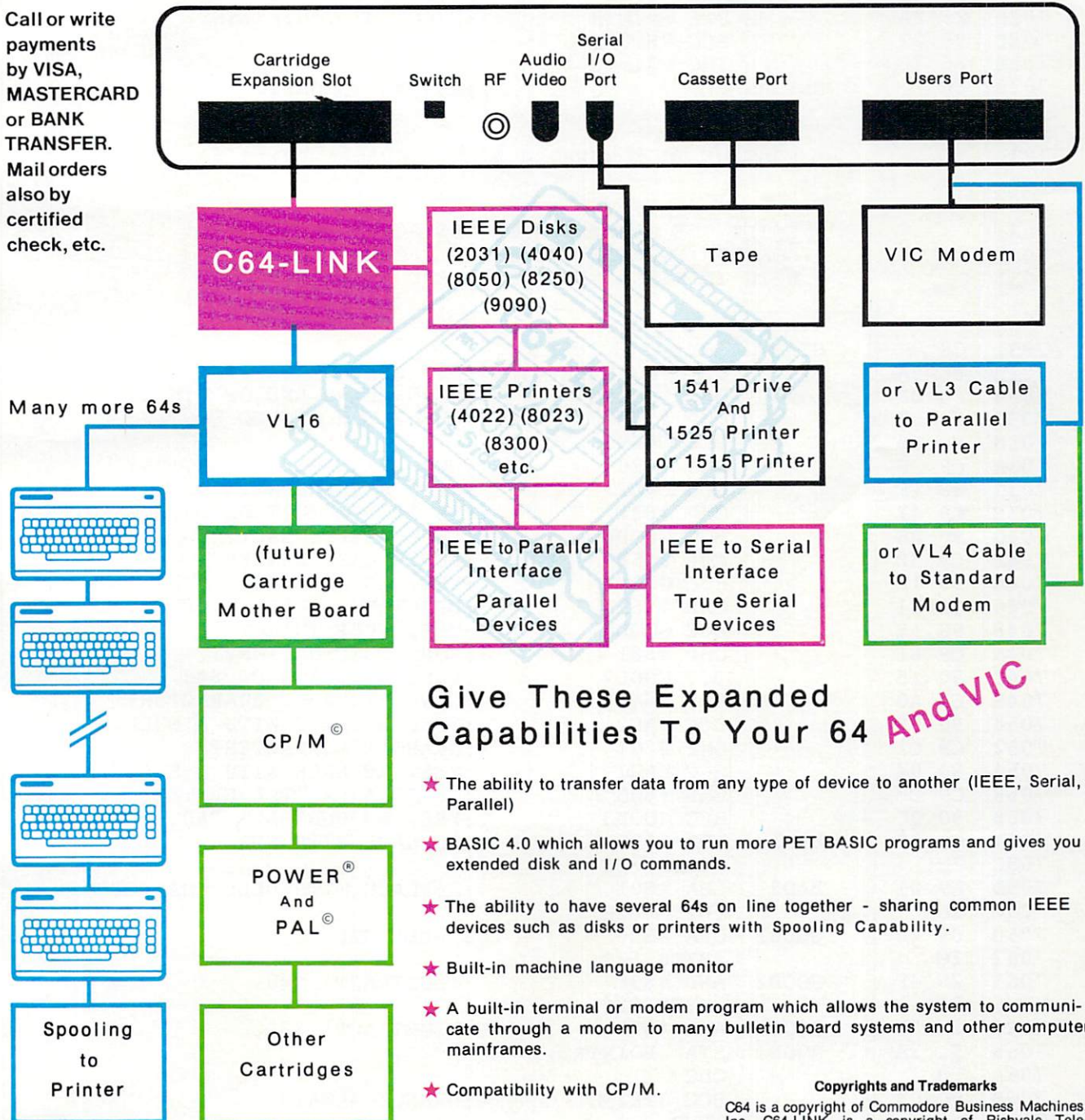
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```

7015 A0 00      ENDLIN LDY #$00          ;USING THE FORWARD
7017 B1 2A          LDA (POINTR),Y      ;LINK ADDRESS, DIRECT
7019 AA          TAX                    ;POINTR TO NEXT LINE
701A C8          INY                    ;IN BASIC PROGRAM.
701B B1 2A          LDA (POINTR),Y
701D F0 06          BEQ EXIT            ;ZERO MEANS END OF PROGRAM.
701F 86 2A          STX POINTR          ;OTHERWISE, UPDATE POINTR.
7021 85 2B          STA POINTR+1
7023 D0 E3          BNE LINE            ;BRANCH ALWAYS TO NEXT LINE.

7025 18          EXIT   CLC              ;ADJUST POINTR BACK
7026 A5 2A          LDA POINTR          ;TO WHERE BASIC WOULD
7028 69 02          ADC #$02            ;LIKE IT, I.E.,
702A 85 2A          STA POINTR          ;START OF VARIABLES.
702C 90 02          BCC RETURN
702E E6 2B          INC POINTR+1
7030 60          RETURN RTS              ;RETURN TO BASIC.

7031          ; ROUTINE TO CONVERT A SINGLE CHARACTER:

7031          ; ENTER THE ROUTINE WITH THE ACCUMULATOR
7031          ; CONTAINING A PET-ASCII CHARACTER, LEAVE
7031          ; WITH IT REPLACED BY STANDARD ASCII

7031 C8          STRING INY
7032 B1 2A          LDA (POINTR),Y      ;GET NEXT CHARACTER.
7034 F0 DF          BEQ ENDLIN          ;ZERO MEANS END OF LINE.
7036 C9 22          CMP #$22            ;CHECK FOR SECOND QUOTE.
7038 F0 D8          BEQ NEXT
703A C9 20          CMP #$20            ;NON-PRINTABLE CHARACTER?
703C 90 1F          BCC BAD2            ;YES, REPLACE WITH NULL.
703E C9 41          CMP #$41            ;IS IT PUNCTUATION OR NUMERALS?
7040 90 26          BCC GOOD4           ;YES, KEEP INTACT.
7042 C9 5B          CMP #$5B            ;LOWER CASE LETTER?
7044 90 1A          BCC GOOD1           ;YES, GO ADD $20.
7046 C9 61          CMP #$61            ;BRACKETS, SLASHES, ETC.?
7048 90 1E          BCC GOOD4           ;YES, KEEP INTACT.
704A C9 81          CMP #$81            ;MORE PUNCTUATION?
704C 90 15          BCC GOOD2           ;YES, GO SUBTRACT $40
704E C9 A0          CMP #$A0            ;NON-PRINTABLE CHARACTER?
7050 90 0B          BCC BAD2            ;YES, REPLACE WITH A NULL.
7052 C9 C1          CMP #$C1            ;GRAPHIC CHARACTER?
7054 90 04          BCC BAD1            ;YES, REPLACE WITH A SPACE.
7056 C9 DB          CMP #$DB            ;IS IT A CAPITAL LETTER?
7058 90 0C          BCC GOOD3           ;YES, GO SUBTRACT $80.
705A A9 20          BAD1   LDA #$20      ;REPLACE WITH SPACE.
705C 2C          .BYTE $2C
705D A9 01          BAD2   LDA #$01      ;REPLACE WITH NULL CHARACTER.
705F 2C          .BYTE $2C
7060 09 20          GOOD1  ORA #$20      ;'ADD' $20.
7062 2C          .BYTE $2C
7063 29 3F          GOOD2  AND #$3F      ;'SUBTRACT' $40.
7065 2C          .BYTE $2C
7066 29 7F          GOOD3  AND #$7F      ;'SUBTRACT' $80.
7068 91 2A          GOOD4  STA (POINTR),Y
706A 18          CLC
706B 90 C4          BCC STRING          ;BRANCH ALWAYS.
706D          .END

```

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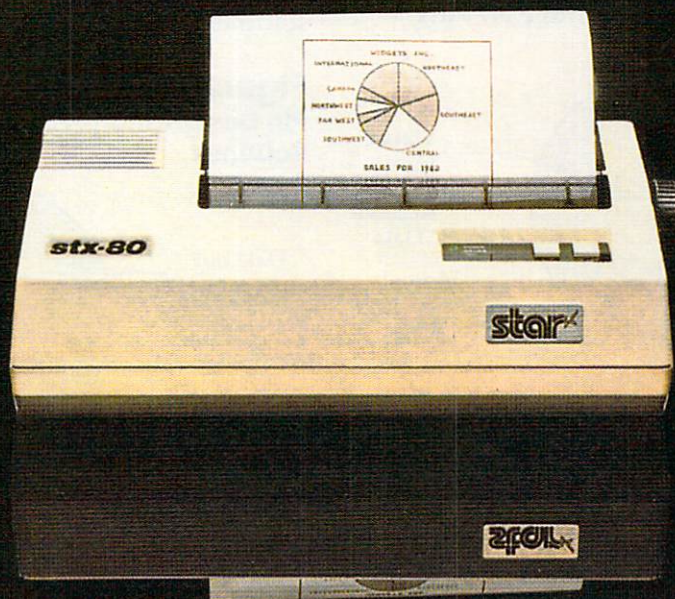
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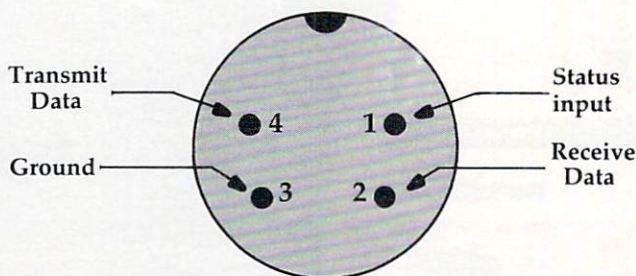
# Connecting A Printer To The TRS-80 Color Computer

Ottis Cowper, Technical Editor

*One of the special features of the TRS-80 Color Computer is the built-in RS-232 serial port interface. This makes connecting a printer pretty straightforward.*

The four-pin RS-232 port on the Color Computer has only the so-called "minimum configuration" RS-232 signals (see Figure 1), but this is still more than most other computer manufacturers provide. You can therefore avoid many of the usual difficulties when interfacing a printer.

**Figure 1:**  
Standard Designations For Serial Port Pins

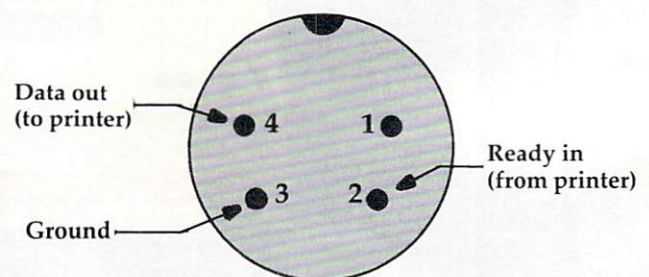


When you want to connect a printer to your TRS-80, the path of least resistance is to use one of the three Radio Shack printers which are directly compatible with the Color Computer. The DMP-100, DMP-200, and DMP-400 are dot-matrix printers which include a switch-selectable, four-pin serial interface in addition to the usual parallel interface. So, adding one of these models is as easy as connecting a four-pin (DIN) to four-pin cable between the printer and the Color Computer serial port. These cables are available at Radio Shack or, if you're a hardware hacker, you could pick up the parts at a local electronics supply store and easily construct your own.

## One Bit At A Time

If you wish to attach another brand of printer, keep in mind that the Color Computer has only a serial (one bit at a time) interface. Many printers come equipped with parallel (eight bits at a time) interfaces. Before you spend several hundred dollars *make sure* that the printer you are buying has an RS-232 serial interface or that one is readily available for your particular model. Another thing to keep in mind when interfacing to other printers is that, for some reason, the Color Computer ROM printer output routines assign uses to the pins of the serial port that do not match their own stated standard designations (see Figure 2).

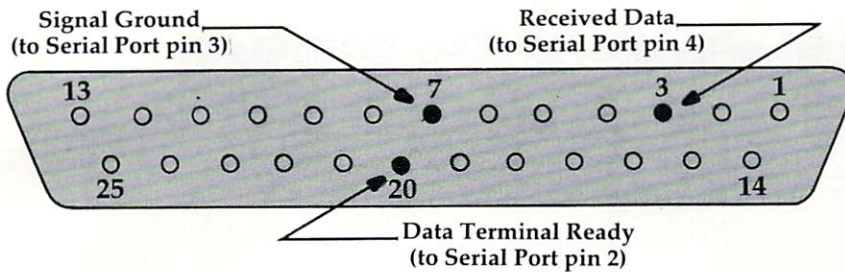
**Figure 2:**  
Pin Designations For Use With ROM Output Routines



The printer's serial interface will most likely have the standard DB25 plug. This is the connector most commonly used in RS-232 communications, and a particular RS-232 signal is assigned to each of the pins on the plug. As an example, Figure 3 shows the connections necessary to connect an Epson MX-80 or MX-100 (with RS-232 serial interface) to the Color Computer. These same connections should work for other printers, but you should check the pin designations in the manual for your particular printer to be sure.



**Figure 3:**  
**DB25 Connector On Printer RS-232 Interface**



**How To Activate Your Printer**

Now you have a printer attached to your computer. What do you do with it? The most obvious use is to make "hard copy" listings of your programs. This is simple; just type LLIST instead of LIST and the output will be routed to the printer. To send any other program output to the printer, just replace the PRINT statements with PRINT #-2. (On the Color Computer, the printer is designated as device -2.) For example, the following line will output a message to the printer:

```
10 PRINT #-2 "SEND THIS TO THE PRINTER PRONTO!"
```

If you have Extended BASIC on your Color Computer, you can format your output with the PRINT USING statement. For example, this line:

```
20 PRINT #-2, USING "$$###.##"; 293.687
```

should cause the printer to print

```
$293.69
```

Another Extended BASIC function you can use with your printer is POS. This returns the current print position. For example, PRINT POS(-2) will tell you the column in which the next character will be printed.

A number of the Radio Shack software packages support printer output. Naturally, the Color *SCRIPSIT* word processing program includes the capability to print out text. The *Speculator* electronic spreadsheet program enables you to print out your worksheets. Other programs which support printout include the *Personal Finance* and *Editor/Assembler* programs. The *Graphics Pack* program supports printout to the Radio Shack CGP-115 color graphics printer. This printer is good for multicolor graphics applications, but only marginally useful for printing text.

**Matching Specifications**

The routines in the ROMs which support output to the printer make certain assumptions about the printer hardware. In particular, the routines expect the data format to be one start bit (logic zero), seven (for Revision 1.0 ROMs) or eight (for Revision 1.1 ROMs) data bits beginning with the least significant bit (LSB), two stop bits (logic ones),

and no parity. The assumed transfer rate is 600 baud. The routines also assume that the printer will automatically provide a carriage return when it encounters a line feed, and that it will provide a busy signal to the computer if it is not ready to accept input. The expected print width is 132 columns.

You should consult the manual for your printer and set the appropriate DIP switches (or

whatever) to configure the printer to match these specifications. If your printer can't meet all the above conditions, several can be changed with POKES to Color Computer memory locations. For example, the value in location 155 controls the print width. If you're using an 80 column printer, you'll want to include the following statement before using the printer:

```
10 POKE 155,80
```

The comma field width (location 153) controls the amount of space left between variables separated by commas in PRINT #-2 statements. The default value for this location is 16. Thus, the line:

```
40 PRINT #-2 "FIRST", "SECOND"
```

will cause the word "FIRST" to be printed beginning at the left margin, and the word "SECOND" to be printed beginning in column 16. You can adjust the value in location 153 to change the format of your printed output. If you change the print width or comma field width (locations 155 or 153), you should also change the last comma field (location 154). This location should contain the value of the print width, minus the comma field width. You can achieve this with:

```
15 POKE 154, PEEK(155) - PEEK(153)
```

Adjusting the rate of data transfer from the default value of 600 baud requires changes to the data in locations 149 and 150. The table below provides the necessary POKES to location 150 for the given baud rates. (For all rates in the table, POKE 149,0.) This information comes from the *TRS-80 Color Computer Technical Reference Manual* (pages 38 and 39), which provides further details on interfacing printers to the Serial Port.

Adjusting The Rate Of Data Transfer	
Desired baud rate	Value to POKE into location 150
300	180
600	87
1200	41
2400	18

# Astrostorm

Peter Lear

*Try to guide your spaceship, carrying emergency medical supplies, through a dangerous asteroid storm. A great deal depends on your skills as a navigator. Many times the success or failure of your mission will depend on your ability to make split-second decisions under pressure. Versions for the VIC, Atari, TI-99/4A, and Apple.*

The mission: you are Captain Bosdiger of the interstellar tug *The Viccard*. While orbiting the fifth planet in the Benard system, you receive a distress call. The call comes from the Solarian system, in need of vital medical supplies. You are to pick them up from the sixth planet in the Benard system and then take them to the third planet in the Solarian system.

There is a time factor. The drugs have a short life. Your calculations indicate that it will be necessary to drop out of hyperspace between the fourth and fifth planets' orbits. There you will be in an asteroid field. You must cross this field in less than two minutes.

## Looking At Astrostorm

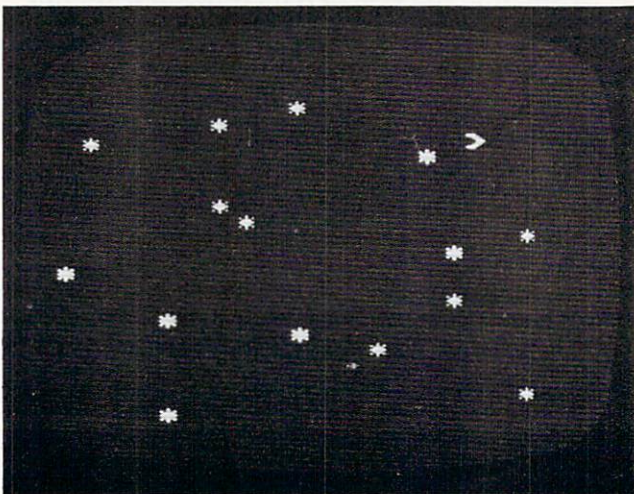
How does the VIC version work? Let's take a look.

In lines 5-230 the screen border is chosen and several variables for the joystick are defined. The player is given the choice of using a joystick or the keyboard. If you choose to use the keyboard, control the movement of the ship with the "Z" (left) or "C" (right) keys. The *VIC Programmers' Reference Guide* helped provide the joystick information necessary to use the first data statement.

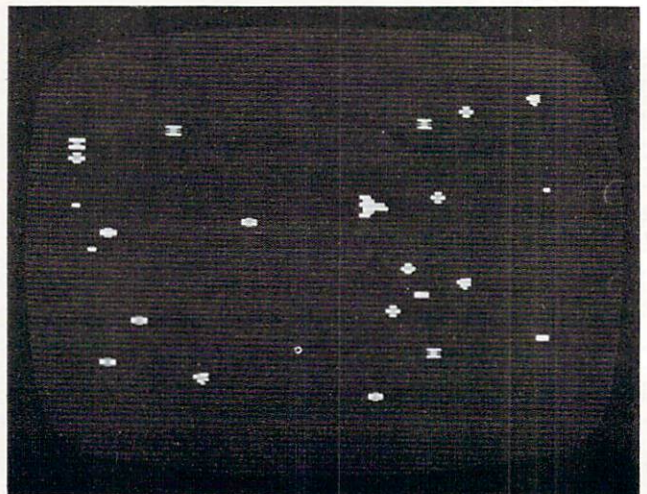
Then we are sent zooming up to line 5000 to make a bit of noise. Some more data is used here. Now we are off to line 910 to ask for the "asteroid depth" that is required. This simply determines where the ship is to be located on the screen. It can be placed between the fifth and eighteenth rows (always starting on the left side).

Line 1030 makes the program versatile enough to use with any VIC-20. For example, initially the VIC starts its screen memory at location 7680. When an extra 8K or more is added, the start of screen memory changes to location 4096. Since 3K cartridges do not change this location, any cartridges can remain inserted.

The game's main playing loop is in lines 2000-2240. It is enclosed in a FOR/NEXT loop and timed for two minutes. All it does is decide on a random color and column for the asteroid. The galactic or solarian credits are based on the position and



*The player's spaceship (upper right) successfully negotiates the moving asteroids in "Astrostorm," VIC-20 version. (Apple and TI versions similar.)*



*A player's spaceship dodges space debris in the Atari version of "Astrostorm."*

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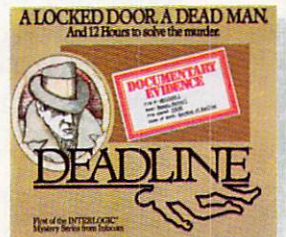
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color of the asteroid. The alarm sound is created by turning voice 36875 on and off with the variable CK. The first two IFs in the game loop check to see if the screen has been crossed. When the ship is moving forward, you gain points; going backward (left), you lose points. And if there is no movement, there is no loss or gain.

The movement of the asteroids is created by scrolling them off the screen. The ship is POKED on the screen. To prevent the ship from scrolling off every move, the program jumps to line 520. Here, with the variable OP (for old position), the

would-be scrolled ships are erased.

A check is made for every move to see if the ship has been hit. When this occurs, the program goes to 8170 to explode the ship. This is where the rest of the data is utilized. It then returns and offers a change in asteroid depth (this option is available for only seven seconds). Then an asteroid field is displayed in motion until either the fire button on the joystick or the keyboard's "H" key is pressed. To add to the excitement, you can think of this as dropping out of hyperspace.

## Atari, TI-99/4A, And Apple Version Notes

Patrick Parrish, Programming Assistant

### Atari Notes

The object of the Atari version of *Astrostorm* is to move your spaceship to the right across the asteroid field six times. The game is played with the keyboard or the joystick (in controller jack #1). In either case, movement of the spaceship is strictly horizontal. Once you start the spaceship moving left or right on the screen, it will continue until you cause a direction change.

With the joystick, left and right movement of the stick causes the spaceship to fly across the screen in the corresponding direction. Shifting the joystick position up or down will halt the spaceship. Under keyboard control, the "<" and ">" keys are used for left and right movement, and again, movement is continuous. If you choose the keyboard option, the spaceship's flight can be halted by pressing any key other than the "<" or ">" keys.

To achieve a high score on *Astrostorm*, avoid moving the spaceship to the left whenever possible, since penalty points are then deducted from your total. But bonus points are given for spaceship movement to the right. As an added incentive, you are awarded a thousand points each time you successfully maneuver the spaceship across the asteroid field.

### TI-99/4A Notes

The object of *Astrostorm* on the TI-99/4A is to advance your spaceship across the asteroid field twelve times. Asteroids scroll from the bottom of the screen. Spaceship movement is horizontal. Control the movement of the ship by pressing the "<" and ">" keys.

This version of the game can be quite challenging since there are several skill levels. As the game begins, the vertical position of the spaceship can be set nearer the bottom of

the screen by specifying a greater "asteroid depth." A greater asteroid depth, of course, requires a faster reaction time. The difficulty of the game can be further increased by requesting a higher asteroid density (difficulty level).

The game loop (lines 500-830) is set to execute 1000 times. This means that you must finish your journey across the asteroid field before this loop is completed. You may find that this time limit is either too easy or too difficult, depending on the skill levels you choose. If so, vary the limit in line 500 as you see fit.

To achieve a high score on *Astrostorm*, avoid moving your spaceship backwards since points are deducted from your total.

### Apple Notes

With the Apple version of *Astrostorm*, you must move the spaceship across the astrofield six times to win. There is no time limit, and the game loop (lines 120-250) will execute until a crash is detected (line 230).

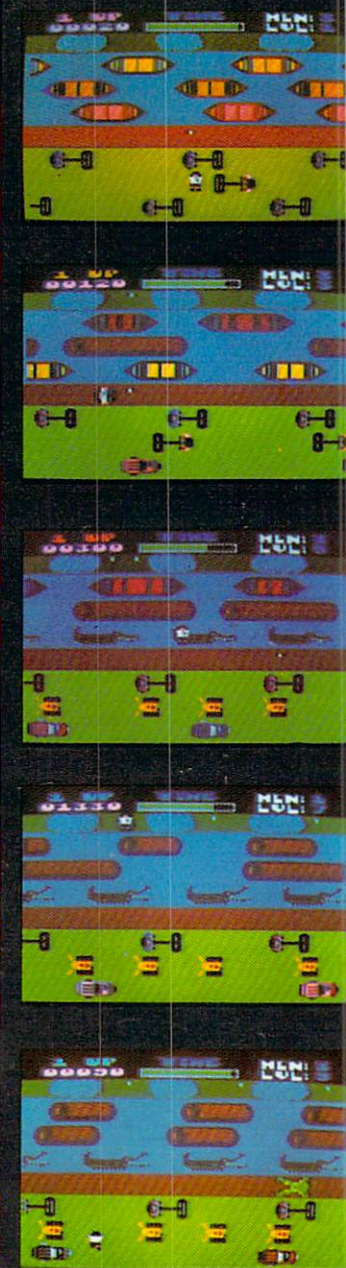
Asteroids scroll from the bottom of the screen. Only horizontal movement of the spaceship is allowed by the program. Movement, which is continuous, is accomplished with the SPACE bar while direction is controlled with the left and right arrow keys.

There are several skill levels. You can make the game more difficult by specifying a higher asteroid depth. This will place the spaceship closer to the bottom of the screen, and consequently, require a quicker reaction on your part to avoid a collision.

Scoring is based on the direction of spaceship movement and difficulty level. Of course, more points are given at greater asteroid depths. Points are awarded for movement of the spaceship to the right and deducted for movement to the left.



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"I had so much fun I almost blew my doughnuts."  
—Theodore Boston III

"I haven't had this much fun since Buffy and I went to Princeton for the weekend."  
—Martha Vineyard

## Program 1: VIC Version

```
5 POKE36879,8
10 PRINT"{CLEAR}{PUR}":POKE37139,0:DD=371
  54:PA=37137:PB=37152
45 IFLF=1THEN1000
47 PRINT"{05 RIGHT}{04 DOWN}ASTROSTORM"
50 PRINT"{DOWN}{05 RIGHT}JOYSTICK(1)":PRINT
  "{05 RIGHT}KEYBOARD(2)"
55 GETR$
60 IFR$="1"THENR=1:GOTO70
65 IFR$="2"THENR=2:GOTO70
68 GOTO55
70 FORJ=0TO2:READJS(J):NEXTJ:GOSUB5000
80 GOTO900
100 POKEDD,127:S3W=-((PEEK(PB)AND128)=0):P
  OKEDD,255
110 P=PEEK(PA):S2=((PAND16)=0)
120 FR=-((PAND32)=0):X=S2W+S3W
130 DN=JS(X+1):RETURN
200 IFPEEK(197)=33THENDN=-1:RETURN
210 IFPEEK(197)=34THENDN=1:RETURN
220 IFPEEK(197)=64THENDN=0:RETURN
230 RETURN
500 IFDN<>0ANDPEEK(S-DN)<>42THENPOKES-DN,32
505 FORII=1TO2
510 POKEOP,32:POKEOP-DN,32
520 OP=OP-22
530 NEXTII:RETURN
900 IFLF=1THEN1000
910 PRINT"THE A.D.[ASTEROID DEPTH] DES
  IRED (5-18)":INPUTL
920 IFL<5THENPRINT"TOO EASY":GOTO900
930 IFL>18THENPRINT"TOO RISKY":GOTO910
940 LF=1:PRINT"{CLEAR}":GOSUB2200
1000 PRINT"{CLEAR}{18 DOWN}"
1020 POKE36878,15
1030 S=4*(PEEK(36866)AND128)+64*(PEEK(36869)
  AND120):C=37888+4*(PEEK(36866)AND128)
1040 CK=1:S=S+22*(L+1):OP=S:SB=S-1:SE=S+23
2000 FORG=1TO418
2010 NA=INT(RND(TI)*22):CC=INT(RND(TI)*7)+1
2040 POKE646,CC:PRINTTAB(NA)"*";
2055 PT=PT+DN*(NA*CC*INT((L^.5)+.5))
2060 IFS=SBTHENPOKES,32:S=S+22:W=W-1
2065 IFS=SETHENPOKES,32:S=S-22:W=W+1
2070 IFPEEK(S)=42ORPEEK(S+22)=42THENPOKE646
  ,1:GOSUB8000:GOSUB7000:GOTO2200
2085 ONRGOSUB100,200:OP=S-22:S=S+DN
2090 CK=CK*-1:POKE36875,127+CK:GOSUB500:POK
  ES,61+DN:POKES+C,1:PRINT
2100 NEXTG
2110 PRINT"{YEL}":POKE36875,0:GOSUB6000
2200 PT=0:IFPEEK(197)=43THENRESTORE:LF=1:GO
  TO70
2210 POKE37139,0:IF(PEEK(PA)AND32)=0THENRES
  TORE:LF=1:POKE37139,128:GOTO70
2215 NA=INT(RND(TI)*22):CC=INT(RND(TI)*7)+1
2220 POKE646,CC:PRINTTAB(NA)"*";
2240 POKE37139,128:GOTO2200
5000 A=20:POKE36878,15
5010 READC,T,Z:T=T*A:Z=Z*A
5030 POKE36875,C:FORI=1TOZ:NEXTI:POKE36875,
  0:FORI=1TOZ:NEXTI
5050 IFZ>0THEN5010
5100 RETURN
6000 POKE36875,0
6005 IFW<6THENPRINT"YOU DID NOT COMPLETE Y
  OUR MISSION.":GOTO6200
6010 PRINT:PRINT"YOU COMPLETED YOUR MISS
  ION.";
6020 PRINT"THE SOLARIAN SYSTEM MINISTER
  HAS AWARDED YOU";PT
```

```
6030 PRINT"SOLARIAN CREDITS FOR YOUR SERVI
  CES.";
6040 PRINT"DO YOU WISH TO MAKE ANOTHER DE
  LIVERY?"
6060 GETR$:IFR$="Y"ORR$="N"THEN6070
6065 GOTO6060
6070 IFR$="N"THENCLR:END
6080 PRINT"SAME ASTEROID DEPTH?"
6100 GETR$:IFR$="Y"ORR$="N"THEN6110
6105 GOTO6100
6110 IFR$="N"THENRUN
6120 RETURN
6200 PRINT"THE SOLARIAN GOVERN- MENT HAS F
  INED YOU";PT;" GALACTIC CREDITS"
6210 PRINT"THEY ARE ALSO HAVE ANOTHER MI
  SSION FOR YOU!":FORI=1TO7000:NE
  XT:RETURN
7000 POKE36875,0:PRINT"{CLEAR}YOU DIDN'T MA
  KE IT.THE SOLARIAN GOVERNMENT HA
  S SENT";
7020 PRINT" YOUR FAMILY":PRINTPT;"GALACTIC
  CREDITS"
7025 PRINT"HIT 'C' TO CHANGE A.D."
7030 FORI=1TO700:IFPEEK(197)=34THENFORJ=1TO
  10:GETR$:NEXTJ:RUN
7040 NEXTI:RETURN
8000 PRINT"{YEL}":POKE36875,0
8060 E(1)=S-23:E(2)=S-22:E(3)=S-1:E(4)=S:E(
  5)=S+23:E(6)=S+22:E(7)=S+1:E(8)=S
8090 FORI=1TO8:READA(I):POKEE(I),A(I):POKEE
  (I)+C,2:NEXTI
8110 A(4)=A(1):A(8)=A(5)
8130 A=2:IFL>17THENA=1
8150 FORI=1TOA:FORJ=1TO8:POKEE(J),32:POKEE(
  J)+C,0:NEXTJ:PRINT
8160 E(1)=E(1)-23-22*(I-1):E(2)=E(2)-22-22*
  (I-1):E(3)=E(3)-1-22*(I-1)
8165 E(4)=E(4)-23-22*(I-1):E(5)=E(1)+23+22*
  (I-1):E(6)=E(6)+22+22*(I-1)
8168 E(7)=E(7)+1+22*(I-1):E(8)=E(8)+23+22*(
  I-1)
8170 FORJ=1TO8:POKEE(J),A(J):POKEE(J)+C,2:N
  EXTJ
8180 FORJ=1TO100:POKE36877,220:NEXTJ:POKE36
  877,0:NEXTI
8200 FORI=1TO6:READA(I):NEXTI:POKE36877,220
8220 FORI=14TO0STEP-2
8235 POKE36878,I
8237 FORJ=1TO6:POKE36879,A(J):FORG=1TO25:NE
  XTG,J
8240 POKE36879,8:NEXTI:POKE36877,0:RETURN
9100 DATA-1,0,1,237,10,1,237,5,1,177,20,5,1
  77,20,5,237,10,1,177,5,1,140,20,5
9105 DATA237,10,1,177,5,1,140,15,2,237,10,1
  ,177,5,1,140,20,5,237,10,1,177,5,
  1,140,25,5
9110 DATA177,10,1,140,5,1,118,25,1,140,20,1
  ,177,15,1,237,25,1,237,20,1,237,1
  0,1,177,25,0
9200 DATA77,66,64,42,77,66,64,42,25,42,127,
  143,159,255
```

## Program 2: Atari Version

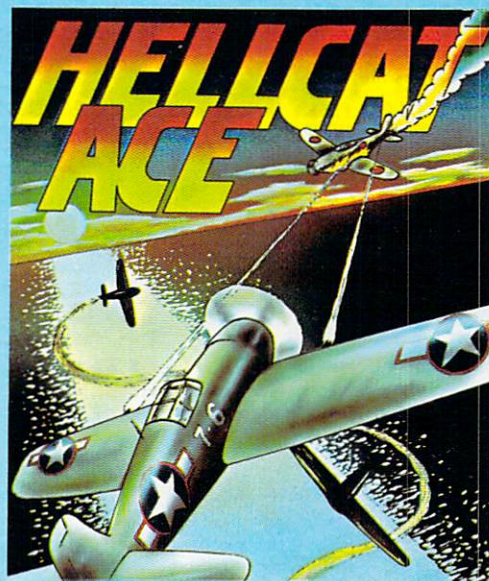
```
5 POKE 53248,0:GOSUB 3000:DIM N*(10)
  :N$="`{ } * . { ( , } X { [ ] { [ ] }"
7 GRAPHICS 0:POKE 752,1:?:DL=PEEK(5
  60)+256*PEEK(561)+4:POKE DL-1,68:F
  OR I=2 TO 24:POKE DL+I,4:NEXT I
10 X=60:Y=50:W=0
20 A=PEEK(106)-8:POKE 54279,A:PMBASE
  =256*A
30 POKE 559,46:POKE 53277,3
```



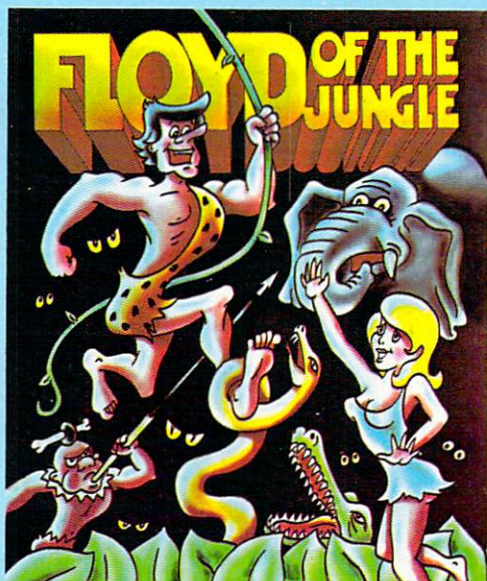
# Experience the MicroProse Challenge !!!



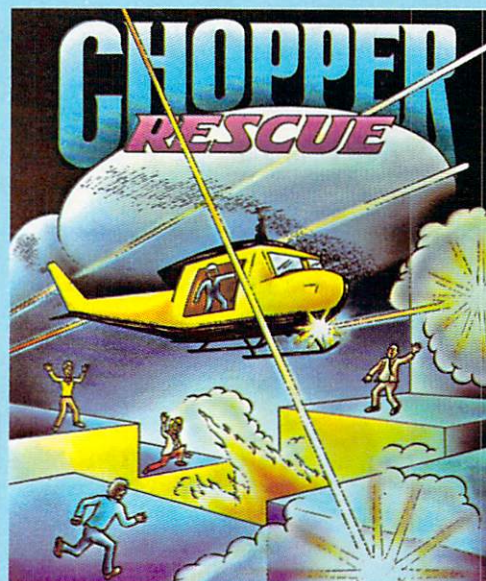
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```

40 FOR I=PMBASE+512 TO PMBASE+640:PO
KE I,0:NEXT I
50 POKE 53248,X
60 POKE 704,216:P0=PMBASE+512+Y
70 FOR I=PMBASE+512+Y TO PMBASE+517+
Y:READ A:POKE I,A:NEXT I
80 DATA 224,112,254,127,112,224
95 POKE 53278,0
97 IF R=2 THEN 500
104 B=STICK(0):IF B<>15 THEN A=B
110 X=X-4*(A=11)+4*(A=7):POKE 53248,
X:PT=PT+10-25*(A=11)
130 IF PEEK(53252) THEN POKE 764,255
:GOTO 2000
140 IF X>200 THEN POKE 53248,60:W=W+
1:PT=PT+1000:X=60
145 IF X<60 THEN POKE 53248,200:X=20
0:PT=PT-1000
150 IF W=6 THEN 1000
190 POSITION 17*(RND(0)*2)+4,23:Z=IN
T(LEN(N$)*RND(0)+1):? N$(Z,Z):PO
KE 710,PEEK(53770)
260 GOTO 97
500 I=PEEK(764)
520 IF I=54 THEN X=X-4:POKE 53248,X:
PT=PT-15:GOTO 130
530 IF I=55 THEN X=X+4:POKE 53248,X:
PT=PT+10:GOTO 130
540 GOTO 190
1000 POKE 764,255:GOSUB 2100:GRAPHIC
S 0:ON W GOTO 2000,1200,1005,10
05,1005,1020,1010
1005 IF W<6 THEN GRAPHICS 0:?"You d
id not complete your mission.":
GOTO 1020
1010 ? :? CHR$(125);"You completed y
our mission."
1020 ? "The Solarian System Minister
has":? "awarded you ";PT;" Sol
arian"
1025 ? "credits for your services.":
GOTO 2010
1200 ? CHR$(125);"The Solarian Gover
nment has fined":? "you ";PT;"
galactic credits."
1210 ? :? "but, they also have anothe
r mission":? "for you!":GOTO 2
010
2000 FOR W=15 TO 0 STEP -.3:SOUND 0
,20*RND(0),0,W:POKE 704,PEEK(53
770):POKE P0+6*RND(0),PEEK(5377
0):NEXT W
2005 GRAPHICS 0:?"You didn't make i
t. The Solarian":? "government
has sent your family ":? PT;" g
alactic credits."
2010 GOSUB 2100:POKE 764,255:?"Play
again? (Y/N)":?:GET #1,A:IF A<
>ASC("N") THEN RUN
2020 GRAPHICS 0:GOSUB 2100:END
2100 POKE 53277,0:POKE 53248,0:RETUR
N
3000 GRAPHICS 0:SETCOLOR 2,6,6
3010 ? "{2 TAB}ASTROSTORM"
3030 ? :? "1. Joystick":? :? "2. Key
board":? "{3 SPACES}Use < and >
for move"
3040 OPEN #1,4,0,"K:":? :? "Select:"
;
3050 GET #1,A:R=A-48:IF R<1 OR R>2 T
HEN 3050
3080 RETURN
3100 END

```

### Program 3: TI-99/4A Version

```

100 RANDOMIZE
110 CALL CLEAR
120 FOR I=5 TO 8
130 CALL COLOR(I,16,1)
140 NEXT I
150 CALL CLEAR
160 PRINT " A S T R O S T O R M !!!
"
170 PRINT
180 PRINT
190 PRINT "POWER SHIP WITH < & > KE
YS"
200 FOR I=1 TO 9
210 PRINT
220 NEXT I
230 FOR I=14 TO 3 STEP -1
240 FOR J=1 TO 20
250 NEXT J
260 CALL SCREEN(I)
270 NEXT I
280 FOR I=1 TO 400
290 NEXT I
300 S=3
310 PT=0
320 RSHIP=10
330 CSHIP=1
340 SHIP=62
350 COL=2
360 RLSHIP=RSHIP
370 CLSHIP=CSHIP
380 CALL CLEAR
390 PRINT "WHAT ASTEROID DEPTH (1-1
0)";
400 INPUT X
410 IF (X>10)+(X<1)THEN 380
420 PRINT
430 PRINT "WHAT DIFFICULTY LEVEL (1
-10)"
440 INPUT DCULT
450 IF (DCULT>10)+(DCULT<1)THEN 380
460 CALL CLEAR
470 CALL SCREEN(S)
480 CALL COLOR(2,16,1)
490 REM VARY LIMIT OF LOOP IN THE N
EXT LINE IF THE GAME IS TOO HAR
D OR TOO EASY
500 FOR LOOP=1 TO 1000
510 FOR I=1 TO INT(RND*X)+1
520 COL=INT(RND*30)+2
530 CALL HCHAR(23,COL,42)
540 NEXT I
550 PRINT
560 CALL GCHAR(RSHIP+DCULT,CSHIP,LO
C)
570 CALL HCHAR(RLSHIP+DCULT-1,CLSHI
P,32)
580 IF LOC=42 THEN 1190
590 CALL SCREEN(S)
600 CALL HCHAR(RSHIP+DCULT,CSHIP,SH
IP)
610 CLSHIP=CSHIP
620 RLSHIP=RSHIP
630 CALL KEY(3,A,STATUS)
640 IF A<>ASC(".")THEN 730
650 CALL SOUND(-700,-5,3)
660 PT=PT+5*DCULT*X
670 CSHIP=CSHIP+1
680 IF CSHIP<>32 THEN 720
690 CSHIP=1
700 S=S+1
710 IF S=15 THEN 1030
720 SHIP=62

```

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```

730 IF A<>ASC(",")THEN 820
740 CALL SOUND(-700,-6,4)
750 SHIP=60
760 PT=PT-8*DCULT*X
770 CSHIP=CSHIP-1
780 IF CSHIP<>1 THEN 810
790 CSHIP=32
800 S=S-SGN(S-3)
810 SHIP=60
820 REM
830 NEXT LOOP
840 CALL CLEAR
850 PRINT " YOU DID NOT COMPLETE YO
UR"
860 PRINT
870 PRINT "MISSION. THE SOLARIAN"
880 PRINT
890 PRINT "GOVERNMENT HAS FINED YOU
"
900 PRINT
910 PRINT PT;"GALACTIC CREDITS."
920 PRINT
930 PRINT
940 PRINT
950 PRINT " BUT, THEY ALSO HAVE "
960 PRINT
970 PRINT "ANOTHER MISSION FOR YOU!
!!"
980 PRINT
990 PRINT
1000 INPUT "ARE YOU GAME (Y OR N)?"
:G$
1010 IF G$="Y" THEN 300
1020 GOTO 1500
1030 REM YOU WIN!!
1040 CALL CLEAR
1050 PRINT " YOU COMPLETED YOUR "
1060 PRINT
1070 PRINT "MISSION. THE SOLARIAN M
INI-"
1080 PRINT
1090 PRINT "STER HAS AWARDED YOU ";
PT
1100 PRINT
1110 PRINT "SOLARIAN CREDITS FOR YO
UR "
1120 PRINT
1130 PRINT "SERVICES AND WISHES YOU
"
1140 PRINT
1150 PRINT "TO MAKE ANOTHER DELIVER
Y!"
1160 PRINT
1170 PRINT
1180 GOTO 980
1190 CALL SCREEN(12)
1200 FOR I=1 TO 50
1210 NEXT I
1220 CALL SCREEN(9)
1230 FOR VOL=24 TO 1 STEP 4
1240 CALL SOUND(200,-7,VOL)
1250 NEXT VOL
1260 FOR VOL=1 TO 24 STEP 4
1270 CALL SOUND(200,-7,VOL)
1280 NEXT VOL
1290 CALL SCREEN(12)
1300 FOR I=1 TO 10
1310 NEXT I
1320 CALL SCREEN(8)
1330 CALL CLEAR
1340 CALL SCREEN(6)
1350 PRINT "{4 SPACES}TOO BAD! THE
SOLARIAN"

```

```

1360 PRINT " GOVERNMENT HAS SENT YO
UR"
1370 PRINT " FAMILY ";PT;" GALACTIC "
1380 PRINT " CREDITS."
1390 FOR I=1 TO 5
1400 PRINT
1410 NEXT I
1420 PRINT "{3 SPACES}HIT -P- TO PL
AY AGAIN"
1430 PRINT " OR -S- TO STOP."
1440 FOR I=1 TO 5
1450 PRINT
1460 NEXT I
1470 CALL KEY(3,K,ST)
1480 IF ST=0 THEN 1470
1490 IF (K=ASC("C"))+(K=ASC("P"))TH
EN 300
1500 END

```

#### Program 4: Apple Version

```

10 REM ASTEROID FIELD - APPLE II VERS
ION
20 FOR I = 770 TO 795: READ M: POKE I,
M: NEXT I
25 DATA 172,01,03,174,01,03,169,04,32
,168,252,173,48,192,232,208,253,13
6,208,239,206,0,03,208,231,96
30 GOTO 1000
100 TEXT : HOME : VTAB 1: PRINT "SCORE
": POKE 34,2
110 FOR I = 1 TO 15:SP = INT ( RND (1
) * 39) + 2: VTAB 24: HTAB (SP): PRINT
"*": NEXT I
115 FOR I = 10 TO 50 STEP 40: POKE 768
,10: POKE 769,I: CALL 770: NEXT I
120 POKE 0P,160: VTAB 24:SP = INT ( RND
(1) * 39) + 2
130 HTAB (SP): PRINT "*"
140 IF PEEK (CP) = 170 THEN GOTO 800
145 POKE CP,CC:OP = CP
146 FOR I = 1 TO 25: NEXT
149 VTAB 1: HTAB 7: CALL - 868: VTAB
1: HTAB 7: PRINT PT
170 M = PEEK ( - 16384): ON M < 128 GOTO
120
180 IF M - 128 = 8 THEN CC = 188:MV =
- 1: GOTO 120
190 IF M - 128 = 21 THEN CC = 190:MV =
+ 1: GOTO 120
200 IF M - 128 < > 32 THEN GOTO 120
210 IF CP < > BP OR MV > 0 THEN GOTO
215
212 ON SF GOTO 120
213 CP = BP + 39:SF = SF - 1: GOTO 230
215 CP = CP + MV
220 IF CP < > BP + 39 THEN GOTO 230
222 ON SF = 6 GOTO 600
225 CP = BP:SF = SF + 1
230 IF PEEK (CP) = 170 THEN GOTO 800
240 IF NOT MV THEN PT = PT + INT ((M
V * ( INT (DL * .2) * ((CP - BP) *
SF))) / 2): GOTO 250
245 PT = PT + (MV * ( INT (DL * .3) * (
(CP - BP) * SF)))
250 GOTO 120
600 REM WIN
610 TEXT : HOME : VTAB 2: HTAB 15: PRINT
"SCORE: ";PT
620 VTAB 8: HTAB 13: FLASH : PRINT "CO
NGRATULATIONS": NORMAL : VTAB 12: HTAB
14: PRINT "YOU MADE IT!"
640 POKE 768,15: POKE 769,50: CALL 770

```

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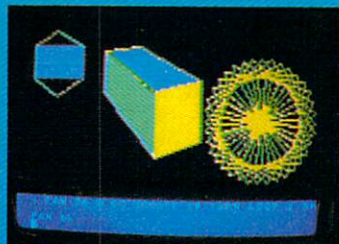
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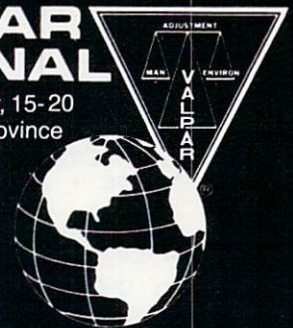
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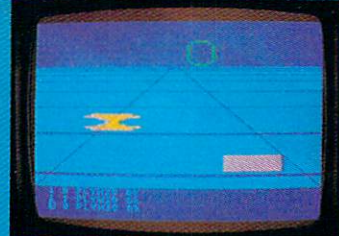
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```

: POKE 768,10: POKE 769,10: CALL 7
70: POKE 768,15: POKE 769,50: CALL 770
650 FOR I = 1 TO 500: NEXT I
660 POKE - 16368,0: GOTO 910
800 REM CRASH
810 V = DL + 2:H = CP - BP
820 IF H < = 1 THEN VTAB V - 1: HTAB
H: PRINT " /": VTAB V: HTAB H: PRINT
" -": VTAB V + 1: HTAB H: PRINT "
"; CHR$ (92): GOTO 850
830 IF H > = 39 THEN VTAB V - 1: HTAB
H: PRINT CHR$ (92);" ": VTAB V: HTAB
H: PRINT "- ": VTAB V + 1: HTAB H:
PRINT "/ ": GOTO 850
840 VTAB V - 1: HTAB H: PRINT CHR$ (9
2);" /": VTAB V: HTAB H: PRINT "-
-": VTAB V + 1: HTAB H: PRINT "/
"; CHR$ (92);
850 FOR I = 1 TO 200:X=PEEK(-16336):NEXT I
890 POKE - 16368,0
900 TEXT : HOME : VTAB 2: HTAB 15: PRINT
"SCORE: ";PT
905 VTAB 10: HTAB 11: PRINT "YOU LOST
YOUR SHIP!"
910 VTAB 21: HTAB 6: PRINT "SAME GAME
? Y)ES, N)O, E)ND ";: GET A$
915 IF A$ = "E" THEN END
920 IF A$ = "Y" OR A$ = CHR$ (13) THEN
GOTO 1130
1000 TEXT : HOME
1010 VTAB 5: HTAB 15: PRINT "ASTROSTORM"
1050 VTAB 10: HTAB 1: INPUT "ENTER DIF
FICULTY LEVEL (5-18) ";DL$
1055 IF LEN (DL$) < 1 OR LEN (DL$) >
2 THEN GOTO 1050
1060 E = 0: FOR I = 1 TO LEN (DL$):CH$

```

```

= MID$ (DL$,I,1): IF ASC (CH$) <
48 OR ASC (CH$) > 57 THEN E = 1
1070 NEXT I: ON E GOTO 1050
1080 DL = VAL (DL$)
1090 IF DL < 5 THEN VTAB 18: PRINT "T
OO EASY": FOR I = 1 TO 1000: NEXT
I: VTAB 18: CALL - 868: GOTO 1050
1100 IF DL > 18 THEN VTAB 18: PRINT "
TOO HARD": FOR I = 1 TO 1000: NEXT
I: VTAB 18: CALL - 868: GOTO 1050
1110 VTAB 15: HTAB 10: INPUT "INSTRUCT
IONS (Y/N) ";A$: IF A$ = "Y" THEN
GOTO 1200
1130 J = 0: FOR I = 1024 TO 1920 STEP 128
1140 J = J + 1
1150 IF J = DL + 2 THEN CP = I:I = 192
1: GOTO 1180
1160 IF J + 8 = DL + 2 THEN CP = I + 4
0:I = 1921: GOTO 1180
1170 IF J + 16 = DL + 2 THEN CP = I +
80:I = 1921
1180 NEXT I
1190 BP = CP:SF = 1:CC = 190:MV = + 1:
PT = 0: GOTO 100
1200 TEXT : HOME
1210 VTAB 3: HTAB 14: PRINT "INSTRUCTI
VTAB 6: PRINT "THE LEFT AND RIGHT
ARROW KEYS CONTROL ": PRINT "THE
DIRECTION OF MOVEMENT OF THE ROCKE
T.": PRINT "PRESS THE SPACE BAR T
O MOVE THE ROCKET."
1230 PRINT : PRINT : HTAB 4: PRINT "PR
ESS SPACE BAR TO BEGIN THE GAME"
1240 VTAB 20: HTAB 8: PRINT "PRESS ANY
KEY WHEN READY": WAIT - 16384,128
1250 GOTO 1130

```

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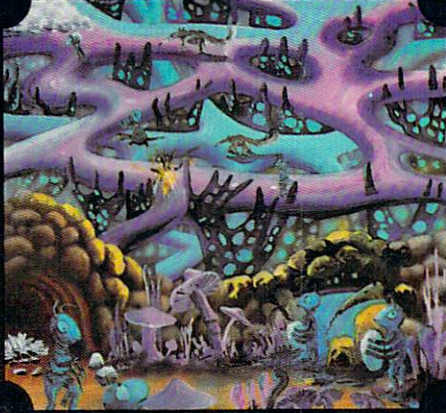
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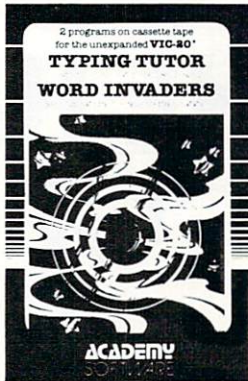
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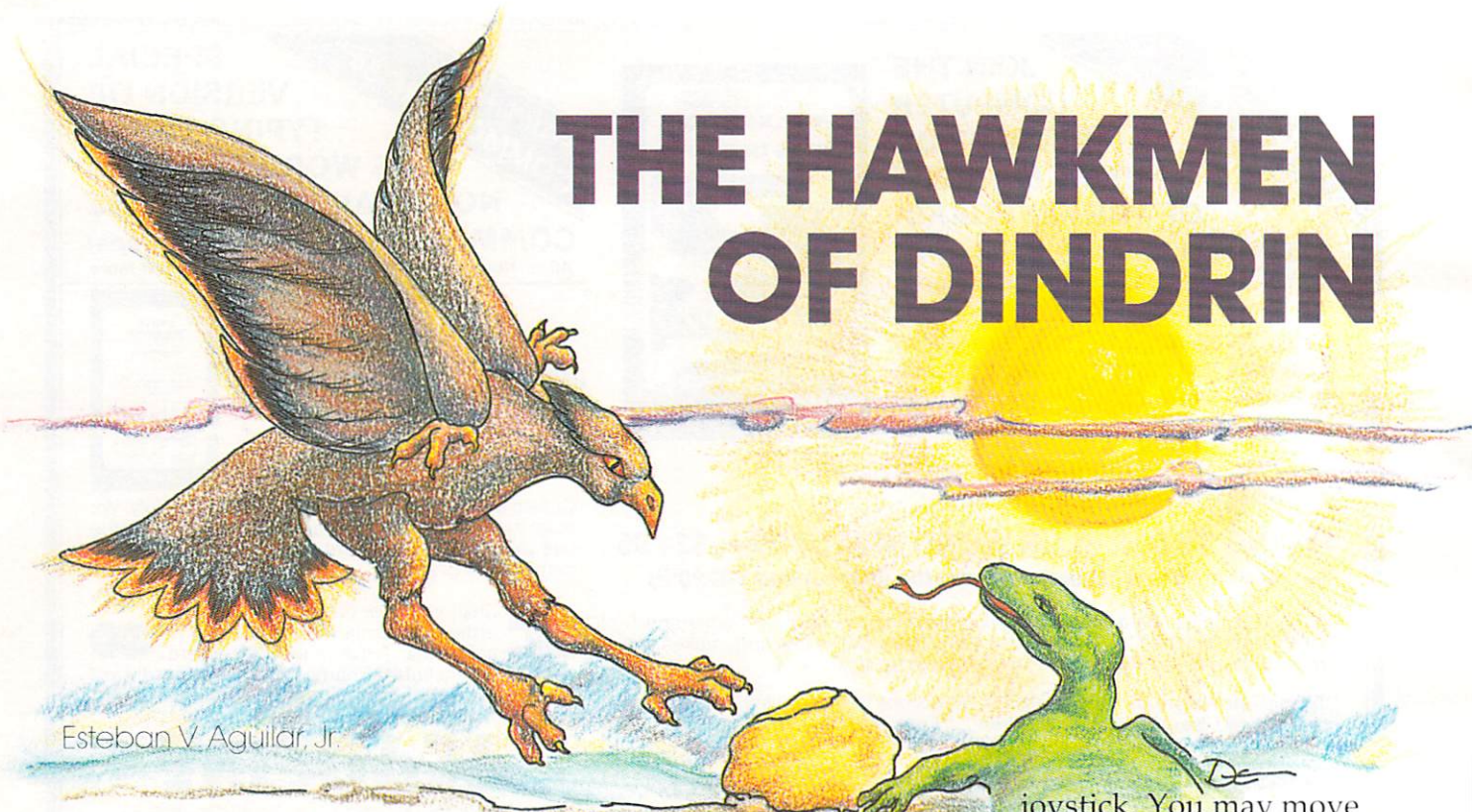
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# THE HAWKMEN OF DINDRIN



Esteban V. Aguilar, Jr.

*Fly down through the dangerous skies of the planet Dindrin to collect golden stones. Retrieve enough of them and you can win the game, but beware of the floaters, skimmers, and lizards. There are versions here for VIC, 64, and Atari. Several special Atari and 64 animation, multicolor sprite, and sound effects techniques are described in the accompanying notes.*

There's a strange planet named Dindrin where multicolored floaters and a giant sky skimmer drift through the daytime skies. On the surface of the planet, vicious land hunters come up from the ground and set polished, golden stones in the sun. It's a form of worship too obscure, too alien to describe.

Suddenly a strange looking hawk-like creature dives down and snatches a stone. With this program and your VIC, you can experience what it's like to be one of the Hawkmen of Dindrin.

The "Hawkmen of Dindrin" is divided into two programs. The first program makes custom characters and automatically loads the main game program. When the game begins, you (the hawkman) start off on the upper left corner of the screen under the cloud layer. You will move across the screen and move lower after every line.

Maneuvering is accomplished with your

joystick. You may move backwards by pulling left on the joystick. Whenever you want to go into a dive or fly upwards, you must pull down or up (respectively) on the joystick. One thing to keep in mind when ascending or descending is that you will move diagonally rather than straight up or down. The winds are powerful on Dindrin. Flying is an art form there.

Once in a while, an obstacle such as the sky skimmer (moving above the surface) or a floater (dominating the skies) will get in your way. When this happens, you can press the red button on the joystick to extend the hawkman's tongue to snap up its prey. You can also do this to obtain points and energy. The skimmer is worth 5 points and 10 energy credits. The floaters are worth 15 points and 20 energy credits.

There are a couple of things to consider before playing the game. As time passes, you will lose energy. If your energy gets too low, the screen border will disappear. If your energy runs out, the game will end. If you have sufficient energy, the border will remain on screen. Second, when you're flying don't run into anything or you'll lose one of your lives. Third, when the game starts after the program is loaded from tape, press the stop button on the cassette player. Otherwise, the joystick will not respond to your commands. To win, you must obtain 10,000 points.



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# Atari And Commodore 64 Notes

Charles Brannon, Program Editor

Several special programming tricks went into the making of the Atari and 64 versions of "The Hawkmen of Dindrin." Most striking is that the Atari and 64 program listings are very similar. The same basic program was used on both machines, but lines specific to each machine's graphics are of course modified. The joystick values returned by STICK(0) (Atari) and PEEK(56321)AND15 (64) are identical, making the game easier to translate.

## Animated Characters

Take a look at the screen photos for Hawkmen. A "patrol snake" sweeps across the bottom of the screen. Airborne "floaters" pop up all over the screen, grinning (as well they might). The hawkman's wings flap. The luminous stones at the bottom of the screen are protected by menacing lizards whose tongues wiggle venomously at you.

To play the game, use a joystick plugged into the first port. Follow the general instructions in the VIC article. The joystick response will be strange and difficult to master, but it is predictable. Your hawkman cannot stick out his tongue, but if you hold down fire, you can safely bump into the smirking floaters (and get points for them!).

## How It's Done

Multicolored characters are used on both the Atari and 64 for the stones and the lizards. The patrol snake is a multicolored sprite on the 64 and is formed on the Atari by overlaying two players to get three colors.

The animation (wing flapping, tongue wiggling) is done by switching between two custom character sets. Every object to be animated has two alternate "views." The same image is copied into both character sets for shapes that should not move, such as the stones or the score line.

## Special Machine Language

A machine language routine is used for smooth, even horizontal motion for the patrol snake. Instead of being called when needed by BASIC, the machine language routine runs continuously "in the background." The machine language routine also flips the character set and, on the Atari, produces a variable sound effect.

## Countdown Timers

On the Atari, the machine language is called automatically by Countdown Timer Two. To use the countdown timer, store the address of your routine in CDTMA2 (\$0228). To start the automatic execution, store a clock value into CDTMV2 (\$021A). The clock value is measured in sixtieths of a second. The time value is decremented every vertical blank, and when it hits zero, your routine is called by an indirect JSR through CDTMA2. After your routine executes, it should store a new timer value so that it will be called again, and then return with RTS.

The beauty of using the countdown timers instead of a vertical blank is twofold: it's easier to set up and disable (to disable, just store a zero into CDTMV2), and you can control how often it's called by the timer value. The routine was being called every sixtieth of a second (value of one), but the character set flipping was so fast it blurred. So a higher value was used, and the snake was speeded up by additional increments of its horizontal position.

## Interrupting The Commodore 64

We used the hardware interrupt request (IRQ) on the Commodore 64. To place a machine language routine so that it automatically executes every sixtieth of a second, you change the IRQ vector at \$0314 (it normally points to the ROM interrupt routines) to point to your machine language routine. After your routine executes, it exits with a JMP to the normal ROM routine.

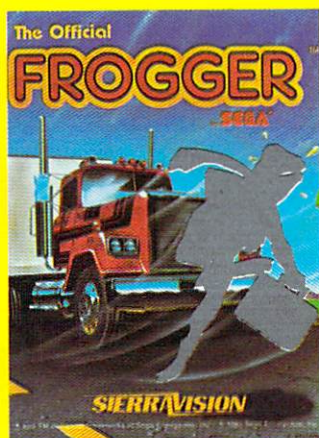
The setup is a little tricky. While you're storing the new IRQ value, you have to use SEI (SEt Interrupt disable bit) to prevent any interrupts from happening. If you don't, an interrupt *could* occur after you had stored the first byte of the vector value but before you changed the second. The interrupt would then vector through a "half baked" value,

NOW

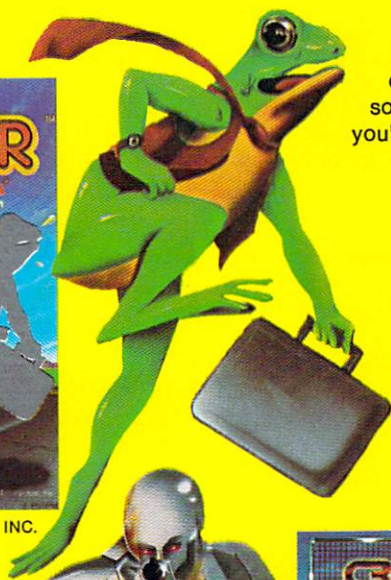
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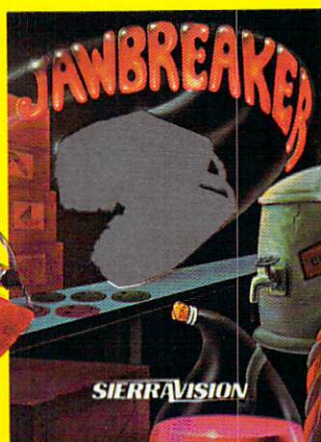
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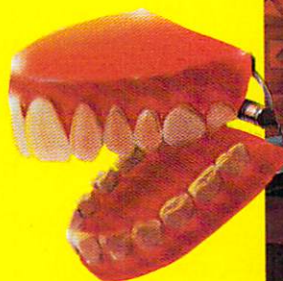
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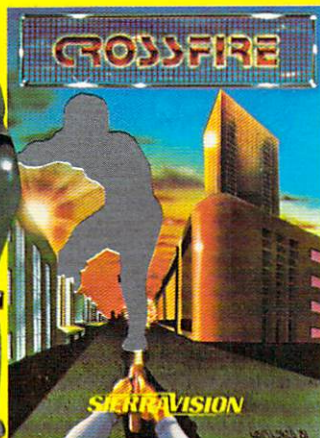


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and end up in limbo.

After you've changed the IRQ vector, you clear the interrupt disable bit (CLI) and return with RTS to BASIC. The machine language routine will then be running continuously in the background, flipping the character set and moving the sprite.

## More On Multicolor

The now famous IRG mode 4 is used on the Atari for multicolored characters. See the Atari Notes for Thunderbird (**COMPUTE!**, January 1983) for more information on multicolored characters. Interestingly, the same character set used on the Atari was used on the 64, even for multicolor. It turns out that both machines use the same format for storing multicolor patterns.

## Commodore 64 Multicolor

Multicolor graphics are really important for good arcade effects. A few years ago, graphic objects (such as a tank or plane) were always a single color. But increasing realism has been a feature of arcade graphics, and multicolored objects are an important aspect of this realism.

Normally, when you define a custom character set on the 64, you create eight rows of pixels (picture elements, dots). Each row is eight dots (or bits) wide. With multicolor, each row is divided up into four two-bit pairs. Each pair of bits can hold a number from 0-3: 00,01,10,11. You use a different number for each color. This reduces the resolution to four multicolor pixels per row, so the lizards and stones are composed of two characters each. You also have to tell the VIC-II chip that you are using multicolor. Do this with:

```
POKE 53270,PEEK(53270) OR 16
```

Disable multicolor with:

```
POKE 53270,PEEK(53270) AND 239
```

Here is a sample multicolor shape:

```
rrrr    r = red  (arbitrary colors)
rbbb    b = blue
rbgg    g = green
rbgg
```

Let's say the binary codes for red, green, and blue are (respectively) 01, 10, and 11. Substituting gives:

```
01 01 01 01    01010101
01 10 10 10    01101010
01 10 11 11    01101111
```

```
01 10 11 11    01101111
```

You can change the colors according to this key:

```
00 Background #0 color register - 53281
01 Background #1 color register - 53282
10 Background #2 color register - 53283
11 Color in lower 3 bits in color memory.
```

That last line needs explaining. You know that to get variously colored characters, you POKE a number from 0-15 into the corresponding color memory location. However, colors 8-15 (accessed by the Commodore key) are really multicolors. Multicolor characters always are displayed with a color from 8-15. You won't get the eight alternate colors (such as grey), but the normal color on the key (15 = yellow). Just add eight to the "normal" color number. So, a bit value of 11 will take on the value in color memory. The other colors will come from the color registers (00 is transparent).

Multicolored sprites are similar. Instead of the normal 24-bit resolution, the bits are grouped into 12 bit pairs. The colors come from:

```
00 - Transparent, screen color
01 - Sprite multicolor register #0 53285
10 - Normal sprite color register
11 - Sprite multicolor register #1 53286
```

You tell the VIC-II chip that you are using a multicolored sprite by:

```
POKE 53276,PEEK(53276) OR (2^X)
```

"x" is the sprite number, from 0 to 7. You can mix multicolored and regular sprites on the same screen. But all multicolored sprites will share the same two multicolor registers.

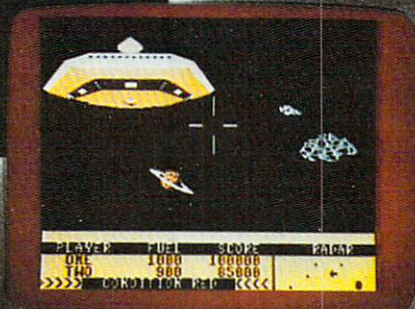
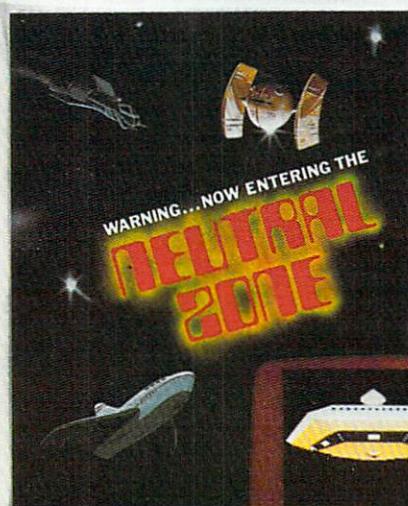
## Simple SID Chip Sound

We were able to get some nice sound effects on the Atari version (such as the thrumming made by a lizard) by experimenting. But with the 24 registers of Commodore's sound synthesis chip, SID, trial and error would take far too long. The "thrumming" noise is made by playing a low-pitched tone through the SID using the variable pulse wave and a fairly long (one second) decay. Another sound effect (I can't really describe it) is made with white noise and a medium decay. The high byte of the pitch is changed as the note is played. There is also another sound effect created by the sawtooth waveform affecting the low byte of the pitch.

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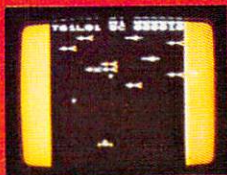
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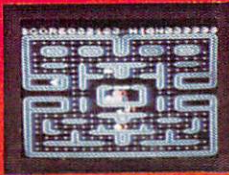
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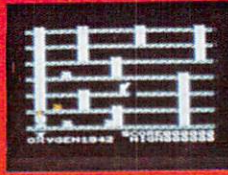
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Un-expanded VIC 20

Keyboard or joystick



## PANIC

A ladder and platform environment where aliens pursue a shovel wielding crew member around the screen. Armed only with a space shovel set traps for the aliens by digging holes in the platforms then pound them to death with the shovel. Multiple screen, hi score, unlimited play, three alien types.

Cassette \$24.00

Un-expanded VIC 20

Keyboard or Joystick

VIC 20™



commodore 64™

# STAR BASE

VIC 20™



commodore 64™



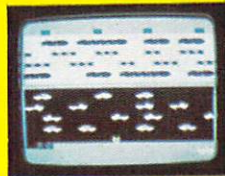
## METEOR

Your ship is being approached by deadly meteors, your long range scan locates approaching meteor and indicates range. Your task is to spot the approaching meteors destroy it with laser fire before impact. Beautiful graphics, damage indicator, full color hi-resolution graphics and sound.

Cassette \$12.00

Un-expanded VIC 20 or Commodore 64

Keyboard or Joystick

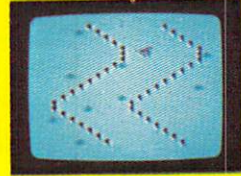


## BUNNY

Using the joystick move the bunny across four lanes of speeding traffic, dodging trucks and cars. Then hop across a swiftly flowing, piranha infested river by jumping on floating logs and friendly turtles to safety. Full color high resolution action game with sound effects.

Cassette \$20.00

Un-expanded VIC 20 or Commodore 64 Joystick required



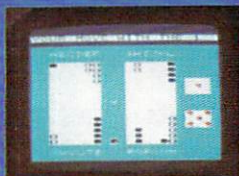
## SKI-RUN

Three different games in one, Downhill, Slalom, Giant Slalom. Each game with nine skill levels. A race against the clock for the fastest time. In Downhill, dodge the many trees and snowdrifts keeping between the pathmarkers. Slalom adds a new dimension to the game with Slalom gates.

Cassette \$20.00

Un-expanded VIC 20 or Commodore 64 Keyboard only

# STAR BASE

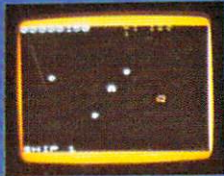


## BACKGAMMON

The traditional game we all know. You versus the computer. Human wits against the power and logic of a computer. Three levels of play, beginner, novice, expert. Single keypress commands for your moves, full color graphics with sound effects. The computer plays a very strong game.

Cassette \$24.00

Commodore VIC-20 with 3K RAM Commodore 64



## ASTEROIDS 20

Pilot a ship in the midst of an asteroid belt, destroy all of the asteroids before they smash the ship. A game for the novice and expert. The game starts with two asteroids and increases with each screen cleared up to 100. Smashed asteroids split into smaller ones, auto increase of 255 speed levels.

Cassette \$24.00

Un-expanded VIC 20 Keyboard or Joystick



## COSMIADS

A fast action game, multicolored aliens of different types break out of formation at random and attack your laser base firing their own deadly missiles. Full color, super fast action with the most superb sound effects. Features bonus mother ship etc.

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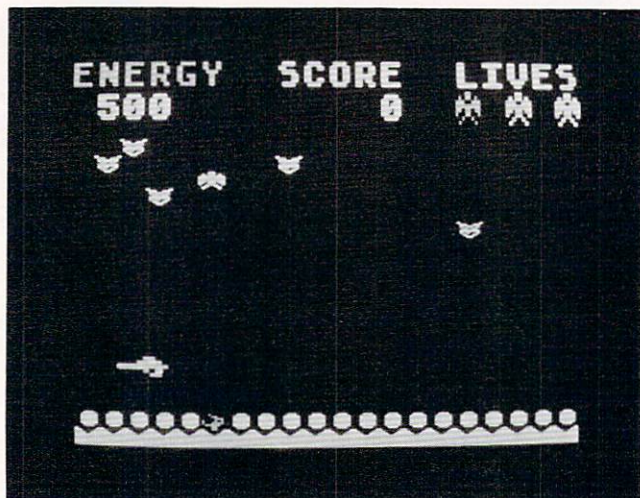
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```

1000 PRINT"{CLEAR}"
1005 PRINT"IF YOU WISH TO PLAY":PRINT"AGAIN
, PRESS THE FIRE BUTTON."
1010 PRINT"{PUR}IF NOT,THEN PRESS THE":PRIN
T"JOYSTICK DOWN."
1015 PRINT"YOUR SCORE:";SC
1020 PRINT"YOUR TIME :";VAL(TI$)
1023 IFSC>=10000THENPRINT"{REV}{RED}YOU HAV
E WON!{OFF}"
1025 J=0
1030 J=PEEK(37151)
1035 IFJ=94THENRUN
1040 IFJ=118THENPOKE36869,240:PRINT"{REV}
HAWKMEN OF DINDRIN      GAME TER
MINATED  {OFF}":END
1050 GOTOL025

```



"Hawkmen Of Dindrin," Atari version.

### Program 3: Hawkmen – Atari Version

```

100 REM HAWKMEN OF DINDRIN
110 REM ATARI VERSION
120 REM
130 REM Enter INVERSE VIDEO with Ata
ri logo key
140 GOSUB 530:ENERGY=500:GOTO 180
150 POSITION 1,1:?" #6;ENERGY;" "":PO
SITION 13-LEN(STR$(SCORE)),1:?" #
6;SCORE;
160 IF ENERGY<=0 THEN 440
170 RETURN
180 IF STICK(0)<>15 THEN ST=STICK(0)
:POKE 77,0
190 IF RND(0)>0.95 THEN POSITION 19*
RND(0),10*RND(0)+3:PUT #6,ASC(FO
OL$(INT(4*RND(0)+1)))
200 IF RND(0)<0.7 THEN 220
210 POSITION INT(10*RND(0))*2,20+(RN
D(0)>0.5):C=33+2*(RND(0)>0.7):?
#6;CHR$(C);CHR$(C+1);
220 IF PEEK(53252) OR PEEK(53253) TH
EN 440
230 COLOR PC:PLOT PX,PY:ENERGY=ENERG
Y-1-9*(1-STRIG(0))
240 POSITION 1,1:?" #6;ENERGY*(ENERGY
>0);" "":IF ENERGY<=0 THEN 440
250 NX=PX+1-2*(STICK(0)=11):NY=PY-(N
X<0)+(NX>19):NX=NX*(NX<20)+20*(N
X<0)
260 NY=NY+(ST=13)-(ST=14):IF NY<3 OR

```

```

NY>20 THEN ST=27-ST:NY=PY
270 LOCATE NX,NY,WHATSIT
280 IF NY>19 THEN Z=PX*2-20*(PX>9):L
OCATE Z,NY+(PX>9),WHATSIT:GOTO 3
30
290 IF WHATSIT=32 THEN COLOR 32:PLOT
PX,PY:PX=NX:PY=NY:GOTO 180
300 IF STRIG(0) THEN 440
310 COLOR 32:PLOT PX,PY:FOR W=15 TO
0 STEP -0.5:SOUND 0,W,12,8:SOUND
1,W,0,8:NEXT W
320 SOUND 0,0,0,0:SOUND 1,0,0,0:WHAT
SIT=32:SCORE=SCORE+10:ENERGY=ENE
RGY-50:GOSUB 150:GOTO 280
330 ST=27-ST:IF WHATSIT<33 OR WHATSI
T>34 THEN 360
340 POSITION Z,NY+(PX>9):PUT #6,32:P
UT #6,32:SCORE=SCORE+10:ENERGY=E
NERGY+50
350 COLOR 32:PLOT PX,PY:PX=NX:SCORE=
SCORE+50:GOSUB 150:GOTO 180
360 IF WHATSIT=32 THEN 180
370 REM GRAB 'EM AND EAT 'EM UP!
380 POKE DL+19,112:POKE DL+20,4:COLO
R 32:PLOT PX,PY
390 POSITION Z,NY+(PX>9):PUT #6,37:P
UT #6,38:POSITION Z,NY-2+(PX>9):
PUT #6,42:PUT #6,36
400 SOUND 0,255,2,15:FOR W=1 TO 500:
NEXT W:SOUND 0,0,0,0
410 POSITION Z,NY+(PX>9):PUT #6,35:P
UT #6,36:POSITION Z,NY-2+(PX>9):
PUT #6,32:PUT #6,32
420 POKE DL+19,6:POKE DL+20,6:GOTO 4
60
430 REM PLAYER MEETS HIS DEMISE
440 FOR I=60 TO 0 STEP -4:SOUND 0,I,
12,1/4:POKE 53274,PEEK(53770):SO
UND 1,1,2,1/4:POKE 53274,PEEK(53
770)
450 COLOR ASC(EXPL$(16-I/4)):PLOT PX
,PY:POKE 53274,PEEK(53770):NEXT
I
460 COLOR 32:IF LIFE<3 THEN PLOT 15+
LIFE*2,1
470 PLOT PX,PY:LIFE=LIFE+1:IF LIFE<4
THEN ENERGY=500:GOSUB 770:GOTO
180
480 POKE 538,0:POKE 53248,0:POKE 532
49,0:SOUND 2,0,0,0:SOUND 3,0,0,0
490 COLOR 32:PLOT 0,5:DRAWTO 19,5:PL
OT 0,7:DRAWTO 19,7:POSITION 5,5:
?" #6;"GGGG oOEG"
500 POSITION 5,7:?" #6;"press START":
POKE 53279,8
510 IF PEEK(53279)<>6 THEN 510
520 RUN
530 REM INITIALIZATION
540 CHSET=(PEEK(106)-12)*256:IF PEEK
(CHSET+8)=2 THEN 600
550 POKE 88,0:POKE 89,CHSET/256-4:?"
CHR$(125):REM clear memory
560 GRAPHICS 18:SETCOLOR 4,0,10:POS
ITION 4,5:?" #6;"THE HAWKMEN":POS
ITION 5,7:?" #6;"Of Dindrin":SETC
OLOR 1,4,4
570 DL=PEEK(560)+256*PEEK(561)+4
580 POKE DL+12,6:POSITION 1,11:?" #6;
"ready in 15 seconds";
590 GOSUB 890:GOSUB 800
600 GRAPHICS 17:DL=PEEK(560)+256*PEE
K(561)+4:DIM FOOL$(4),PC$(4),EXP

```



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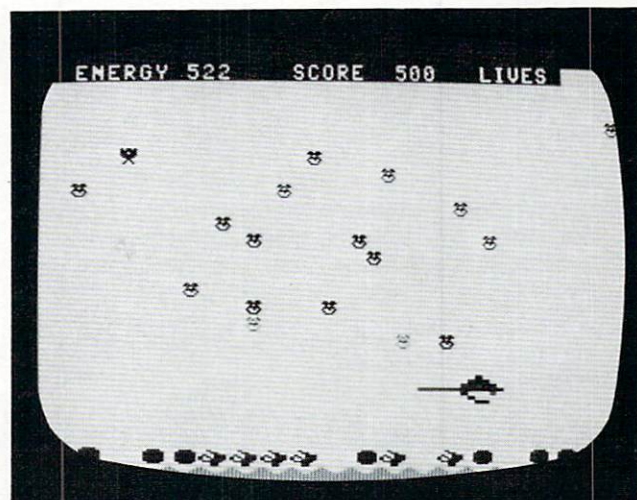
L$(16):RESTORE 630
610 FOR I=1 TO 4:READ A:FOOL$(I)=CHR
$(A):NEXT I:FOR I=1 TO 4:READ A:
PC$(I)=CHR$(A):NEXT I
620 FOR I=1 TO 16:READ A:EXPL$(I)=CH
R$(A):NEXT I
630 DATA 41,169,9,137,43,171,11,139,
44,172,12,140,45,173,13,141,46,1
74,14,142,47,175,15,143
640 POKE DL-1,71:POKE DL+2,7:POKE DL
+21,4:POKE DL+22,4:POKE DL+23,4:
POKE DL+24,4:POKE 756,CHSET/256
650 SETCOLOR 0,13,14:SETCOLOR 1,7,12
:SETCOLOR 2,12,8:SETCOLOR 3,4,14
:SETCOLOR 4,5,4
660 POSITION 0,0:?"#6;"ENERGY score
LIVES"
670 POSITION 0,1:?"#6;" 500
(8 SPACES)0 ";PC$(2,2);" ";PC$(
3,3);" ";PC$(4,4);
680 POSITION 0,22:FOR I=0 TO 19:PUT
#6,39:PUT #6,40:NEXT I
690 POSITION 0,20:FOR I=0 TO 19:PUT
#6,33:PUT #6,34:NEXT I
700 POSITION 10,20:PUT #6,35:PUT #6,
36
710 PMBASE=CHSET-1024:P0=PMBASE+512:
P1=P0+128:POKE 54279,PMBASE/256:
POKE 559,46:POKE 53277,3:POKE 62
3,32
720 POKE 704,4*16+8:POKE 705,14:POKE
53256,1:POKE 53257,1
730 RESTORE 740:FOR I=0 TO 4:READ A:
POKE P0+90+I,A:NEXT I:FOR I=0 TO
2:READ A:POKE P1+91+I,A:NEXT I
740 DATA 12,30,255,8,6,4,240,2
750 FOR I=1 TO 5:POSITION 19*RND(0),
10*RND(0)+3:R=INT(4*RND(0)+1):?
#6;FOOL$(R,R):NEXT I
760 SOUND 2,0,12,2:SOUND 3,0,12,2:A=
USR(1664)
770 PX=5:PY=5:PC=ASC(PC$(LIFE+1,LIFE
+1)):COLOR PC:PLOT PX,PY:POKE 53
278,0
780 IF STICK(0)=15 THEN 780
790 RETURN
800 RESTORE 810:FOR I=1664 TO 1710:R
EAD A:POKE I,A:NEXT I:RETURN
810 DATA 104,169,139,141,40,2
820 DATA 169,6,141,41,2,230,203,230,
203
830 DATA 230,203,165,203,141,0
840 DATA 208,141,1,208,141,6,210
850 DATA 73,255,141,4,210,173,244,2
860 DATA 73,12,141,244,2,169
870 DATA 2,141,26,2,96
880 GOTO 880
890 FOR I=128 TO 471:Z=PEEK(57344+I)
:POKE CHSET+I,Z:POKE CHSET+I+102
4,Z:NEXT I
900 RESTORE 940
910 READ A:IF A=-1 THEN RETURN
920 FOR J=0 TO 7:READ B:POKE CHSET+A
*8+J,B:NEXT J:GOTO 910
930 DATA 0,0,0,0,0,0,0,0,0
940 DATA 1,2,9,9,9,9,9,2,0
950 DATA 2,160,88,88,88,88,160,0
960 DATA 3,12,3,16,196,195,63,3,3
970 DATA 4,0,192,252,236,252,240,192
,192
980 DATA 5,3,35,131,139,139,171,35,3
990 DATA 6,192,192,224,232,202,194,1
94,200

```

```

1000 DATA 7,64,80,84,85,85,85,85,85
1010 DATA 8,1,5,21,85,85,85,85,85
1020 DATA 9,0,102,219,36,126,137,66,
60
1030 DATA 10,0,15,0,51,63,15,15,3
1040 DATA 128,0,0,0,0,0,0,0,0
1050 DATA 129,2,9,9,9,9,9,2,0
1060 DATA 130,160,88,88,88,88,88,160
,0
1070 DATA 131,12,3,0,192,195,63,3,3
1080 DATA 132,0,192,252,204,252,240,
192,192
1090 DATA 133,3,3,35,171,139,139,131
,35
1100 DATA 134,192,200,194,194,202,23
2,224,192
1110 DATA 135,64,80,84,85,85,85,85,8
5
1120 DATA 136,1,5,21,85,85,85,85,85
1130 DATA 137,129,102,90,36,126,82,3
6,24
1140 DATA 138,0,15,0,48,63,3,15,15
1150 DATA 11,153,219,231,255,90,24,3
6,66
1160 DATA 139,24,90,231,255,219,153,
36,66
1170 DATA 12,217,219,231,75,2,24,36,
66
1180 DATA 13,216,225,235,69,7,2,40,6
6
1190 DATA 14,192,192,145,3,67,1,72,1
30
1200 DATA 15,192,128,8,1,1,0,16,128
1210 DATA 140,217,219,247,99,22,24,3
6,68
1220 DATA 141,216,225,227,71,23,130,
32,66
1230 DATA 142,192,200,129,3,131,1,64
,130
1240 DATA 143,192,144,0,1,1,0,8,128
1250 DATA -1

```



"Hawkmen Of Dindrin," Commodore 64 version.

#### Program 4: Hawkmen - Commodore 64 Version

```

100 REM HAWKMEN OF DINDRIN
110 REM COMMODORE 64 VERSION
120 POKE52,48:POKE56,48:CLR:GOSUB500:EN=50
0:GOTO160

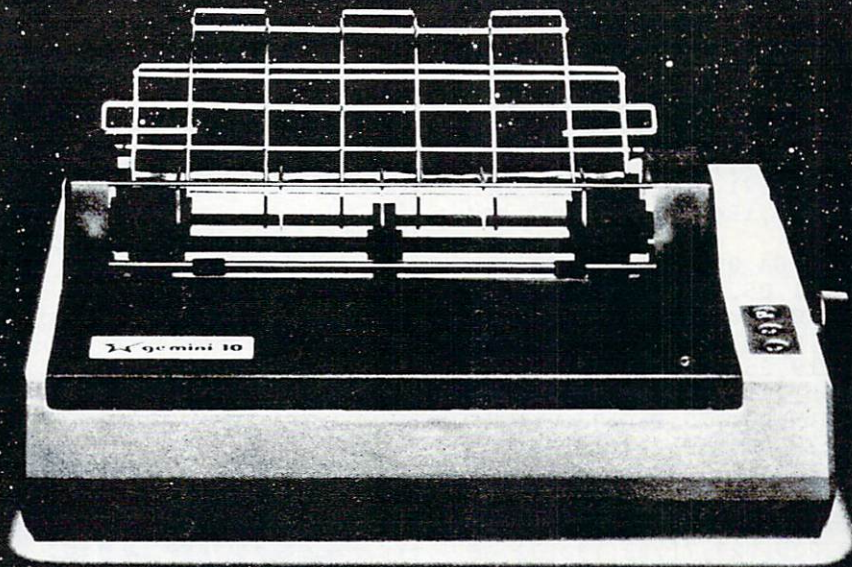
```

```

130 PRINT "{HOME}{REV}{RED}";TAB(9) "{LEFT}"
;EN;"{BLU}";TAB(26-LEN(STR$(SC)))
;SC;
140 IF EN<=0 THEN 410
150 RETURN
160 IF (PEEK(56321) AND 15) <> 15 THEN JS=PEEK(56
321) AND 15
170 IFRND(1) > .9 THEN Q=LL*RND(1)+(15*RND(1)+
2)*LL:POKET+Q,FOOL:POKEC+Q,6*RND(
1)+2
180 IFRND(1) < .7 THEN 200
190 Q=920+INT(20*RND(1))*2:Z=33-2*(RND(1)>
.7):POKET+Q,Z:POKET+Q+1,Z+1
200 IF PEEK(V+31) THEN 410
210 Q=PX+LL*PY:POKET+Q,PC:POKEC+Q,6:EN=EN-
1-9*(1-(PEEK(56321) AND 16)/16)
215 PRINT "{HOME}{REV}{RED}"TAB(9);"{LEFT}"
;-EN*(EN>0);"{LEFT} ";:IF EN<=0 THEN 410
220 NX=PX+1+2*(JS=11):NY=PY+(NX<0)-(NX>39)
:NX=-NX*(NX<40)-40*(NX<0)
230 NY=NY-(JS=13)+(JS=14):IF NY<2 OR NY>23 THE
NJS=27-JS:NY=PY
240 WHATSIT=PEEK(T+NX+LL*NY)
250 IF NY>22 THEN 300
260 IF WHATSIT=32 THEN POKET+PX+LL*PY,32:PX=N
X:PY=NY:GOTO 160
270 IF PEEK(56321) AND 16 THEN 410
280 POKET+PX+LL*PY,32:POKES+24,15:POKES+5,
9:POKES+6,0:POKES+1,10
281 FORI=0 TO 10:POKES,I*20:POKES+4,32:POKES
+4,33:NEXT:POKES+24,0
290 WHATSIT=32:SC=SC+10:EN=EN-50:GOSUB 130:
GOTO 250
300 JS=27-JS:IF WHATSIT<33 OR WHATSIT>34 THEN 3
30
305 Q=(NX AND 254)+LL*NY:POKET+Q,32:POKET+Q+
1,32:EN=EN+50
310 GOTO 320
288 POKET+PX+LL*PY,32:Q=LL*NY+NX:POKET+Q,3
7:POKET+Q+1,38:POKET+Q-LL,42
320 POKET+PX+LL*PY,32:PX=NX:SC=SC+50:GOSUB
130:GOTO 160
330 IF WH=32 THEN 160
340 REM GRAB 'EM AND EAT 'EM UP!
350 POKET+PX+LL*PY,32:Q=LL*NY+(NX AND 254):P
OKET+Q,37:POKET+Q+1,38:POKET+Q-LL,42
360 POKET+Q-LL+1,36:POKEC+Q-LL,13:POKEC+Q-
LL+1,13
370 POKES+24,15:POKES+1,0:POKES,255:POKES+
3,8:POKES+2,0:POKES+5,12:POKES+6,0
375 POKES+4,64:POKES+4,65:FORW=1 TO 1500:NEX
T:POKES+4,64:FORL=STOS+24:POKEL,0
:NEXT
380 POKE T+Q,33:POKET+Q+1,34:POKET+Q-LL,32
:POKET+Q-LL+1,32
390 GOTO 430
400 REM PLAYER MEETS HIS DEMISE
410 POKES+24,15:POKES+5,9:POKES+6,0:POKES,
200
420 FORI=0 TO 90 STEP 6:Q=PX+LL*PY:POKET+Q,44+
I/30:POKEC+Q,8*RND(1)
425 POKE 53280,16*RND(1):POKES+1,I:POKES+4,
128:POKES+4,129:NEXT
427 FORL=STOS+24:POKEL,0:NEXT
430 POKE 53280,0:IF LI<3 THEN POKET+35+LI*2,32
440 POKET+PX+LL*PY,32:Z=PEEK(V+31):LI=LI+1
:IF LI<4 THEN EN=500:GOSUB 720:GOTO 160
450 SYS 52992:REM TURN OFF ML
460 PRINT "{HOME}{03 DOWN}{REV}";TAB(15);"{
BLK}G{RED}A{CYN}M{PUR}E{RIGHT}{
GRN}O{BLU}V{YEL}E{RED}R{BLU}"
470 PRINTTAB(7) "{DOWN}{REV}PRESS {RED}FIRE
{BLU} TO PLAY AGAIN"
480 IF (PEEK(56321) AND 16) THEN 480
490 RUN
500 REM INITIALIZATION
510 POKE 53280,0:POKE 53281,1
515 T=1024:C=55296:S=54272:LL=40
520 CHSET=12288:IF PEEK(CHSET+264)=2 THEN 5
70
530 PRINT "{CLEAR}":CS="{BLK}{RED}{CYN}{
PUR}{GRN}{YEL}{BLU}":FORI=1 TO 7:PR
INT "{HOME}{DOWN}";MID$(CS,I,1);:G
OSUB 2000:NEXT
550 PRINTTAB(10) "{03 DOWN}{02 RIGHT}{BLK}R
EADY IN {RED}22{BLK} SECONDS";
560 GOSUB 750:GOSUB 840
570 PRINT "{CLEAR}";:FOOL=41
575 FORL=STOS+24:POKEL,0:NEXT
580 PC=43:POKE 53282,10:POKE 53283,2
590 POKE 53272,(PEEK(53272) AND 240) OR 12:REM
ENABLE NEW CHARACTER SET
600 POKE 53270,PEEK(53270) OR 16:REM SET MU
LTICOLOR MODE
610 PRINT "{HOME}{RED}{REV} ENERGY 500 {
BLU} SCORE 0 {GRN} LIVES {
OFF}{PUR}+ + +"
630 FORI=0 TO 39 STEP 2:Q=24*LL+I:POKET+Q,39:P
OKET+Q+1,40:POKEC+Q,7:POKEC+Q+1,7:NEXT
640 FORI=0 TO 39 STEP 2:Q=23*LL+I:POKET+Q,33:P
OKET+Q+1,34:POKEC+Q,13:POKEC+Q+1,
13:NEXT
650 Q=10+23*LL:POKET+Q,35:POKET+Q+1,36
660 V=53248:REM START OF VIC-II CHIP REGIS
TERS
670 POKEV,220:POKEV+1,194:POKEV+21,1:POKEV
+39,7:POKE 2040,13
680 POKEV+23,1:POKEV+29,1:POKE 53285,3:POKE
53286,4:POKE 53276,PEEK(53276) OR 1
681 FORI=0 TO 63:POKE 832+I,0:NEXT:RESTORE
685 FORI=0 TO 18:READA:POKE 832+8+I,A:NEXT
690 DATA 192,0,3,240,0,15,124,85,95,255,0,1
2,8,0,3,0,0,240
700 FORI=1 TO 5:Q=40*RND(1)+(10*RND(1)+3)*LL
:POKET+Q,FOOL:POKEC+Q,6*RND(1)+2:NEXT
710 SYS 52992:REM START ML ROUTINE
720 PX=5:PY=5:PC=43:POKET+PX+LL*PY,PC:POKE
C+PX+LL*PY,6
730 IF (PEEK(56321) AND 15)=15 THEN 730
740 RETURN
750 RESTORE:FORI=0 TO 18:READA:NEXT:FORI=0 TO
96:READA:POKE 52992+I,A:NEXT:RETURN
760 DATA 120,173,21,3,201,234,208,19
770 DATA 169,39,141,20,3,169,207,141
780 DATA 21,3,169,0,133,251,133,252
790 DATA 76,37,207,169,49,141,20,3
802 DATA 169,234,141,21,3,88,96,165
804 DATA 251,141,0,208,173,16,208,41
806 DATA 254,5,252,141,16,208,24,165
808 DATA 251,105,4,133,251,165,252,105
810 DATA 0,133,252,240,12,165,251,201
812 DATA 91,144,6,169,0,133,251,133
814 DATA 252,165,162,74,144,8,173,24
816 DATA 208,73,2,141,24,208,76,49
818 DATA 234
840 POKE 56334,PEEK(56334) AND 254:POKE 1,PEEK
(1) AND 251
841 FORI=0 TO 511:POKE 13312+I,PEEK(54272+I):
POKE 15360+I,PEEK(54272+I):NEXT
842 POKE 1,PEEK(1) OR 4:POKE 56334,PEEK(56334)
OR 1
860 READA:IFA=-1 THEN RETURN
870 FORJ=0 TO 7:READB:POKECHSET+A*8+J,B:NEXT
J:GOTO 860

```

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```

880 DATA 32,0,0,0,0,0,0,0,0
890 DATA 33,2,9,9,9,9,9,2,0
900 DATA 34,160,88,88,88,88,160,0
910 DATA 35,12,3,16,196,195,63,3,3
920 DATA 36,0,192,252,236,252,240,192,192
930 DATA 37,3,35,131,139,139,171,35,3
940 DATA 38,192,192,224,232,202,194,194,20
0
950 DATA 39,64,80,84,85,85,85,85,85
960 DATA 40,1,5,21,85,85,85,85,85
970 DATA 41,0,102,219,36,126,137,66,60
980 DATA 42,0,15,0,51,63,15,15,3
990 DATA 288,0,0,0,0,0,0,0,0
1000 DATA 289,2,9,9,9,9,9,2,0
1010 DATA 290,160,88,88,88,88,160,0
1020 DATA 291,12,3,0,192,195,63,3,3
1030 DATA 292,0,192,252,204,252,240,192,192
1040 DATA 293,3,3,35,171,139,139,131,35
1050 DATA 294,192,200,194,194,202,232,224,1
92
1060 DATA 295,64,80,84,85,85,85,85,85
1070 DATA 296,1,5,21,85,85,85,85,85
1080 DATA 297,129,102,90,36,126,82,36,24
1090 DATA 298,0,15,0,48,63,3,15,15
1100 DATA 43,153,219,231,255,90,24,36,66
1110 DATA 299,24,90,231,255,219,153,36,66
1120 DATA 44,217,219,231,75,2,24,36,66
1130 DATA 45,216,225,235,69,7,2,40,66
1140 DATA 46,192,192,145,3,67,1,72,130
1150 DATA 47,192,128,8,1,1,0,16,128
1160 DATA 300,217,219,247,99,22,24,36,68
1170 DATA 301,216,225,227,71,23,130,32,66
1180 DATA 302,192,200,129,3,131,1,64,130
1190 DATA 303,192,144,0,1,1,0,8,128
1200 DATA -1
2000 PRINT" {REV} {02 RIGHT} {02 RIGHT} {0
2 RIGHT} {03 RIGHT} {RIGHT} {02
RIGHT} {RIGHT} {03 RIGHT} {RIGHT}
{RIGHT} {03 RIGHT} "
2010 PRINT" {REV} {02 RIGHT} {RIGHT} {02
RIGHT} {RIGHT} {03 RIGHT} {RIGHT}
{RIGHT} {02 RIGHT} {RIGHT} {
RIGHT} {03 RIGHT} {02 RIGHT} "
2020 PRINT" {REV} {RIGHT} {RIGHT} {
RIGHT} {RIGHT} {RIGHT} {03 RIGHT
RIGHT} {RIGHT} {RIGHT} {RIGHT} {
03 RIGHT} {RIGHT} {RIGHT} "
2030 PRINT" {REV} {02 RIGHT} {RIGHT} {02
RIGHT} {RIGHT} {RIGHT} {RIGHT} {
RIGHT} {RIGHT} {02 RIGHT} {03
RIGHT} {RIGHT} {03 RIGHT} {02
RIGHT} "
2040 PRINT" {REV} {02 RIGHT} {RIGHT} {02
RIGHT} {02 RIGHT} {RIGHT} {02
RIGHT} {02 RIGHT} {RIGHT} {03
RIGHT} {RIGHT} {RIGHT} {03
RIGHT} {03 DOWN} "
2060 PRINTSPC(15);"{REV} {02 RIGHT} "
2070 PRINTSPC(15);"{REV} {02 RIGHT} {02
RIGHT} "
2080 PRINTSPC(15);"{REV} {02 RIGHT} {02
RIGHT} "
2090 PRINTSPC(15);"{REV} {02 RIGHT} {02
RIGHT} "
2100 PRINTSPC(15);"_{REV} {OFF} {REV} {0
2 DOWN}"
2110 PRINT" {REV} {02 RIGHT} {RIGHT}
{03 RIGHT} {RIGHT} {02 RIGHT}
{02 RIGHT} {RIGHT} {03 RIGHT} ~
"
2120 PRINT" {REV} {02 RIGHT} {02 RIGHT} {
03 RIGHT} {02 RIGHT} {RIGHT} {02
RIGHT} {RIGHT} {02 RIGHT} {02

```

```

RIGHT} {02 RIGHT} {02 RIGHT} "
2130 PRINT" {REV} {02 RIGHT} {02 RIGHT} {
03 RIGHT} {RIGHT} {RIGHT} {RIGHT}
{02 RIGHT} {RIGHT} {03 RIGHT} ~
{02 RIGHT} {RIGHT} {RIGHT} "
2140 PRINT" {REV} {02 RIGHT} {02 RIGHT} {
03 RIGHT} {02 RIGHT} {RIGHT} {02
RIGHT} {RIGHT} {02 RIGHT} {02
RIGHT} {02 RIGHT} {02 RIGHT} "
2150 PRINT" {REV} {02 RIGHT} {RIGHT} ~
{03 RIGHT} {RIGHT} {02 RIGHT} {
03 RIGHT} {RIGHT} {RIGHT} {03
RIGHT} "
2160 RETURN

```

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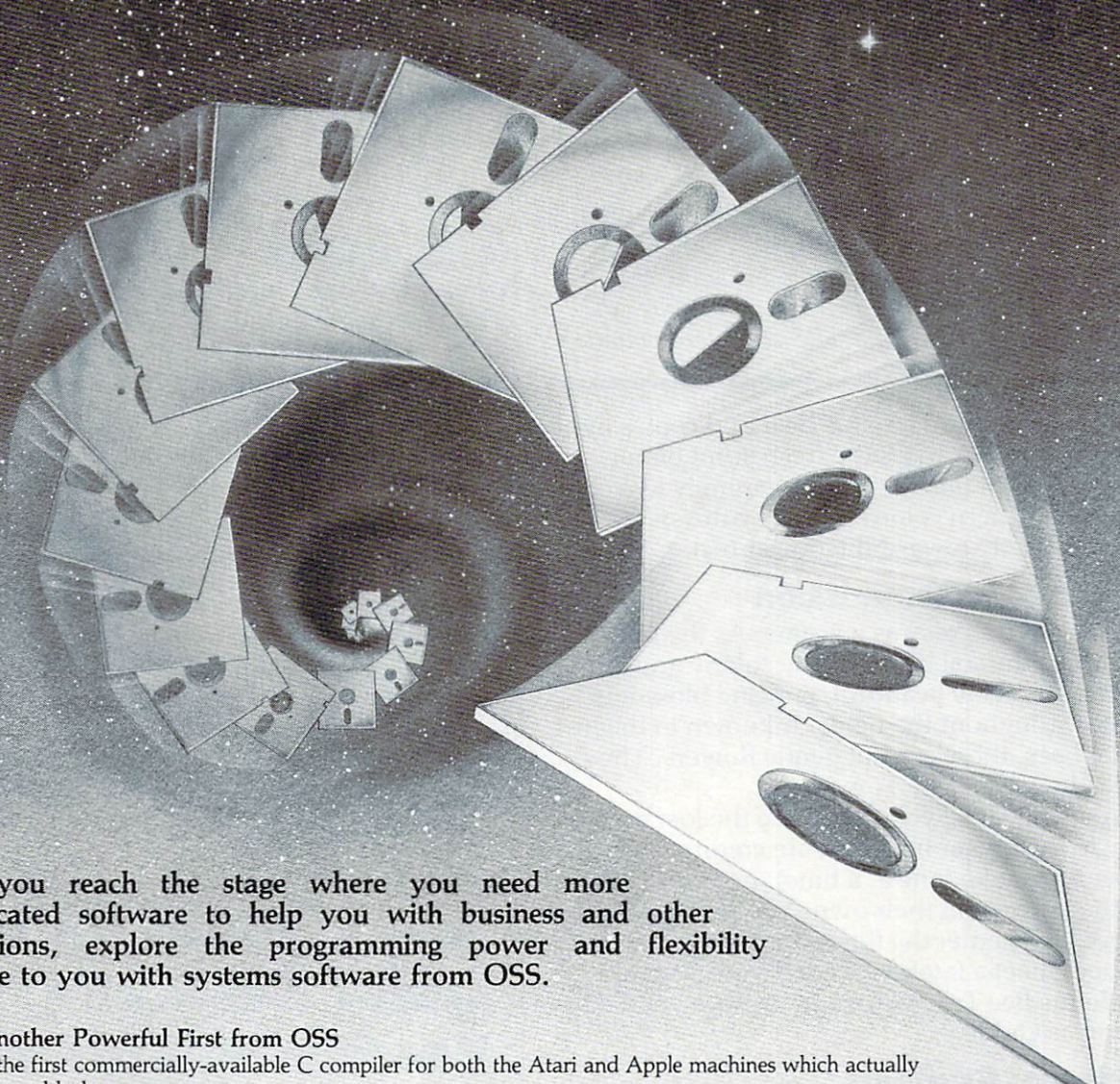
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# Bee Trap

Robert L. Lykins

*You're a scout who leads worker bees – one at a time – from the bottom of the screen to the flower bed at the top. Beware the Venus Bee Traps along the way. Versions for VIC, Atari, and the TRS-80 Color Computer.*

Spring has sprung. The air is clear and cool; a light northerly breeze carries the fresh scent of new flowers. A hum fills the air as seemingly lost bees from the southern colony, lured by the sweet winds, fly lazily toward the flower bed.

## The Queen's Commission

Alas, all is not as rosy as it seems. As the midday sun warms the soil between the colony and the flowers, strangely beautiful, enticing blossoms appear throughout the field. Unknown to the lost worker bees, these are not gentle flowers. They are deadly Venus Bee Traps.

As Guide Bee, you must take the lost bees safely to the flower bed. You are credited only for the bees you take (one at a time), not those that find the flowers on their own. You lose credit for one bee if you enter the flower bed empty-handed. If 50 bees meet a fateful end or if you are caught by a Venus Bee Trap yourself, you lose your commission as Guide.

## Multicolor Graphics

This program is a good example of the value of multicolor graphics on the VIC. By POKEing the character color location with a number ranging from 8 to 15 (instead of the usual 0 to 7), you get not only a different color but also a different character shape. The bees are really asterisks and the Venus Bee Traps are club symbols.

To illustrate this mode, first POKE in the screen and border color combination desired. This is important because these colors play a role in the color and apparent shape of the multicolor mode characters. Next, POKE 646 with a number from 8 to 15. Then type characters from the keyboard to see the resulting shape and color combinations. Beautiful designs may be drawn by repeating the same character many times. Make this easier by POKEing 650 with # 128. This makes all keys repeat.

## Keyboard Play

For play without a joystick, add KB=197 to line 10 and eliminate lines 3, 5, 7, 30, 32, 35, and 40. Change FIRE BUTTON to SPACE BAR in line 120 and line 3400. Eliminate line 312. Re-enter the following lines:

```
130 IFPEEK(KB)<>32THEN130
310 REM READ KEYS: Y (UP), B (DOWN), G (LEFT),
    H (RIGHT)
315 IFPEEK(KB)=11THEND1=D1-22:GOTO 335
320 IFPEEK(KB)=35THEND1=D1-1:GOTO 335
325 IFPEEK(KB)=19THEND1=D1-1:GOTO 335
330 IFPEEK(KB)=43THEND1=D1+1
3415 IFPEEK(KB)=32THEN150
```

Readers who would like a tape copy of this program may send \$3 with a blank tape and a self-addressed, stamped mailer to:

Robert L. Lykins  
P.O. Box 8140  
Anchorage, AK 99508

## Atari And TRS-80 Color Computer Version Notes For Bee Trap

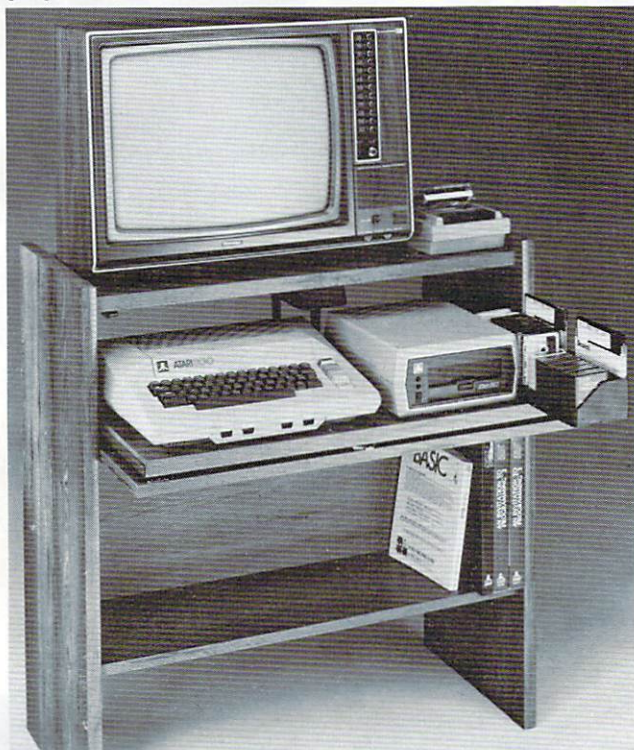
To play these versions of Bee Trap you follow the same rules as the VIC version. A guide bee safely leads stray bees to the flower bed while avoiding the deadly Venus Bee Trap. The guide is controlled with the joystick. On the Atari, plug the joystick into controller jack #1; on the Color Computer, plug the joystick into the right port.

The game ends either when 50 lost bees have been taken by the Venus Bee Traps or when the guide bee collides with a Bee Trap. As the guide bee, be sure not to enter the flower bed without a lost bee. Terrible sounds will result, and you will be penalized one credit.

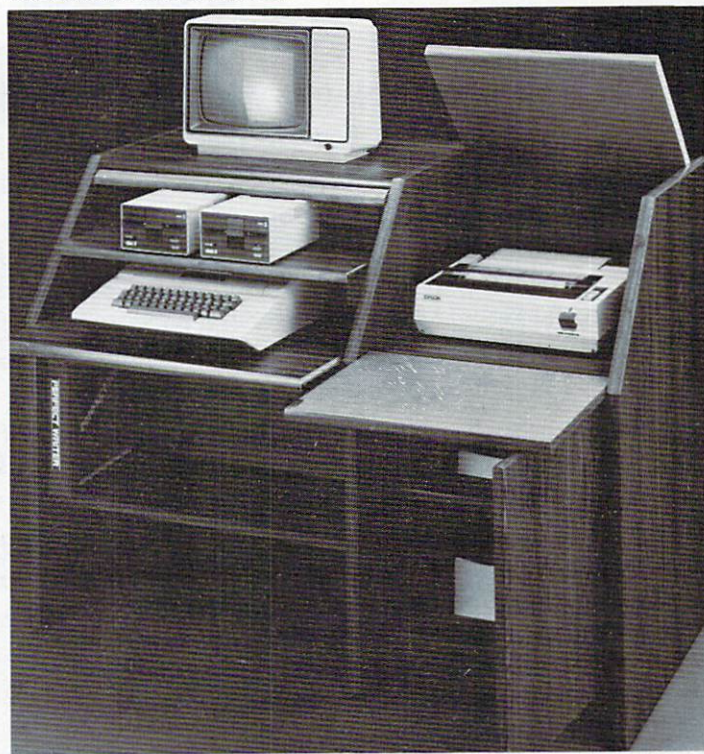


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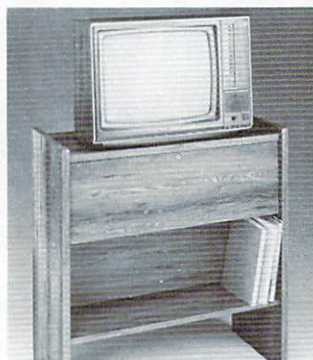
The fold up locking door keeps unwanted fingers off the key board when not in use.

To store joysticks just turn them upside down and slide them into the inverted storage rack.

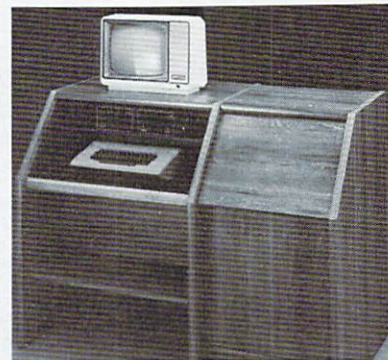
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The slide out software tray has room for 14 cartridges or cassettes and up to 30 diskettes. Most brands of software will fit between the adjustable partitions with a convenient hook for the spare key at rear.

Stand fits Atari 400 & 800, Commodore 64 & VIC 20, Ti 99/4A and TRS-80. Cabinet dimensions overall 36" high x 33-7/8" wide x 16" deep.



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Twist tabs on the back of the center panel allow for neat concealed grouping of wires while a convenient storage shelf for books or other items lies below.

The printer sits behind a fold down door that provides a work surface for papers or books while using the keyboard. The lift up top allows easy access to the top and rear of the printer. A slot in the printer shelf allows for center as well as rear feed printers.

Behind the lower door are a top shelf for paper, feeding the printer, and a bottom shelf to receive printer copy as well as additional storage.

Stand fits same computers as the CS-1632 as well as the Apple I and II, IBM-PC, Franklin and many others.

The cabinet dimensions overall: 39-1/2" high x 49" wide x 27" deep.

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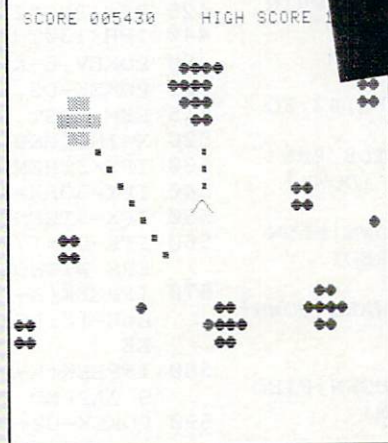
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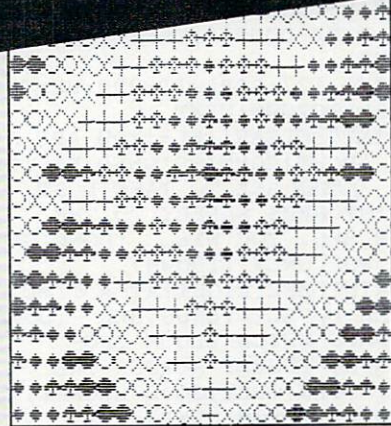


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```

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

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applications. With hard copy  
program listings that help me  
debug my programs.



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creations. Software includes  
*Kaleidoscope* and *Sketch Pad*  
graphics programs.

```

Recipe 334
CHEESE BERRY PIE

Ingredients

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

Procedure

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

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



## AlphaCom™

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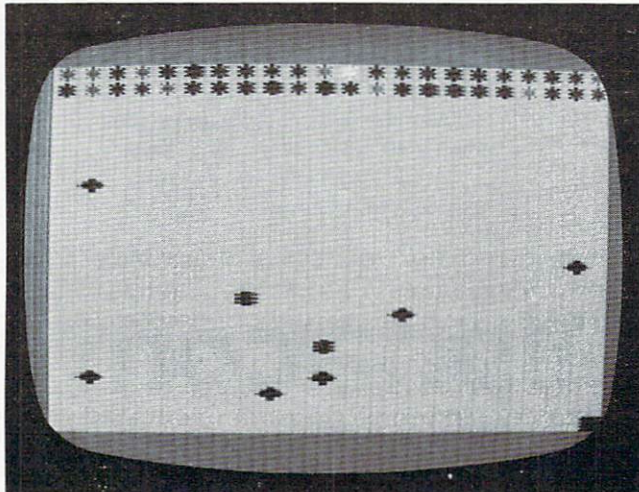
## Program 1: VIC Version

```

3 GOTO 10
5 J1=NOTPEEK(37151)AND60-((PEEK(JS)AND12
  8)=0)
7 RETURN
10 Q=36879:J=37137:JS=37152
30 POKEQ,110:PRINT"{CLEAR}{06 DOWN}{02
  RIGHT}{WHT}PLUG IN JOYSTICK","{02
  DOWN}{02 RIGHT}PRESS FIRE BUTON

32 POKE 37154,127:REM ACTIVATE PORT B
35 GOSUB 5
40 IFJ1<>32THEN35
50 PRINT"{CLEAR}":POKEQ,93:FORL=1TO3:PRIN
  T"{03 DOWN}{05 RIGHT}B E E T R ~
  A P{02 DOWN}";:NEXT:FORL=1TO999:N
  EXT
60 POKEQ,127:FORL=1TO999:NEXT:POKEQ,42:FO
  RL=1TO2000:NEXT
80 PRINT"{CLEAR}{BLK}YOU ARE A GUIDE BEE ~
  {DOWN}COMMISSIONED BY THE {DOWN}
  QUEEN BEE TO TAKE LOST
90 PRINT"BEES SAFELY TO THE {DOWN}FLOW
  ER BED. YOU WILL {DOWN}GET CREDI
  T FOR ONLY 1{DOWN}
100 PRINT"BEE{RIGHT}AT A TIME. BEWARE{DOWN}
  THE LOVELY VENUS BEE {DOWN}
  TRAPS WHICH BLOOM PRO-
110 PRINT"FUSELY ACROSS THE {DOWN}FIEL
  D. {GRN}{REV}GOOD LUCK!?!{DOWN}
115 FORL=1TO200:NEXT
120 PRINT"{WHT}{REV}{RIGHT}(PRESS FIRE BUT
  TON){UP}
130 GOSUB 5:IFJ1<>32 THEN 130
150 C=30720:P=7680:N=36877:V=36878:B=36875
  :K=8248:HH=36874
175 K1=7735:H=240:SC=0:S=0:D1=0:D2=0:R=0
190 REM PRINT FLOWERS
200 POKEQ,191:PRINT"{CLEAR}":FORL=0TO43
225 POKEP+L,42
230 POKEP+L+C,INT(RND(1)*8):NEXT
305 POKEK1+D1,32:REM ERASE GUIDE BEE
310 REM READ JOYSTICK
312 J1=NOTPEEK(37151)AND60-((PEEK(JS)AND12
  8)=0)
315 IFPEEK(JS)=119THEND1=D1+1:GOTO335
320 IFJ1=4THEND1=D1-22:GOTO 335
325 IFJ1=8THEND1=D1+22:GOTO 335
330 IFJ1=16THEND1=D1-1
335 IFK1+D1>8185THEND1=450:REM PREVENT SCR
  EEN EXIT

```



Two bees evade Venus Beetraps in the VIC-20 version of "Bee Trap."

```

340 IFK1+D1<7724ANDS>0THEN2000:REM ENTER F
  LOWERS WITH BEE
345 IFK1+D1<7724THEND1=0:POKEQ,110:FORL=1T
  O2000:NEXT:SC=SC-1:POKEQ,191:REM ~
  ENTER W/0 BEE
350 IFD2<50ANDX<2THENXX=INT(RND(1)*351)+44
  :POKEK1+C+XX,X+12:POKEK1+XX,88
351 REM RANDOM TRAP PLACEMENT
360 IFPEEK(K1+D1)=42THEND2=0:S=S+1:H=H-10:
  REM CATCH LOST BEE
370 IFPEEK(K1+D1)=88THEN3000:REM GUIDE BEE
  IS ZAPPED
380 POKEK1+D1+C,8:POKEK1+D1,42:REM PRINT G
  UIDE BEE
425 REM BUZZING SOUNDS
440 IFH<130THENH=240
450 POKEV,6-X/6:POKEB,160-X:POKEHH,H
505 POKEK-D2,32:REM ERASE LOST BEE
515 REM LOST BEE MOVEMENT
520 X=INT(RND(1)*(H/5-22))
530 IFX<3THEND2=D2+22
540 IFX=3ORX=4THEND2=D2+1
550 IFX=5THEND2=D2-1
560 IFK-D2<7724THEND2=0:REM BEE FINDS FLOW
  ERS WITHOUT GUIDE
570 IFPEEK(K-D2)=42ANDD2>62THEND2=0:S=S+1:
  H=H-10:REM LOST BEE FINDS GUIDE B
  EE
580 IFPEEK(K-D2)=88THEN1000:REM LOST BEE I
  S ZAPPED
590 POKEK-D2+C,14:POKEK-D2,42:REM PRINT LO
  ST BEE
600 GOTO305
1000 POKEQ,42:FORL=1TO10STEP.1:POKEV,10-L:P
  OKEN,200-L*5:NEXT:POKEN,0:D2=0
1050 R=R+1:IFR=50THEN3000
1075 IFR>40THENPOKEQ,249:GOTO305
1100 POKEQ,191:GOTO305
2000 POKEQ,127:SC=SC+1:PRINT"{HOME}{02
  DOWN}{04 RIGHT}{RED}CREDIT"SC;
2100 IFSC=1THENPRINT"BEE":GOTO2300
2200 PRINT"BEES
2300 FORL=1TO75STEP.3:POKEB,175+L:NEXT:PRIN
  T"{UP}
  ":S=0:
  D1=0:GOTO1100
3000 POKEQ,10:FORL=1TO10STEP.1:POKEV,15-L:P
  OKEB,200-L*5:NEXT:POKEB,0:POKEHH,
  0
3100 PRINT"{HOME}{02 DOWN}{RIGHT}{CYN}FINAL
  CREDIT"SC;
3200 IFSC=1THENPRINT"BEE":GOTO3400
3300 PRINT"BEES
3400 PRINT"{DOWN} HIT {REV}S{OFF} TO STOP, ~
  PRESS FIREBUTTON TO REPLAY"
3403 GET A$
3410 IF A$="S" THEN 3500
3415 GOSUB 5:IF J1=32 THEN 150
3420 GOTO 3403
3500 POKE 37154,255:POKE Q,27:PRINT"{CLEAR}
  {BLU}":END

```

## Program 2: Atari Version

```

105 DL=PEEK(560)+256*PEEK(561)+4
110 SCREEN=PEEK(88)+256*PEEK(89)
120 GRAPHICS 2:SETCOLOR 2,0,0
125 POKE 752,1
130 SETCOLOR 0,7,10:POSITION 3,4:PRI
  NT #6;"B E E {3 SPACES}T R A P"
135 FOR I=1 TO 3:SOUND 0,0,0,0:SOUND
  1,0,0,0:SOUND 1,140,12,4:SOUND
  1,45,12,4:FOR K=1 TO 200:NEXT K:
  NEXT I

```

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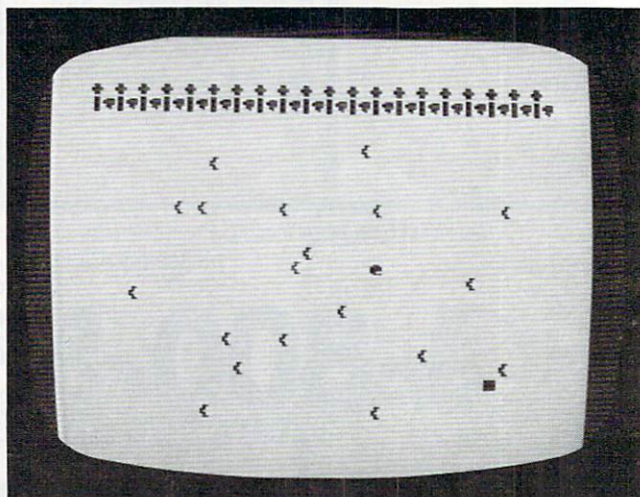
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```

140 PRINT "{3 SPACES}- PLUG JOYSTICK
    INTO JACK #1 -":FOR I=1 TO 950:
NEXT I:SOUND 0,0,0,0:SOUND 1,0,0
,0:GRAPHICS 0
150 PRINT "? :PRINT "{4 SPACES}YOU A
RE A GUIDE BEE COMMISSIONED":?
160 PRINT "BY THE QUEEN BEE TO TAKE
LOST BEES":?
170 PRINT "SAFELY TO THE FLOWER BED.
YOU WILL":?
180 PRINT "GET CREDIT FOR ONLY 1 BEE
AT A TIME.":?
190 ? "BEWARE THE VICIOUS VENUS BEE
TRAPS":?
200 PRINT "WHICH BLOOM PROFUSELY ACR
OSS THE"
210 ? :PRINT "FIELD!"
220 POSITION 14,17:PRINT "GOOD LUCK!
!!!"
225 POKE 752,1
230 POSITION 2,20:PRINT " PRESS THE
FIRE BUTTON TO START"
240 IF STRIG(0)<>0 THEN 240
245 K=SCREEN+1074:K1=SCREEN+100:H=24
0:SC=0:S=0:D1=0:D2=0:R=0
248 GRAPHICS 0:SETCOLOR 4,1,12:SETCO
LOR 2,2,11
250 POKE 752,1:POSITION 0,0:FOR I=1
TO 20:PRINT CHR$(123);CHR$(32);:
NEXT I
255 FOR I=2 TO 24:POKE DL+I,4:NEXT I
:POKE DL-1,4+64
260 POSITION 0,1:FOR J=1 TO 20:PRINT
CHR$(124);CHR$(0);:NEXT J:REM P
RINT FLOWER BED
305 POKE K1+D1,0:REM ERASE GUIDE BEE
310 REM READ JOYSTICK
312 IF STICK(0)<>15 THEN POKE 77,0
315 IF STICK(0)=7 THEN D1=D1+1:GOTO
335
320 IF STICK(0)=14 THEN D1=D1-40:GOT
O 335
325 IF STICK(0)=13 THEN D1=D1+40:GOT
O 335
330 IF STICK(0)=11 THEN D1=D1-1
335 IF K1+D1>SCREEN+959 THEN D1=D1-4
0:REM PREVENT SCREEN EXIT
340 IF K1+D1<SCREEN+80 AND S>0 THEN
2000:REM ENTERS FLOWERS W/ BEE
345 IF K1+D1<SCREEN+80 THEN D1=0:SET
COLOR 4,9,12:FOR I=1 TO 300:NEXT
I:SC=SC-1:SETCOLOR 4,1,12:REM E
NTER W/O BEE
350 IF D2<90 AND X<2 THEN XX=INT(RND
(1)*680)+80:POKE K1+XX,28:REM RA
NDOM TRAP PLACEMENT
360 IF PEEK(K1+D1)=3 THEN D2=0:S=S+1
:H=H-10:REM CATCH LOST BEE
370 IF PEEK(K1+D1)=28 THEN 2900:REM
GUIDE BEE IS ZAPPED
380 POKE K1+D1,32:REM PRINT GUIDE BE
E
425 REM BUZZING SOUNDS
440 IF H<130 THEN H=240
450 SOUND 0,140,12,4:SOUND 1,H,12,4:
SOUND 2,45,12,2
505 POKE K-D2,0:REM ERASE LOST BEE
515 REM LOST BEE MOVEMENT
520 X=INT(RND(1)*(H/5-22))
530 IF X<3 THEN D2=D2+40
540 IF X=3 OR X=4 THEN D2=D2+1
550 IF X=5 THEN D2=D2-1
560 IF K-D2<SCREEN+80 THEN D2=0:REM
BEE FINDS FLOWERS W/O GUIDE
570 IF PEEK(K-D2)=3 AND D2>120 THEN
D2=0:S=S+1:H=H-10:REM LOST BEE F
INDS GUIDE BEE
580 IF PEEK(K-D2)=28 THEN 1000:REM L
OST BEE IS ZAPPED
590 POKE K-D2,3:REM PRINT LOST BEE
600 GOTO 305
1000 SETCOLOR 4,4,12:FOR I=50 TO 150
:SOUND 3,I,10,4:NEXT I:SOUND 3,
0,0,0
1050 D2=0:R=R+1:IF R=50 THEN 2900
1060 FOR I=1 TO 200:NEXT I
1100 SETCOLOR 4,1,12:GOTO 305
2000 SETCOLOR 4,4,12:SETCOLOR 2,2,6:
SC=SC+1:POKE DL+3,2
2050 FOR I=0 TO 70:SOUND 1,I,10,4:NE
XT I:FOR I=0 TO 30:NEXT I:SOUND
1,0,0,0
2100 POSITION 12,2:PRINT "CREDIT";
SC;:IF SC=1 THEN PRINT "BEE":
GOTO 2300
2200 PRINT "BEES"
2300 FOR L=1 TO 500:NEXT L:FOR L=5 T
O 27:POSITION L,2:PRINT " ":NEX
T L:POKE DL+3,4
2310 S=0:D1=0:SETCOLOR 2,2,10:GOTO 1
100:REM SCORE SOUND
2900 SOUND 0,0,0,0:SOUND 1,0,0,0:SOU
ND 2,0,0,0
3000 SETCOLOR 4,7,12:SETCOLOR 2,2,8:
FOR I=100 TO 255:SOUND 1,I,10,4
:NEXT I:SOUND 1,25,2,4:FOR I=0
TO 30:NEXT I
3100 SOUND 1,0,0,0:FOR I=3 TO 4:POKE
DL+I,2:NEXT I
3200 POSITION 9,2:PRINT "FINAL CRED
IT";SC;:IF SC=1 THEN PRINT "B
EE":GOTO 3400
3300 PRINT "BEES"
3400 POKE 764,255:PRINT " HIT @ TO S
TOP/FIREBUTTON TO REPLAY"
3420 IF STRIG(0)=0 THEN 245
3425 IF PEEK(764)=47 THEN POKE 764,2
55:GRAPHICS 0:END
3430 GOTO 3420

```



The Atari version of "Bee Trap" uses multicolored characters for the flowers (top), bees (center and lower right), and the bee traps.

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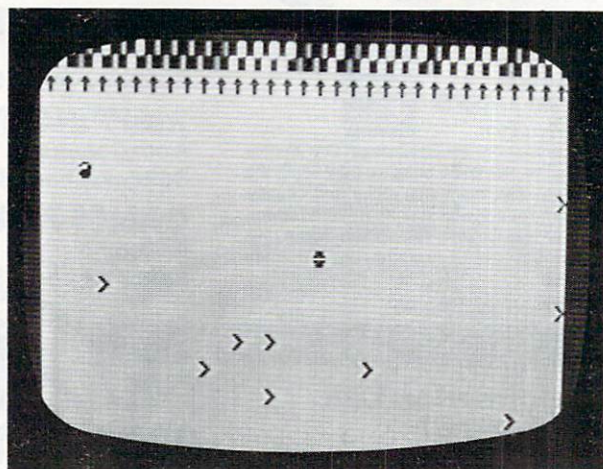
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### Program 3: Color Computer Version

```

100 CLS
110 PRINT@232,"[E] [E] [E(3 SPACES)] [E] [E] [E]
120 PRINT@389,"PLUG IN RIGHT JOYSTI
CK"
130 SOUND 1,30:FOR I=1 TO 500
140 NEXT I
150 CLS
160 PRINT:PRINT"(3 SPACES)YOU ARE A
GUIDE BEE COMMIS-"
170 PRINT"SIONED BY THE QUEEN BEE T
O TAKE"
180 PRINT"LOST BEES SAFELY TO THE F
LOWER"
190 PRINT"BED. YOU WILL GET CREDIT
FOR"
200 PRINT"ONLY ONE BEE AT A TIME. B
EWARE"
210 PRINT"THE VICIOUS VENUS BEE TRA
PS"
220 PRINT"WHICH BLOOM PROFUSELY ACR
OSS"
230 PRINT"THE FIELD."
240 PRINT@362,"GOOD LUCK!!!"
250 FOR I=1 TO 300:NEXT I
260 PRINT@451,"PRESS FIRE BUTTON TO
BEGIN"
270 GOSUB 600:IF FIRE=0 THEN 270
280 CLS:E=0
290 K1=1104:P=1024:SC=0:S=0:D1=0:D2
=0:R=0:H=240:K=1503+RND(32)
300 REM PRINT FLOWERS
310 FOR I=1 TO 32:C=128+16*RND(7)+6
:PRINT CHR$(C);:NEXT I
320 FOR I=1 TO 32:PRINT"^";:NEXT I
330 E=E+1:POKE K1+D1,96:REM ERASE G
UIDE BEE
340 H1=JOYSTK(0):V=JOYSTK(1):REM RE
AD RIGHT JOYSTICK
350 IF H1=0H AND V=0V THEN 370
360 SOUND 1,1
370 IF H1=0 THEN D1=D1-1:GOTO 410
380 IF H1=63 THEN D1=D1+1:GOTO 410
390 IF V=0 THEN D1=D1-32:GOTO 410
400 IF V=63 THEN D1=D1+32
410 OH=H1:OV=V:IF K1+D1>1535 THEN D
1=D1-32:REM PREVENT SCREEN EXIT
420 IF K1+D1<1088 AND S>0 THEN 680:
REM ENTER FLOWERS WITH BEE
430 IF K1+D1<1088 THEN D1=0:SC=SC-1
:SOUND 50,3:REM ENTER W/O BEE
440 IF D2<70 AND X<2 THEN XX=RND(30
4)+64:POKE K1+XX,126:REM RANDOM
TRAP PLACEMENT
450 IFPEEK(K1+D1)=64THEN D2=0:S=S+1
:H=H-10:E=-30:REM CATCH LOST BE
E
460 IF PEEK(K1+D1)=126 THEN 760:REM
GUIDE BEE IS ZAPPED
470 POKE K1+D1,99:REM PRINT GUIDE B
EE
480 IF H<130 THEN H=240
490 POKE K-D2,96:REM ERASE LOST BEE
500 REM LOST BEE MOVEMENT
510 X=RND(H/5-23)
520 IF X<3 AND E>5 THEN D2=D2+32
530 IF X=3 OR X=4 THEN D2=D2+1
540 IF X=5 THEN D2=D2-1
550 IFK-D2<1088 THEN D2=0:K=RND(32)
+1503:REM BEE FINDS FLOWERS W/O
UT GUIDE
560 IF PEEK(K-D2)=99 AND D2>90 THEN
D2=0:S=S+1:H=H-10:E=-35:REM LO
ST BEE FINDS GUIDE BEE
570 IF PEEK(K-D2)=126 THEN 630:REM
LOST BEE IS ZAPPED
580 IF E>5 AND S=0 THEN POKE K-D2,6
4:REM PRINT LOST BEE
590 GOTO 330
600 REM JOYSTICK FIRE BUTTON ROUTIN
E
610 Z=PEEK(65280):FIRE=(Z=126)OR(Z=
254)
620 RETURN
630 REM LOST BEE ZAPPED
640 D2=0:E=-5
650 R=R+1:IF R=50 THEN 760
660 SOUND 50,5:K=1503+RND(32)
670 GOTO 330
680 REM GUIDE SUCCESSFULLY CARRIES
LOST BEE INTO FLOWER BED
690 SC=SC+1:E=-2
700 FOR I=130 TO 190 STEP 5:SOUND I
,1:NEXT I
710 PRINT@72,"CREDIT ";SC;
720 IF SC=1 THEN PRINT" BEE":GOTO 7
40
730 PRINT" BEES"
740 FOR I=1 TO 500:NEXTI:PRINT@70,"
(24 SPACES)"
750 S=0:D1=0:D2=0:K=1503+RND(32):GO
TO 330
760 FOR I=190 TO 110 STEP -5:SOUND
I,1:NEXT I
770 PRINT@68," FINAL CREDIT ";SC;
780 IF SC=1 THEN PRINT" BEE":GOTO 8
10
790 PRINT" BEES"
800 FOR I=1 TO 200:NEXT I
810 PRINT@101,"PLAY AGAIN (Y OR N)"
;
820 INPUT A$:IF A$="Y" THEN 280
830 CLS:END

```



"Bee Trap," TRS-80 Color Computer version.

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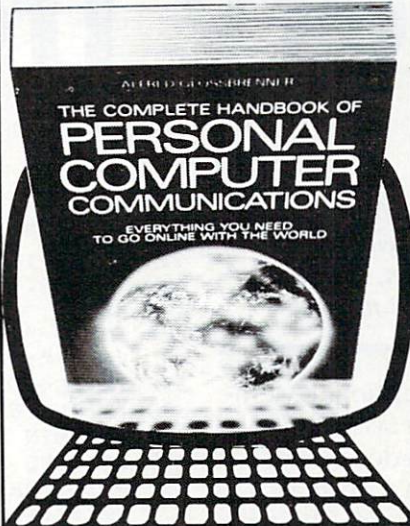


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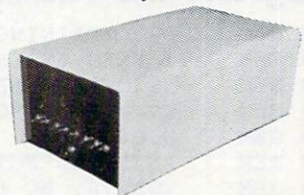
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# Memory Trainer

Harvey B. Herman, Associate Editor

For 64, VIC, PET/CBM, Atari, TI, and Apple – this program might help you improve your memory skills. Some people, training in a similar fashion, have been able to quickly memorize random 80-digit numbers.

A provocative article, entitled "Exceptional Memory," appeared recently in *American Scientist* (vol. 70, no. 6, p. 607, 1982). The authors described experiments in which a person with a normal memory was trained to recall a sequence of over 80 random digits. How?

When most people read a random sequence once, they can remember only five to nine digits, the apparent limit of short-term memory (STM).

One might call this prodigious feat of memory (recalling 80 digits) *exceptional*, but the authors said that this skill may not be uncommon. Diligent practice, in one case 230 hours over 20 months, resulted in improvement in the ability to rapidly transfer information into long term memory (LTM). A "normal" memory could thereby be transformed into an "exceptional" one.

How easy it would be to automate the task of memory training by using a computer. Consequently, after reading the article, I sat down at my Commodore 8032 and wrote "Memory Trainer." Random digits are flashed on the screen at a specified rate, rather than being read to the subject. If the sequence is repeated correctly, the next sequence of digits is increased by one. When an error is made, the length of the sequence decreases by one. The subject can stop the experiment at any point, whereupon the maximum number length achieved is displayed.

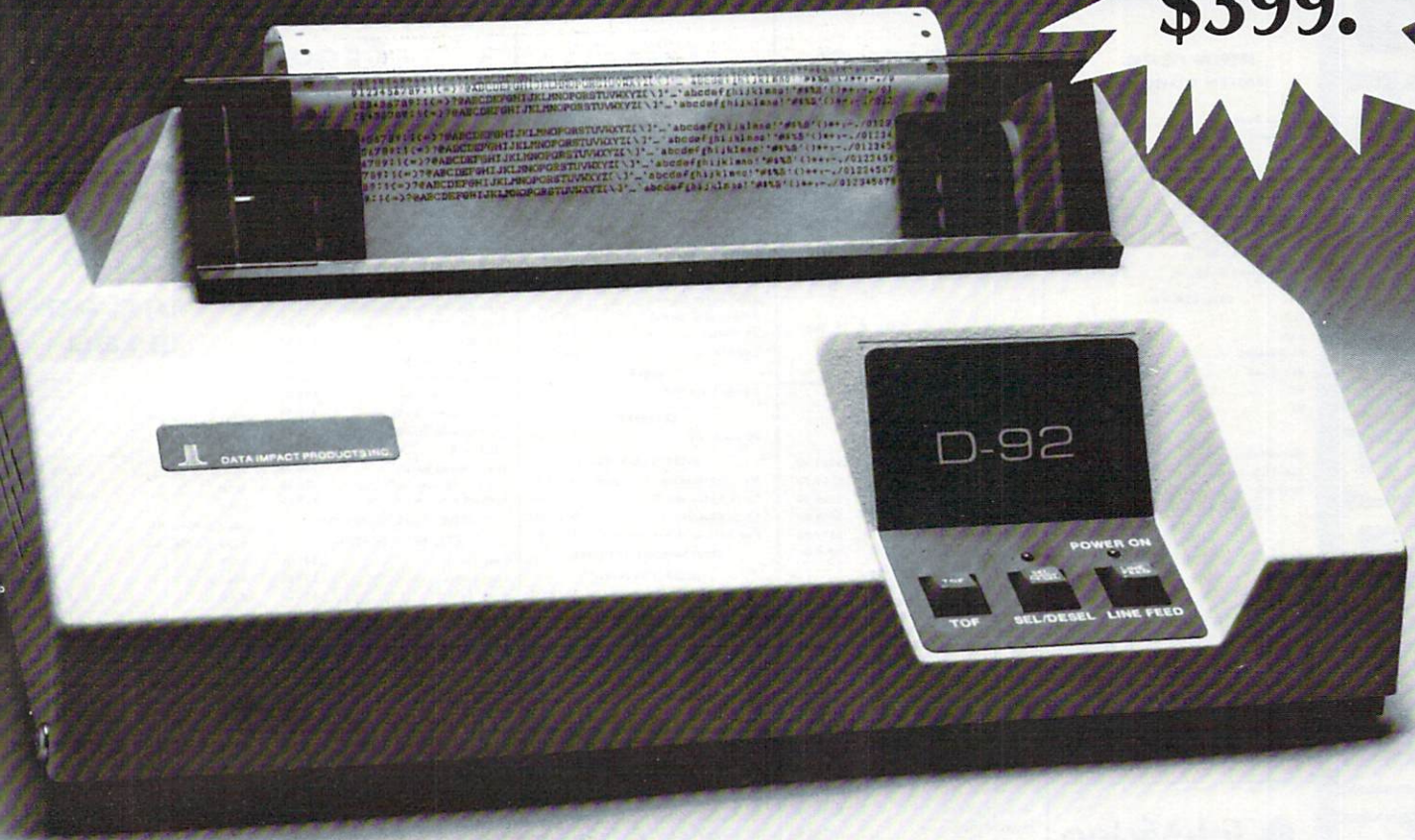
## Program 1: 80-Column CBM Version

```
100 REM MEMORY TRAINING PROGRAM
110 REM PATTERNED AFTER TECHNIQUE IN:
120 REM "EXCEPTIONAL MEMORY" BY
130 REM K.A. ERICSSON AND
140 REM W.G. CHASE
150 REM AMERICAN SCIENTIST
160 REM VOL 70, NO 6, PG 607, 1982.
170 REM
180 REM PROGRAM BY HARVEY B. HERMAN
190 REM
200 REM MAX 76 DIGITS
210 DIM N(76)
220 MA=0:REM MA=MAX CORRECT SCAN
230 PRINT "{CLEAR}{REV}MEMORY TRAINING PROGRAM"
```

```
240 PRINT
250 INPUT "DIGIT RATE (SEC/DIG) 1{03
LEFT}";DR
260 IF DR<.5 THEN DR=.5
270 PRINT
280 INPUT "INITIAL SEQUENCE LENGTH 5{03
LEFT}";SL
290 IF SL<2 THEN SL=2
300 IF SL>76 THEN SL=76
310 REM MIN DIGIT RATE .5 SEC/DIG
320 REM SEQ LEN - MIN 2:MAX 76
330 PRINT:PRINT"{REV}CURRENT DIGIT SPAN{
OFF}";SL;"{LEFT} "
340 REM FLASH GET SET AND DIGITS
350 PRINT:PRINT "{REV}GET SET{OFF}";:FOR I
=1 TO 300:NEXT I
360 PRINT "{07 LEFT}GET SET";CHR$(7):PRINT
"*":PRINT "{UP}";:FOR I=1 TO 1250:
NEXT I:PRINT
370 FOR I=1 TO SL
380 N(I)=INT(RND(1)*10)
390 T=TI
400 PRINT "{UP}{REV}";N(I);"{OFF}";:FOR J=
1 TO 100:NEXT J
410 PRINT "{03 LEFT}";N(I)
420 IF TI<T+DR*60 THEN 420
430 NEXT I
440 PRINT "{UP} ";
450 PRINT:PRINT "INPUT DIGITS":FL=0
460 PRINT "
";
470 PRINT "
":INPUT "{02 UP} *{03
LEFT}";A$
480 IF LEN(A$)<>SL THEN FL=1:GOTO 540
490 FOR I=1 TO SL
500 IF VAL(MID$(A$,I,1)) <> N(I) THEN FL=1
:I=SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES SEQ L
EN BY ONE
530 REM FL=1 - INCORRECT - DECREASES SEQ L
EN BY ONE
540 PRINT:IF FL=1 THEN PRINT "{REV}INCORRE
CT{OFF} - TRY A SHORTER SPAN NEXT
":SL=SL-1
550 IF FL=1 THEN PRINT "
";
560 IF FL=1 THEN PRINT "
":PRINT "{ UP}";
570 IF FL=1 THEN FOR J=1 TO SL+1:PRINT RIG
HT$(STR$(N(J)),1);:NEXTJ:GOTO620
580 PRINT "{REV}CORRECT{OFF} - TRY A LON
GER SPAN NEXT ":SL=SL+1
590 IF MA<SL-1 THEN MA=SL-1
600 PRINT "
";
610 PRINT "
":PRINT "{UP}";
620 PRINT:PRINT:INPUT "AGAIN Y{03 LEFT}"
;N$:IF SL<1 THEN SL=1
```

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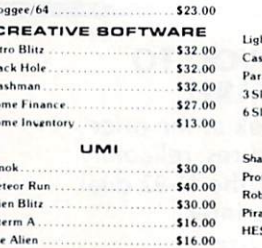
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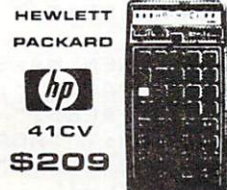
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```

630 IF SL>76 THEN SL=76
640 IF LEFT$(N$,1)="Y" THEN PRINT"{HOME}{0
5 DOWN}";:GOTO 330
650 PRINT:PRINT "HOPE YOU IMPROVED YOUR DI
GIT SPAN":PRINT
660 PRINT "{REV}HIGHEST CORRECT DIGIT SPAN
{OFF}";MA;"{UP}"

```

## Program 2: 40-Column PET/CBM And 64 Version

Substitute the following lines in Program 1 to run on a 40-column PET/CBM or the Commodore 64.

```

470 PRINT "
":INPUT "{03 UP} *{03
LEFT}";A$
560 IF FL=1 THEN PRINT "
":PRINT "{02
UP}";
610 PRINT "
":PRINT "{02 UP}";

```

## Program 3: VIC Version

Substitute the following lines in Program 1 to run Memory Trainer on the VIC-20.

```

40 GOTO 100
50 POKE 36878,8:POKE 36875,225:FOR I=1 TO
30:NEXT I:POKE 36875,0:RETURN
230 PRINT "{CLEAR} {REV}MEMORY TRAINER"
250 INPUT "DIG RATE(SEC/DIG) 1{03 LEFT}";
DR
270 REM DELETE THIS LINE FROM PROGRAM 1
280 INPUT "INIT SEQ LENGTH 5{03 LEFT}";SL
360 PRINT "{07 LEFT}GET SET":GOSUB 50:PRIN
T "*":PRINT "{UP}";:FOR I=1 TO 12
50:NEXT I:PRINT
470 PRINT "
":INPUT "{04 UP} *{03
LEFT}";A$
540 PRINT:IF FL=1 THEN PRINT "{REV}INCORRE
CT{OFF}-TRY LESS":SL=SL-1
560 IF FL=1 THEN PRINT "
":PRINT "{04
UP}";
580 PRINT "{REV}CORRECT{OFF}-TRY MORE "":S
L=SL+1
610 PRINT "
":PRINT "{04 UP}";
640 IF LEFT$(N$,1)="Y" THEN PRINT"{HOME}{0
4 DOWN}";:GOTO 330
650 PRINT"{CLEAR}{DOWN}":PRINT "HOPE YOU I
MPROVED YOURDIGIT SPAN!":PRINT

```

## Program 4: Atari Version

```

200 REM MAX 95 DIGITS
210 DIM N(95),A$(95),N$(3)
220 MA=0:REM MA=MAX CORRECT SPAN
230 GRAPHICS 0:PRINT "{8 SPACES}MEMO
RY TRAINING PROGRAM":PRINT
240 PRINT "DIGIT RATE (SEC/DIG) 1
{2 LEFT}";:INPUT DR
250 IF DR<0.5 THEN DR=0.5
260 PRINT
280 PRINT "INITIAL SEQUENCE LENGTH
5{2 LEFT}";:INPUT SL
290 IF SL<2 THEN SL=2

```

```

300 IF SL>95 THEN SL=95
310 REM MIN DIGIT RATE .5 SEC/DIG
320 REM SEQ LEN - MIN 2:MAX 95
330 PRINT :PRINT "CURRENT DIGIT SPAN
";SL
340 REM FLASH GET SET AND DIGITS
350 POKE 752,1:PRINT :PRINT "GET SET
";:FOR I=1 TO 300:NEXT I
360 PRINT "{7 LEFT}GET SET";CHR$(253
):PRINT "*":PRINT "{UP}";:FOR I=
1 TO 500:NEXT I:PRINT
370 FOR I=1 TO SL
380 N(I)=INT(RND(1)*10)
390 POKE 20,0:POKE 19,0
400 PRINT "{UP}";CHR$(N(I)+176);:FOR
J=1 TO 100:NEXT J
410 PRINT "{LEFT}";N(I)
420 IF (PEEK(19)*256+PEEK(20))/60<DR
THEN 420
430 NEXT I
440 PRINT "{UP} ";
450 PRINT :PRINT "INPUT DIGITS":FL=0
460 PRINT "{96 SPACES}"
470 POKE 752,0:PRINT "{3 UP} *
{2 LEFT}";:INPUT A$
480 IF LEN(A$)<>SL THEN FL=1:GOTO 54
0
490 FOR I=1 TO SL
500 IF VAL(A$(I,I))<>N(I) THEN FL=1:
I=SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES S
EQ LEN BY ONE
530 REM FL=1 - INCORRECT - DECREASES
SEQ LEN BY ONE
540 PRINT :IF FL=1 THEN POSITION 2,1
4:?"INCORRECT - TRY A SHORTER S
PAN NEXT":SL=SL-1
550 IF FL=1 THEN PRINT "{80 SPACES}";
560 IF FL=1 THEN PRINT "{20 SPACES}";
PRINT "{3 UP}";
570 IF FL=1 THEN FOR J=1 TO SL+1:PRI
NT N(J);:NEXT J:GOTO 620
580 POSITION 2,14:?"CORRECT - TRY A
LONGER SPAN NEXT{3 SPACES}":SL=
SL+1
590 IF MA<SL-1 THEN MA=SL-1
600 PRINT "{38 SPACES}";
610 PRINT "{56 SPACES}"
620 POSITION 2,18:?"AGAIN
{3 SPACES}Y{2 LEFT}";:INPUT N$:I
F SL<1 THEN SL=1
630 IF SL>95 THEN SL=95
640 IF N$(1,1)="Y" THEN POSITION 2,5
:GOTO 330
650 PRINT "{UP}HOPE YOU IMPROVED YOU
R DIGIT SPAN!"
660 PRINT :PRINT "HIGHEST CORRECT DI
GIT SPAN ";MA

```

## Program 5: Apple Version

```

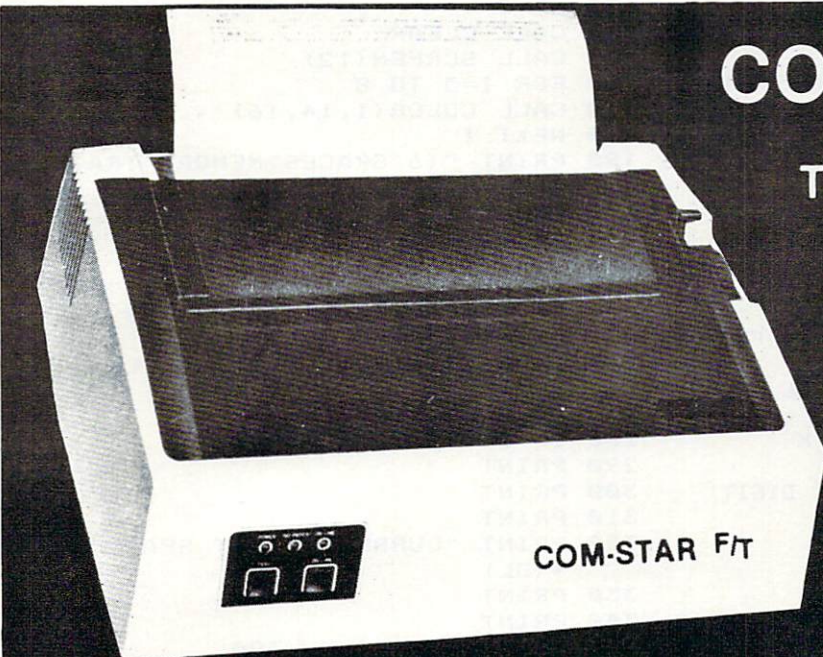
200 REM MAX 76 DIGITS
210 DIM N(76)
220 MA = 0: REM MA=MAX CORRECT SPAN
230 TEXT : HOME : INVERSE : PRINT "MEM
ORY TRAINING PROGRAM": NORMAL
240 PRINT
250 INPUT "DIGIT RATE (1-10) ? ";DR
260 IF DR < 1 OR DR > 10 THEN 230
270 PRINT
280 INPUT "INITIAL SEQUENCE LENGTH ? "
;SL

```

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```

290 IF SL < 2 THEN SL = 2
300 IF SL > 76 THEN SL = 76
320 REM SEQ LEN - MIN 2:MAX 76
330 PRINT : INVERSE : PRINT "CURRENT D
IGIT SPAN";: NORMAL : PRINT " ";SL
340 REM FLASH GET SET AND DIGITS
350 PRINT : FLASH : PRINT "GET SET";: FOR
I = 1 TO 300: NEXT I: NORMAL : HTAB
1: PRINT "GET SET";
360 PRINT CHR$(7): PRINT "*";: FOR I
= 1 TO 1250: NEXT I
370 FOR I = 1 TO SL
380 N(I) = INT ( RND (1) * 10)
400 HTAB 1: INVERSE : PRINT N(I);: FOR
J = 1 TO 100: NEXT J: NORMAL
410 HTAB 1: PRINT N(I);: IF I = SL THEN
HTAB 1: PRINT " ";
420 FOR K = 1 TO DR * 100: NEXT K
430 NEXT I
450 PRINT : PRINT : PRINT "INPUT DIGIT
S":FL = 0
460 PRINT "
";
470 PRINT "
": VTAB 13: PRINT "*";: HTAB
1: INPUT "":A$
480 IF LEN (A$) < > SL THEN FL = 1: GOTO
540
490 FOR I = 1 TO SL
500 IF VAL ( MID$ (A$,I,1)) < > N(I)
THEN FL = 1:I = SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES SE
Q LEN BY ONE
530 REM FL=1 - INCORRECT - DECREASES
SEQ LEN BY ONE
540 IF FL = 1 THEN INVERSE : VTAB 15:
PRINT "INCORRECT";: NORMAL : PRINT
" - TRY A SHORTER SPAN NEXT ":SL =
SL - 1
550 IF FL = 1 THEN PRINT "
";
560 IF FL = 1 THEN PRINT "
": VTAB 1
6
570 IF FL = 1 THEN FOR J = 1 TO SL +
1: PRINT RIGHT$ ( STR$ (N(J)),1);
: NEXT J: GOTO 620
580 VTAB 15: INVERSE : PRINT "CORRECT"
;: NORMAL : PRINT " - TRY A LONGER
SPAN NEXT ":SL = SL + 1
590 IF MA < SL - 1 THEN MA = SL - 1
600 PRINT "
";
610 PRINT "
": VTAB 18
620 HTAB 1: VTAB 19: INPUT "AGAIN (Y O
R N) ? ":N$: VTAB 19: HTAB 18: PRINT
" ": IF SL < 1 THEN SL = 1
630 IF SL > 76 THEN SL = 76
640 IF LEFT$ (N$,1) = "Y" THEN VTAB
6: GOTO 330
650 PRINT : HTAB 7: PRINT "HOPE YOU IM
PROVED YOUR SPAN!": PRINT
660 HTAB 7: INVERSE : PRINT "HIGHEST C
ORRECT DIGIT SPAN";: NORMAL : PRINT
" ";MA: VTAB 23
130 MA=0
140 CALL CLEAR
150 CALL SCREEN(12)
160 FOR I=5 TO 8
170 CALL COLOR(I,14,16)
180 NEXT I
190 PRINT "{6 SPACES}MEMORY TRAINER
"
200 FOR I=1 TO 3
210 PRINT
220 NEXT I
230 INPUT "DIGIT RATE (1-10) ? ":DR
240 IF DR<1 OR DR>10 THEN 140
250 PRINT
260 INPUT "INITIAL SEQUENCE LENGTH
? ":SL
270 IF SL<2 THEN SL=2
280 IF SL>90 THEN SL=90
290 PRINT
300 PRINT
310 PRINT
320 PRINT "CURRENT DIGIT SPAN "&STR
$(SL)
330 PRINT
340 PRINT
350 IF H$<>"Y" THEN 390
360 FOR I=1 TO 6
370 PRINT
380 NEXT I
390 PRINT "get set"
400 PRINT "*"
410 FOR I=9 TO 11
420 CALL COLOR(I,10,7)
430 NEXT I
440 FOR I=1 TO 200
450 NEXT I
460 FOR I=9 TO 11
470 CALL COLOR(I,2,1)
480 NEXT I
490 CALL SOUND(150,300,10)
500 FOR I=1 TO 200
510 NEXT I
520 FOR I=1 TO SL
530 N(I)=INT(RND*10)
540 CALL HCHAR(23,3,N(I)+48)
550 FOR J=1 TO DR*20
560 NEXT J
570 CALL HCHAR(23,3,32)
580 FOR K=1 TO 10
590 NEXT K
600 NEXT I
610 CALL HCHAR(23,3,32)
620 FL=0
630 PRINT
640 PRINT
650 IF H$<>"Y" THEN 690
660 FOR I=1 TO 4
670 PRINT
680 NEXT I
690 PRINT "INPUT DIGITS"
700 INPUT "":A$
710 PRINT
720 PRINT
730 FOR I=1 TO 200
740 NEXT I
750 IF LEN(A$)=SL THEN 780
760 FL=1
770 GOTO 850
780 FOR I=1 TO SL
790 IF VAL(SEG$(A$,I,1))=N(I) THEN 8
20
800 I=SL
810 FL=1

```

## Program 6: TI-99/4A Version

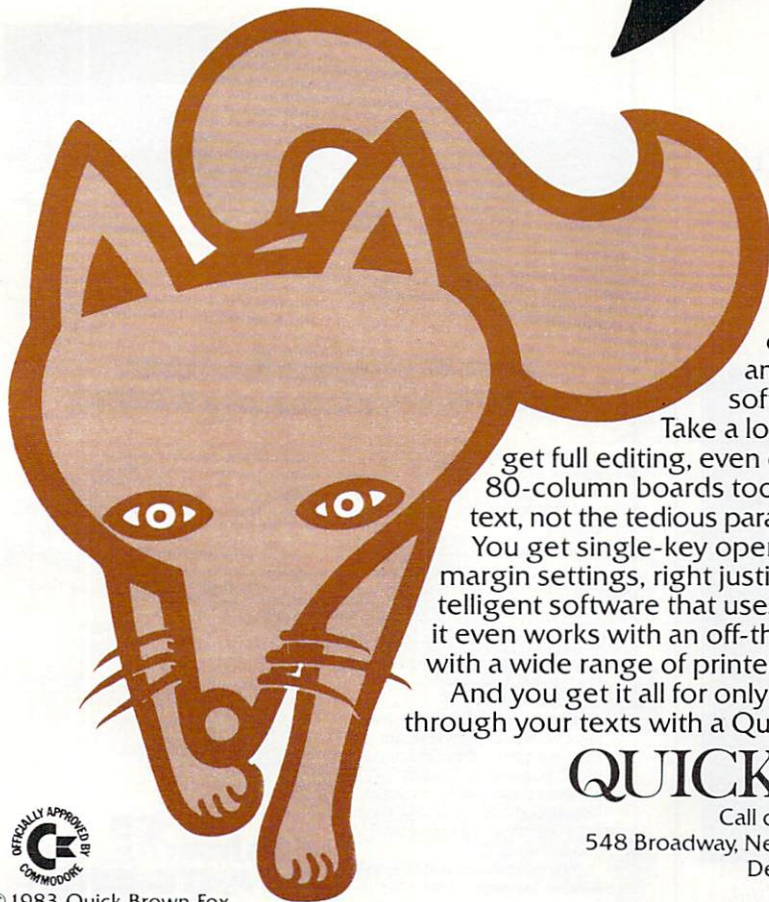
```

100 RANDOMIZE
110 REM MAX 90 DIGITS
120 DIM N(90)

```



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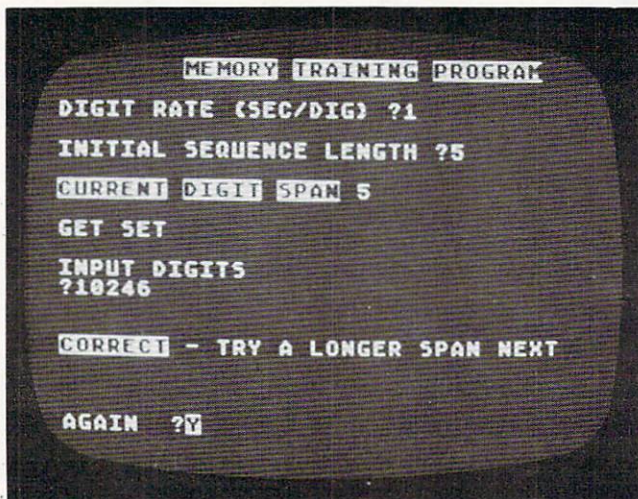


```

820 NEXT I
830 REM FL=0 -CORRECT- INCREASE SEQ
    LEN BY ONE
840 REM FL=1 -INCORRECT-
850 CALL CLEAR
860 IF FL=0 THEN 980
870 PRINT "INCORRECT-TRY A SHORTER
    SPAN"
880 PRINT
890 SL=SL-1
900 PRINT "YOUR RESPONSE=";A$
910 H$=""
920 FOR I=1 TO SL+1
930 H$=H$&STR$(N(I))
940 NEXT I
950 PRINT
960 PRINT "ACTUAL SEQUENCE=";H$
970 GOTO 1020
980 PRINT " CORRECT-TRY A LONGER SP
    AN"

990 SL=SL+1
1000 IF MA>=SL-1 THEN 1020
1010 MA=SL-1
1020 FOR I=1 TO 10
1030 PRINT
1040 NEXT I
1050 PRINT "{6 SPACES}AGAIN (Y OR N
    ) ? "
1060 CALL KEY(0,F,STATUS)
1070 IF STATUS=0 THEN 1060
1080 H$=CHR$(F)
1090 CALL CLEAR
1100 IF H$="N" THEN 1120
1110 GOTO 320
1120 PRINT "HOPE YOU IMPROVED YOUR
    SPAN!"
1130 FOR I=1 TO 10
1140 PRINT
1150 NEXT I
1160 FOR I=3 TO 4
1170 CALL COLOR(I,13,12)
1180 NEXT I
1190 PRINT "-HIGHEST CORRECT DIGIT
    SPAN-"
1200 PRINT
1210 PRINT
1220 PRINT "{11 SPACES} (;MA;)"
1230 FOR I=1 TO 500
1240 NEXT I
1250 END

```



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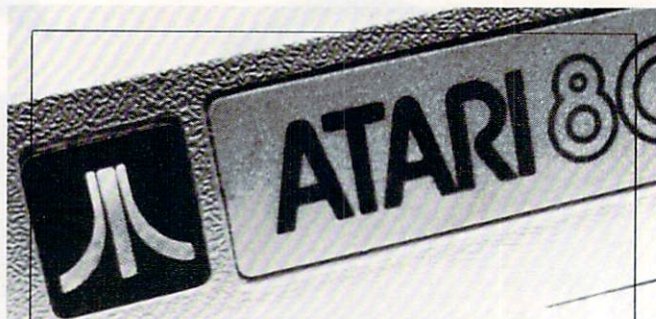
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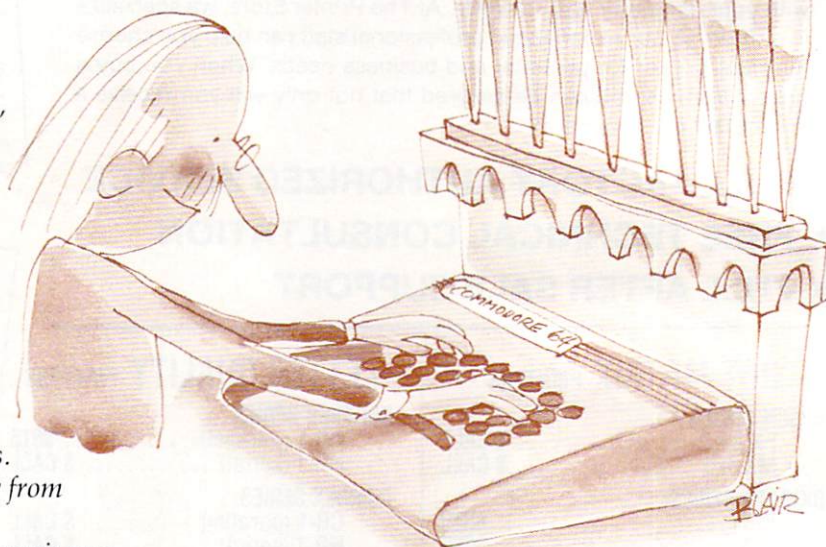
Chris Metcalf and Marc Sugiyama

*This excellent program simulates a realtime, full-function, synthesizer control panel for Commodore 64 sound and music. Your keyboard becomes the connection between you and the sounds you hear. The screen displays a double piano keyboard and the status of the other elements of the sounds you are creating.*

*MusicMaster's functions include: slide, one-key access to all the primary chords, timbre, envelope, duration, octave, maintain, polyphony, waveform, and others. All available immediately and automatically from the keyboard.*

*The power and versatility of the 64's "music synthesizer on a chip" offer the programmer-musician extraordinary control over sound: its shape, color, even interactions between sounds (modulation). There is much freedom, but this also means that there are many aspects of each sound for the programmer to control. MusicMaster automates this control: for example, you can play chords as easily as single notes. Above all, you'll learn the meaning of the various sound registers – because you'll hear the effect as you change the registers. Now you can begin to fully explore the amazing sounds of the 64.*

Enter the MusicMaster program into your Commodore 64 as you would enter any other BASIC program. MusicMaster includes two short machine language subroutines in DATA statements, so be certain that all those numbers are entered correctly. After you have entered and



saved the program, run it. Be sure that the volume of your television or audio output device is turned up enough so that you can hear the computer.

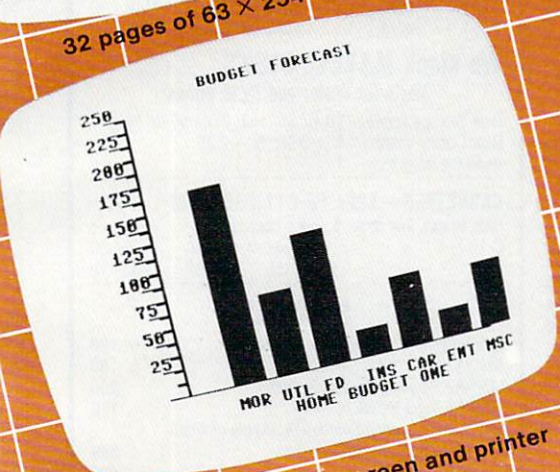
Shortly before the message "PLEASE STAND BY" has left the screen, the computer will display the instructions. Across the top of the screen, you will find a row of indicators. The first item on this row is the OCTAVE, which has a range from one to eight. This is followed by the VOICE number, which indicates the particular *timbre* of your output. After this is a series of letters which indicate the current mode of operation. These modes will be described below. The last indicator is the VOLUME, with a range of 0 to 15.

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**A B Computers**

The lower keyboard is a continuation of the upper keyboard; thus the lower set of keys plays the higher notes.

Below the keyboards is a description of the functions assigned to the programmable function keys. The left column describes the unshifted function keys, and the right column describes the shifted function keys.

**F1 and F3:** These keys allow you to change the volume of the music. Pressing F1 will increase the volume one step, and pressing F3 will decrease the volume one step. Notice how the VOLUME indicator changes as you press either one of these keys. Remember that the volume ranges from 0 to 15; 0 is completely silent, and 15 is the maximum volume.

**F4:** Pressing F4 will change the status of the Maintain mode, indicated by the "M" in the indicator row. When this mode is in operation, the "M" will be in reverse field. When this mode is activated, the computer does not release the tones after the keys have been pressed. Instead, the tones continue until other keys are pressed. To silence all the voices, press the space bar.

**F6:** This key changes the status of the Multivoice mode. This mode is indicated by the "V" in the indicator row. A reverse field "V" indicates that the mode is in operation. The Multivoice mode enables more than one voice to be played at the same time. The program "powers on" with this mode activated. If this mode is not activated, then one tone follows the next on the same voice, and chords cannot be played. This has some disadvantages, but it is useful in conjunction with the Slide mode. With this mode, you can have up to three simultaneous voices.

**F7 and F5:** Pressing these keys changes the status of the Slide and Chord modes. They will be described below.

**F2:** This key allows you to define your own waveforms.

## Making Music

Once the program is ready, press the following key sequence: QWERTYUI. You should hear a C major scale. If you do not, check the program for typing errors. Now try this key sequence: IOP@(up arrow)(RUN/STOP)Z. This time you should hear the same scale, but one octave higher.

Pressing the sequence ZXCVBNM, produces another scale one octave higher than the last. Now try pressing the keys QET all at once to get a C-major chord. Each note of this chord is assigned one voice. Since there are only three voices, the computer can accept only three keys at one time as input.

If you want to change octaves, press the control key and a number from one to eight, one being

the lowest octave and eight the highest. Some of the voices do not work well in very low octaves. Pressing the Commodore key and a number will change the VOICE number. This, too, has a range of one to eight.

The Slide mode is very interesting. A reverse-field "S" on the status row indicates that the Slide mode is active. The Slide mode will work regardless of the Multivoice and Maintain modes. When in this mode, the computer steps smoothly through the tones rather than moving by half tones as a piano would. This can produce an intriguing, eerie effect with the Maintain mode activated. For example, enter the Slide mode, make sure that the Maintain and Multivoice modes are activated, and press the following key sequence: QETIP\*ZCB, . As always, you can silence the voices by pressing the space bar.

## Forming Chords

Another mode of operation is the Chord mode. This allows for *single key* control over different types of chords and their inversions. Once you activate the Chord mode, a second indicator row appears. On the left is the chord name, and on the right is the chord position – root, first inversion, or second inversion.

The root chord is a chord in which the lowest note is also the key of the chord. For example, the C major triad is formed using the notes C, E, and G. When the notes are in that order, CEG, the chord is a root chord. If the notes of the chord start on a different note than C, then we have the inversions of the chord. For example, E and G, with high C, is the first inversion, and G, with high C and E, is the second inversion.

To change the chord type, press the shift-key and a number from one to nine. The chords which are available correspond to the following numbers: (1) Major; (2) Minor; (3) Diminished; (4) Augmented; (5) Major Seventh; (6) Minor Seventh; (7) Dominant Seventh; (8) Major Sixth; (9) Minor Sixth.

The inversions are selected by pressing the shift key and the plus sign for root, the minus sign for the first inversion, and the pound sign for the second inversion.

In order to play a chord, you must first select the chord type and inversion that you want, and then press the note on the keyboard which corresponds to the lowest note of your chord. For example, if you want to play a D flat minor second inversion chord, enter the Chord mode, select the minor chord and the second inversion (by pressing shift-2 and shift-pound-sign) and press "R", which corresponds to the note F on the musical keyboard. The chord that you will hear is comprised of the following notes: F, B flat, and high D flat. (Since the Slide mode can slide only one



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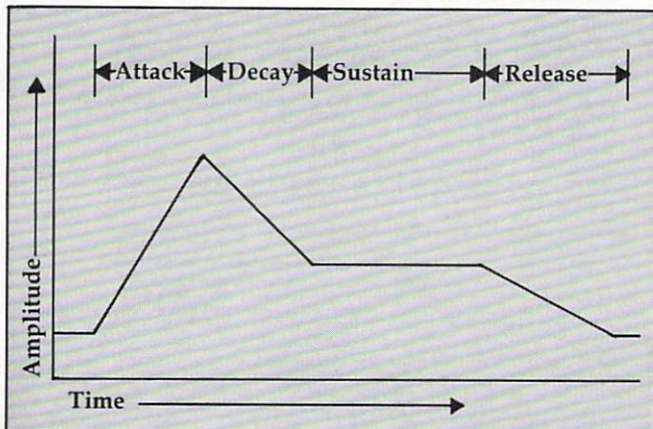
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voice at a time, the Chord and Slide modes are incompatible, so turning on one automatically turns off the other.)

## Attack, Decay, Sustain, Release

To define your own waveform, press F2. Once you are in this mode, the computer asks a series of questions that apply to the construction of a new waveform. The first question is which waveform you wish to change. Pressing RETURN with no other input returns program control to the play mode. After this question, the computer displays the current Attack, Decay, Sustain, and Release values, and asks for new values. Pressing RETURN with no other input or giving a bad input returns you to the first question.

### The Envelope



The attack rate is the time that it takes the sound to reach its highest volume level. The larger the number, the more time it takes. Decay is the time it takes the sound to drop to the Sustain volume level. Sustain is the volume level at which the sound remains until the Release is initiated. The Release rate is the time that it takes the sound to soften from the sustain level to silence (see the figure).

After these questions, the computer asks for the waveform type. You must enter the first letter of the type of waveform desired. If the Pulse waveform is selected, then the pulse rate must be entered. The authors of the Commodore 64 manual have written the pulse value as two numbers, the LOW pulse and the HIGH pulse. To obtain a single value for the pulse rate, take the HIGH pulse times 256 and add it to the LOW pulse. Once these questions have been answered, the computer returns to the playing mode with the voice set to the one you have just modified.

## Program Structure

The mechanics are fairly simple since most of the program is written in BASIC. The REMs identify the major sections of the program (see the table for a description of variables). However, some

programming tricks are used. The POKE214,X command moves the cursor to line X on the screen. But a PRINT with no statement must follow this POKE or the cursor will not move to its new location. A POKE 788,53 disables the RUN/STOP key,

### Variables

A	miscellaneous
A\$	miscellaneous
AD	attack/decay for define waveform routine
AD()	table of attack/decay values
BF	constant pointer to buffer (198)
C\$( )	table of chord names
C()	table of chord note offsets
C1	chord number
C2	chord inversion
CH	chord mode flag
ER	INPUT routine error flag
ET	constant pointer for multikey input routine
FF	constant 255
FH()	table of high bytes of frequencies
FL()	table of low bytes of frequencies
HB	256 constant
I	miscellaneous
IK	constant for "inkey" or keyboard matrix value
IN	value for input from INPUT routine
IN\$	input string from INPUT routine
J	miscellaneous
K()	conversion table for ASCII values
LL	polyphonic flag
LN\$	constant line
MN	multivoice flag
NH	constant high byte location 901
NL	constant low byte location 900
NM\$( )	"root," "first," or "second" (for chord inversion display)
OC	number of half steps offset (octave)
P	maintain mode flag
PH()	table of pulse high bytes
PL()	table of pulse low bytes
PU	pulse rate for define waveform routine
R	frequency number and miscellaneous
RA	slide mode register start pointer
RB	slide mode register end pointer
S	constant 54272
S1	constant 49152 (for multikey GET routine)
S2	constant 49403 (for music loader routine)
SL	slide mode flag
SP\$	constant 39 spaces (for blanking)
SR	sustain/release value for define waveform routine
SR()	table of sustain/release values
T	current base address of SID
T()	table of last used base locations
V	computer voice number
VL	volume
VN	constant voice number location for music loader (251)
WF	waveform holder for define waveform routine
WV	current waveform
WV()	table of waveform values

All variables beginning with "Z" are low numeric constants.

# COMMODORE 64

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but this can be annoying when listing programs. To re-enable the RUN/STOP key, POKE 788,49. WAIT is also employed when waiting for input (WAIT 198,255).

The SYSS1 (to 49152) is a full keyboard scan routine for the Commodore 64. This routine is very useful because it allows the user to enter more than one key at a time.

The machine language routine returns the ASCII values of the keys being pressed to addresses 830, 831, and 832. (Due to a hardware problem involving the way the keyboard is wired, certain combinations of keys yield incorrect values.) The number of keys being pressed is stored in location 829. This routine could be used by games in which a multiple input is required. It could also be adapted to work on other Commodore computers, such as the VIC-20 and the PET/CBM series.

A second machine language subroutine simply loads the values from 900-906 into the appropriate voice in the sound chip. Select the increment for voices 0, 1, and 2 (0, 7, or 14), POKE 251 with this value, then SYS(49408). The subroutine does not start the note, but leaves it to BASIC, via a POKE to the sound chip (SID), for the corresponding voice.

If you find any problems in this program, or can offer any improvements or comments, please write to either of us at the addresses listed below. If you do not want to enter the program yourself, please send a standard (1541) floppy disk or a cassette tape, a self-addressed stamped mailer and \$3 to either of the addresses listed below.

Chris Metcalf  
123 Ardmore Rd.  
Kennsington, CA 94707  
Marc Sugiyama  
5969 Chabolyn Terr.  
Oakland, CA 94618

*Note:* This program contains a number of characters which are not currently part of the listing conventions. To obtain any of the characters in the left column, type the keys indicated in the right column. ("Logo" indicates the Commodore logo key at the lower left of the keyboard.) For any underlined characters in the listing, see the table in "How To Type **COMPUTE!**'s Programs."

{ORG} LOGO & 1	{LTG} LOGO & 6
{BRN} LOGO & 2	{LTB} LOGO & 7
{LTR} LOGO & 3	{GY3} LOGO & 8
{GY1} LOGO & 4	{C} CTRL & C
{GY2} LOGO & 5	{X} CTRL & X

## MusicMaster

```

200 GOTO460
210 :
220 :
230 REM SLIDE SUBROUTINE
240 IFRA<0THENRA=R
250 RB=R:T=S+V*Z7:POKEVN,V*Z7:POKENL,FL(RA)
    :POKENH,FH(RA):SYSS2:POKET+Z4,WV
    +Z1
260 FORI=RATORBSTEPSGN(RB-RA)/2:POKET,FL(I)
    :POKET+1,FH(I):NEXT
270 IFPEEK(IK)=JANDPEEK(IK)-64THEN270
280 RA=RB:POKET+Z4,WV+P:V=V+MN*(Z1+Z3*(V=Z
    2)):RETURN
290 :
300 REM CHORD SUBROUTINE
310 POKEBF,Z0:FORI=Z0TOZ2:A=R+C(C1,C2,I):P
    OKEVN,I*Z7:POKENL,FL(A)
320 POKENH,FH(A):SYSS2:NEXT:POKES+Z4,WV+Z1
    :POKES+11,WV+Z1:POKES+18,WV+Z1
330 IFPEEK(IK)=JANDPEEK(IK)-64THEN330
340 POKES+Z4,WV+P:POKES+11,WV+P:POKES+18,W
    V+P:RETURN
350 :
360 REM POLYPHONIC SUBROUTINE
370 A=PEEK(IK):SYSS1:J=PEEK(ET):IFJ=Z0ORA=
    ZSTHENRETURN
380 FORI=Z1TOJ:R=K(PEEK(ET+I))+OC:IFR=OCTH
    ENNEXT:RETURN
390 T(I)=V*Z7:POKEVN,T(I):POKENL,FL(R):POK
    ENH,FH(R):SYSS2
400 IFMNTHEENV=V+Z1:IFV=Z3THEENV=Z0
410 NEXT:FORI=Z1TOJ:POKES+T(I)+Z4,WV+Z1:NE
    XT
420 SYSS1:IFJ=PEEK(ET)ANDA=PEEK(IK)THEN420
430 FORI=Z1TOJ:POKES+T(I)+Z4,WV+P:NEXT:GOT
    O370
440 :
450 :
460 REM INITIALIZE VARIABLES
470 PRINT"{CLEAR}"CHR$(142);CHR$(8);:POKE5
    3280,0:POKE53281,0:POKE788,52:REM
    IGNORE RUN/STOP
480 FORI=1TO39:SP$=SP$+" ":LN$=LN$+"#":NEX
    T
490 PRINT"{WHT}OCTAVE=5 VOICE=1 :C:S:M:{
    REV}V{OFF}:{REV}P{OFF}: VOLUME=10
    {RIGHT}"LN$
500 POKE214,23:PRINT:PRINTTAB(15)"MUSICMAS
    TER{HOME}{02 DOWN}
510 A$="PLEASE STAND BY{WHT}":POKE214,21:P
    RINT:PRINTTAB(13){GRN}"A$:S=5427
    2:GOSUB1580
520 DIMFL(134),FH(134),K(255),C(8,2,2):OC=
    48:VL=10:MN=1:LL=1:RA=-1
530 Z1=1:Z2=2:Z3=3:Z4=4:Z7=7:ZS=64:FF=255:
    HB=256
540 IK=197:BF=198:VN=251:NL=900:NH=901:ET=
    829:S1=49152:S2=49408:FORI=Z1TO41
550 K(ASC(MID$("Q2W3ER5T6Y7UI9O0P@-*&↑{
    HOME}{C}ZSXDCVGBHJNM,./",I)))=I:NEXT
560 PRINTTAB(13){CYN}{UP}"A$:R=5.8:A=1078
    7.4138:J=Z2*(-Z1/12)
570 FORI=94TO0STEP-1:FH(I)=INT(A*R/HB):FL(I)
    =A*R-HB*FH(I):A=A*J:NEXT
580 PRINTTAB(13){UP}"A$:GOSUB1310
590 :
600 REM READ ALL DATA
610 FORI=Z0TO8:FORJ=Z0TOZ2:READC(I,J,0),C(
    I,J,1),C(I,J,2):NEXT:READC$(I):NEXT
620 READNM$(0),NM$(1),NM$(2):FORI=1TO8:REA

```

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```

DAD(I),SR(I),WV(I),PL(I),PH(I):NEXT
630 FORR=1TO2:READI,J:FORA=ITOJ:READIN:POK
EA,IN:NEXT:NEXT
640 PRINTTAB(9)"{DOWN}(USE CONTROL-X TO EX
IT)":I=1:GOSUB860
650 :
660 :
670 REM NUCLEUS
680 WAITBF,FF:J=PEEK(1K):GETA$:R=K(ASC(A$)
)+OC:IFR=OCTHENGOSUB800:GOTO680
690 IFSLTHENGOSUB240:GOTO680
700 IFCHTHENGOSUB310:GOTO680
710 IFLLLTHENGOSUB370:GOTO680
720 T=S+V*Z7:POKEVN,V*Z7:POKENL,FL(R):POKE
NH,FH(R):SYSS2:POKET+Z4,WV+Z1
730 IFMNTHEENV=V+Z1:IFV=Z3THEENV=Z0
740 IFPEEK(1K)=JANDPEEK(1K)-64THEN740
750 POKET+Z4,WV+P:WAITBF,FF:GETA$:J=PEEK(1
K):R=K(ASC(A$))+OC:IFR-OCTHEN720
760 GOSUB800:GOTO680
770 :
780 :
790 REM PARAMETER FUNCTIONS
800 IFCH=0THEN830
810 FORI=0TO2:IFA$=MID$("[]",I+1,1)THENC2
=I:PRINT"{HOME}{DOWN}"TAB(23)NM$(
I):RETURN
820 NEXT:A=ASC(A$):IFA>32ANDA<42THENC1=A-3
3:PRINT"{HOME}{DOWN}"TAB(11)C$(C1
):RETURN
830 FORI=1TO8:IFA$<>MID$("{BLK}{WHT}{RED}{
CYN}{PUR}{GRN}{BLU}{YEL}",I,1)THE
NNEXT:GOTO850
840 OC=12*(I-Z1):PRINT"{HOME}"TAB(7)MID$(S
TR$(I),2):RETURN
850 FORI=1TO8:IFA$<>MID$("{ORG}{BRN}{LTR}{
GY1}{GY2}{LTG}{LTB}{GY3}",I,1)THEN
NEXT:GOTO880
860 POKE902,PL(I):POKE903,PH(I):WV=WV(I):P
OKE904,WV:POKE905,AD(I):POKE906,S
R(I)
870 PRINT"{HOME}"TAB(16)MID$(STR$(I),2):RE
TURN
880 IFA$<>"{F1}"ANDA$<>"{F3}"THEN930
890 VL=VL-(VL<15ANDA$="{F1}")+(VL>0ANDA$="
{F3}"):POKES+24,VL
900 PRINT"{HOME}"TAB(37)RIGHT$("0"+MID$(ST
R$(VL),2),2):RETURN
910 :
920 REM STYLE FUNCTIONS
930 IFA$="{F4}"THENP=1-P:POKE1047,13+128*P
:GOTO1580
940 IFA$="{F6}"THENMN=1-MN:POKE1049,22+128
*MN:GOTO1580
950 IFA$="{F8}"THENLL=1-LL:POKE1051,16+128
*LL:RETURN
960 IFA$="{F7}"THENS�=1-SL:RA=-1:POKE1045,
19+128*SL:CH=1:GOTO990
970 IFA$<>"{F5}"THENL010
980 POKE1045,19:SL=0
990 CH=1-CH:POKE1043,3+128*CH:IFCH=0THENPR
INT"{HOME}{DOWN}"LN$:PRINTSP$:RET
URN
1000 PRINT"{HOME}{DOWN}"SP$"{RIGHT}{UP}CHOR
D TYPE:"C$(C1)TAB(23)NM$(C2)" INV
ERSION{RIGHT}"LN$:RETURN
1010 IFA$=" "THENGOSUB1580:RA=-1:POKEBF,Z0:
RETURN
1020 IFA$="{X}"THENGOSUB1580:PRINT"{CLEAR}"
;:POKE788,49:END
1030 IFA$<>"{F2}"THENRETURN
1040 :
1050 :
1060 REM DISPLAY WAVEFORM PARAMETERS
1070 GOSUB1470:POKE214,13:PRINT
1080 PRINT"VOICE TO BE DEFINED (1-8)":J=1:
GOSUB1500
1090 IFIN<1ORIN>8THENGOSUB1470:GOTO1400
1100 I=IN:PRINTTAB(31)"ATT:"MID$(STR$(INT(A
D(I)/16)),2)
1110 PRINTTAB(31)"DEC:"MID$(STR$(AD(I)AND15
),2)
1120 PRINTTAB(31)"SUS:"MID$(STR$(INT(SR(I)/
16)),2)
1130 PRINTTAB(31)"REL:"MID$(STR$(SR(I)AND15
),2)
1140 PRINTTAB(31)"WVF:{CYN}"MID$("{SAWTRIPUL
NSE",3*LOG(WV(I))/LOG(2)-11,3)"{WHT}
1150 IFWV(I)=64THENPRINTTAB(31)"PLS:"MID$(S
TR$(PH(I)*HB+PL(I)),2)
1160 :
1170 REM DEFINE A NEW WAVEFORM
1180 POKE214,14:PRINT:PRINT"ATTACK RATE (0-
15)":J=2:GOSUB1500:IFERTHEN1070
1190 AD=IN:PRINT"DECAY RATE (0-15)":GOSUB1
500:IFERTHEN1070
1200 AD=AD*16ORIN:PRINT"SUSTAIN LEVEL (0-15
)":GOSUB1500:IFERTHEN1070
1210 SR=IN:PRINT"RELEASE RATE (0-15)":GOSU
B1500:IFERTHEN1070
1220 SR=SR*16ORIN:PRINT"{CYN}S{WHT}AW {CYN}
T{WHT}RIANGLE {CYN}P{WHT}ULSE {
CYN}N{WHT}OISE":J=1:GOSUB1500
1230 FORJ=1TO4:IFIN$<>MID$("{STPN",J,1)THENN
EXT:GOTO1070
1240 WF=2^(J+3):IFWF<>64THEN1260
1250 PRINT"PULSE RATE (0-4095)":J=4:GOSUB1
500:PU=IN:IFIN<0ORIN>4095THEN1070
1260 WV(I)=WF:PL(I)=PU-HB*INT(PU/HB):PH(I)=
INT(PU/HB):AD(I)=AD:SR(I)=SR
1270 GOSUB1470:GOSUB1410:GOTO860
1280 :
1290 :
1300 REM DISPLAY KEYBOARDS
1310 POKES+24,VL:PRINT"{HOME}{03 DOWN}"TAB(
9)"{REV}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{
RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{
RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}
"
1320 PRINT" LOW      '{REV}{OFF}2{REV}{
OFF}3{REV}{OFF}5{REV}{OFF}6{
REV}{OFF}7{REV}{OFF}9{REV}{
OFF}0{REV}{OFF}-{REV}{OFF}4{
REV} S "
1330 PRINT"KEYBOARD '{REV}{OFF}2{REV}{
OFF}3{REV}{OFF}5{REV}{OFF}6{
REV}{OFF}7{REV}{OFF}9{REV}{
OFF}0{REV}{OFF}-{REV}{OFF}4{
REV} S "
1340 PRINTTAB(9)"_{REV}Q]W]E]R]T]Y]U]I]O]P]
@]*]↑]"
1350 PRINTTAB(13)"{DOWN}*{REV}{RIGHT}{
RIGHT}{RIGHT}{RIGHT}{RIGHT}{
RIGHT}{RIGHT}{RIGHT}{OFF}4"
1360 PRINT" HIGH      *{REV}{OFF}S{REV}
{OFF}D{REV}{OFF}G{REV}{OFF}H{
REV}{OFF}J{REV}{OFF}L{REV}{
OFF}:{REV}{OFF}4"
1370 PRINT"KEYBOARD '{REV}{OFF}2{REV}{
OFF}3{REV}{OFF}5{REV}{OFF}6{
REV}{OFF}7{REV}{OFF}9{REV}{
OFF}0{REV}{OFF}-{REV}{OFF}4{
REV} S "
1380 PRINTTAB(13)"*_{REV}Z]X]C]V]B]N]M],.] /
{OFF}4"
1390 :
1400 REM DISPLAY FUNCTION MENU
1410 POKE214,13:PRINT:PRINT"F1 -- LOUDER
F2 -- DEFINE WAVEFORM
1420 PRINT"{DOWN}F3 -- SOFTER      F4 -- {"

```

```

CYN}MAINTAIN{WHT}
1430 PRINT"{DOWN}F5 -- {CYN}CHORDS{WHT}
      F6 -- {CYN}MULTIVOICE{WHT}
1440 PRINT"{DOWN}F7 -- {CYN}SLIDES{WHT}
      F8 -- {CYN}POLYPHONIC{WHT}":RETURN
1450 :
1460 REM CLEAR DISPLAY AREA
1470 POKE214,12:PRINT:FORJ=1TO11:PRINTSP$:N
EXT:RETURN
1480 :
1490 REM INPUT SUBROUTINE
1500 IN$="":PRINT"? ";
1510 PRINT"{REV} {OFF}{LEFT}";:WAITBF,FF:
      GETA$:IFA$="{X}"THEN1020
1520 A=ASC(A$):IFA=13THENPRINT" ":IN=VAL(IN
      $):ER=(IN<0ORIN>15)ORIN$="":RETURN
1530 IFA=20ANDLEN(IN$)THENPRINT" {02 LEFT}
      {LEFT}";:IN$=LEFT$(IN$,LEN(IN$)-1)
1540 IF(AAND127)<35ORLEN(IN$)=JTHEN1510
1550 PRINTA$;:IN$=IN$+A$:GOTO1510
1560 :
1570 REM CLEAR MUSIC CHIP
1580 FORI=4TO18STEP7:POKES+I,0:NEXT:FORI=0T
O23:POKES+I,0:NEXT:RETURN
1590 :
1600 :
1610 REM CHORD DATA
1620 DATA,4,7,,3,8,,5,9,"MAJOR",,,3,7,,
      4,9,,5,8,"MINOR"
1630 DATA,3,6,,3,9,,6,9,"DIMINISHED",,4,8,,
      4,8,,4,8,"AUGMENTED"
1640 DATA,4,11,,4,11,,4,11,"MAJOR 7TH",,3,
      10,,3,10,,3,10,"MINOR 7TH"
1650 DATA,4,10,,4,10,,4,10,"DOMIN 7TH",4,7,
      9,4,7,9,4,7,9,"MAJOR 6TH"
1660 DATA3,7,9,3,7,9,3,7,9,"MINOR 6TH"," R
OOT"," FIRST",SECOND
1670 :
1680 REM WAVEFORM PARAMETER DATA
1690 DATA,249,16,,,,249,32,,,,249,64,160,15
      ,,249,128,,,,240,16,,,,204,204,16,,
1700 DATA,252,64,200,,192,240,32,,
1710 :
1720 REM MULTI-INPUT ASSEMBLY CODE
1730 DATA49152,49294,120,169,,141,61,3,170,
      169,254,133,252,165,252,141,,220,173
1740 DATA1,220,157,143,192,232,56,38,252,17
      6,239,162,,160,,189,143,192,42,176
1750 DATA29,72,132,253,138,10,10,10,5,253,1
      68,185,79,192,238,61,3,172,61,3,153
1760 DATA61,3,104,192,3,240,12,164,253,200,,
      192,8,208,219,232,224,8,208,209,88
1770 DATA96,17,135,134,133,136,29,13,20,0,6
      9,83,90,52,65,87,51,88,84,70,67,54
1780 DATA68,82,53,86,85,72,66,56,71,89,55,7
      8,79,75,77,48,74,73,57,44,64,58,46
1790 DATA45,76,80,43,47,94,61,1,19,59,42,92
      ,3,81,2,32,50,4,95,49
1800 :
1810 REM MUSICLOADER ASSEMBLY CODE
1820 DATA49408,49454,169,212,133,252,169,,1
      60,6,145,251,136,145,251,170,169,8
1830 DATA136,145,251,138,145,251,136,192,1,
      208,249,188,41,193,185,132,3,145,
      251
1840 DATA232,224,6,208,243,96,2,3,,1,6,5 ©

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## Commodore 64 Programmer's Reference Guide

Anu M. Gupta

This book is Commodore's answer to the many questions of Commodore 64 owners. The manual included with the 64 can get you started, but the serious programmer will probably find much in this book of great value.

### Thorough Coverage

The 486-page guide is thorough in its documentation of the 64's features. It begins by covering the rules governing programming in BASIC. There are examples showing how to set up expressions and the hierarchy of mathematical operations. A section on programming techniques shows the main ways to input information into the computer, and methods for conserving memory.

The second chapter is a BASIC "dictionary," with complete information and examples of what each command does. It's an excellent reference when encountering new commands. The short tutorial on using the keyboard and screen editor should put newcomers to the 64 at ease.

The next chapter is an in-depth discussion on using the screen graphics of the 64. The material includes the vital memory locations for video display, display modes, programmable characters, bit-mapping, smooth scrolling, and sprites. The guide devotes more than 50 pages of

the graphics chapter to programming sprites and contains sample programs with explanations. This section alone may be worth the price of the book.

The chapter on sound also combines sample programs with explanatory text to show how the programmer can make use of the 64's sound capabilities. It deals with volume, multiple voices, waveforms, envelopes, filtering, and modulation to help you create the sounds you are after.

*Machine language.* These two words cause some BASIC programmers to pause and catch

their breath. Chapter 5 uses a relatively simple vocabulary to introduce some aspects of machine language programming. It covers several topics, including the kernal, instruction sets, and addressing modes, to name a few. A complete memory map of the 64 is featured at the end of this chapter.

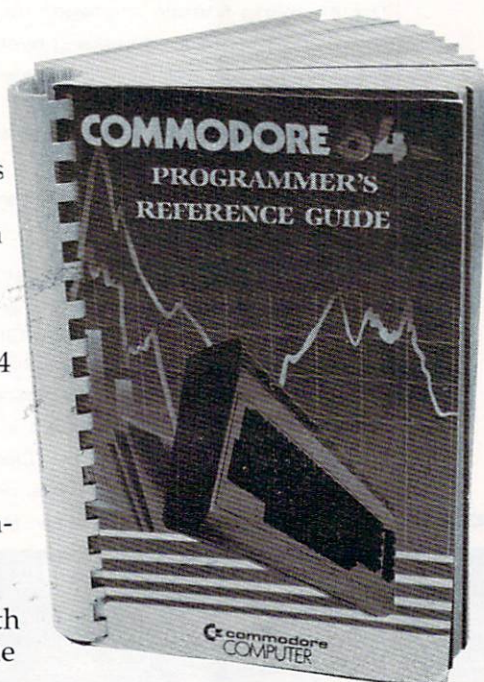
An input/output guide constitutes the last chapter, with information on output to such devices as modems and printers. It also illustrates how to make full use of the RS-232 interface, user port, serial bus, and expansion port. There is also a section on using paddles, joysticks, and light pens.

### 100 Pages of Reference Tables

Following the last chapter are more than 100 pages of reference tables, including BASIC abbreviations, screen display codes, ASCII codes, note values for music, pinouts of all the major chips, error messages, chip specifications, and a quick reference card. The last page is perhaps the biggest surprise of all, a full fold-out schematic diagram of the 64 for hardware enthusiasts.

Commodore has done a solid job with this book. It provides 64 users with important assistance in increasing their understanding of their computer. While the book makes no attempt to teach programming as such, it is a fine reference book.

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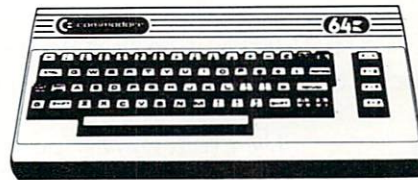
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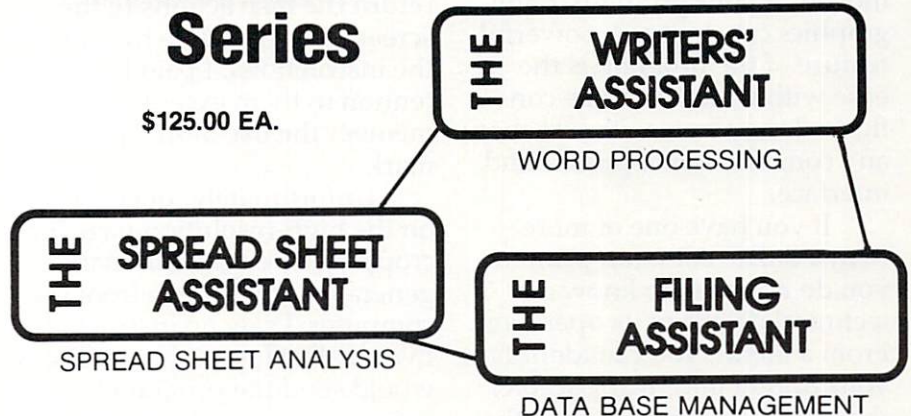
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# The Printographer Graphics Printer Package For The Apple

Richard Cornelius

*The Printographer*, by Stephen Billard, is a utility program which processes high-resolution images on the Apple II computer and sends them to a printer. You can perform cropping operations on the high-resolution screen and determine the format in which the image will appear on the printer. The package comes with one disk including instructions on how to make backup copies and a 27-page manual.

## Operates With Any Printer

The first question that many people will ask about *The Printographer* is, "Will it work with my printer?" The answer is yes, indeed, if your printer has any graphics capability. A powerful feature of the program is the ease with which it can be configured to operate with just about any combination of printer and interface.

If you have one of more than a dozen common printers, you do not need to know any technical details of its operation. From a menu, you can identify your printer and, if applicable, the particular interface card that you have. This menu automatically appears the first time you boot the disk. The printer specifications that you select are then saved to the disk so that on subsequent runs you are moved directly into the main program without having to identify your particular printer again.

The manual explains how to rerun the printer-selection program should you wish to run *The Printographer* with a different printer. If your printer is not one of those on the menu, then you explain how your printer proces-

ses information, but the program on the disk still does most of the work.

*The Printographer* performs its various cropping operations on the high-resolution screen quickly and smoothly. Pictures can be cropped from the top, bottom, or either side, or in a diamond or oval shape within the boundaries you specify. Starting over again is accomplished by a single keystroke, and the mechanics of operating the program are easy to understand.

However, I did encounter a problem. The cropping instructions are given on the text page and include, logically enough, the use of the question mark to return the instructions to the screen. The first time through the instructions, I paid little attention to them except to remember the use of the question mark.

Unfortunately, once I was on the high-resolution page for cropping, the question mark generated only a beep from the computer; I saw no instructions. Eventually I found that a CTRL-C would send the program to a point from which I could return to the instructions, but the first time through I had to reboot the disk just to see the instructions again.

## Easy To Use

Most of the program is very easy to use. The general format employs the ESC key to move a highlighting identifier through the menu and the RETURN key to actually select the item that is highlighted. I was impressed with how easy it was to select a high-resolution picture from among a mixture of Applesoft,

text, and binary files on one of my own disks. *The Printographer* gave me a menu of only the high-resolution images on my disk. It even ignored other binary files that were not high-resolution pictures.

The printing routines seem to work exactly as specified. Pictures can be printed in normal or inverse mode, vertically or horizontally on the page, magnified up to nine times, and tabbed over on the page. Routines for doing this printing from your own programs are available (not copy-protected) on the disk with instructions in the documentation on how to use them. Images can also be saved on a disk in one of three forms: a regular binary file, a compressed version that saves space, or a printer image. If you have the right printer setup, this last form allows printer spooling so that the computer is not tied up while the graphics are being printed.

The documentation is clear and complete. It is not packaged in a fancy (and expensive) padded binder, but it contains all of the information that I would want to know about the software. The primary part of the documentation is written so that no technical knowledge of the Apple or printers is required. The appendices, however, contain technical details such as writing your own printer driver and memory management so you can use some of the *Printographer* routines within your own programs.

The backup procedure seems to work well. Parts of the disk are copy-protected. The disk, however, comes with its own copying program which, according to the documentation, will make a total of three backup copies of the disk. This copy program uses a single drive, supposedly for assuring maximum reliability during the copying process. The copy program works essentially like COPY on the Apple System

Master Disk.

All in all, *The Printographer* is a useful utility which is relatively easy to use. It comes with complete documentation. The program is not without faults, but technical support is easy to obtain. The price seems in line with the capabilities of the program. Its strongest feature is the manner in which it can easily be configured to work with whichever graphics printer you might happen to have.

The Printographer  
Southwestern Data Systems  
10761-E Woodside Avenue  
Santee, CA 92071  
\$49.95

## Marathon For Atari

Mike Kinnamon

### More Than A Math Drill

*Marathon* departs somewhat from typical math drill programs. It makes use of the Atari's graphics and sound capabilities. The object is to advance your marathon runner from the starting line at the left of the screen to the finish line at the right. This is accomplished by giving the correct answer to the math problem presented before your opponent does or before the timer runs out.

When the game is loaded from disk or cassette, an option allows one or two players. You may then select which mathematical operation the game will focus on - addition, subtraction, multiplication, or division. You may opt for a mixture of these operations by selecting the general category instead.

### Four Levels Of Difficulty

There are four levels of difficulty: walker, jogger, sprinter, and olympian. Each successively higher level decreases the amount of time allowed to correctly answer the math prob-

lems. Pressing START begins the game.

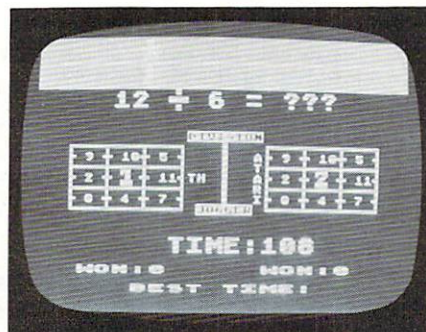
A math problem, nothing larger than two-digit numbers, will appear near the middle of the screen. Two matrices (one for each player) containing eight answers from which to choose appear on each side of the screen.

Once a player has located the correct answer on the matrix, he or she uses the joystick to position the cursor over the appropriate cell and presses the red button to indicate the answer. The player who gets the right answer first is rewarded with the advancement of his or her marathon runner at the top of the screen.

The game continues in this manner until one of the player's marathon runners crosses the finish line. On every fifth problem, the players are asked to identify the multiple of a given number. At the game's conclusion, the winning player will be ranked from "Walker-Team Six" to "Olympian-Team One." These rankings are derived from a combination of correct answers, advancements due to the opponent's incorrect responses, and the number of times that the timer expired.

### Good Graphics

Geoff Brown, the author of *Marathon*, employs effective mixed screen modes and color schemes. The flow of the program is smooth and bug-free.



Runners are locked in a tie at the top of the screen while the program awaits the answer to a math problem in Marathon.

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I have used this program in my fourth- through sixth-grade classes and found it helpful in motivating students who need remediation. Ten to 15 minutes seemed to be the attention span for the majority of the students. *Marathon* can be put to good use in the classroom.

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Cal Hunter

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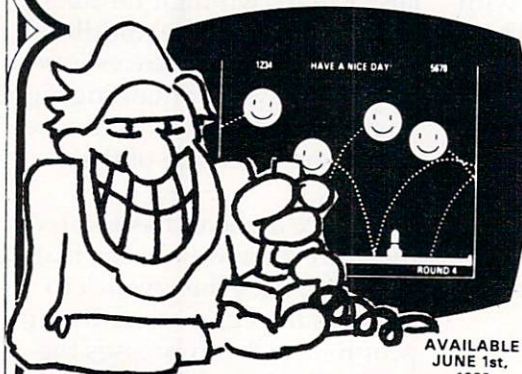
After browsing the magazine advertisements, I chose *Disk Data Manager* by MicroSpec. It requires a minimum of 8K expansion for a VIC (to handle up to 600 records). With even greater expansion, up to 1200 records can be maintained.

Novices should have no difficulty handling the program. The instruction manual is well-written and thorough, and program prompts are self-explanatory. It's worth the time, however, to carefully read the instruction manual before loading and running the program.

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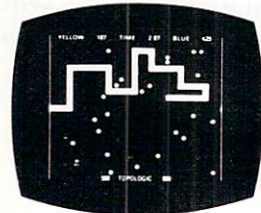
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Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

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

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

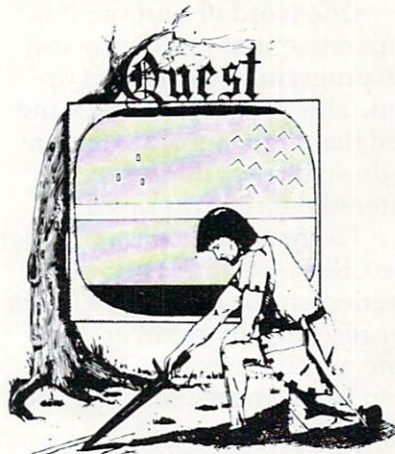
**Dungeons of Death** — Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character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

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

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

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

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



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

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screen displays. When the program is loaded and run, a menu appears:

```
CReate a File
ADd a Record
DElete a Record
CHange a Record
BRowse thru the File
SEArch the File
PRint the File
EXit the File
```

Entering the first two characters executes the desired function. The first time you run the program, the only valid options will be to CReate a File or EXit the File. A data base description file is required to perform the other options.

One word of caution: It is imperative that you *always* exit the program with the EXit option. This procedure closes and updates all file records. Failure to do so can result in all newly entered data being erased.

To create a file format, enter the CReate option. You will be queried on the number of fields per record. Any number up to nine may be selected. You will then be prompted to name each field.

My prospect file required seven fields:

```
Field #1 Name
Field #2 Address
Field #3 Phone
Field #4 Sex
Field #5 Age
Field #6 Rating
Field #7 Comments
```

The *Disk Data Manager* permits me to add new prospects, delete a record when it is no longer needed, or change a record when new information is obtained. It's efficient. At any time, I can browse through my prospects or even search for a particular record. If I wish, I can print out a complete listing of the desired information in any category.

The PReint option offers several functions. You may print your entire file in record number sequence, or you may specify a field to sort on. If you select a field to sort on, you will be asked

to specify the low and high limits. For instance, in the above prospect file, if you elected to sort on field #5, you could elect a low of 35 and a high of 50. The report would then be printed listing only persons in the file between 35 and 50 years of age.

### Commodore 64 Version

When I recently traded in my VIC for a Commodore 64, I ordered the *64 Data Manager*, a somewhat more elaborate version of the same program.

The menu is the same. The add, delete, and change options are still basically the same, but the browse function permits you to examine the next record forward or backward.

The SEArch and PReint options offer some very useful changes. Instead of the sort by low and high parameters, you may now become more specific by entering selection criteria. The message line will prompt: "field# (eq, ne, gt, lt, ge, le) Argument." You may select one of the two-character equivalency parameters. They stand for equal, not equal, greater than, less than, greater than equal to, and less than equal to. Argument stands for the value you wish the field compared against. An example might illustrate this concept best:

Field #	Field ID
1	Name
2	Age
3	Sex
4	Salary

We wish to select persons over 30 years old who are male and earn \$20,000 or less. We would then enter the following criteria:

```
2gt30
3eqmale
4le20000
```

*Disk Data Manager* is quite a flexible, valuable tool.

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## Ghost Encounters For Atari

Tina Halcomb

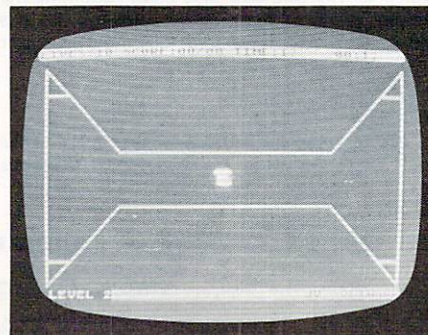
*Ghost Encounters*, by J. V. Software, is a realtime graphic adventure game. It requires an Atari 400 or 800, at least 16K of memory, and one joystick. *Ghost Encounters* is available on diskette and cassette.

You begin your quest in a base room which contains the doors leading to each additional room (for that particular level). As you complete each task, or exit a room for whatever reason, you are returned to the base room from which you can decide your next challenge. Upon entering a room which contains a treasure, you hear four bell tones. What you must do is tag the prize and exit the room without being destroyed.

### Agile Monsters

You can be destroyed in a couple of ways – by monsters or by the timer. Several different monsters will hunt you. Being touched by one of them will cost you one life, and you are promptly returned to the base room for whatever level you are playing. The various monsters seem to be much more agile than you (the ghost). You can move north, south, east, west and four diagonal directions, but you are limited – you can't move through walls.

The enemy *can* go through walls and in most cases moves



The ghost begins its treasure hunt in *Ghost Encounters*.



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much faster than the ghost. Dodging these creatures can be very risky. You can run from them, or you can shoot at them. If you are a real marksman you can do both, but you had better be quick. In order to shoot at an object, you must move in the direction of that object, because the bullets are aimed in the direction you were moving immediately prior to releasing the fire button. So, to shoot at something that is chasing you, you must stop running and fire before your enemy closes in on you.

### Puzzles

Not all rooms have monsters in them. In some, you must solve a puzzle to gain passage to your prize. The ghost can transform into eight different shapes which assist in solving the puzzles.

No matter what your opposition in each room, you must beat the timer. The countdown rate is different from room to room. Each time the timer counts to zero, you lose one life. You may restore the timer any time by passing through a door.

### Treasure Hunt

The object of the game is to collect as many prizes as you can before you lose your ten lives. Once you capture all the prizes for any level, you are automatically promoted to the next level, and the game continues. The faster you capture the prizes, the better your score will be.

The game responds a bit slowly to the constantly changing joystick position. Also a feature which would allow the game to be saved would be resumed at another time would be nice.

This game has qualities that are similar to those of the arcade games and other characteristics in common with adventure games. All in all, it's very entertaining.

Ghost Encounters  
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# A Beginner's Guide To Typing In Programs

## What Is A Program?

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

## BASIC Programs

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

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

## Brackets And Special Characters

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

## About DATA Statements

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

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen

may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

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

## Get To Know Your Machine

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

## A Quick Review

- 1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.
- 2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.
- 3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type **COMPUTE!**'s Programs" elsewhere in the magazine.)

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

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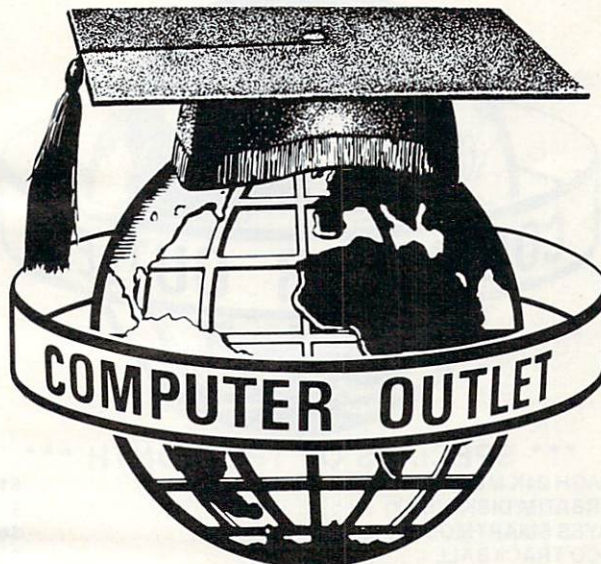
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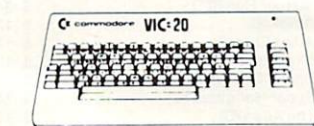
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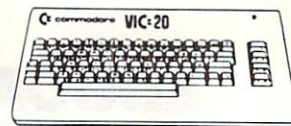
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# How To Type COMPUTE!'s Programs

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: **ACBDEF**. Enter these characters with the Atari logo key, **{A}**.

When you see	Type	See	
(CLEAR)	ESC SHIFT <	↵	Clear Screen
(UP)	ESC CTRL -	↑	Cursor Up
(DOWN)	ESC CTRL =	↓	Cursor Down
(LEFT)	ESC CTRL +	←	Cursor Left
(RIGHT)	ESC CTRL *	→	Cursor Right
(BACK S)	ESC DELETE	⌫	Backspace
(DELETE)	ESC CTRL DELETE	⌫	Delete character
(INSERT)	ESC CTRL INSERT	⌵	Insert character
(DEL LINE)	ESC SHIFT DELETE	⌫	Delete line
(INS LINE)	ESC SHIFT INSERT	⌵	Insert line
(TAB)	ESC TAB	⇧	TAB key
(CLR TAB)	ESC CTRL TAB	⌫	Clear tab
(SET TAB)	ESC SHIFT TAB	⇧	Set tab stop
(BELL)	ESC CTRL 2	🔔	Ring buzzer
(ESC)	ESC ESC	⌫	ESCAPE key

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

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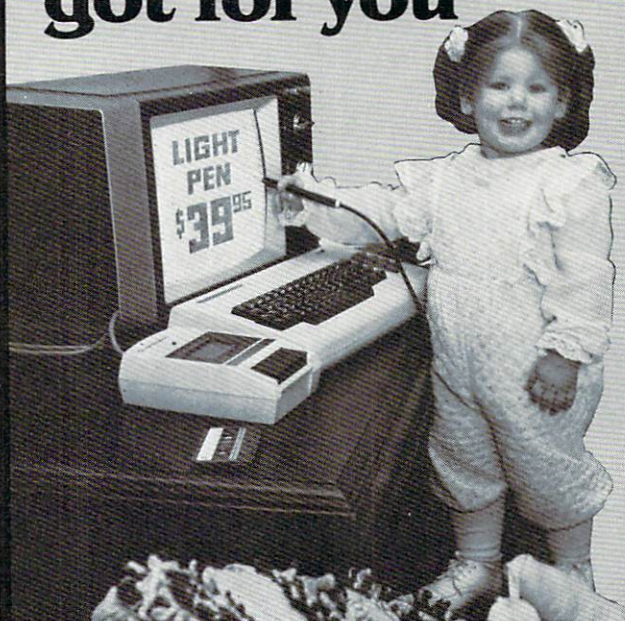


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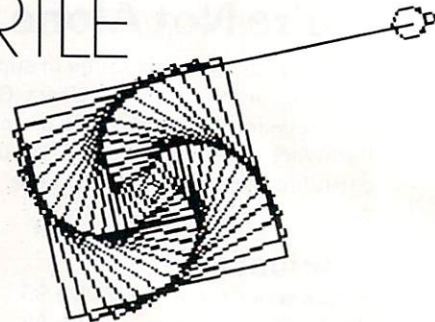
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# FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

## HES Turtle Graphics II

I visited with the people from HES at their booth at the Las Vegas Consumer Electronics Show this January. At that time I was given a glimpse of Turtle Graphics II, a graphics language they developed for the Commodore 64. I was pleased by what I saw, and even more pleased when a preliminary copy of the language was sent for me to review.

HES Turtle Graphics II supports two kinds of display screens – the LORES, or text, screen, and the HIRES, or 320 x 200 pixel, color graphics screen. Furthermore, this language also supports the Commodore 64 sprite graphics.

The software package contains:

1. A program editor
2. A sprite shape editor
3. An I/O handler for disk, tape or printer, and
4. A trace mode

While Turtle Graphics II does not have a mode for the immediate execution of commands, the program editor is so easy to use that this is not a great drawback.

Syntactically, Turtle Graphics II is a cross between Atari PILOT and the turtle graphics portion of TI Logo. To illustrate this, I have created the listings below in Turtle Graphics II, Atari PILOT, and TI Logo. The listing is for a procedure that generates a squiral pattern similar to that used in the Friends of the Turtle emblem. To make the listings easier to compare, I have numbered all the lines and made sure that similar lines have similar numbers.

Before analyzing the Turtle Graphics II syntax in detail, you should compare the three listings. You can see that the HES language is intermediate between TI Logo and Atari PILOT. When you examine the syntax chosen for the HES sprite graphics, the relation to TI Logo is even more evident (for example, to start or stop sprite movement, you type FREEZE or THAW).

This is not to suggest that HES Turtle Graphics II is in any way a replacement for Logo. Logo has many features that just aren't available on other languages. But, if you want to explore turtle graphics on the Commodore 64, this language is a fine starting point.

### HES Turtle Graphics II

```
1 LABEL SQUIRAL
2 HIRES
3 PEN UP
4 MOVE TO 100-160
5 SETHEADING TO 90
6 PEN DOWN
7 CALCULATE Y=0
8 LABEL ADD 2
9 CALCULATE Y=Y+2
10 FORWARD Y
11 ROTATE RIGHT 89
12 TEST IF (Y>180)
13 IF FALSE JUMP ADD 2
14 ROUTINE END
```

### Atari PILOT

```
1 *SQUIRAL
2 GR: CLEAR
3 GR: PEN UP
4 GR: GOTO 0,0
5 GR: TURNT0 0
6 GR: PEN YELLOW
7 C: #Y=0
8 *ADD2
9 C: #Y=#Y+2
10 GR: DRAW #Y
11 GR: TURN 89
12
13 J (#Y<181): *ADD2
14 E:
```

### TI Logo

```
1 TO SQUIRAL
2 TELL TURTLE CLEARSCREEN
3 PEN UP
4 SXY 0 0
5 SETHEADING 0
6 PEN DOWN
7 MAKE "Y 0
8 ADD2:
9 MAKE "Y :Y + 2
10 FORWARD :Y
11 RIGHT 89
12 TEST Y > 180
13 IFF GO "ADD2
14 END
```



## Nonstandard Features

Before leaving the listings, there are a few nonstandard "features" that need to be mentioned. First, the HES turtle does not start in the middle of the screen; it starts in the upper left corner. Also, the MOVE TO command accepts the Y-axis (measured from 0 at the top) first, followed by the X-axis. I know of no other language that accepts coordinates in this sequence.

Two other nonstandard turtle characteristics involve the SETHEADING TO command. A heading of 0 degrees faces the turtle to the right (instead of straight up), and turning angles for this command increase in a counterclockwise (instead of clockwise) direction. The starting angle and starting position for the turtle make sense if you recall that the original turtle graphics package from these people used only the text display.

None of these characteristics is a show-stopper - as long as each is understood from the beginning.

There are many features of HES Turtle Graphics II that I find delightful. The sprite editor lets you easily create shapes, change their color and magnification, and save them on tape or disk for later use. The sprite editor contains eight predefined shapes that can be changed to anything you wish. The shapes provided include a boat, rocket, truck, ball, space shuttle, house, man,

and woman. Sprites can be made to wrap around the screen if so desired (this causes them to appear at the opposite edge of the screen if they are moved off one end). You can also set the speed and visibility of any sprite, and can even control a sprite's position directly with a joystick.

The program editor lets you enter two-letter abbreviations for all commands (for example, you can enter IT instead of IF TRUE JUMP). And yet, when the program is listed, all abbreviated words are fully expanded to their English counterparts.

While I am primarily interested in the high resolution graphics turtle, the low resolution (character-based) turtle graphics has some interesting features. One of the more powerful is the CHECK FOR command that looks for the existence of a chosen character directly ahead of the turtle. This command allows Turtle Graphics II users to create maze-solving programs.

Turtle Graphics II is a language worth considering if you are interested in turtle graphics, but don't need the rest of the power found in Logo.

## Next Time

In the last few weeks, several people have asked me for a side-by-side comparison of PILOT and Logo. The result of such a comparison includes some surprises, as you will see next month. ©

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## Turning Logo Upside Down

Fred D'Ignazio, Associate Editor



In my February 1983 **COMPUTE!** column I put out a call for new computer languages for kids. I related my experiences with my own children (ages three and seven), trying to teach them to program. Frankly, I admitted that my efforts had failed. Neither child seemed to have the least inclination to learn how to program.

You readers responded to the column in a big way. You told me about your own thoughts about kids and programming, and you passed on news about programming projects and languages that you had learned about. I want to thank you for all this information. I will be printing excerpts from your letters in the coming months. Also, I am anxious to hear from even more of you. I believe kids' computer languages are the cutting edge of the revolution in computer learning. They deserve all the attention and debate we can muster up.

### Enter *Delta Drawing*

Shortly after I wrote my February column, I received a copy of Spinnaker Software Company's *Delta Drawing* program for the Apple II Plus. (Versions for other computers are expected soon.) At

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*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), The Star Wars Question and Answer Book About Computers (Random House), and How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) (McGraw-Hill).*

*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!***

first, I thought *Delta Drawing* was just another new "paint" program or simplified "turtle graphics" program. Then I dug further.

Now, my family and I have spent a dozen hours playing with *Delta Drawing*, and I am convinced that it is something more. I now believe that it is a first, but significant, step toward a powerful new computer language for kids.

### I Want To Play *Mystery House!*

This is how my seven-year-old daughter, Catie, and I were first introduced to *Delta Drawing*:

I took the plastic off the *Delta Drawing* case and handed the disk to Catie. Catie put the disk in the Apple computer's disk drive and booted up the program.

We answered a couple of quick questions (did we have a color monitor? <Yes – a must>; did we have a printer? <No>). Then a little upside-down "V" appeared on the center of the screen. Under the V was a blinking dot. Around the edge of the screen was a blue box.

The manual calls the upside-down V the "Delta Drawing cursor." But Catie knew better. "That's a turtle," she said. "The blinking dot is her tail." Catie named the turtle DeeDee (for "DD" – *Delta Drawing*).

I thought things were going pretty well. That's when Catie got bored. (Catie gets bored easily.)

"I'm tired of this game," she said.

"But we haven't even started," I replied.

"I don't care. I want to play *Mystery House!*"

*Mystery House* (from On-Line Systems) is one of Catie's favorite adventure games (along with *Cranston Manor*, also from On-Line, and *Copts and Robbers*, from Sirius).

Did I respond to Catie's obstinance with tact and gentle persuasion? Of course not. I did what any normal parent would do. I yelled at her.

Naturally, she responded by crying and I felt guilty. You really botched it, Fred, I thought to myself.

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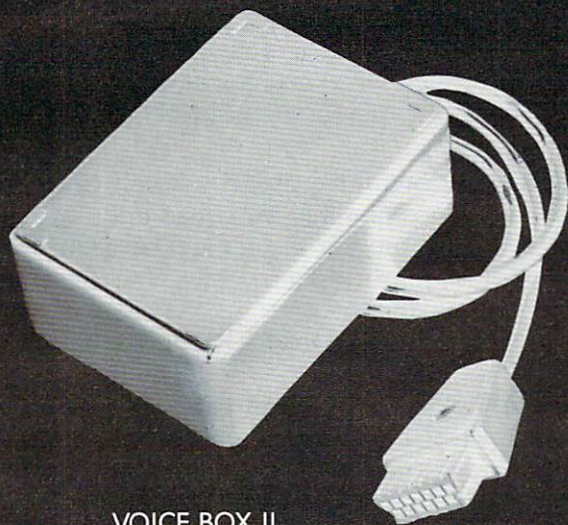
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and on the new VOICE BOX II . . . . .

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- A talking or singing ALIEN face with software that allows the user to change the face and 8 mouth patterns as he sees fit.
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- A talk and spell program by Ron Kramer. Users can program any vocabulary for this spelling game. In fact, this program can even speak in a foreign language like French, where the user must spell the correct word in English, or vice versa.
- GREEN GOBLINS—A talking arcade game by John Wilson.
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Catie started banging on the Apple keyboard. All of a sudden, DeeDee came to life and drew a small straight line toward the top of the screen. She made a cute little "blink" or "clink" sound. Catie stopped crying and stared.

"Can I make my own pictures?" she asked.

Encouraged, I pulled out the "Fast Start" cards that accompany the *Delta Drawing* manual. Catie and I both avoided the manual. At 80 pages of fairly tiny print, it looked too intimidating, both for daughter and daddy.

But the Fast Start cards were different. Each one is made of shiny, plastic-coated, heavy-stock paper. Each one has a picture at the top and a few commands to show you how the picture was made. The cards are two-sided, numbered (with big numbers!) from one to fourteen.

One card tells you on one side how to load *Delta Drawing*, and on the back gives you all of the *Delta Drawing* commands. I discovered that Catie had pressed the Apple's "D" key and caused DeeDee to *draw*.

Catie and I looked at the pictures on the Fast Start cards. We grew excited. It looked like we could get DeeDee to draw all the standard stuff: circles, squares, triangles, and the like. We could also get DeeDee to draw three-dimensional cubes and "paint" the sides; play a game of Tic-Tac-Toe, and draw a colorful scene with an orange house, green grass, a blue sky, and an orange sun.

But how?

I did the adult thing and turned to card #1 and began trying to decipher the command beneath the picture. Meanwhile, Catie did the kid thing and began punching buttons. A couple of minutes later, I was still on card #1, but Catie had discovered that the "R" button made DeeDee turn right 30 degrees and the "L" button made her turn left 30 degrees. Catie showed me how she could press the "U" button and make DeeDee do a fancy U turn; and the "M" button to get DeeDee to scoot across the screen with her pen up – that is, she moved without drawing.

Catie squealed. "DeeDee didn't obey me," she said. "She went up and I wanted her to go down." We looked at the card with the command summary. We discovered that by pressing the "E" button we could make DeeDee backtrack and erase her last step.

I threw the Fast Start cards on the table. From that point on, we began improvising. Occasionally, we picked up the cards and borrowed commands off them, when we needed to make DeeDee do something we wanted her to do.

It sounds really impressive when I say that "Catie and I improvised." Actually, I advised Catie what to do, and she ignored me. This seemed to be a very successful strategy to learn *Delta Drawing*.

After a while, I gave up and let Catie take the lead.

Catie's approach was to do things with commands she already knew. For example, the first thing she did was hit the D (Draw) key until DeeDee drew herself off the top of the screen and popped back onto the bottom of the screen.

Catie wondered why DeeDee could "tunnel" off the screen, like Ms. Pac Man. Why didn't DeeDee bump her nose on the blue wall at the edge of the screen?

We looked at the Fast Start card with the command summary and found that there is a "B" command that makes DeeDee "bounce" instead of tunnel. When we pressed the B key, the wall turned green. To get DeeDee back into tunnelling mode, we had to press a "W" (wraparound) key.

Watching Catie at work was like watching a baby learn to speak for the first time – only in fast motion. She was learning a new language, and the moment she learned a new word in the language, she used it to express herself.

In fact, the reason she learned new words was to be able to express herself. She was motivated to master the language's vocabulary so she could do what she set out to do. And when she learned each new word, she automatically incorporated it into all the other words she knew. She was associating each word and developing word sequences – her own personal "grammar" in the new language.

Catie's experimental approach was efficient, but it also led us occasionally into dead ends and surprises. For example, Catie got DeeDee to draw a house out of a square and a triangle. She filled the house with purple, by pressing "C" to choose the color, then by holding the CTRL button down and typing "F" (Fill). Then she tried to color the grass green. She pressed "C" and picked green. She typed CTRL-F, and green started washing like a wave across the screen. Then the green went out of control. It slipped through a tiny hole in the line that separated the grass and the sky, and it filled the sky, too. It ended up filling the entire picture, except for the purple house.

Catie howled!

## A Sun Not A Circle

One thing that I immediately liked about *Delta Drawing* was the quick way Catie could make a picture. Also, I liked the precise, geometric way she constructed pictures. I have a problem with "paint" programs that use joysticks because my fine motor skills never passed the "klutz" stage. But, looking at Catie create pictures in *Delta Drawing*, I had hopes that even I might be able to make something pretty.

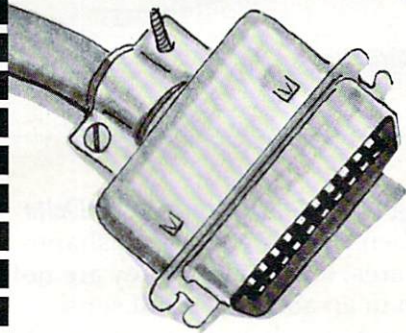
That is, if Catie would ever give me a turn.

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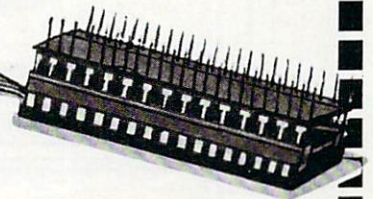
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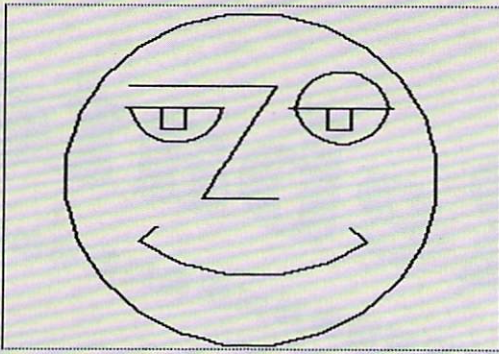
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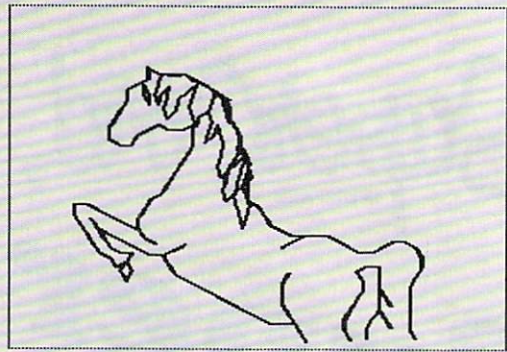
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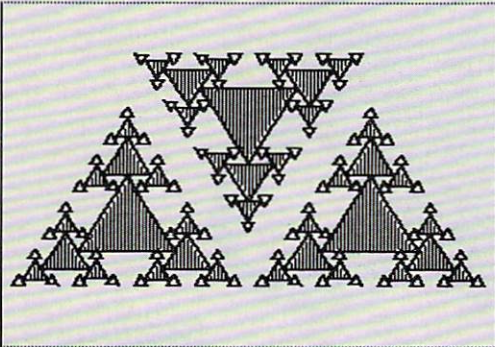
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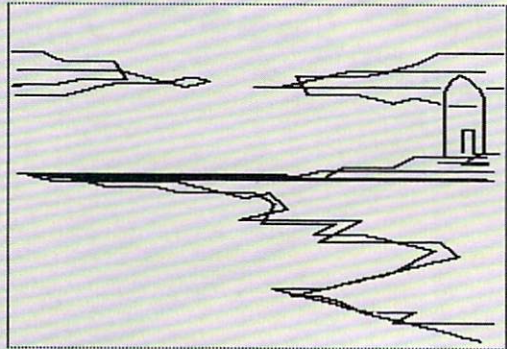
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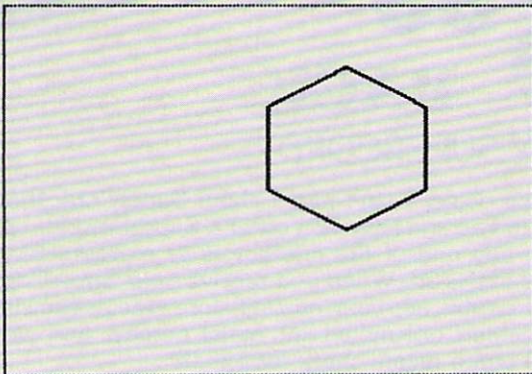
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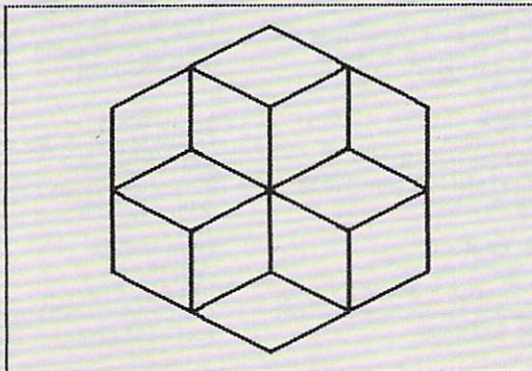
Triangle experiment by Jock Gill



Seascape by Clifford Wong



1<... 3D .. >D .. 2R .....>1 hexagon element  
2<... 6<1>.. hexagon



1<... 3D .. <D .. 2R .....>1  
2<... 6<1>.. 2R .....>2  
3<... 6<2>.. hexagon with 60 degree turn  
6 hexagons (motif #1)

Another thing that pleased me about *Delta Drawing* is that when children are using shapes like triangles, squares, and circles – they are not dealing with them in an abstract, adult sense. After all, shapes by themselves are boring. But shapes that resemble real-world objects like hats, planets, boxes, mountains, etc., are interesting. And shapes that can be combined into “building blocks” to make a new world are even more interesting. With *Delta Drawing*, Catie not only combined the shapes, she created new shapes to act as the proper building blocks for the world she was trying to create.

### The Catie Robot Makes A Circle

With both Catie and Eric (three years old), I had tried the classic Logo experiment where you get the child to play “turtle” and figure out how to walk in a circle around the floor. I had often tried, but I had always failed.

The easy part was getting Catie and Eric to play turtle and figure out how to draw a circle. They took a baby step forward then made a small turn to the right. Then they repeated two steps over and over until they made a circle.

Fine. But then came the hard part – entering a program into the computer to make the turtle do what Catie and Eric had discovered so easily.

This is where I hit a brick wall. Catie and Eric had no interest in creating a "circle" procedure (program) in Logo. In fact, they never got past the first command – FORWARD or FD.

For Catie and Eric, it was too much effort for too little reward. And they didn't want to wait for the computer to learn the procedure. Why couldn't the computer obey them and make the circle immediately?

With Logo it couldn't, but with *Delta Drawing* it could. To make a circle, Catie typed D (Draw) and R (Right), then D and R, then D and R again. As she typed, DeeDee responded and drew the circle. It was easy to type D and R, and Catie got immediate results. After drawing the circle for the first time, she colored it orange with just a single command – CTRL-F. Then, on her own, she figured out how to make DeeDee move around the edge of the circle and make rays. She had turned her circle into a sun.

### Our First Delta Drawing Program

Catie and I were doing great – until I accidentally bumped the "1" button on the keyboard and Catie's beautiful picture disappeared.

I thought she was going to kill me.

Quickly, I scanned the card with the command summary, looking for an "Unerase" button. "Why did that happen?" I grumbled. "Stupid program!"

I didn't find an unerase command on the card, but I did discover the "T" (text) command. I pushed the T button. DeeDee vanished. The screen filled with words.

There was Catie's program! It was still there.

I flipped through the big manual. A moment later I realized what I had done. By accident, when I pressed the "1" button, I had saved Catie's picture as a *program* – program #1. To get the picture back, I had to call the program. Doing that was unbelievably easy. I just had to push the "1" button again.

We switched back to DeeDee by pressing the "G" (Graphics) button. Then Catie pushed the "1" button, and, superfast, DeeDee drew and painted her picture. It was good as new.

### Automatic Pictures

That's when Catie and I discovered the "A" button. The A button executes the Automatic command. The Automatic command automatically calls the last saved program and obeys it – over and over until you punch the ESC (escape) button.

I had a brainstorm. I had Catie type in a CTRL-D (a half-draw) and a CTRL-R (a half-turn right). DeeDee did her stuff.

Then I told Catie to press the "1" button. She did. Now we had a program that, when we

pressed "T", looked like this:

```
1< ... ^D .. ^R ... >1
```

The program looked puny and not very exciting. What was it good for? To find out, I asked Catie how we could make DeeDee automatically obey program #1 – over and over. With just a moment's thought, Catie pressed the "A" button.

A couple of seconds later, we had a circle!

To get DeeDee to stop drawing, Catie pressed the ESC button. Catie and I were excited: using program #1 as a building block, we had created a "circle" program – program #2. We saved program #2 by pressing the "2" button.

We drew circles all over the picture screen and got DeeDee to paint them different colors. Then we tried something simpler – and neater.

We erased all our current commands by typing CTRL-E. We pressed the "T" button. Our first two programs were still intact.

We pressed 2 and got a quick circle. Then we pressed the "L" button. DeeDee turned 30 degrees to the left. We saved these two commands as program #3. The first three programs looked like this:

```
Program #1 1< ... ^D .. ^R ... >1
```

```
Program #2 2< ... 25<1> ... >2
```

This came from pressing the A button.

```
Program #3 3< ... <2> .. L ... >3
```

When you see a number inside brackets, like <2>, it means you are calling a program – this time program #2. The 25<1> means you are calling program #1 25 times. We got the computer to do this just by pressing the A button – once! – and the ESC button to stop DeeDee.

Next Catie typed the A button. DeeDee drew a circle, turned left 30 degrees, drew another circle, turned left 30 degrees, drew another circle, and so on. In about a minute she had rotated her way around the picture screen. She had drawn a three-dimensional figure: a doughnut! Catie, on her own, moved DeeDee and had her paint the doughnut's center orange and the background violet. *After the doughnut was drawn* (not before), Catie and I pressed "T" to see what the program looked like. Here it is:

```
Program #4 4< ... 44<3> .. 2L .. M .. C:2
```

```
.. ^F .. 8M .. C:5 .. ^F ..
```

Remember: the most formidable command – 44 "calls" of program #3 was achieved by pressing the A button *once*.

Catie and I saved our doughnut in just a few seconds. We pressed CTRL-S, and the computer asked if we wanted to save or recall (load) something. We pressed "S" for save. Then the computer asked us if we wanted to save the program ("T" – text) or the picture ("G" – graphics). We typed "T." The computer told us to load in our

own disk. We did, and it asked us to name our *Delta Drawing* file – we called it DONUT. Then the computer saved it.

## Nested Building Blocks

*Delta Drawing's* real power comes from its ability to save pictures as building blocks; from its ability to combine simple building blocks into blocks that are more and more elaborate and complex. And you can gain access to all these building blocks just by pressing the CTRL-A buttons. When you press CTRL-A, the computer asks you which building block (program) you want. You can choose any number, from 1 to 9.

By pushing just a few buttons, Catie and I created our doughnut. We built the doughnut from a draw and turn program, a circle program, and a circle and turn program. Just as easily, we could have created "house" programs, "people" programs, "tree" programs, and so on. We could have formed a picture by positioning DeeDee on the screen and calling the program we wanted.

## A Kid's Language

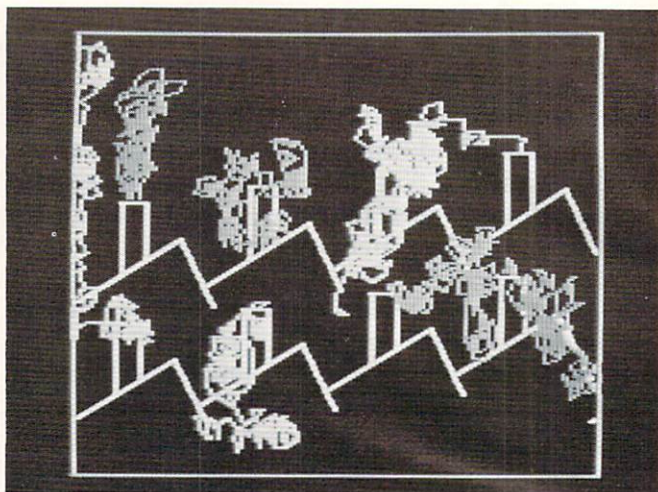
*Delta Drawing* represents, I hope, one of the early representatives of a new generation of children's software that combines simplicity with great power. Also, it is open-ended. It is a language. Once the child learns the language, she can do whatever she wants. And she can do a lot *even as she is learning the language*.

This simplicity, power, and freedom are what made the program a hit with Catie. And when her brother showed up, and learned a few buttons, they made a big hit with him, too. All of a sudden programming becomes an activity with immediate results that are meaningful to the child, controlled by the child, and that challenge and stimulate the child to be original and inventive.

This is certainly a good start toward a kids' language of the future. And it's not a bad adult's language, either. My wife Janet and I have had a ball creating pictures with *Delta Drawing*. Here is a piece of software that is equally fascinating and easy to use for a three-year-old, a first grader, and two jaded adults. The generation gap between the different members of the family disappears when we use *Delta Drawing*. We are all equally caught up in exploring its possibilities. And no single member of the family seems to have an edge. This is a very nice feature of the program.

## Upside Down Logo

Why did I claim that *Delta Drawing* is like Logo turned on its head? Because with Logo (and most other languages), you have to type in the commands in your program before you can run the program and create a picture. With *Delta Drawing* you make the picture first, and in making the



*Delta Drawing*

picture you create a program. It's just the opposite. It's Logo upside down!

*Delta Drawing* costs \$59.95 and runs on the Apple II+. By spring, a new version will be available on the IBM PC. By next fall you can look for it on the Atari 800, the VIC, the Commodore 64, and possibly on other low-priced computers.

To inquire about *Delta Drawing*, write:

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

## New Resources

Since my last column I've received two interesting new books.

### *The Computer Camp Book*

*The Computer Camp Book* is published by The Yellow Springs Computer Camp, Inc. It has 224 pages and costs \$12.95. To order the book, write:

*The Computer Camp Book*  
1424 Glen View Drive  
Yellow Springs, OH 45387

or call 513-767-7717.

The book is a wealth of information about computer camps, including:

- How to start and run your own computer camp
- Ideas and materials for teaching and learning
- Computer literacy activities
- A look at different computer camps
- A nationwide guide to computer camps, courses, and workshops
- A guide to computing resources (including a five-page guide to computing resources for handicapped people)

### *Parent's Guide to Computers in Education*

The *Parent's Guide* was written by David Moursund. It is a real buy – 80 pages for only \$3.50. To get the *Guide*, write:



Parent's Guide  
 Dept. of Computer & Information Science  
 University of Oregon  
 Eugene, OR 97403

or call 583-686-4429.

The book covers a lot of ground in a clear, simple style. Some of the subjects covered include: the school of the future, introduction to computers, hardware and software, computers in education, "What You Can Do," a buyer's plan, a glossary, and a list of resources.

A unique feature of the book is that it is really two books in one. A second book, entitled "Here Comes the Dawn (If Only I Can Find the Switch)," written by Merle Marsh, appears in little italicized text boxes at the foot of every few pages. It begins, on page 3: "I tried to enter the Computer Age by quietly sneaking up on the new technology ...."

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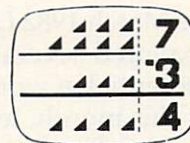
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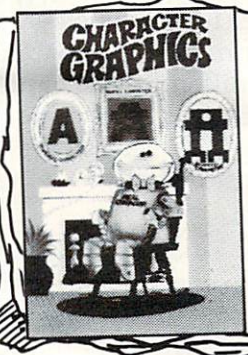
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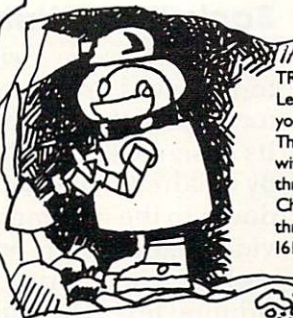
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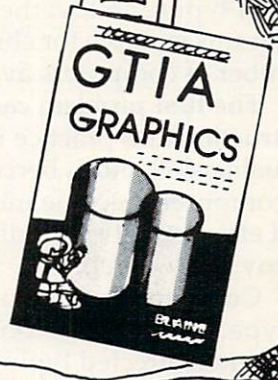
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# Learning With Computers

Glenn M. Kleiman

In the March 1982 *Learning with Computers* column, we explored several projects which demonstrated the potential of word processing as an educational tool. This month, let's take another look at word processing for classrooms and homes – some of the practical difficulties. We'll also review a word processing program suitable for children.

Writing requires both the mental process of composing sentences to express the intended meanings and the physical process of putting words onto paper. Many children find the physical process to be slow and tedious, leading them to dislike writing and to be unwilling to edit and revise what they have written.

The advantage of computerized word processing is that it makes the physical process easier, so it becomes simple to create and alter written text. Each time changes are made, the computer can print a new copy, so the writer doesn't have the tedious chore of rewriting or retyping the entire text just to make a few changes. This ease of revision encourages students to write more, edit more, produce better essays, and take greater pride in their written work.

## Word Processing In Schools

However, the use of word processing in schools has been limited for several reasons: children's lack of typing ability; the lack of word processing programs suitable for children; and an insufficient number of computers available.

The first problem can be overcome by some instruction and practice in typing. Typing is a valuable skill and is becoming even more valuable as computers become more prevalent. The time and effort spent mastering typing is worthwhile at any grade level.

Computers can be used to help children learn to type. In March we looked at the benefits of computer-directed typing drill and practice. A variety of typing-teacher programs are available. With some practice, most children are able to type as quickly as they write, and typing with a word processor means errors can be corrected easily and the writing always looks neat. Typing is particularly advantageous for those children who have difficulties with the fine motor control required to write neatly.

The second problem, lack of suitable software,

may come as a surprise to those of you who are aware of the large number of word processing programs available for small computers. It is true – there are some excellent programs. But these programs are designed for business and professional applications, not for classrooms and homes.

Professional word processing programs contain many features beyond the fundamental insert, delete, rearrange, and print capabilities. There may be options for arranging numbers in columns, producing form letters, creating indexes, and other advanced functions. There may also be different ways of performing similar functions; so, for example, three different procedures may be used to delete single words, sentences, and paragraphs. This can be most efficient for an experienced user who writes a great deal. But the time required to learn the system, the complexity of using it, and the cost of the programs make most professional word processors poorly suited for classroom and home applications.

Giving a child a professional word processing program to write a 500 word essay is like giving someone a sledgehammer to tack a poster to the wall. Fortunately, word processing programs designed specifically for different users and uses are becoming available. One new program, called the *Bank Street Writer*, is advertised as "the first word processor for the entire family."

## Bank Street Writer

The *Bank Street Writer* is an easy-to-learn and easy-to-use word processor that is sufficiently powerful for most of the writing done in homes and schools. Its designers, intending the program to be used by children, have kept the number of commands down to the minimum necessary. They also provide clear prompts on the computer screen for each step in entering, erasing, rearranging, or printing text. The children are protected from accidentally erasing or losing their writing – a real problem with some sophisticated word processors.

The *Bank Street Writer* divides the screen into two areas, a text area and a prompt area. The text area shows what you have written. The prompt area displays all the commands, so you don't have to remember them.

The program has three modes: *write*, *edit*,

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and *transfer*. Entering text in the write mode is similar to using a typewriter with an erase key which makes it easier to correct typing mistakes. From write mode, you can press ESC to enter edit mode.

Edit mode is for altering the text. The prompt area tells you which four keys move the cursor. To insert text, you simply move the cursor to where you want the text to appear and then press ESC to go back to write mode. Then, as you type,

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**Word processing is potentially one of the most valuable educational uses of computers. It puts children in charge of the computer and provides them with a powerful tool they can appreciate.**

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the words in the existing text move over to make space for the new ones.

The prompt area in edit mode also contains a menu with *erase*, *move*, *find*, *unerase*, *move-back*, *replace*, and *transfer menu* options. You select an option by moving a marker on the menu. The prompt area then tells you exactly how to proceed. For example, if you select *erase*, the computer tells you to move the cursor to the beginning of the text to be erased. When you press the RETURN key to signal that this has been done, you are prompted to move the cursor to the end of the text to be erased. As you do so, the words to be erased are highlighted. Next you are asked whether you are sure you want to erase the highlighted words. If you type Y, the words disappear, and the remaining words close up the space. If you type N, the words remain, and the program goes back to the edit mode menu.

The *unerase* and *move-back* options can be used after an erase or move operation. The erased or moved words reappear, and you are then asked if they should, in fact, be put back into their original position. These options are valuable for two reasons. First, they allow children to recover easily from mistakes. Nothing is more frustrating than accidentally erasing or misarranging your essay just because you pressed the RETURN key by accident.

Second, these options encourage children to try different arrangements of words and sentences and to evaluate which is best. The facility for testing different ways of expressing their ideas encourages children to improve their writing. It is also excellent for children working together –

they can actually see how each other's suggestions will look without having to do a great deal of rewriting.

Transfer mode, which can be selected from edit mode, is used to save the writing on a disk, retrieve prior writing from disk, merge two files into one, and get the computer to print copies. Before printing, you are prompted to enter (or accept the default settings for) the number of characters per line and the amount of spacing between lines, and to indicate whether pages should be numbered and whether you want a heading on each page. You can also specify to have a file printed as a continuation of the previous file, so that long documents can be divided into individual files and then printed contiguously.

There is also a utility program which lets you set the word processor for different hardware configurations and set the defaults for spacing, page size, and so on. And a tutorial program is on the back of the disk to help you learn to use the word processor.

The *Bank Street Writer* does have certain limitations. You cannot change the spacing within a file – once you have chosen double-spaced printing, the entire file must be double-spaced. It has centering capability, but lacks underlining. The erase and move commands are limited to 15 lines of text (530 characters) at a time. To erase or move more, you have to repeat the command. Find and replace are limited to a maximum of 29 characters in a string. Also, if you divide a single document into separate files, you will have to apply the replace command to each one separately. These limitations make the *Bank Street Writer* unsuitable for large amounts of text. It is designed for such things as letters and school essays, not books or extensive business correspondence.

The *Bank Street Writer* is the best word processing program I have seen for children. I am delighted that it is available because I regard word processing as potentially one of the most valuable educational uses of computers. Word processing puts children in charge of the computer and provides them with a powerful tool they can appreciate. It encourages them to write and helps them improve their writing – something that is sometimes neglected in the classroom. Of course, word processing is also a valuable tool for teachers, and the *Bank Street Writer* is suitable for them.

The *Bank Street Writer* is available for Apple II and Atari computers, and a Commodore 64 version is being prepared. Two packages are available. The home package, available from Bröderbund Software (1938 Fourth Street, San Rafael, CA 94901), includes two copies of the program/tutorial disk and a written manual. The school package, available from Scholastic Inc. (730 Broadway, New York, NY 10003), contains three copies

of the program/tutorial disk, a student's manual, and a teacher's guide. The home package sells for about \$70, the school package for about \$95.

## The Need For Many Computers

This brings us to the final problem in using word processing in classrooms: it is an equipment-intensive activity, and most schools do not have a sufficient number of computers. Writing requires time, and to take full advantage of word processing, much of that time has to be spent in front of a computer. There have been attempts to solve this traffic problem, including having children write the first draft of their essays on paper and then having adults type the text into the computer. The children mark their changes on paper and then edit their essays on the computer. This at least exposes children to word processing, and may be the best alternative, given inadequate computer time for each child.

However, it does not let the children experience actually composing text on the computer, and this is what encourages them to analyze, evaluate, edit, and improve their writing. The simple fact is that taking full advantage of the potential of word processing requires more computers than are currently available in most schools. Still, whatever introduction to word processing can be provided is valuable, and with the continuing drop in hardware and software prices,

computers and word processing may soon become more accessible.

## Word Puzzle Programs

There are several excellent word puzzle programs available for teachers and children who do have access to one or two computers in their school for a few hours a week. These programs show children some of the potential of computers and require minimal computer time and children enjoy them. My favorite is *Crossword Magic*. This program has students enter their words and clues, and it creates a crossword puzzle for them. There are also programs which create word search and anagram puzzles from lists of words students enter. Here are some sources for word puzzle programs, each of which is easy to use and performs its intended function very well.

*Crossword Magic*, for Apple II and Atari computers, is from L & S Computerware, 1589 Fraser Drive, Sunnyvale, CA 94087. This program requires a graphics printer, such as the Epson MX-80 with Grafrax or the C. Itoh Prowriter.

Word search and anagram programs for the Apple II are available from Hi Tech, 126 Lighthouse Ave., Santa Cruz, CA 95060.

A word search program for the PET is available on *Cursor #14* from The Code Works, Box 550, Goleta, CA 93017. ©

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# Micros With The Handicapped

Susan Semancik & C. Marshall Curtis

## Developing A Communications Program

*Making selections from a complicated menu can be made easier and faster in a number of ways. This is Part 5 in a series on developing a communications program for the handicapped. The programs, for the PET and VIC, demonstrate various methods of active and passive entry selection. These programs are easily adapted to any computer using Microsoft BASIC.*

Once a menu is displayed, procedures must be considered for selecting an entry of the menu. This can be done passively, where the computer controls positioning and the user controls selecting, or actively, where the user controls both positioning and selecting. In a passive approach, the computer points to each menu entry individually, pausing for a predetermined amount of time based on the user's ability to respond. If no response is made during the pause, then the computer continues to scan the menu sequentially.

Passive interaction is good for persons with severe motor impairment, since a single movement can indicate the user's response. But, depending on the size of the menu, the computer can take time to point to a desired menu entry. Different types of scanning techniques can speed up a passive selection process.

In an active selection procedure, the user indicates the position of the menu entry. This is the way we've selected a menu entry in our program examples so far, by having the user type the entry's row and column numbers to make a selection. Another method for this procedure is to use an alternative input device, such as a joystick, to control a pointer on the screen. When the pointer has been moved opposite the desired menu entry, the joystick's button could be used to indicate that a selection is desired.

Program 1 is a passive selection algorithm that can replace lines 300-360 in any of the previous

examples (April 1983) that allowed selection of a menu entry. Hitting any key during the pause time will select the indicated menu entry and place it in the message area of the screen. The format we're displaying has two top screen lines reserved for input functions (to be discussed in a later article), middle lines for the menu, and sufficient bottom lines for a message of 160 characters. Review part two of this series (June 1982) if a different menu setup is desired.

Program 1 shows how an arrow can be used on the PET computer to indicate that a menu entry is being scanned. Since the entries in a column have various lengths less than or equal to the column's width, it is necessary to calculate each entry's length for proper spacing in the message area. This is accomplished in lines 312 and 314 by the variable E. Line 530 embeds a space after each word entry placed in the message area. When we consider other user input options, we will provide a means of eliminating spaces between words and adding punctuation marks for those that need correspondence quality messages.

To make the message more readable on the screen, line 505 insures that no words will be split at the right-hand edge of the screen. So far, our routine works well if your menu is composed only of columns of individual words. But, if any column has rows of characters (as in our DAILY menu), our selection process will not recognize the individual characters, but will put the entire row into the message area. It will be easier to adjust for the selection of individual characters if we agree that all character columns will appear on the right-hand side of the screen.

If the number of such columns is to vary from menu to menu, then we will need to add another menu parameter, CC, which will give the number of character columns in the menu. For our DAILY menu, CC=1, and for our TIME menu, CC=0. In

Program 1 (April, p. 135) CC should be appropriately added to lines 20 and 330; and in Programs 2 and 3 (April, p. 135), to line 216.

## Scanning Display Indicators

We will change the selection process in Program 1 so that if a selection of a character row is made, then a secondary scanning will be done within that row. We can do this easily for highlighting and flashing, but only with at least one blank line between menu rows when using the arrow indicator. Notice that neither the automatic embedding of spaces nor the prevention of word-splitting is used with character selections. If you always have a space as one of the characters in your column of characters, and if you plan ahead, these omissions should not be a problem.

When forming a word from a column of characters, you usually need multiple letter selections. This can be accomplished by scanning the character column until no more selections are made from it. Otherwise, in a sequential scanning procedure, there could be a considerable time delay between the selection of consecutive characters. After a character selection is made, you could continue the scan from the same character selected, from the start of the selected character's row, or from the start of the selected character's column. The last option gives the greatest flexibility, especially if the characters are arranged according to frequency of use. To achieve the first option, change line 465 to GOTO 444; for the second option, change line 465 to GOTO 442; and for the third option, change line 465 to K=1:RETURN, and add the following line:

```
318 IF K THEN K=0:R=1:GOTO 310
```

The improvements discussed for Program 1 have been incorporated in the following example. Program 2 employs an active user response procedure on a VIC computer, where a joystick is used to control the movement of a pointer and the joystick's button is used for selecting. A delay may be helpful; otherwise, multiple selections may unexpectedly result.

Try an arrow delay at line 465, a button delay at 470, and/or a character selection delay at 478, using FOR DE=1 TO 100:NEXT DE preceding the contents of the line(s) indicated. Notice that the original menu was shortened so the arrow could fit to the right of each column of the menu. Also, since the joystick routine can interfere with normal keyboard operation, be sure to push the RUN and RESTORE keys together to reset normal operations if the program is stopped in line 400.

### Program 1: PET Computer Using Arrow Indicator

```
299 REM DE=DELAY FOR PAUSE, PM=# OF POSITIONS IN MESSAGE AREA, J=CURRENT POS.
```

```
300 DE=100:SP=32768:HA=159:J=0:PM=200:REM ~
    HA=SCREEN VALUE FOR HORIZONTAL ARROW ~
303 SM=SP+W*25-PM:VA=158:REM SCREEN VALUE ~
    FOR VERTICAL ARROW
305 FOR C=1 TO CM:FOR R=1 TO RM
310 PA=SP+(SR-1)*W+(R-1)*W+(R-1)*BR*W+S(C)
    -1+L(C):REM PA=SCREEN POS. OF ARROW
312 P1=PA-L(C):P2=PA-1:E=P2:FORI=P2TOP1STE
    P-1:IFPEEK(I)<>32THENE=I:I=P1
314 NEXTI
315 POKE PA,HA:GOSUB400:POKEPA,32
320 NEXT R,C
325 GOTO305
399 REM USER RESPONSE ROUTINE
400 X=0:P=0
410 GET A$:IF A$<>""THEN 500
420 P=P+1:IF P<DE THEN 410
430 RETURN
499 REM PUT SELECTION INTO MESSAGE AREA
500 P1=PA-L(C):P2=PA-1:REM P1=START OF EN
    TRY, P2=END OF ENTRY
505 Y=W-(J-W*INT(J/W)+1):IFE-P1>YTHENJ=J+
    Y+1:IFJ>=PMTHENJ=0
510 FOR I=P1 TO E:POKE SM+J,PEEK(I)
520 J=J+1:IF J=PM THEN J=0
530 NEXTI:POKESM+J,32:J=J+1:IF J=PM THEN J=0
540 RETURN
```

### Program 2: For The Unexpanded VIC Computer

Note: This program uses a joystick in an active selection process with an arrow indicator, character selection, and different colors for the menu and message.

```
8 REM HIT RUN/RESTORE WHEN PROGRAM IS ST
    OPED
9 REM DELETE REMARKS TO FIT PROGRAM ON U
    NEXPANDED VIC
10 PRINT CHR$(147);:REM CLEAR TEXT SCREE
20 W=22:RM=6:BR=1:CM=4:BC=1:RI=2:SR=3:SC=
    1:CC=1:REM CC=# OF CHARACTER COLU MNS
25 DIM S(CM),L(CM):S(1)=SC
30 DATA 3,3,5,7:REM COLUMN WIDTHS/LAST ON
    E SHORTENED TO FIT POINTER ON SCREEN
35 IF C=1 THEN 50
38 REM CALCULATE STARTING POSITION FOR EA
    CH COLUMN
40 FOR I=2 TO CM:READ L(I-1):S(I)=S(I-1)+
    L(I-1)+BC:NEXT I:READ L(CM)
50 IF SR=1 THEN 70
60 FOR X=1 TO SR-1:PRINT:NEXT X:REM POSIT
    ION CURSOR TO FIRST ROW OF MENU
65 LP=S(CM)+L(CM)-1:IF LP>W THEN 200
70 TP=0:FOR R=1 TO RM:FOR C=1 TO CM:READ ~
    M$
75 P=S(C)-1+TP
80 PRINT TAB(P);M$;:NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT:GOTO 1
    00:REM WRAPAROUND ADVANCES A 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 BL
    ANK ROWS BETWN COLUMN ENTRIES
120 NEXT R
130 GOTO 300
140 DATA DR.,IS,COLD,INGEDS1
145 DATA I,AM,WHEN,"AOTFR3"
150 DATA YOU,ARE,DRINK,.ULHCP5
155 DATA MOM,EAT,WANT,?MYWK7
160 DATA DAD,NO,TIME,"VJQZX9"
165 DATA HOT,YES,SLEEP,";$02468"
200 PRINT "MENU SIZE ERROR!":END
```

```

290 REM SP=STARTING MEMORY AREA FOR SCREEN
/CP=COLOR MAP FOR SCREEN
292 REM CL=MENU COLOR/HA=HORIZONTAL ARROW/
VA=VERTICAL ARROW
294 REM J=# OF POSITIONS USED IN MESSAGE A
REA
300 SP=7680:CL=PEEK(646):CP=38400-SP:HA=15
9:J=0:PM=110
301 XD=37154:XR=37152:XL=37151:POKE37139,0
:REM JOYSTICK REGISTERS
302 REM SM=STARTING POSITION FOR MESSAGE A
REA/PM=# OF POSITIONS IN MESSAGE AREA
303 SM=SP+W*23-PM:VA=158:MC=2:IF CL=2 THEN
CL=6:REM MC=RED MESSAGE COLOR
305 C=1:R=1:REM C=MENU COLUMN #/R=MENU ROW#
310 PA=SP+(SR-1)*W+(R-1)*W+(R-1)*BR*W+S(C)
-1+L(C)
311 REM P1=STARTING POSITION, P2=END OF CO
LUMN POSITION FOR MENU ENTRY
312 P1=PA-L(C):P2=PA-1:E=P2:FOR I=P2 TO P1
STEP-1:IF PEEK(I)<>32 THEN E=I:I=P1
313 REM E=ENDING POSITION FOR MENU ENTRY/P
A=SCREEN POSITION FOR HOR. ARROW
314 NEXT I
315 POKE PA,HA:POKE PA+CP,MC
320 GOSUB 400
330 IF Z=5 THEN 470
340 IF Z=4 THEN R=R+1
350 IF Z=3 THEN R=R-1
360 IF Z=2 THEN C=C+1
370 IF Z=1 THEN C=C-1
375 IF C<1 THEN C=1
377 IF R<1 THEN R=1
380 IF C>CM THEN C=CM
385 IF R>RM THEN R=RM
390 POKE PA,32:GOTO 310
399 REM WAIT FOR JOYSTICK MOVE OR BUTTON
400 Z=0:POKE XD,127:XV=PEEK(XR)AND128:POKE
XD,255:IF XV=0 THEN Z=2:GOTO 460
410 XV=PEEK(XL):IF (XVAND63)=63 THEN 460
420 IF (XVAND4)=0 THEN Z=3
430 IF (XVAND8)=0 THEN Z=4
440 IF (XVAND16)=0 THEN Z=1
450 IF (XVAND32)=0 THEN Z=5
460 IF Z=0 THEN 400
465 RETURN
469 REM CHARACTER SELECTION
470 IF C<CM-CC+1 THEN GOSUB500:GOTO 320
472 I=P1:POKE PA,32
474 POKE I+W,VA:POKE I+W+CP,MC
476 GOSUB 400
478 IF Z<>5 THEN 484
480 Z=0:POKE SM+J,PEEK(I):POKE SM+J+CP,MC:
J=J+1:IF J=PM THEN J=0
482 GOTO 476
484 POKE I+W,32:IF Z=4ORZ=3 THEN 340
486 IF Z=2 THEN I=I+1:IF I>E THEN 340
488 IF Z=1 THEN I=I-1:IF I<P1 THEN 340
490 GOTO 474
499 REM ADD SELECTION TO MESSAGE
500 P1=PA-L(C):P2=PA-1
504 REM NO WORD SPLITTING AT RIGHT EDGE OF
SCREEN
505 Y=W-(J-W*INT(J/W)+1):IF E-P1>=Y THEN J
=J+Y+1:IF J>=PM THEN J=0
510 FOR I=P1 TO E:POKE SM+J,PEEK(I):POKE S
M+J+CP,MC
520 J=J+1:IF J=PM THEN J=0
525 REM EMBED SPACE AFTER NON-CHARACTER SE
LECTIONS
530 NEXT I:POKE SM+J,32:POKE SM+J+CP,MC:J=
J+1:IF J=PM THEN J=0
540 Z=0:RETURN

```

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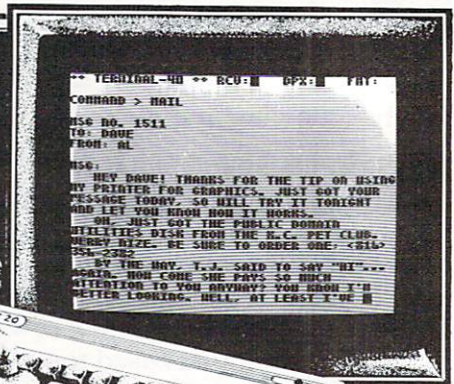
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# Data Searcher

Jerry Sturdivant

Programmers are always looking for ways to make their programs more "friendly," easier to use.

This special search routine will accept all kinds of wrong input and still come up with the right match. For VIC, PET, and 64.

Have you ever searched through a file for something but just couldn't find it? You know it's in there, but your spelling may be off by one letter and the strings just won't match?

Or you know the city of Albuquerque is in the program, but you can't spell it? Or you don't know if you're supposed to add the state? And if you *do* need to type the state, should you use the two-letter abbreviation? Is New Mexico supposed to be NE or NM?

In short, if a program has to search for a string match, you can solve all these problems by adding a Truncating Search Routine.

Let's look at the example program. Here a user enters the name of a city, and the program gives the elevation. If no match is found for the user's request, rather than having line 120 report "CITY NOT FOUND": GOTO 70, the program performs a *truncating search* (lines 160 to 210).

The routine searches only that first part of each City string equal to the length of the Request string. If there is no match, it shortens the end of the Request string by one letter and searches the shorter portion of each City string. It will continue to shorten and search until it finds a match or runs down to two letters. It will print all matches found for that length Request string.

Suppose the user gets the two-letter abbreviation of Maine wrong. If the user requests PORTLAND MA rather than ME or types out the complete word "MAINE", it will still find PORTLAND ME. If the user requests just PORTLAND, the search will print both PORTLANDs. As for our Albuquerque problem, the word can be badly misspelled and still be found. A user who understands the Truncating Search would just enter ALBU. It's a very handy and user-friendly routine, especially for poor spellers.

## Data Searcher Demonstration Program

```
10 REM PICK CITY - PRINT CITY AND ELEVATI
   ON
20 NUMBER OF CITIES=5
30 DIM CITY$(NUMBER OF CITIES),ELEV$(NUMB
   ER OF CITIES)
40 FOR I=1 TO NUMBER OF CITIES
50 READ CITY$(I),ELEV$(I)
60 NEXT
70 T=0:PRINT"ENTER CITY NAME"
80 INPUT REQUEST$
90 FOR I=1 TO NUMBER OF CITIES
100 IF REQUEST$=CITY$(I) THEN PRINT CITY$(
    I),ELEV$(I):GOTO 70
110 NEXT
120 REM          NOTHING FOUND
130 REM  SEARCH SIMILAR SPELLING
140 REM =====
150 PRINT"SEARCHING FOR SOMETHING SIMILAR
   "
160 FOR Z=LEN(REQUEST$) TO 2 STEP -1
170 FOR I=1 TO NUMBER OF CITIES
180 IF LEFT$(REQUEST$,Z)=LEFT$(CITY$(I),Z)
    THEN PRINT CITY$(I),ELEV$(I):T=1
190 NEXT I
200 IF T THEN 70
210 NEXT Z
220 PRINT"CITY NOT FOUND":GOTO 70
230 REM          DATA
240 REM          8888888888
250 DATA ALBUQUERQUE NM,4500
260 DATA BISHOP CA,4100
270 DATA PORTLAND MA,45
280 DATA PORTLAND OR,37
290 DATA THE DALLES OR,85
```

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J. F. Johnson

*The Apple computer allows shapes to be manipulated from within a BASIC program. Although shapes are very useful in two-dimensional dynamic graphics, the process of creating shapes and entering them into a shape table is tedious, and errors are exceedingly difficult to correct. This program simplifies the process of defining a shape. All required binary to hexadecimal conversions require no user intervention and a shape table is automatically constructed, with each new shape added to the current table.*

Many of the shape-drawing routines currently available for the Apple allow a shape to be created within a rectangular drawing area, with a bit map of this entire area, then stored as the shape. This technique is fine for creating relatively small shapes. However, as the size of the shape increases (so that the rectangular area the size of either hi-res page is required to enclose the shape), the amount of wasted space (i.e., bytes which are "off" and represent only the background) becomes considerable. A bit map of a shape requiring a rectangular area of this size would require 7-8 K.

This program creates shapes in the manner explained in the Applesoft manual (Chapter 9). The head-to-tail vector method is used to initially define the shape. These vectors are then "unwrapped" and sequentially combined in pairs for conversion from their individual binary codes into equivalent hexadecimal code. Each hexadecimal byte represents one byte in the shape definition. The shape is then added to the table in memory with the table's index also updated. Shapes which would have required up to 8K in a table have been reduced to less than 1K using this program.

## Capabilities Of Key Shape Maker

The following can be accomplished with Key Shape Maker:

- 1) Construct a shape table comprised of 1-255 shapes.
- 2) Create a table with a maximum length of 6K.
- 3) Alter any shape after it has been entered into the table. Also, add "buffer bytes" at the end of each shape definition so that any shape can be slightly enlarged relative to its original

definition.

- 4) Correct mistakes which occur while entering vectors during a shape definition by erasing them in a sequential fashion.
- 5) View all the shapes in the current table (using the game paddles).
- 6) Display any particular shape, with the effect of ROT and SCALE variations (using the game paddles) on the shape immediately displayed on the hi-res screen.
- 7) Once a shape table is BSAVED to diskette using this utility, it may be BLOADED with the utility and the stored shapes redefined and new shapes added (assuming the table does not contain the maximum number of shapes originally designated).
- 8) The current shape table in RAM can be destroyed, and a new table created or an old table BLOADED into memory.

## Use An EXEC File To Initialize

The entire program is written in Applesoft. The following program creates a text file, "Key Shape Loader", which reassigns the beginning of the program pointer (104, 103) and then RUNs the program.

## Program 1.

```
5 REM KEY SHAPE LOADER MAKER
10 D$ = CHR$(4)
15 PRINT D$"MON C,I,0"
17 PRINT D$"DELETE KEY SHAPE LOADER"
20 PRINT D$"OPEN KEY SHAPE LOADER"
30 PRINT D$"WRITE KEY SHAPE LOADER"
40 PRINT "POKE 104,96"
50 PRINT "POKE 103,1"
60 PRINT "POKE 24576,0"
70 PRINT "RUN KEY SHAPE MAKER"
80 PRINT D$"CLOSE KEY SHAPE LOADER"
90 END
```

By EXECing the text file Key Shape Loader, the required POKES are completed, and then the Applesoft program "Key Shape Maker" is RUN.

## Use Of RAM By "Key Shape Maker"

The Applesoft program is LOADED at \$6001 (24577), just above the second hi-res page of graphics. The second hi-res page is used for the temporary storage of vectors that define the current shape. These vectors are then paired and converted into their equivalent hexadecimal code, with the resulting hex code defining the shape

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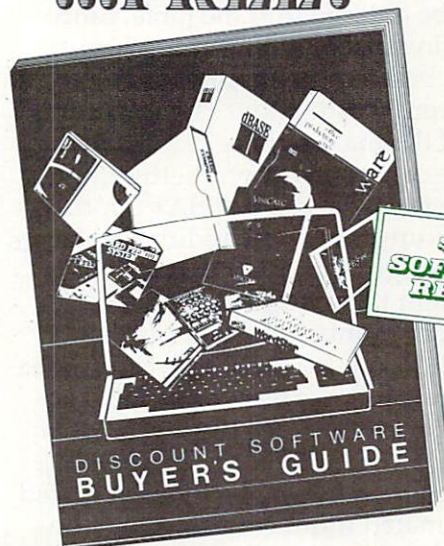
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stored on the second hi-res page. If the shape is to be saved, the hex code is then transferred to the shape table. The creation and display of all shapes utilizes the first hi-res page. The shape table is stored at \$800 (2048), and its length may not exceed \$2000 (8196) since the first hi-res page is used for display purposes.

## Execution

The user is initially prompted for the number of shapes that will be entered into the table. Since extra shapes are invariably required at a future date, it is always best to enter a number larger than what is currently estimated. The minimum number is 1, and the maximum is 255. Since the table need not be completed at one setting, the partially constructed table can be BSAVED, then BLOADED at a future date, with additional shapes added (up to the original number that was user-specified) or current table shapes redefined.

This maximum number of shapes is then POKEd into \$801. Room for the shape table index (which immediately follows starting at \$802) is then allocated. The index stores the locations of all shapes relative to the start of the table (\$800). The index must contain two bytes for each stored shape. If the estimated number of shapes to be stored in this table is low, it will not be possible to exceed this limit since room in the table for the index can not be changed using this program. Location \$800 initially contains a value of zero, and is incremented by one upon the addition of each shape to the table.

The shapes are created using two different sets of four keys. Plotting vectors are entered using the I, K, M, and J keys, while the nonplotting vectors are entered using the E, D, X, and S keys. Both sets of keys are arranged on the keyboard in a north-east-south-west fashion, with the right-hand set for plotting and the left-hand set for nonplotting. The back arrow key (<-) may be used to sequentially erase vectors starting with the last one entered, and is very useful for correcting any mistakes. The keystroke "!" (a shift-1) terminates the shape definition.

Prior to the actual construction of the shape, a "dot-cursor" is positioned on the first hi-res screen. This is the point at which the shape definition is initiated. The shape is then displayed as it is constructed, using the previously defined keystrokes. Due to the algorithm used to display the shape as it is defined, any nonplotting vectors which cross any existing outline of the shape will result in the boundary being erased where the crossover occurs.

However, when the final shape is displayed for verification, it will exhibit the contiguous boundary that was originally constructed. Also displayed during the construction of the shape

are the current x and y coordinates of the "dot-cursor," the three-digit binary code of each vector as it is entered, and the maximum number of bytes which may be used to define the present shape.

When the definition of the shape is terminated, the keystroke vectors are converted to hexadecimal code, with the resulting shape displayed prior to its storage in the table. If the user chooses to save the shape, he or she appends it to the current table, updates the corresponding index locations, and increments location \$800 by one. If the shape is not saved, the defining of additional shapes simply continues.

## Applesoft Shape Table Commands

Several subroutines in this program allow the user to experiment with several shape table commands and to view the result. This was purposely included to aid the user in exploring the capabilities (as well as the limitations) of shapes within Applesoft. This will perhaps facilitate inclusion of shape tables within programs.

The SCALE command allows the expansion of a defined shape. Since the originally defined shape is constructed using the smallest SCALE value, a figure may only be expanded using this command. It will soon be discovered, however, that the contiguous boundary of a shape may become segmented when its size is enlarged through SCALEing, and may rapidly become unrecognizable. This can usually be overcome by redefining the same shape boundary using a different sequence of plotting/nonplotting vectors. The ability to redefine any given shape will allow the user to experiment.

Rotations in the plane of the screen are controlled by the ROT command. An inverse relationship exists between the number of unique rotational values defined by the ROT command and the SCALE command. Increasing ROT from 0 to 64 will rotate it 360 degrees about the origin. As the value for SCALE increases from 0, more unique rotational values are recognized between the ROT values of 0 and 64, and hence the incremental rotational angle decreases. By making the original shape very small, and then expanding it using the SCALE command, a smaller angle of rotation can be realized between the ROT values of 0 and 64. The values for both of the commands may be varied for a chosen shape, with the effects on the shape displayed on the screen.

A shape may be displayed from Applesoft using either the DRAW or XDRAW commands. The XDRAW command simply complements the current color of the shape at its present location and is very convenient for displaying and erasing shapes. The DRAW command requires that HCOLOR be changed from a value of 3 to 0 if the shape is to first be drawn and then erased. These

commands may also display the same shape differently. If any nonplotting vectors cross the boundary of plotting vectors in the original shape definition, the DRAW command (HCOLOR=3) will display a contiguous shape.

The XDRAW command, however, displays the shape with any regions of plotting/nonplotting vector overlap being effectively erased. This should be taken into consideration when originally defining the shape boundary, since one of the two display techniques may be preferred in the Applesoft program which uses the shapes. The shape display for verification purposes (prior to appending the shape to the current table) is displayed using DRAW (HCOLOR=3). During viewing of a shape in the current table with ROT and SCALE variations, the shape is drawn and erased using XDRAW.

## Using A Shape Table

Key Shape Maker creates a shape table starting at \$800 (2048) in RAM. It may be BLOADED into another region if there exists a conflict with the storage of the controlling Applesoft program or a machine language program which must occupy this region. There are two DOS entry points which store both the starting address and length of a BLOADED file. Since the user determines the starting address of a binary file, only the length must be determined. This is accomplished in the following manner.

After BSAVEing your shape table to diskette, BLOAD it back into memory (this may be done in direct execution or under Key Shape Maker control). If the shape table has been loaded by an Applesoft program, press the reset button. Now enter the following as a direct execution instruction, where <ret> simply designates pressing the return key.

```
PRINT PEEK(43616) + PEEK(43617) * 256 <ret>
```

The base ten number that appears on the screen immediately after this instruction is the length of the shape table (see Appendix E of the DOS manual, DOS Entry Points And Schematics). Using this additional piece of information, the user is offered some flexibility in BLOADing the shape table into various regions of RAM. For example, a shape table of byte length 350 may be BLOADED at location 24577 (immediately above the second hi-res page) with the following instruction in an Applesoft statement.

```
100 PRINT CHR$(4) "BLOAD SHAPE TABLE-1,
A24577, L350"
```

The final piece of information which must be supplied is the location of the shape table. The pointer designating the beginning of the current shape table is located on the zero page of memory, and is comprised of the locations \$E8 (232) and

\$E9 (233). The integer value obtained by dividing the starting address by 256 is POKEd into 233, with the remainder POKEd into 232 (i.e.,  $24577 / 256 = 96$  with a remainder of 1).

```
110 POKE 233,96 : POKE 232,1
```

Your Applesoft program will now be able to effectively use the shape table currently residing in RAM.

## Program 2.

```
5 REM KEY SHAPE MAKER
60 REM TS=START OF SHAPE TABLE///VC=MARKER
  ER USED IN DISPLAY OF 6 DIGITS REPRESENTING
  2 VECTORS///VS=MARKER FOR START OF TEMPORARY
  STORAGE FOR VECTOR TABLE AND ENSUING TEMPORARY
  STORAGE DERIVED SHAPE///16395=START OF TEMPORARY
  SHAPE TABLE
70 A* = "PRESS ! TO STOP DRAWING SHAPE."
80 TS = 2048: POKE TS,0:VC = 16389:VS = 1639
  6:LI = 2050:MI = 2051:D* = CHR*(4): GOTO
  4000
100 HCOLOR= 3: H PLOT X,Y: FOR J = 1 TO 20: NEXT
  J: HCOLOR= 0: H PLOT X,Y:X = PDL (0) /
  .913:Y = PDL (1) / 1.6: IF PEEK ( - 1
  6287) > 127 OR PEEK ( - 16286) > 127 THEN
  RETURN
105 GOTO 100
110 S1 = INT (1 + PDL (0) * ( PEEK (TS) -
  1) / 240): ROT= 0: HCOLOR= 3: SCALE= 1:
  RETURN
115 S2 = INT (1 + PDL (0) * ( PEEK (TS) -
  1) / 240): RETURN
120 XDRAW S1 AT X,Y: V TAB 24: H TAB 1: CALL
  - 868: PRINT "SHAPE #"S1".";
125 GOSUB 115: IF PEEK ( - 16287) > 127 THEN
  RETURN
130 IF S2 < > S1 THEN XDRAW S1 AT X,Y:S1 =
  S2: GOTO 120
135 GOTO 125
140 GOSUB 110
145 V TAB 5: H TAB 1: CALL - 868: PRINT "SHA
  PE #"S1"."
150 GOSUB 115: IF S2 < > S1 THEN S1 = S2: GOTO
  145
152 IF PEEK ( - 16287) > 127 THEN RETURN
154 GOTO 150
158 S1 = INT ( PDL (1) * 7 / 240): RETURN
159 S2 = INT ( PDL (1) * 7 / 240): RETURN
160 GOSUB 158
162 V TAB 10: H TAB 1: CALL - 868: PRINT "HC
  OLOR="S1"."
164 GOSUB 159: IF S2 < > S1 THEN S1 = S2: GOTO
  162
166 IF PEEK ( - 16286) > 127 THEN RETURN
168 GOTO 164
170 GOTO 166
172 R1 = PDL (0) / 3:S1 = PDL (1) / 3: RETURN
173 R2 = PDL (0) / 3:S2 = PDL (1) / 3: RETURN
174 GOSUB 172
175 HCOLOR= HC: ROT= R1: SCALE= S1: DRAW SH
  AT X1,Y1: V TAB 24: H TAB 1: CALL - 868
  : PRINT "ROT=" INT (R1) SPC( 8)"SCALE="
  INT (S1);
176 GOSUB 173: IF R2 < > R1 OR S2 < > S1 THEN
  R1 = R2:S1 = S2: CALL 62450: GOTO 175
177 IF PEEK ( - 16287) > 127 OR PEEK ( -
  16286) > 127 THEN RETURN
178 GOTO 176
200 POKE TS + 1, VAL (NS*): RETURN : REM M
  AXIMUM NUMBER OF SHAPES THAT CAN BE ENT
  ERED INTO THIS TABLE
203 PA = 256 * PEEK (MI) + PEEK (LI) + TS:
  RETURN
205 PA = TS + 4 + 2 * VAL (NS*): RETURN : REM
  IS LOCATION IN TABLE WHERE FIRST SHA
  PE WILL BE SAVED
210 LS = TS + 2 * SH:MS = TS + 1 + 2 * SH:DD
  = 256 * ( PEEK (MS + 2) - PEEK (MS)) +
  ( PEEK (LS + 2) - PEEK (LS)): RETURN
```

```

212 LI = TS + 2 * ( PEEK (TS) + 1);MI = LI +
1: RETURN ; REM INIT INDEX FOR TABLE
THAT HAS BEEN LOADED
215 LI = LI + 2;MI = MI + 2: RETURN ; REM
INCREMENT INDEX LOCATION FOR NEXT SHAPE
220 LI = LI - 2;MI = MI - 2: RETURN ; REM
DECREMENT INDEX LOCATION FOR FIRST SHAP
E TO BE DRAWN IN LOADED OR ALTERED TABL
E
225 IP = VS; RETURN ; REM INITIALIZE LOCATI
ON WHERE PLOTTED VECTORS ARE STORED TEM
PORARILY UNTIL THEY ARE CONVERTED INTO
A SHAPE
230 N = VS + 1;SL = VS + 1: RETURN ; REM IN
ITIALIZE TWO COUNTERS WHICH ARE USED DU
RING THE CONVERSION OF STORED VECTORS I
NTO A SHAPE
235 PA = TS + 256 * PEEK (MS) + PEEK (LS);
RETURN ; REM LOCATION IN TABLE OF STA
RT OF NEXT SHAPE
240 POKE LI, INT (((PA - TS) / 256) - INT
((PA - TS) / 256)) * 256 + .5); POKE MI
, INT ((PA - TS) / 256); RETURN ; REM
POKE STARTING LOCATION FOR GIVEN SHAP
E IN APPROPRIATE INDEX LOCATION
250 A = 0;B = 0;C = 0: RETURN ; REM INITIA
LIZE A,B,C TO ZERO
255 L = IP - VS;K = INT (L / 2) + INT ((L /
2 - INT (L / 2)) * 2 + .05); RETURN ; REM
L=#BYTES CONTAINING VECTORS//K=#BYTES
REQUIRED TO STORE SHAPE;1 SHAPE BYTE P
ER 2 VECTOR BYTES
260 POKE 233,64; POKE 232,9; POKE 16393,1; POKE
16395,4; POKE 16396,0; RETURN ; REM D
EFINE UNIT SHAPE TABLE WHERE TEMPORARIL
Y DEFINED SHAPE EXISTS
265 POKE 233,8; POKE 232,0; RETURN ; REM L
OCATION OF SHAPE TABLE
270 RS = PEEK (TS + 1) - PEEK (TS); RETURN
; REM RB=# OF SHAPES THAT MAY STILL B
E ENTERED INTO SHAPE TABLE
299 REM PLOT/ERASE POINT AT CURRENT X,Y UN
TIL KEY PRESS OCCURS.
300 XO = X;YO = Y; HCOLOR= 3; HPLLOT XO,YO; FOR
J = 1 TO 20; NEXT J; HCOLOR= 0; HPLLOT X
O,YO; FOR J = 1 TO 20; NEXT J; IF PEEK
(- 16384) < 128 THEN 300
310 HCOLOR= 3; POKE - 16368,0;Z = PEEK (-
16384); RETURN
324 REM PLOT PRESENT POINT IF ENTERED VEC
TOR IS A PLOT-THEN-MOVE VECTOR
325 HCOLOR= 3; HPLLOT XO,YO; RETURN
329 REM ERASE PREVIOUS POINT PLOTTED
330 HCOLOR= 0; HPLLOT XO,YO; RETURN
349 REM EVALUATE KEY PRESS IN TERMS OF NEW
X,Y COORDINATES.
350 F1 = 0
352 IF Z = 73 OR Z = 69 THEN Y = Y - 1: GOSUB
362; RETURN ; REM MOVE UP
354 IF Z = 75 OR Z = 68 THEN X = X + 1: GOSUB
364; RETURN ; REM MOVE RIGHT
356 IF Z = 77 OR Z = 88 THEN Y = Y + 1: GOSUB
366; RETURN ; REM MOVE DOWN
358 IF Z = 74 OR Z = 83 THEN X = X - 1: GOSUB
368; RETURN ; REM MOVE LEFT
360 F1 = 1; RETURN ; REM FLAG F1 SET TRUE
IF NO U,R,D,L MOVE
362 IF Y < 0 THEN Y = 0;F1 = 1
363 RETURN
364 IF X > 279 THEN X = 279;F1 = 1
365 RETURN
366 IF Y > 159 THEN Y = 159;F1 = 1
367 RETURN
368 IF X < 0 THEN X = 0;F1 = 1
369 RETURN
399 REM EVALUATE 3 DIGIT BINARY EQUIVALENT
OF INDIVIDUAL VECTOR
400 F1 = 0; IF Z = 73 THEN A = 1;B = 0;C = 0
; RETURN
402 IF Z = 75 THEN A = 1;B = 0;C = 1; RETURN
404 IF Z = 77 THEN A = 1;B = 1;C = 0; RETURN
406 IF Z = 74 THEN A = 1;B = 1;C = 1; RETURN
408 IF Z = 69 THEN A = 0;B = 0;C = 0; RETURN
410 IF Z = 68 THEN A = 0;B = 0;C = 1; RETURN
412 IF Z = 88 THEN A = 0;B = 1;C = 0; RETURN
414 IF Z = 83 THEN A = 0;B = 1;C = 1; RETURN
418 F1 = 1; RETURN
424 REM PRINT PRESENT COORDINATES OF X,Y
425 VTAB 21; HTAB 1; CALL - 868; PRINT "X=
"X,"Y="Y; RETURN
449 REM ERASE CURRENT POINT AND MOVE BACK
ONE POINT
450 PP = PEEK (IP); IF IP = VS THEN RETURN
; REM CAN'T ERASE PAST ORIGIN OF SHAPE
455 IF PP = 0 OR PP = 4 THEN Y = Y + 1: GOSUB
475; RETURN
460 IF PP = 1 OR PP = 5 THEN X = X - 1: GOSUB
475; RETURN
465 IF PP = 2 OR PP = 6 THEN Y = Y - 1: GOSUB
475; RETURN
470 IF PP = 3 OR PP = 7 THEN X = X + 1: GOSUB
475; RETURN
475 XO = X;YO = Y; GOSUB 330; POKE IP,0;IP =
IP - 1; RETURN
499 REM POKE VECTOR INTO RAM LOCATION IP
500 IP = IP + 1; POKE IP,4 * A + 2 * B + C; RETURN
509 REM POKE BINARY EQUIVALENT OF VECTOR M
OVE
510 P(1 + I * 3) = A;P(2 + I * 3) = B;P(3 +
I * 3) = C
515 IF I = 1 THEN FOR J = 0 TO 5; POKE 187
2 + J,48; NEXT J; FOR J = 0 TO 2; POKE
1875 + J,P(4 + J) + 48; NEXT J; RETURN
520 FOR J = 0 TO 2; POKE 1872 + J,P(1 + J) +
48; NEXT J; RETURN
525 FOR J = 1 TO 6;P(J) = 0; NEXT J; RETURN
600 HGR2 ; HGR ; SCALE= 1; ROT= 0; HCOLOR=
3;XX = 139;YY = 80;X = XX;Y = YY; RETURN
; REM HI-RES INITIALIZATION
700 BL = 8190 - PA;DI = 24576 - 16396;VL = D
I; RETURN ; REM NEW TABLE BYTE LIMITS
710 NS = PEEK (2048);LI = TS + 2 * (NS + 1)
;MI = TS + 1 + 2 * (NS + 1);PA = TS + 2
56 * PEEK (MI) + PEEK (LI)
720 BL = 8190 - PA; IF DI < 2 * (8190 - PA) THEN
VL = DI; RETURN
730 VL = 2 * (8190 - PA); RETURN
765 F1 = 0; IF VL < 100 THEN F1 = 1
767 RETURN
770 F2 = 0; VTAB 21; PRINT "THERE ARE "8190 -
PA" BYTES REMAINING FOR MORE"; PRINT "S
HAPES IN CURRENT TABLE IF YOU HAVE NOT
CONSTRUCTED THE LAST SHAPE."
775 IF 8190 - PA < 100 THEN PRINT "NO MORE
SHAPES MAY BE ADDED TO CURRENT TABLE.
";F2 = 1
780 RETURN
800 F3 = 0;VL = VL - 1; VTAB 21; HTAB 33; CALL
- 868; PRINT VL
805 IF VL < 200 THEN VTAB 22; HTAB 1; PRINT
"ONLY "VL - 190" MOVES LEFT."; FOR J =
1 TO 1000; NEXT J; HTAB 1; CALL - 868;
IF VL < = 191 THEN F3 = 1
810 RETURN
975 VTAB 24; HTAB 5; CALL - 958; PRINT "PR
ESS ANY LETTER TO CONTINUE."; GET Z;J
= FRE (0); RETURN
999 REM INITIALIZE SHAPE TABLE PARAMETERS
1000 TEXT ; HOME ; PRINT TAB( 5);"THE NUMB
ER OF SHAPES THAT MAY BE ENTERED IN
A SHAPE TABLE IS IN THE RANGE OF 1-255.
IT IS ALWAYS BEST TO ALLOW EXTRA ROO
M FOR ADDITIONAL SHAPES YOU MAY WISH TO
INCLUDE IN THE FUTURE."
1010 INPUT " ENTER A NUMBER BETWEEN 1 A
ND 255, THEN PRESS RETURN.";NS; IF VAL
(NS) < 1 OR VAL (NS) > 255 THEN 1000
1020 GOSUB 200; REM POKE MAX # OF SHAPES
THAT CAN BE ENTERED INTO THIS TABLE
1030 GOSUB 205; REM INITIAL RAM LOCATION F
OR FIRST SHAPE
1040 GOSUB 240; REM STARTING POINT OF FIRS

```

```

T SHAPE AND POKE INTO INDEX
1050 GOSUB 700: REM BL,DI,VL
1055 RETURN
1060 GOSUB 250: REM INITIALIZE COMPONENTS
OF VECTOR MOVE
1070 GOSUB 600: REM HI-RES INIT
1080 RETURN
1200 TEXT : HOME : PRINT TAB( 5);"BEFORE A
CTUALLY DRAWING A SHAPE, THE BLINKIN
G DOT MAY BE MOVED TO ANY POSITION O
N THE SCREEN. USE THE E,S,D AND X KEY
S FOR DOT POSITIONING ONLY."
1205 PRINT "PRESS ! WHEN READY TO DRAW A SH
APE."
1210 PRINT TAB( 5);"THE SHAPE YOU ARE TO D
RAW MAY THEN BE COMPRISED OF PLOTTING
AS WELL AS NON PLOTTING VECORS. USE TH
E E,S,D AND X KEYS FOR NONPLOTTING VE
CTORS, AND THE I,J,K AND M KEYS FOR P
LOTTING VECTORS."
1220 PRINT "THE LEFT ARROW KEY (<-) MAY BE
USED TO ERASE MISTAKES, AND THE ! KEY
TO TERM- INATE THE SHAPE.": PRINT
1240 PRINT TAB( 1);"-NONPLOTTING-"; SPC( 9
);"-PLOTTING-"
1250 PRINT TAB( 2);"E-MOVE UP" SPC( 7)"I-P
LOT THEN MOVE UP"; PRINT TAB( 2);"S-MO
VE LEFT" SPC( 5)"J-PLOT THEN MOVE LEFT"
1260 PRINT TAB( 2);"D-MOVE RIGHT" SPC( 4)"
K-PLOT THEN MOVE RIGHT": PRINT TAB( 2)
;"X-MOVE DOWN" SPC( 5)"M-PLOT THEN MOVE
DOWN"
1270 PRINT TAB( 12);"<- ERASER": PRINT TAB(
12);"! STOP"
1280 GOSUB 975
1285 HOME : VTAB 23: PRINT "PRESS ! WHEN YO
U ARE READY TO DRAW YOUR SHAPE.": GOSUB
600: GOSUB 425
1290 GOSUB 300: IF Z = 33 THEN XI = X:YI =
Y: HOME : RETURN
1300 GOSUB 350: GOSUB 425: GOTO 1290
1350 GOSUB 225: GOSUB 425: GOSUB 525:I = 0:
GOSUB 515: VTAB 22: HTAB 1: PRINT A#: IF
NOT F5 THEN GOSUB 720: GOSUB 800: IF
F3 THEN RETURN
1360 I = 1 - I: REM TOGGLE
1370 IF F5 THEN HTAB 1: VTAB 24: CALL - 8
68: PRINT "YOU HAVE UP TO "2 * DD - 3 -
(IP - 16394)" MOVES LEFT.": IF 2 * DD -
3 - (IP - 16394) = 0 THEN RETURN
1380 GOSUB 300: IF Z = 33 THEN RETURN
1390 IF Z = 8 THEN GOSUB 450: GOSUB 425: GOTO
1360: REM ERASE LAST MOVE
1400 IF Z = 69 AND I = 0 THEN VTAB 22: HTAB
1: PRINT "THIS MOVE HAS NO EFFECT ON TH
E SHAPE.": FOR J = 1 TO 2000: NEXT J: HTAB
1: CALL - 868: PRINT A#: GOTO 1370
1405 GOSUB 350: IF F1 THEN 1370: REM EVAL
KEY PRESS FOR NEW X,Y : SET FLAG F1 IF
ILLEGAL
1410 GOSUB 400: REM EVALUATE 3 DIGIT BINAR
Y EQUIVALENT OF KEY PRESS
1420 GOSUB 500: REM SAVE VECTOR MOVE WITH
POKE
1430 GOSUB 510: REM DISPLAY 'ACCUMULATOR'
WITH TEXT POKES
1440 GOSUB 425: REM PRINT NEW X,Y COORDS
TO SCREEN
1450 IF Z > 72 AND Z < 78 THEN GOSUB 325: REM
PLOT POINT ON HI-RES FOR APPROPRIATE
PLOTTING VECTOR
1455 IF NOT F5 THEN GOSUB 800: IF F3 THEN
RETURN
1460 GOTO 1360
1500 GOSUB 230
1510 GOSUB 255
1520 FOR J = 1 TO K: POKE N, ( PEEK (SL) + 8
* PEEK (SL + 1)):SL = SL + 2:N = N +
1: NEXT J: POKE N,0: REM POKE SHAPE 'O
N TOP OF' VECTORS
1530 GOSUB 260: HGR : ,HCOLOR= 3: DRAW 1 AT
XI,YI: GOSUB 265
1540 HOME : VTAB 21: PRINT "DO YOU WISH TO
SAVE THIS SHAPE (Y/N)?": GET Z#: IF Z#
< > "Y" AND Z# < > "N" THEN 1540
1545 IF F5 THEN RETURN
1550 IF Z# = "N" THEN RETURN
1560 FOR J = N + 1 TO N + 2 + .25 * (N - VS
+ 1): POKE J,0: NEXT J: REM EXPAND S
HAPE 25% BY ADDING ZEROS AT END
1570 N = J - 1: FOR J = VS + 1 TO N: POKE PA
, PEEK (J):PA = PA + 1: NEXT J: REM T
RANSFER SHAPE FROM TEMPORARY LOCATION T
O SHAPE TABLE
1580 NS = PEEK (TS):NS = NS + 1: POKE TS,NS
: REM INCREASE # SHAPES IN INDEX BY 1
1590 GOSUB 215: GOSUB 240: REM POKE DATA
INTO THIS INDEX LOCATION///INCREMENT IN
DEX LOCATIION OF NEXT SHAPE
1610 RETURN
1700 GOSUB 600: HOME : VTAB 21: PRINT "USE
THE GAME PADDLES TO POSITION THE DOTAT
WHICH POINT THE SHAPE WILL BE DRAWN. PR
ESS EITHER BUTTON WHEN READY TO VIEW S
HAPES.":
1720 X = 140:Y = 80: GOSUB 100:NS = PEEK (2
048): HOME : VTAB 21: PRINT "USE THE X
GAME PADDLE TO VIEW ALL SHAPESIN CURREN
T TABLE. PRESS BUTTON WHEN FINISHED
VIEWING.": GOSUB 110: GOSUB 120: RETURN
1750 TEXT : HOME : PRINT TAB( 5);"THE FOLL
OWING SEQUENCE WILL BE FOLLOWED IN
VIEWING A SHAPE."
1755 PRINT : PRINT "1) INPUT SHAPE NO. USIN
G X GAME PADDLE.": PRINT : PRINT "2) IN
PUT HCOLOR USING Y GAME PADDLE.": PRINT
: PRINT "3) MOVE SHAPE TO DESIRED POSIT
ION.": PRINT : PRINT "4) USE X PADDLE T
O VARY ROT, AND Y PADDLE TO V
ARY SCALE.": GOSUB 975
1760 HOME : PRINT TAB( 5);"USE THE X GAME
PADDLE TO CHOOSE YOURSHAPE NO. PRESS T
HE PADDLE'S BUTTON WHEN FINISHED.": GOSUB
140:SH = S1
1765 PRINT : PRINT TAB( 5);"INPUT THE HCOL
OR USING THE Y PADDLE.PRESS ITS BUTTON
WHEN FINISHED.": GOSUB 160:HC = S1
1770 HGR : HOME : VTAB 21: PRINT TAB( 5);"
USE THE GAME PADDLES TO LOCATE THE POI
NT WHERE THE SHAPE WILL BE DRAWN. PR
ESS EITHER BUTTON WHEN FINISHED.": GOSUB
100:XI = INT (X):YI = INT (Y)
1775 HOME : VTAB 21: PRINT TAB( 5);"USE PA
DLES TO VARY ROTATION (X) ANDSCALE (Y)
. PRESS EITHER BUTTON TO STOP.": VTAB
23: PRINT "SHAPE # "SH SPC( 3)"HCOLOR="H
C SPC( 3)"X="XI SPC( 3)"Y="YI: GOSUB 17
4: RETURN
1800 FOR J = N - VS + 1 TO DD:N = N + 1: POKE
N,0: NEXT J
1810 N = VS + 1:J = 256 * PEEK (MS) + PEEK
(LS) + TS: FOR K = 1 TO DD - 1: POKE J,
PEEK (N):J = J + 1:N = N + 1: NEXT K: RETURN
3500 GOSUB 1000
3501 GOSUB 1060: REM ENTRY FOR ADDING TO E
XISTING TABLE
3502 HOME : GOSUB 770: GOSUB 975: IF F2 THEN
RETURN
3505 GOSUB 270: HOME : TEXT : PRINT RS" SHA
PES MAY BE ADDED TO THE CURRENT": PRINT
"TABLE WHICH CONTAINS "; PEEK (2048);"
SHAPES.": GOSUB 975
3510 IF NOT RS THEN 3575
3515 HOME : PRINT TAB( 5);"DO YOU WISH TO
DRAW A SHAPE": PRINT "Y/N?": GET Z#: IF
Z# < > "Y" AND Z# < > "N" THEN 3515
3520 IF Z# = "N" THEN 3575
3525 GOSUB 1200
3530 GOSUB 1350
3535 GOSUB 1500
3540 GOTO 3502
3575 RETURN
3650 GOSUB 8000: ONERR GOTO 20000
3660 PRINT : PRINT D#"BLOAD"NA*,A"TS: GOSUB
270: GOSUB 212: GOSUB 203: GOSUB 700: POKE
216,0: RETURN
3670 HOME : PRINT TAB( 5);"YOUR FILE NAME
LENGTH IS ZERO. DO YOU STILL WISH TO
BLOAD A SHAPE TABLE FROM DISKETTE (Y/
N)?": GET Z#: IF Z# < > "Y" AND Z# < >

```

```

"N" THEN 3670
3680 IF Z# = "N" THEN RETURN
3690 IF Z# = "Y" THEN 3650
4000 HOME : IF PEEK (TS) > 0 THEN 4100
4010 PRINT TAB( 5);"PRESS THE NUMBER OF YOUR CHOICE.": PRINT : PRINT "1) DRAW SHAPES/CONSTRUCT A SHAPE TABLE.": PRINT "2) BLOAD A SHAPE TABLE THAT HAS BEEN CONSTRUCTED WITH THIS ROUTINE.": PRINT "3) QUIT."
4014 GET Z#: IF VAL (Z#) < 1 OR VAL (Z#) > 3 THEN HOME : GOTO 4010
4016 IF Z# = "3" THEN 30000
4020 ON VAL (Z#) GOSUB 3500,3650
4030 GOTO 4000
4100 HOME : PRINT TAB( 5);"PRESS THE NUMBER OF YOUR CHOICE.": PRINT
4105 PRINT : PRINT "1) DISPLAY SHAPES IN CURRENT TABLE.": PRINT : PRINT "2) ADD SHAPES TO CURRENT TABLE.": PRINT : PRINT "3) CHANGE A SHAPE IN CURRENT TABLE."
4110 PRINT : PRINT "4) BSAVE CURRENT TABLE TO DISKETTE.": PRINT : PRINT "5) DELETE TABLE CURRENTLY IN MEMORY.": PRINT : PRINT "6) QUIT.": PRINT
4120 GET Z#: IF VAL (Z#) < 1 OR VAL (Z#) > 6 THEN 4100
4130 IF Z# = "6" THEN 30000
4150 HOME : ON VAL (Z#) GOSUB 5200,5400,5600,5800,6000
4160 GOTO 4000
5200 TEXT : HOME : IF PEEK (TS) = 0 THEN PRINT "THERE ARE NO SHAPES IN TABLE.": GOSUB 975: RETURN
5205 GOSUB 265: PRINT TAB( 5);"PRESS THE NUMBER OF YOUR CHOICE.": PRINT : PRINT "1) VIEW ALL SHAPES.": PRINT : PRINT "2) VIEW ONLY ONE SHAPE.": PRINT : PRINT "3) RETURN TO MAIN MENU."
5210 GET Z#: IF VAL (Z#) < 1 OR VAL (Z#) > 3 THEN 5200
5215 IF Z# = "3" THEN RETURN
5220 ON VAL (Z#) GOSUB 1700,1750: GOTO 5200
5400 GOSUB 3501: RETURN
5600 TEXT : HOME : IF PEEK (TS) = 0 THEN PRINT TAB( 5);"THERE IS NO TABLE CURRENTLY IN MEMORY.": GOSUB 975: RETURN
5610 PRINT TAB( 5);"THERE ARE " PEEK (2048) " SHAPES IN TABLE.": INPUT " ENTER THE NUMBER OF THE SHAPE YOU WISH TO CHANGE, OR A ! TO RETURN TO THE MAIN MENU.": SH#: IF SH# = "!" THEN F5 = 0: RETURN
5620 SH = VAL (SH#): IF SH < 1 OR SH > PEEK (TS) THEN 5600
5630 F5 = 1: GOSUB 210: GOSUB 1200: GOSUB 1350: GOSUB 1500
5640 IF Z# = "Y" THEN GOSUB 1800
5660 GOTO 5600
5800 IF PEEK (TS) = 0 THEN PRINT "THERE ARE NO SHAPES IN TABLE.": GOSUB 975: RETURN
5805 PRINT "IF YOU WISH TO SAVE THIS TABLE ON A DIFFERENT DISKETTE, PUT IT IN THE DRIVE AT THIS TIME.": PRINT : PRINT "PUT THE UTILITY DISKETTE BACK INTO THE DRIVE AFTER THE DISK DRIVE'S RED LIGHT GOES OFF.": GOSUB 975: GOSUB 8000: PRINT
5810 PRINT : PRINT D#"BSAVE"NA#,A"TS",L"PA - TS": RETURN
5820 HOME : PRINT TAB( 5);"YOUR FILE NAME LENGTH IS ZERO. DO YOU STILL WISH TO SAVE THE SHAPE TABLE THAT IS CURRENTLY IN MEMORY (Y/N)?:": GET Z#: IF Z# < "Y" AND Z# > "N" THEN 5820
5830 IF Z# = "N" THEN RETURN
5840 GOTO 5800
6000 HOME : PRINT TAB( 5);"TYPE THE WORD " : FLASH : PRINT "DELETE": NORMAL : PRINT " TO DESTROY": PRINT "THE SHAPE TABLE THAT IS CURRENTLY IN MEMORY. TYPE " : FLASH : PRINT "SAVE": NORMAL : PRINT " IF YOU DO NOT WISH TO DESTROY THE SHAPE TABLE THAT CURRENTLY IS IN MEMORY."
6005 PRINT : INPUT " PRESS THE RETURN KEY AFTER YOUR CHOSEN ENTRY -> ": Z#
6010 IF Z# < "DELETE" AND Z# > "SAVE" THEN 6000
6020 IF Z# = "DELETE" THEN RUN
6030 RETURN
8000 HOME : PRINT TAB( 5);"ENTER THE NAME OF THE TABLE, THEN PRESS RETURN. THE TOTAL LENGTH CAN NOT EXCEED 30 CHARACTERS, AND THE FIRST CHARACTER MUST BE A LETTER."
8005 NA# = "": X = 2: Y = 6: HTAB X: VTAB Y
8010 GET Z#
8020 IF LEN (NA#) = 0 AND ASC (Z#) < 65 OR LEN (NA#) = 0 AND ASC (Z#) > 90 THEN VTAB 10: HTAB 1: PRINT "THE FIRST CHARACTER MUST BE A LETTER.": FOR I = 1 TO 1500: NEXT I: HTAB 1: CALL - 868: HTAB X: VTAB Y: GOTO 8010
8030 IF Z# = " " THEN VTAB 10: HTAB 1: PRINT "DO NOT USE ANY COMMAS.": FOR I = 1 TO 1500: NEXT I: HTAB 1: CALL - 868: HTAB X: VTAB Y: GOTO 8010
8040 IF ASC (Z#) = 8 AND LEN (NA#) > 1 THEN X = X - 1: HTAB X: CALL - 868: NA# = LEFT# (NA#, LEN (NA#) - 1): GOTO 8010
8050 IF ASC (Z#) = 8 AND LEN (NA#) = 1 THEN X = X - 1: HTAB X: CALL - 868: NA# = " " : GOTO 8010
8055 IF ASC (Z#) = 13 OR LEN (NA#) > 29 THEN RETURN
8060 PRINT Z#: NA# = NA# + Z#: X = X + 1: HTAB X: GOTO 8010
8070 IF ASC (Z#) = 13 THEN RETURN
20000 ER = PEEK (222): LN = PEEK (218) + PEEK (219) * 256
20010 IF LN = 3660 THEN 21000: REM FILE NOT FOUND ERROR WHEN ATTEMPTING TO LOAD A SHAPE TABLE
20020 IF ER = 11 AND LN = 5810 THEN PRINT "FIRST CHARACTER IN FILE NAME MUST BE A LETTER, AND NO COMMAS MAY APPEAR IN THE NAME. PRESS ANY KEY TO CONTINUE.": GET Z#: Z# = "4": GOTO 4150
20050 STOP
21000 POKE 34,7: HOME : PRINT TAB( 5);"YOUR INPUT FILE NAME DOES NOT EXIST ON DISKETTE. DO YOU WISH TO SEE A CATALOG LISTING OF THE DISKETTE THAT IS CURRENTLY IN THE DRIVE (Y/N)?:": POKE 34,0
21010 GET Z#: IF Z# < "Y" AND Z# > "N" THEN 21000
21020 IF Z# = "N" THEN GOTO 21050
21030 PRINT : PRINT D#"CATALOG"
21040 PRINT : PRINT TAB( 5);"PRESS ANY LETTER TO CONTINUE.": GET Z#
21050 POKE 216,0: GOTO 4000
30000 END

```

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# Atari Player/Missile Graphics Simplified

Staffan Sandberg

*You've seen the wonderful things the Atari can do with player/missile graphics, but until now you've either had to settle for slow moving wobbles or learn machine language. Here is an overlay method which is simple to use and results in extremely fast animation of up to five players.*

---

In the overlay method we will design overlays or patterns that we can place on the screen. We can create as many patterns as we want and use them as often as we want. Each overlay is eight dots wide and anything from one to 128 dots high. The overlay allows specified dots to be lit up on the screen. When we want an object to appear to be moving, we place one of the overlays on the screen by specifying its X and Y coordinates. We then give it new X and Y coordinates, and it appears to move. This process is very fast, so the object appears to move quite quickly. These overlays are totally separate from player/missile graphics. It is the combination of the overlays and player/missile graphics that allows us the freedom of movement of the overlay method.

To use overlays, just follow these steps:

**Step 1:** Decide how many players you wish to use and set aside enough memory to hold them. That is, what is the maximum number of objects you want on the screen at one time? You can have up to five. We must give each one a name and set aside 128 spaces for it because each player is potentially 128 dots high. We do this by DIMensioning the space:

```
10 DIM PM1$(128), PM2$(128), PM3$(128)
```

The DIMensioning must be the first thing the computer sees when it is turned on, so before you start programming, turn off the computer and turn it back on. This is necessary because as the computer constructs a variable table, the variables are stored in the order that they are entered. The variable table is not cleared by typing NEW. We want these variables at the beginning of the table so we can find them easily later. If they are not the first thing that the computer sees, the method

will not work.

**Step 2:** Design the overlays or patterns that you wish to use. Remember, you can create as many overlays as you wish. They are stored in strings (ALIEN\$, SHIP\$, etc.), so you must give each overlay a name and DIMension its size. When deciding the size of each overlay, keep the following questions in mind:

1. How tall do you want to make your overlay?
2. What directions do you want to move your player?
3. How fast do you want to move your players?

You don't need to worry about the width of the overlay. But you must decide how many dots high you wish to make an overlay. It can be up to 128 dots in height (an average spaceship might be six dots high). If you are going to be moving your players down the screen, you must leave blank spaces to cover up the old overlay, and you must take into account the speed at which your player will move. The speed is measured in Dots Per Move (DPM). If your players will be moving at a top speed of three DPM up and down the screen, then you need to leave three spaces above and three spaces below. To help decide the size to be DIMensioned for each overlay, use the formula:

$$\text{SIZE} = \text{height of overlay} + \text{DPM up} + \text{DPM down}$$

## SHIP\$ And ALIEN\$ Examples

In our example we will have one ship which we'll call SHIP\$, with a height of six moving up and down at the speed of five DPM, and another ship which we'll call ALIEN\$, with a height of eight moving neither up nor down.

```
20 SIZE1=16:SIZE2=8
30 DIM SHIP$(SIZE1), ALIEN$(SIZE2)
```

We also want a blank overlay that we use to erase the player from the screen quickly. We'll call this overlay CLEAR\$. It should be 128 dots high so that it can erase anything on the 128 dot high player.

40 DIM CLEAR\$(128)

Now you must create the overlays line by line. Each line or row is made up of dots or "boxes." Each box is numbered from right to left 1, 2, 4, 8, 16, 32, 64, and 128 (see Figure 1).

Figure 1.

128	64	32	16	8	4	2	1
-----	----	----	----	---	---	---	---

To create the overlays you must decide which boxes you want filled or lit up on the screen. You then add the value of each filled box for each row (see Figures 2 and 3).

Figure 2.

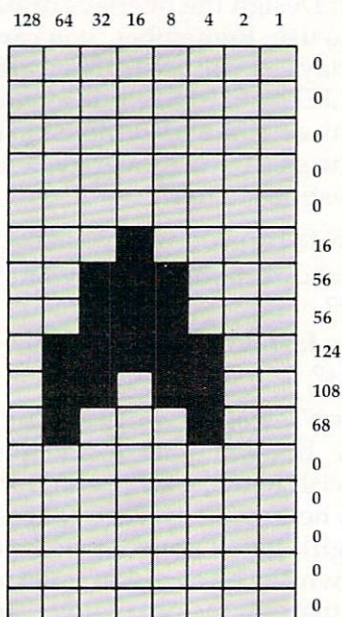
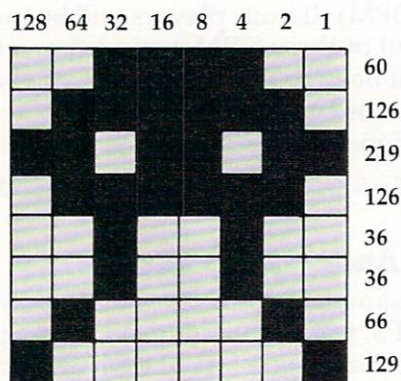


Figure 3.



Now that you have the totals for each row, you must put them in the string that you have DIMensioned for them. This is done in a short loop such as the one below.

```
50 FOR ROWS=1 TO SIZE1
60 READ DOTS
70 SHIP$(ROWS,ROWS)=CHR$(DOTS)
80 NEXT ROWS
```

```
90 DATA 0,0,0,0,0
100 DATA 16,56,56,124,108,68
110 DATA 0,0,0,0,0
120 FOR ROWS=1 TO SIZE2
130 READ DOTS
140 ALIEN$(ROWS,ROWS)=CHR$(DOTS)
150 NEXT ROWS
160 DATA 60,126,219,126,36,36,66,129
```

You need a loop for each overlay that you have.

You also need to create the blank overlay, CLEAR\$, by entering 128 blank lines into CLEAR\$.

```
170 FOR ROWS=1 TO 128
180 CLEAR$(ROWS,ROWS)=CHR$(0)
190 NEXT ROWS
```

Step 3: Tell the computer that you are going to be using Player/Missile Graphics with overlay method by entering the following lines, substituting a value for NUMBEROFPLAYERS.

```
200 A=4*(INT(PEEK(742)/4)-1)
210 POKE 54279,A
220 VSA=256*PEEK(135)+PEEK(134)
230 BOA=256*PEEK(141)+PEEK(140)
240 PM=256*A+512
250 DISP=PM-BOA
260 ADD=2
270 FOR T=1 TO NUMBEROFPLAYERS
280 PMHIGH=INT(DISP/256)
290 PMLOW=DISP-256*PMHIGH
300 POKE VSA+ADD,PMLOW
310 POKE VSA+ADD+A,PMHIGH
320 DISP=DISP+128:ADD=ADD+8
330 NEXT T
```

If you are going to have five players on the screen at one time, you must change line 240 from PM = 256 \* A + 512 to PM = 256 \* A + 384. This tells the computer to let us use the fourth missile as a player.

Step 4: Now we are ready to add the initial specifications, such as color, size and shape to the players. First, line 340 places the blank overlay on each player, clearing out any stray data.

```
340 PM1$=CLEAR$: PM2$=CLEAR$: PM3$=CLEAR$
```

Next we set the Player/Missile Graphics to double line resolution and turn on the P/M Graphics (a 3 enables them and a 0 disables them).

```
350 POKE 559,46: POKE 53277,3
```

To set the colors of the players, we must POKE the color register for each player with the proper color number. The registers go from 704 (for Player 0) through 707 (for Player 3). The fifth player takes on a combination of the colors of the other four. The colors that I have chosen are: COLOR1 is yellow, COLOR2 is white, and COLOR3 is pink.

```
360 COLOR1=25:COLOR2=11:COLOR3=74
370 POKE 704,COLOR1: POKE 705,COLOR2: POKE 706,COLOR3
```

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



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The size of the players is automatically set to normal. If you want to change the size, POKE 0 for normal, 1 for double, and 3 for quadruple size into the size register for the corresponding player. These registers go from 53256 (for Player 0) through 53259 (for Player 3).

POKE 53256,1 would make Player 0 double size.

Now we can place the player on the screen. First, we give the player an X (horizontal) value and POKE it into the horizontal position register for each player. The registers go from 53248 (for Player 0) through 53251 (for Player 3). The horizontal positions that show up on the screen range from about 50 to 200 (depending on your TV). Numbers lower than 50 and greater than 200 are to the right and left of the screen.

```
380 X1=125:X2=75:X3=175
390 POKE 53248,X1: POKE 53249,X2: POKE 53250,X3
```

Now we must give our player a Y (vertical) value and an overlay. The format is PM\$(Y value)=overlay.

```
400 Y1=150:Y2=25:Y3=25
410 PM1$(Y1)=SHIP$: PM2$(Y2)=ALIEN$: PM3$(Y3)=ALIEN$
```

To move the player around the screen, change the X and/or the Y value and repeat steps 390 and 410. Be sure not to change the X value more than the maximum DPM that you decided earlier. If you do, you will leave parts of the overlay on the screen.

## Program 1. Player/Missile Graphics Example 1

```
5 REM PMSAMPLE1
10 DIM PM1$(128),PM2$(128),PM3$(128)
20 SIZE1=16:SIZE2=8
30 DIM SHIP$(SIZE1),ALIEN$(SIZE2)
40 DIM CLEAR$(128)
50 FOR ROWS=1 TO SIZE1
60 READ DOTS
70 SHIP$(ROWS,ROWS)=CHR$(DOTS)
80 NEXT ROWS
90 DATA 0,0,0,0,0
100 DATA 16,56,56,124,108,68
110 DATA 0,0,0,0,0
120 FOR ROWS=1 TO SIZE2
130 READ DOTS
140 ALIEN$(ROWS,ROWS)=CHR$(DOTS)
150 NEXT ROWS
160 DATA 60,126,219,126,36,36,66,129
170 FOR ROWS=1 TO 128
180 CLEAR$(ROWS,ROWS)=CHR$(0)
190 NEXT ROWS
200 A=4*(INT(PEEK(742)/4)-1)
210 POKE 54279,A
220 VSA=256*PEEK(135)+PEEK(134)
230 BOA=256*PEEK(141)+PEEK(140)
240 PM=256*A+512
250 DISP=PM-BOA
260 ADD=2
```

```
270 FOR T=1 TO 3
280 PMHIGH=INT(DISP/256)
290 PMLOW=DISP-256*PMHIGH
300 POKE VSA+ADD,PMLOW
310 POKE VSA+ADD+1,PMHIGH
320 DISP=DISP+128:ADD=ADD+8
330 NEXT T
340 PM1%=CLEAR$:PM2%=CLEAR$:PM3%=CLEAR$
350 POKE 559,46:POKE 53277,3
360 COLR1=25:COLR2=11:COLR3=74
370 POKE 704,COLR1:POKE 705,COLR2:POKE 706,COLR3
380 X1=125:X2=75:X3=175
390 POKE 53248,X1:POKE 53249,X2:POKE 53250,X3
400 Y1=75:Y2=25:Y3=25
410 PM1$(Y1)=SHIP$:PM2$(Y2)=ALIEN$:PM3$(Y3)=ALIEN$
420 IF STICK(0)<8 THEN X1=X1+3
430 IF STICK(0)>8 AND STICK(0)<13 THEN X1=X1-3
440 IF STICK(0)=14 THEN Y1=Y1-3
450 IF STICK(0)=13 THEN Y1=Y1+3
460 POKE 53248,X1:PM1$(Y1)=SHIP$
470 IF STICK(1)<8 THEN X2=X2+2
480 IF STICK(1)>8 AND STICK(1)<13 THEN X2=X2-2
490 POKE 53249,X2
500 IF STICK(2)<8 THEN X3=X3+2
510 IF STICK(2)>8 AND STICK(2)<13 THEN X3=X3-2
520 POKE 53250,X3
530 GOTO 420
```

## Program 2. Player/Missile Graphics Example 2

```
5 REM PMSAMPLE2
10 DIM PM$(128)
20 DIM SHIP$(16),CLEAR$(128)
30 FOR ROW=1 TO 16
40 READ DOTS
50 SHIP$(ROW,ROW)=CHR$(DOTS)
60 NEXT ROW
70 DATA 0,0,0,0,0
80 DATA 16,56,56,124,108,68
90 DATA 0,0,0,0,0
100 FOR ROW=1 TO 128
110 CLEAR$(ROW,ROW)=CHR$(0)
120 NEXT ROW
130 A=4*(INT(PEEK(742)/4)-1)
140 POKE 54279,A
150 VSA=256*PEEK(135)+PEEK(134)
160 BOA=256*PEEK(141)+PEEK(140)
170 PM=256*A+512
180 DISP=PM-BOA
190 ADD=2
200 FOR T=1 TO 1
210 PMHIGH=INT(DISP/256)
220 PMLOW=DISP-256*PMHIGH
230 POKE VSA+ADD,PMLOW
240 POKE VSA+ADD+1,PMHIGH
250 DISP=DISP+128:ADD=ADD+8
260 NEXT T
270 PM%=CLEAR$
280 POKE 559,46:POKE 53277,3
290 POKE 704,12
300 POKE 53248,50
310 PM$(10)=SHIP$
320 N=1
330 FOR X=60 TO 190 STEP N
```



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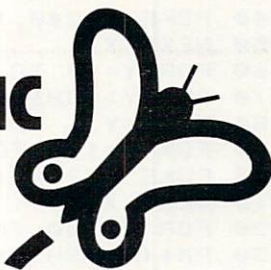
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```

340 POKE 53248,X
350 NEXT X
360 FOR Y=10 TO 100 STEP N
370 PM$(Y)=SHIP$
380 NEXT Y
390 FOR X=190 TO 60 STEP -N
400 POKE 53248,X
410 NEXT X
420 FOR Y=100 TO 10 STEP -N
430 PM$(Y)=SHIP$
440 NEXT Y
450 N=N+0.1
460 IF N>5 THEN N=1
470 GOTO 330

```

©

Beginners: see the special program typing instructions on page 144.

# Slow List On The VIC-20

Ken Bowd

*Watching a listing fly by faster than you can read it can be a frustrating experience. Here's a simple way to get control of your VIC's speed and slow down, stop, or speed up the LIST command.*

When you don't have a printer, editing a program can sometimes require special techniques. As you LIST, the program flows past faster than you can follow it. Even under CTRL, it is sometimes difficult. There are machine language programs that allow you to slow LIST down, but there is an easier and shorter answer for the VIC owner. The key is memory location 37879.

As complete as the *VIC-20 Programmer's Manual* is, it does not document this location. Whatever its exact function, there is a definite connection between its value and the rate at which the system clock keeps time. The clock can be caused to run faster or slower than realtime. For instance, you can increase or decrease the handicap on timed games with as few as seven keystrokes.

To give you an idea of what can be done, a POKE of 0 here will cause the clock to run 60 times faster than realtime. Conversely, if you POKE 37879,255, the clock will be keeping time at about 25% of realtime. The normal value of this location is 64.

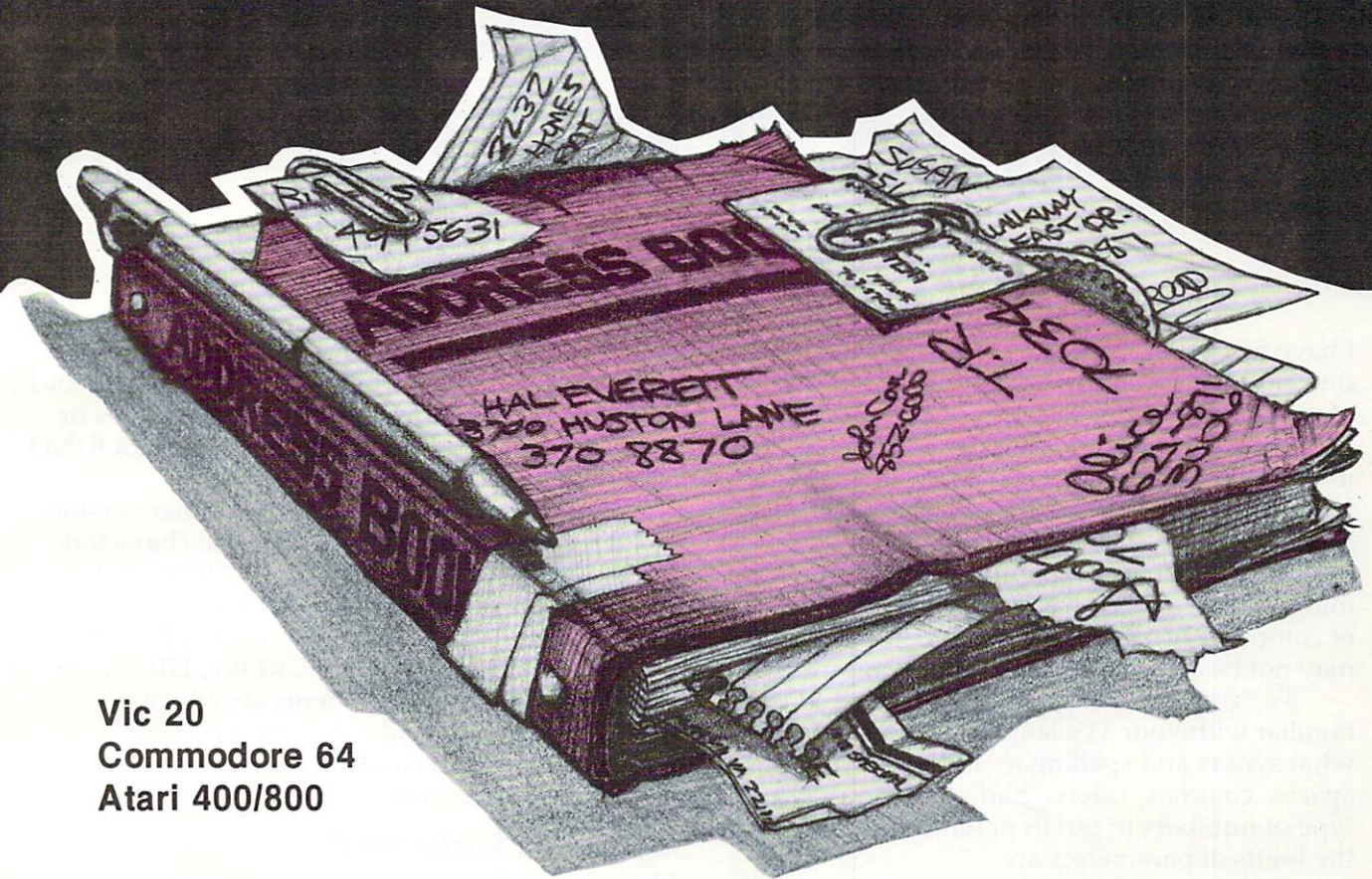
Probably the most beneficial effect of this location is its influence on the LIST command. If a POKE 37879,0 is entered and a list is then requested, you will have much better control. If you hold SHIFT down while listing, the VIC will list one line every one and one-half seconds. Holding CTRL down as well will cause the list to stop. You can still stop the list with RUN/STOP and edit as usual. Values greater than zero will gradually speed up the list.

If you have a Super Expander cartridge plugged in and location 37879 POKEd to zero, the DRAW, COLOR, etc., commands will execute very slowly when CTRL is held down. This feature may be useful in game programming.

There are, however, side effects. The blink rate of the cursor increases as location 37879 is POKEd lower. Since the speed of the cursor movement around the screen also is linked to this location, putting the cursor where you want it can be tricky.

By the way, it is interesting to note that if you PEEK 37879, a value of zero is often returned. This will often occur after a RUN/STOP RESTORE. The clock will be running at realtime. If you enter POKE 37879,0, the cursor will begin flashing rapidly. We haven't changed location 37879, but the VIC responds by keeping time much faster. ©

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# PROGRAMMING THE TI

C. Regena

## Translating Programs Into TI BASIC

I have had several requests to explain how to translate a BASIC program from another brand of microcomputer to TI BASIC. For example, you may see a program that fits your needs, but it's written for the Apple, or Atari, or TRS 80. How can you rewrite it so that it works on your TI-99/4A?

All the main microcomputers use a programming language called BASIC. However, each brand of computer has its own form of BASIC which may not be compatible with other computers.

To "convert" programs, you first need to be familiar with your TI's language idiosyncrasies: what syntax and spelling to use; where to put spaces, commas, colons, and semicolons; what type of numbers to put in parentheses; and what the limits of parameters are.

The command module for TI Extended BASIC makes conversion easier because Extended BASIC increases programming power by allowing multi-statement lines, PRINT AT or DISPLAY AT features, and more versatile IF-THEN-ELSE logic. This column, however, concerns conversions to the built-in console TI BASIC.

You cannot load a program from cassette or diskette from another brand of microcomputer to your own. In general, the *baud rates* (the rates at which information is transferred from one place to another) are different, and each computer has special character codes which may not be recognized by another computer. Graphics are especially machine-specific.

### Games With Graphics And Sound

Action games are probably the most challenging programs to translate because they use graphics and sound. You could run the program on the computer for which it was written (to see what it looks like) and then write your own TI graphics. It's really easier to design your own graphics and

sound than to try to convert line by line. If you see a command in another program with the word SOUND or PLAY, the command is for noises or music; and TI BASIC will require a CALL SOUND statement.

Typical graphics statements in other versions of BASIC contain PRINT with special characters in quotes, or such words as LINE, DRAWTO, HLINE, VLINE, CIRCLE, PAINT, COLOR, SET-COLOR, SET, PSET, RESET, PRESET, INVERSE, GRAPHICS, GR, PMODE, SCREEN, DRAW, or PLOT. Many POKE statements also display graphics or play sounds. Also numbers for graphics commands may be contained in DATA and READ statements.

### Common Statements

Many general-purpose programs can be easily converted from a printed listing for another brand of computer. Below are examples of common statements and the translations. The left column contains examples you may see in listings for other computers. The right column gives the TI BASIC equivalent.

Other computers that allow multi-statements often use a colon to separate commands. For the TI simply separate the statements with new line numbers. If there are any branching statements, be especially careful of proper logic and program flow.

100 X=1:Y=1:Z=2	100 X=1
110 PRINT Y:GOTO 400	102 Y=1
	104 Z=2
	110 PRINT Y
	112 GOTO 400

Spaces which are required in TI BASIC may be omitted in other versions of BASIC:

200FORX=1TO5:PRINTX: NEXTX	200 FOR X=1 TO 5
	202 PRINT X
	204 NEXT X



A NEXT statement requires the name of the loop variable, and NEXT statements may not be combined.

```
200 FOR D = 1 TO 500:NEXT 200 FOR D = 1 TO 500
202 NEXT D
300 FOR I = 1 TO 10 300 FOR I = 1 TO 10
310 PRINT I 310 PRINT I
320 FOR J = 1 TO 100:NEXT J,I 320 FOR J = 1 TO 100
322 NEXT J
324 NEXT I
```

Some computers have special function keys to clear the screen, or they may use the command CLS.

```
100 PRINT {CLEAR} 100 CALL CLEAR
100 CLS
```

CLS with a number following the command clears the screen with a certain color number. TI BASIC can use CALL CLEAR then CALL SCREEN(C) for the color C.

INPUT statements in TI BASIC may have a prompt which is followed by a colon. Other computers may use a semicolon or a comma.

```
200 PRINT "NUMBER?"; 200 INPUT "NUMBER?":N
210 INPUT N
300 INPUT "ENTER 300 INPUT "ENTER
COST";C COST":C
```

TI BASIC allows colons in the PRINT statements to indicate blank lines or to start a new line.

```
200 PRINT:PRINT:PRINT X 200 PRINT ::X
300 PRINT "JOHN":PRINT 300 PRINT "JOHN":"JACK"
"JACK"
400 FOR L = 1 TO 5 400 PRINT :::::
410 PRINT
420 NEXT L
```

An IF statement must contain a line number rather than a command after THEN or ELSE. Some computers do not have the ELSE option, but in your translations you may notice it would be appropriate to use an ELSE.

```
200 IF X = 20 THEN X = 1 200 IF X <> 20 THEN 210
210 PRINT X 202 X = 1
210 PRINT X
300 IF A = B THEN C = 1: 300 IF A <> B THEN 310
GOTO 100
310 A = A + 1 302 C = 1
304 GOTO 100
310 A = A + 1
400 IF N < 10 THEN N = 400 IF N >= 10 THEN 600
N + 1:GOTO 100
410 GOTO 600 402 N = N + 1
404 GOTO 100
500 IF I > J THEN 250 500 IF I > J THEN 250 ELSE 700
510 GOTO 700
```

Random numbers may be generated in a variety of ways. The TI BASIC command RND yields a decimal from 0 to 1 (which may then be multiplied by another number). The INT command is used to get random integer numbers (whole numbers). For example, INT(10\*RND) yields a random

number from 0 to 9, so INT(10\*RND) + 1 or INT(10\*RND + 1) will give a random number from 1 to 10. INT(5\*RND) + 10 will give a random integer from 10 to 14 - 10, 11, 12, 13, or 14.

TI BASIC also has the command RANDOMIZE to mix up the random selection. Other computers may not have this function or may use the words RANDOM or RAND.

To get a random number from 1 to 6, the following statements are equivalent.

VIC-20	X = INT(6*RND(0)) + 1
TRS-80 CC	X = RND(6)
Apple	X = RND(6) + 1
Atari	X = INT(6*RND(1)) + 1
TI	X = INT(6*RND) + 1

GET and INKEY\$ check to see which key has been pressed on the keyboard for a single key-stroke answer. Some computers may "buffer" several keys. The equivalent TI statement is CALL KEY.

```
200 GET A$:IF A$ = "" 200 CALL KEY (0,K,S)
THEN 200
210 IF A$ = "Y" THEN 300 210 IF K = 89 THEN 300
220 IF A$ = "N" THEN END 220 IF K < > 78 THEN 200
ELSE 200 230 END
```

```
200 A$ = INKEY$:IF A$ = "" THEN 200
210 IF A$ = "Y" THEN 300
220 IF A$ = "N" THEN END
230 GOTO 200
```

## How Variables Vary

String variables are handled differently in different computers, so it helps to know what the other computer is doing to be able to convert to the TI. For example, the Atari requires a DIMension statement for the string length. The TI uses a DIMension statement when the string is in an array. The TRS-80 Color Computer may have a statement such as PCLEAR 2000 to clear more memory for strings.

LEN(A\$) returns the length of the string variable A\$. Some computers give the length of the null string, "", as 1, but the TI says the length is zero.

To combine strings in TI BASIC, use the ampersand symbol.

```
200 D$ = A$ + B$ + "XYZ" 200 D$ = A$&B$&"XYZ"
```

LEFT\$, MID\$, and RIGHT\$ are functions that refer to part of the string. The TI BASIC equivalent function is SEG\$.

200 B\$ = LEFT\$(A\$,5)	200 B\$ = SEG\$(A\$,1,5)
(Left five characters of A\$ starting with the first character)	
210 C\$ = MID\$(A\$,7,3)	210 C\$ = SEG\$(A\$,7,3)
(Three characters of A\$ starting with the 7th character)	
220 D\$ = RIGHT\$(A\$,2)	220 D\$ = SEG\$(A\$,LEN(A\$)-1,2)
(Right or last two characters of A\$)	
230 E\$ = RIGHT\$(A\$,R)	230 E\$ = SEG\$(A\$,LEN(A\$)-R+1,R)
(Right R characters of A\$)	

The PRINT AT or PRINT @ statement is another statement you may wish to convert. The PRINT AT statement is followed by one or two numbers which indicate a position on the screen to begin printing. There are two main ways to write this procedure in TI BASIC.

```
200 PRINT TAB(COL);"HELLO".....
      (where the colons scroll the printing up to the
      proper row.)
```

To print without scrolling:

```
200 MS = "MESSAGE"
210 FOR I = 1 TO LEN(MS)
220 CALL HCHAR(ROW,COL-1+I,ASC(SEGS
      (MS,I,1)))
230 NEXT I
```

Lines 210-230 graphically place one letter at a time for the length of the message on the screen.

Several microcomputers distinguish between integers (whole numbers) and floating point numbers (numbers which may contain a decimal). Often the symbol % is used to designate an integer in a variable name (as in B%). This is similar to the way we use \$ to designate a string variable such as \$\$\$. In TI BASIC all numbers are able to contain a decimal (they are floating point numbers). TI BASIC programmers also do not need to worry about single precision and double precision designations.

A function you may see in other listings is FIX. FIX(N) is the same as INT(N) which returns the integer or whole number portion of a number N.

Two symbols you may see in listings are "tokens" or abbreviations: ? (question mark) is the abbreviation for the word PRINT, and ' (apostrophe) is the abbreviation for REM or REMARK.

You may also need to adjust DATA and READ statements because TI BASIC contains the command RESTORE. Other computers might not have it. RESTORE means to start at the beginning of the data list with the next READ statement. You may also RESTORE data beginning with a certain line number. RESTORE 430 indicates that the next READ statement should start with the first data item in line 430. ©

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# VIC, 64, And PET Supermon Questions And Answers

Jim Butterfield, Associate Editor

Several questions are frequently asked about Supermon, the machine language monitor program published in various versions for Commodore computers in past **COMPUTE!** issues. Some are general, but a number of these questions refer specifically to Supermon64 (**COMPUTE!**, January 1983).

**Q** How does Supermon compare to other monitor systems: say, VICmon, Extramon, Micromon, etc.?

**A** Many of the other monitor packages are more powerful than Supermon, having extra commands. Supermon is particularly good for beginners, because:

- it self-relocates, making it easy to load into various configurations of machines;
- it doesn't alter normal interrupt sequences (except, to a limited extent, where Single Step is implemented).

But many experienced users move along to other packages which have features that they like.

**Q** Where does Supermon fit into memory?

**A** The program called Supermon on disk or tape is not Supermon itself: it's a building program which constructs the "live" Supermon at top-of-memory.

When you load Supermon, you load the building program into the same area normally occupied by BASIC. When you say RUN, an operating version of Supermon is constructed and sealed off so that it won't be disturbed. This version of Supermon normally stays put until you turn off the power.

If you return to BASIC (using the .X command), you should not go back to Supermon by saying RUN – that would build a second working copy of Supermon. In fact, it's best to say NEW the moment you return to BASIC to avoid the chance of this happening.

**Q** How do I get back to Supermon, then?

**A** On VIC and Commodore 64, type: SYS 8. On

CBM/PET computers, except for original ROM units, type: SYS 4. On original ROM PETs, type SYS 1024.

**Q** If SYS 8 gets me to Supermon, does that mean that Supermon is located at address 8?

**A** No. At the appropriate address (8, 4, or 1024), you'll find a zero. Now, zero corresponds to the command BRK (Break). And with Supermon implanted, this command may be taken to read: "Go directly to Supermon. Do not pass GO."

Thus, the zero or Break command "finds" Supermon and takes you there. This is a handy feature. When you are writing a machine language program, you can end a piece of coding with BRK; when you run the program, it will stop at that point and go to the monitor.

**Q** I tried to disassemble Supermon, using its built-in disassembler, but it didn't look sensible. Am I missing something?

**A** Don't try to disassemble the "builder" version of Supermon – it's not a finished machine language program since it contains both program and "relocation" information. Look instead at the completed version. In a normal Commodore 64, for example, the finished Supermon will start at hexadecimal address 97ED. In other machines, it's usually easiest to find by looking at the BASIC top-of-memory pointer (hex 34 and 35 on PET/CBM, hex 37 and 38 on VIC and 64). Supermon starts at the address indicated.

Don't forget that, like any other machine language program, Supermon contains both instructions and data, and you can't meaningfully disassemble data. It's especially difficult with things like mnemonics such as LDX where the three characters are packed into two bytes. For example, values 1C and D8 contain, in packed form, the three letters of the mnemonic BRK – if you can figure it out.

**Q** I don't like the screen colors of Supermon64. What can I do about them?

**A** Sorry about that. For lecturing purposes, I

picked black and white so that students could see what I was typing and what the computer typed. It looks OK on my monitor, but several others have complained.

An easy way to improve visibility is to change the background color to grey. POKE 53281,12 produces a color combination that many users like. Try values other than 12 if this doesn't suit you.

If you want more control, you can go to where Supermon sets the colors and change the code as you like. You may find these locations with the Hunt command. Try searching the relocated Supermon for the color change to white with:

```
.H 97ED 9FFF A9 05 20 D2 FF
```

You should find one occurrence. Change the 05 (ASCII code for "white") to another color, or perhaps to 01 for no color change.

There are a lot more changes to black. Hunt for them with:

```
.H 97ED 9FFF A9 90 20 D2 FF
```

You'll find a dozen. You may change each 90 ("black") to the color of your choice or to no change. Each color change, by the way, is associated with a particular display function, so if you want memory displays in green and disassemblies in black, try various combinations.

To make permanent changes, you'll need to change the Supermon builder program. In this case, do your hunts in the BASIC area, e.g.,

```
.H 0800 11EA ....
```

**Q** Command .P doesn't send to the printer. Why?

**A** This command generates a format suitable for sending to the printer. You must hook in the printer with a BASIC command before calling in Supermon:

```
OPEN 4,4:CMD 4:SYS 8
```

(or SYS 4 as your system needs). The same technique can be used to send monitor output to disk. By the way, CBM BASIC 4.0 won't allow you to use SYS 4 if you want to hook in a printer or other output device: you must "Call" the monitor with SYS 54386 to keep the printer connected.

When you're finished with the printer, type .X to return to BASIC, and then:

```
PRINT#4:CLOSE 4
```

**Q** I want to put Supermon somewhere else, not in the top of memory where it normally goes. How?

**A** Just change the top-of-memory pointer (decimal 52 and 53 in the PET, decimal 55 and 56 in the VIC or 64) to where you want the top-of-Supermon to go, and run the Supermon builder program. Then, if it's necessary, put the top-of-memory pointer back to wherever you want it.

**Q** Why don't you print an assembly listing of Supermon64 so we can see how it works?

**A** The uncommented listing runs for 16 pages. With comments and explanations, it would go at least 30 or 40 pages. That's a lot of space, and it's not clear that there is sufficient interest in this rather specialized program to make publication desirable.

**Q** When I do a .D disassembly, why does the cursor end up on the last line instead of on the line below?

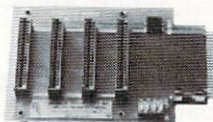
**A** So that you can type D, Return, and get a continuation of the disassembly. If you don't want to continue, give a cursor down before your next command.

**Q** Supermon64 doesn't have single step. Right?

**A** Right. Things get delicate when a user wants to play with the interrupt facility. It seemed to me that the system would be cleaner without the .I command used in previous versions of Supermon.

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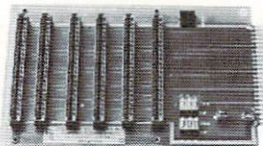
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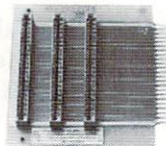
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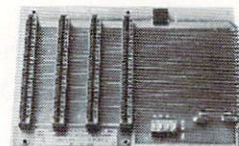
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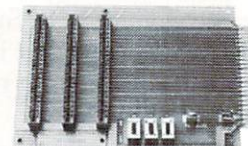
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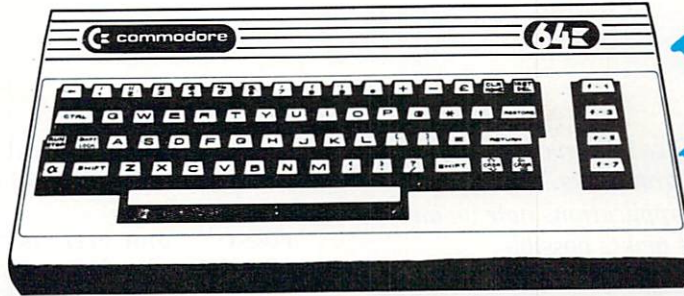
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# An Interesting Fragment Of Code

Chris Crawford

*This fascinating byte-folding idea has several potential uses for machine language programmers. If you find it obscure, however, try out the applications note on an Atari to see one of the effects it makes possible.*

Three years ago, a programmer showed me a fragment of code and challenged me to figure out what it did. After a great deal of head-scratching and paper-scribbling, I had to admit that I couldn't figure out what it did. The confusing code was:

```
LDA FIRST
EOR SECOND
AND SELECT
EOR SECOND
STA RESULT
```

This is a very tricky and obscure piece of code. Loosely speaking, it takes the two bytes FIRST and SECOND and folds parts of them together into a single byte, RESULT. More precisely, it takes the individual bits from the two bytes and puts them together into a new byte. The bits in SELECT control this process. In general, bit DX of RESULT will be equal to bit DX of FIRST if bit DX of SELECT is equal to 1; if bit DX of SELECT is equal to 0, then bit DX of RESULT will be equal to bit DX of SECOND. For example, if SELECT is 0, RESULT will be the same as SECOND; if SELECT is \$FF, RESULT will be the same as FIRST. If SELECT is \$F0, then the high nybble (highest four bits) of RESULT will be the high nybble of FIRST, and the low nybble of RESULT will be the low nybble of SECOND. Let's work out an example:

```
FIRST: 01010111 ($57)
SECOND: 10101101 ($AD)
SELECT: 11110000 ($F0)
```

INSTRUCTION	ACCUMULATOR
LDA FIRST	01010111 (\$57)
EOR SECOND	11111010 (\$FA)
AND SELECT	11110000 (\$F0)
EOR SECOND	01011101 (\$5D)
STA RESULT	01011101 (\$5D)

The output of this code makes more sense when the bits are grouped suggestively:

```
FIRST: 0101 0111 ($57)
SECOND: 1010 1101 ($AD)
SELECT: 1111 0000 ($F0)
RESULT: 0101 1101 ($5D)
```

The pattern should be obvious. The upper four bits come from FIRST, the lower four bits come from SECOND.

## Using A Byte Mixmaster

This may all seem rather confusing and pointless to you. Why would anybody want to mix together a bunch of bits? What good is a mixmaster for bytes? As it happens, this code fragment has a number of uses, and makes some very interesting graphics effects possible.

The simplest application for this code is for nondestructive bit-packing. In most assembly language programs, each byte represents a single quantity. This makes it easier for us to keep things straight. For example, consider the idea of giving orders to an army in a game like *Eastern Front 1941*. An army can move in only one of four directions: up, down, right, and left. It therefore takes only two bits to represent a single order. If we store one order in each byte, it will waste six bits. Now, if we are storing only one order, the waste of six bits is not significant. But *Eastern Front 1941* allows eight orders per unit and up to 160 units. That amounts to 1280 possible orders. At one byte per order, it would cost 1280 bytes to store all that information, when only 2560 bits, or 320 bytes, are truly needed. Thus, 960 bytes would have been wasted in a 16K program. Tsk, tsk, we can't have that.

The solution is bit-packing. We pack four independent orders into a single byte. The trick to bit-packing lies in changing some of the bits without disturbing the other bits. That's where our magic code comes in. It can fold a pair of bits into a byte without disturbing the rest of the byte.

# COMPUTE!'s Mapping The Atari

**Author:** Ian Chadwick  
(Introduction by Bill Wilkinson)  
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The inner workings of today's advanced personal computers unfortunately remain a mystery to many users. From beginners to machine language programmers, people are hungry for vital information about the insides of their machines. For example, there are tens of thousands of memory locations...which are safe to use? How can changing one number in a certain memory cell dramatically speed up output to the disk drive? Which memory address reveals what Operating System is in the computer? How can changing certain numbers in various memory locations improve a program's sound and graphics?

The key to finding one's way around the inside of a computer is a memory map. But often this important information is unavailable from the manufacturer. Or it can be obtained only in piecemeal fashion from scattered sources.

Now, for the first time, there is a comprehensive guidebook available for the Atari 400/800 computers which answers all of these questions, and hundreds more. *Mapping The Atari*, by Ian Chadwick, is a complete reference guide and memory map for one of the most popular of personal computers. From memory location zero to 65,535, *Mapping The Atari* is the most exhaustive memory sourcebook ever offered to Atari users.

Chadwick started by diligently assembling all the information he could find. Then he went a step further by testing this information, to verify its accuracy. And finally, he added months of his own research, delving deep into little-known areas of the Atari's memory to explore every secret. The result, *Mapping The Atari*, is an indispensable reference work for Atari programmers.

But *Mapping The Atari* is more than just a comprehensive reference book. It is also a tutorial for all inquisitive Atari enthusiasts – not just advanced programmers. *Mapping The Atari* explains each memory location in depth for beginning and intermediate programmers. Some descriptions of important locations fill several pages. And the book is packed with ready-to-type example programs and routines which show exactly how to put the information to work.

There's more. A special introduction by Bill Wilkinson, an author of Atari BASIC and the Atari Disk Operating System, explains how to access the Atari's memory in every available programming language. And there are ten appendices, covering such topics as "VBLANK Processes," "Atari Timing Values," "Color," "Sound And Music," "Player/Missile Graphics Memory Map," "Display Lists," and others. And to make the book still more useful, there are two indices – an Index By Label, and an Index By Subject.

Best of all, *Mapping The Atari* is from **COMPUTE! Books**, associated with **COMPUTE!** Magazine, the leading consumer publication of home, educational, and recreational computing. **COMPUTE!** has led the way for Atari owners since the computers were first introduced in 1979. In the **COMPUTE!** tradition, *Mapping The Atari* is carefully written and edited to be useful to beginners and experts alike. And it is spiral-bound to lie flat while typing programs.

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Here's an example: suppose that we have an order (only two bits) in the accumulator. The order is right-justified; that is, the two critical bits are in the lowest order position in the byte. Another way of saying this is that the accumulator contains a number between zero and three. Suppose also that the X register contains the order sequence number; that is, it tells whether this is the first order in the final byte, the second, the third, or the fourth. Thus, the X register contains a number between one and four. Finally, suppose that the bit-packed byte is labelled ORDER. The code to do the trick is:

```

MASK   DB   3,$C,$30,$C0
        LDY  #0
LOOP   DEX
        BEQ  FOLDIN
        ASL  A
        ASL  A
        INY
        BNE  LOOP
FOLDIN EOR  ORDER
        AND  MASK,Y
        EOR  ORDER
        STA  ORDER

```

## Safe Graphics Animation

You may still wonder what makes this code so useful. After all, seldom do you need to work so hard to save bytes. There are still more uses of this code fragment. One of the most common uses of this code is for graphics. Suppose you have a bit-mapped display and desire to move a number of objects around the screen without disturbing the background. If you had player/missile graphics, you would simply use them directly. However, let us say that for some reason you cannot use player/missile graphics. Perhaps you are stuck with a primitive machine lacking such a facility. Perhaps you need to move so many objects that player/missile graphics are insufficient. In such a case, our magic code fragment is just the ticket for your problem. With it you can go into a bit map and modify only the bits you need to change without disturbing the other bits of the map. This is essential if you are to move objects around on the screen without disturbing the background.

The basic idea behind this code can be extended to entire chunks of a bit map. Instead of merely mixing together the bits in single bytes, we can mix together the bits in two different bit-maps. Thus, if we have two source bit maps, suggestively labeled FIRST and SECOND, we can write a loop that will perform this fragment of code on every single pair of bytes in the two source bit maps to produce a final bit map that reflects both source maps. The degree to which one or the other source map appears in our final map depends on the value of SELECT. If SELECT is equal to zero, then only the second map will ap-

pear. If SELECT is \$FF, then only the first map will appear. If SELECT is some other value, then we will see portions of both bit maps mixed together. If we use a random number for SELECT each time we process a byte, we will get a random mix of the two maps. If we then repeat the process of mixing the two many times in one second, the viewer will see a rather intriguing flickering display of the two bit maps enfolded together.

We can extend the idea even further. If we now use a random number generating routine that allows us to specify the average number of bits that will be set in the random number used for SELECT, we can then control the degree to which we see either the first or the second bit map. For example, if we use random numbers with an average of six bits set, we shall see mostly the first bit map with only a faint image of the second superimposed. If we then create a routine that starts off using an average of zero bits set and then increases the average number of bits set in sequence until finally all eight bits are set, we will see on the screen a dissolve from the second image to the first.

This technique can be extended further by chaining together enfolding fragments in sequence. Thus, if we enfold FIRST with SECOND to get RESULT, we can then enfold RESULT with THIRD to get a new result. This allows us to mix three images together, an impressive trick that has little utility. It is of some value in improving the overall visual impact of the dissolve algorithm. If the third image is a random bit map, the transition during the dissolve will look a little less mechanical. Unfortunately, it will run more slowly.

There is a more important conclusion we can draw from this little adventure with five lines of assembly code. The moral of the story is that imagination is often more important in programming than technical prowess. I understood this code fragment at the technical level for a long time, but I did not realize its potential until recently. I wonder how many more programming jewels like this one are out there, waiting to be uncovered by imagination, wit, or, as in my own case, dumb luck?

## Fragment For Atari 400/800

```

100 REM DEMO FOR ENFOLD.OBJ
110 REM
120 DIM SDLIST(5)
130 OPEN #1,4,0,"K:"
140 P=PEEK(106)
150 FOR I=0 TO 2
160 POKE 106,P-I*8
170 GRAPHICS 4+16
180 SDLIST(I*2)=PEEK(560):SDLIST(I*2
+1)=PEEK(561)
190 NEXT I:POKE 106,P:GOSUB 390:REM
READ IN ML ROUTINE
200 CURR=0:X=0:Y=0:COLOUR=1

```





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```

210 POKE 560,SDLIST(CURR*2):POKE 561
,SDLIST(CURR*2+1)
220 DL=PEEK(560)+256*PEEK(561)+4:POK
E 88,PEEK(DL):POKE 89,PEEK(DL+1)
230 IF PEEK(53279)=5 THEN CURR=1-CUR
R:GOTO 210
240 IF PEEK(53279)=3 THEN 310
250 IF PEEK(764)<255 THEN GET #1,A:C
OLOUR=A-48*(A>48)
260 S=STICK(0):LOCATE X,Y,Z:COLOR 1+
(Z=1):PLOT X,Y:COLOR COLOUR:PLOT
X,Y
270 NX=X+(S>4 AND S<8)*(X<79)-(S>8 A
ND S<12)*(X>0)
280 NY=Y+(S=5 OR S=13 OR S=9)*(Y<23)
-(S=6 OR S=10 OR S=14)*(Y>0)
290 IF STRIG(0) THEN COLOR Z:PLOT X,Y

```

```

300 X=NX:Y=NY:GOTO 230
310 FIRST=SDLIST(0)+SDLIST(1)*256:FI
RST=PEEK(FIRST+4)+256*PEEK(FIRST
+5)
320 SECOND=SDLIST(2)+SDLIST(3)*256:S
ECOND=PEEK(SECOND+4)+256*PEEK(SE
COND+5)
330 RESULT=SDLIST(4)+SDLIST(5)*256:R
ESULT=PEEK(RESULT+4)+256*PEEK(RE
SULT+5)
340 POKE 560,SDLIST(4):POKE 561,SDLI
ST(5)
350 FOR I=0 TO 255
360 A=USR(1536,FIRST,SECOND,RESULT,I
)
370 NEXT I
380 GET #1,A:GOTO 210
390 FOR I=0 TO 40:READ A:POKE 1536+I
,A:NEXT I:RETURN
400 DATA 104,104,133,204,104,133
410 DATA 203,104,133,206,104,133
420 DATA 205,104,133,208,104,133
430 DATA 207,104,104,133,209,160
440 DATA 0,177,203,81,205,37
450 DATA 209,81,205,145,207,200
460 DATA 192,240,208,241,96

```

## Atari Applications Note

The program above illustrates the binary manipulation discussed in Chris Crawford's article. It lets you draw pictures on one of two screens with a joystick. Press FIRE to lay down points. To switch between the two screens, press SELECT (hold down SELECT for an interesting effect). You can change colors by pressing "0" (to erase) or "1" (to draw). For the purposes of the illustration, you are limited to one color and only half the normal height of GRAPHICS 4.

### A Fascinating OPTION

The page flipping and joystick doodling are only a means to an end. The interesting effect happens when you press OPTION. A machine language routine in page six combines screens one and two in various ways, displaying them on a third page which you can see.

This is not page flipping. The data (points, pixels) on one screen are combined with the data on the other by "enfolding" pairs of bytes as described by Crawford. You can pass the SELECT byte to the machine language routine. Our demonstration uses the numbers 0-255 as SELECT to roughly transform the second screen into the first.

You could change the FOR/NEXT loop to "255 to 0 STEP-1" to reverse the process. Try changing the last parameter in the USR statement for different effects. You can use random numbers, for example. Trying different numbers may help you to better understand the powerful potential of Crawford's bit enfolding technique.

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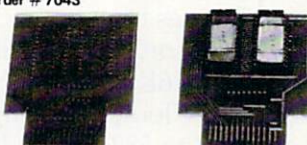
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# Commodore 64 Video— A Guided Tour

Jim Butterfield, Associate Editor

*This is the fifth installment of a seven-part series exploring the phenomenal 64 video chip and how to harness its power for your own programs. For practice, here's a step-by-step illustration of how to build a moon lander game.*

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). We looked through the video control words at 53248 to 53286 (hex D000 to D026), and then discussed video memory planning.

## First, The Craft

Here's a short program to demonstrate some of the features of the 64's video chip. We'll write a small lunar lander program.

First, let's draw the sprites for the rocket:

```
100 DATA 0,24,0,0,60,0,0,198,0,1,131,0,1,131,0,3,1,
    128,3,1,128,3,1,128
110 DATA 3,1,128,3,1,128,3,1,128,3,1,128,1,131,0,1,
    131,0,1,131,0
120 DATA 0,102,0,0,126,0,0,0,0,0,0,0,0,0,0,0,0
```

A fairly crude craft – you can improve it if you like. We have drawn the sprite into 63 bytes of memory; one more and we can continue to the next sprite.

```
130 DATA 0 :REM gap between sprites
```

## Then The Flame

Now we're going to draw the rocket flame as a separate sprite. Why? Because later, when we look for collisions, we don't care what the flame hits, just what the rocket hits. There's another reason: when we're not thrusting, we can simply turn this sprite off, and the flame disappears.

```
140 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0,0,0
150 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,66,0,0,
    36,0,0,24,0,0,24,0
```

Mostly zeros. The flame is only at the bottom of the sprite. OK, we're ready to go. Let's clear the screen and print instructions:

```
160 PRINT CHR$(147)
170 PRINT "LUNAR LANDER  JIM BUTTERFIELD"
180 PRINT
190 PRINT "PRESS 'SPACE' FOR MAIN THRUST"
200 PRINT "PRESS 'F1'    FOR LEFT THRUST"
210 PRINT "PRESS 'F7'    FOR RIGHT THRUST"
220 PRINT
230 PRINT "WATCH OUT FOR THE MINES."
240 PRINT
250 PRINT "LAND GENTLY OR YOU'LL BOUNCE!"
```

While the user is reading the instructions, we can read in the sprites and put them into slots 13 and 14. We can also set our sprite "position" addresses as variables, and identify sprites 0 and 1 as using pictures 13 and 14.

```
260 REM SET UP
270 FOR J=0 TO 126:READ X:POKE 832+J,X:NEXT J
280 X0=53248:Y0=53249:C0=53279
290 X1=53250:Y1=53251:E=53269
300 POKE 2040,13:POKE 2041,14
```

We'll make the rocket exhaust go "behind" the main screen. This way, as we land, the exhaust will go behind the background. We'll also give it color to distinguish it from the rocket ship itself (you can pick your own).

```
310 POKE 53275,2
320 POKE 53288,3 : REM THRUST COLOR
330 PRINT "READY TO START";
340 X$="Y":INPUT X$
```

Variable E is used to enable the sprites. When we're ready, we'll turn them on; for now they can stay off.

```
350 POKE E,0
360 IF X$<>"Y" AND X$<>"YES" THEN END
```

We're ready to fly. Let's put the sprite high on the left part of the screen. Then we'll draw a screen with "mines" for the player to avoid.

```
370 V=100:H=100:V0=0:H0=0
380 POKE 54296,15:POKE 54278,240
390 REM DRAW SCREEN
400 PRINTCHR$(147)
410 FOR J=1 TO 18:PRINT:NEXT J
420 FOR J=1 TO 4:FOR K=1 TO 30
430 C$="":IF RND(1)<.1 AND (K<20 OR K>25) THEN
    C$="#"
440 PRINT C$;:NEXT K:PRINT:NEXT J
450 FOR J=1 TO 30:PRINT"=";:NEXT J
```

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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					53267
D014				X	Y	53268

D016	X	X	Reset	Multi Color	Col Select	X-Scroll	53270
------	---	---	-------	-------------	------------	----------	-------

D018	VM13	Screen	VM12	VM11	VM10	Character Base	CB12	CB11	X	53272
D019	IRQ	Interrupt Sense	←	→	LP	SSC	SBC	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	→	D000	D00E	Sprite 7	→	D00E	53248
Sprite 1	→	D001	D00F	Sprite 6	→	D00F	53249
				Sprite 5	→		
				Sprite 4	→		
				Sprite 3	→		
				Sprite 2	→		
				Sprite 1	→		
				Sprite 0	→		
						X	53287
						Y	53294
						Color	53294

D027	D02E	X	Color	53287	53294
------	------	---	-------	-------	-------

D010	X-Position High	0	1	2	3	4	5	6	7	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
------	---------------------------------	-------

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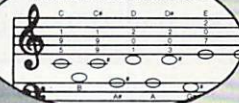
**BASIC** statements and options are documented

### BASIC STATEMENTS

**DEF FN** (name) (var)=formula  
**DIM** var(n,...n), [var(m,...m),...]  
**FOR** var=init TO limit [STEP  
variable

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38400	7680					
38422	7702					

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## Keyboard Checks

Let's place the sprite, and start the main play by checking the keyboard. We check for two different things: a new key (K\$), or an old key still being held down (K):

```
460 POKE X0,H:POKE Y0,V:POKE X1,H:POKE Y1,V
470 K=PEEK(203):GET K$
480 REM MAIN FLIGHT LOOP - TEST KEYS
490 IF K$="" GOTO 550
500 K0=ASC(K$):V1=.1:H1=0
```

Let's check for the space bar. If it's on, we want to energize the rocket, and the rocket flame. Our vertical thrust will be upwards (-.5), and we'll note that we want to enable the flame video with a note that E0=3. We'll spot lateral thrust as keys F1 and F7, and set value H1 accordingly.

```
510 E0=1:IF K0=32 THEN V1=-.5:E0=3
520 IF K0=133 THEN H1=-.2
530 IF K0=136 THEN H1=.2
540 GOTO 560
550 IF K=64 THEN V1=.1:H1=0:E0=1
```

Here's where we turn on our sprites - either rocket only (E0=1) or both rocket and flame (E0=3). As long as we're turning rockets on and off, we might as well add sound effects, too:

```
560 IF PEEK(E)=E0 GOTO 600
570 REM THRUST SOUND
580 POKE E,E0:IF E0=1 THEN POKE 54276,0:
  GOTO 600
590 POKE 54273,8:POKE 54276,129
600 IF H1=H9 GOTO 630
610 H9=H1:K=SGN(ABS(H9))*129:POKE 54273,99:
  POKE 54276,K
```

Gravity, thrust, or lateral thrust - they all involve *acceleration*. We add acceleration to our speed to get new speed; then we add speed to position to get new position.

```
620 REM LET'S MOVE IT!
630 V0=V0+V1:H0=H0+H1
```

To prevent the player going off screen, we'll invent a "field force" around the screen boundary. If you hit it, you'll bounce; that is, your speed will flip to the opposite direction. We'll fudge a bit. The "high bit" of the X position is tricky to set in BASIC; there's often a flicker during the moment that we set the low and high values. So let's limit the player's travel to the left-hand three quarters of the screen and avoid the problem.

```
640 REM FIELD FORCE BOUNDARIES
650 IF V<50 THEN V0=ABS(V0)
660 IF H<20 THEN H0=ABS(H0)
670 IF H>240 THEN H0=-ABS(H0)
680 V=V+V0:H=H+H0
```

We move the craft simply by changing its coordinates. Then we check the collision register to see if we've hit anything.

There's a problem here. It seems that collision is noted when the screen is drawn, not when you set the coordinates. BASIC isn't super fast, but it could be fast enough to miss that collision. If you

watch the program closely, you will see that the rocket sometimes "bounces" after it goes below ground level.

There's an additional contributing factor. BASIC, being slow, may need to move the rocket several pixels in distance at a time. So, rather than just touching the ground and stopping, the rocket may leap from just above the ground to well into it, if it's going quite fast.

```
690 REM MOVE CRAFT, CHECK COLLISION
700 POKE X0,H:POKE Y0,V:POKE X1,H:POKE Y1,V
710 C=PEEK(C0):IF(C AND 1)=0 GOTO 470
```

Collision says we've hit something. We can look at our height (Y position) to see if it's the ground. If not, it must be a mine.

```
720 IF V>218 GOTO 780
730 IF V+V0<218 GOTO 470
```

We could do a sensational explosion here, but we'd need to define more sprites, or modify the ones we've got. Try your hand at it if you like. For the moment, hitting a mine will cause the rocket to disappear.

```
740 REM WE SEEM TO HAVE HIT A MINE
750 PRINT CHR$(19);"CRASHED!":POKE E,0
760 GOTO 820
```

## Bounce And Overshoot

I arbitrarily decided to make the craft bounce if it hits too fast. If you'd rather crash, go ahead. See the previous note.

```
770 REM HIT THE DECK ... TOO FAST?
780 IF V0>1 OR V0<0 THEN V0=-ABS(V0):GOTO 470
790 PRINT CHR$(19);"LANDED!":POKE E,1
```

Because we may "overshoot" the ground and dig a little hole, we'll reset the vertical position of a successfully landed rocket to look neat. Then we wind up the game, or play another one.

```
800 POKE Y0,219
810 REM ALL DONE - SHUT DOWN
820 POKE 54276,0:POKE 54296,0
830 PRINT "WANT TO TRY AGAIN";
840 GOTO 340
```

There are many features you can add - such as a fuel supply.

We could have done a pretty background in high resolution graphics, but this would make it difficult to add features (if you wish) like meter readouts. In fact, I've used very dull graphics, but you may consider that a challenge.

That's it. We've done a simple sprite exercise. It's really not hard, even in BASIC. In machine language, it's almost too easy; you'll find that you need to slow your program down, or everything will happen too fast.

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# Easy VIC Machine Language Saves

Poul Christensen

*The VIC and other Commodore machines allow you to place machine language routines next to your BASIC program. Once you know how, the method is simple and makes your program shorter and easier to load. This method is demonstrated with a simple example and a step-by-step description.*

When you write in BASIC on your VIC, you will sometimes find that the resulting program isn't fast enough. With imagination and rewriting you can often make it faster, but sooner or later you may reach the point when only machine language will help.

Where do you place the machine code, and how do you load it in with its BASIC program as a single entity?

## Placing And Loading

The most common method is to choose some unused area such as the tape buffers or the memory below the screen image. Of course, you cannot put your coding there directly, so you must write your machine code in DATA statements and include a routine to read your data and POKE the values in place during the program RUN.

If your only problem is speed, this method may work fine. It takes a little longer to load the program, and it takes time to POKE the machine code into the computer, but the main part of your program *will* run faster. But what if you also have memory constraints? You have extra DATA statements and extra code, so you are using up even more memory than before.

Fortunately, there is an easier and better way.

If you look in memory locations 45 and 46, you will find the "start of data" register. This is also the "end of the BASIC program" address. It's the address right after the last BASIC statement. (You can get the decimal number of the address in RAM where your program ends by:

?PEEK(45) + PEEK(46)\*256.) When you save your program on tape or disk, this "register" determines how much you are saving and, therefore, how much you will load when you read your program in again.

## Tricking The VIC

We can make VIC believe that the program extends past the last BASIC statement, and we can use the extra space for a machine program. Although we still have the problem of getting the machine language there in the first place, once it *is* there it will be saved with the program, so it becomes a permanent part of the program. If we add, delete, and change lines, we will change the length of the BASIC program, *but our machine code will stay right where it belongs, next to the last statement.*

## A Practice Program

Let's put the theory into practice. This program has no serious purpose, but it serves well as a demonstration. The program simply shows three eight-letter words on the screen and, every three seconds, moves the words around. You'll see why we want to use machine language, and how we go about it.

```
10 PRINT"{CLEAR}{06 DOWN}";TAB(7);"ROTATI
   ON"
20 PRINT TAB(7);"CONFUSES"
30 PRINT TAB(7);"THE MIND"
40 PRINT"{WHT}";TAB(7);"XXXXXXXX{BLK}"
50 TI$="000000"
60 IF TI$<>"000003" THEN 60
70 GOSUB 100
80 GOTO 50
100 FOR I=8 TO 1 STEP -1
110 POKE 7818+66+I,PEEK(7818+I)
120 POKE 7818+I,PEEK(7818+22+I)
130 POKE 7818+22+I,PEEK(7818+44+I)
140 POKE 7818+44+I,PEEK(7818+66+I)
150 NEXT
160 RETURN
```

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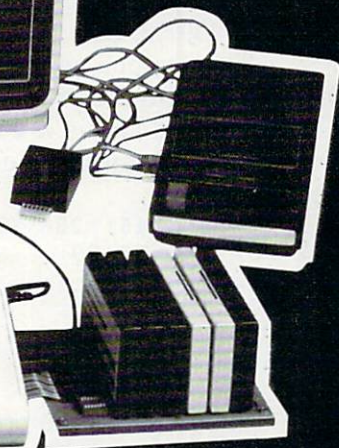
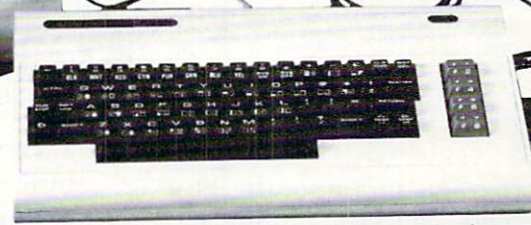
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When you run the program, you see the characters move. Let's speed up the program by programming the subroutine in machine language:

		Hex		Decimal	
LDX	#8	A2	08	162	8
LDA	7818,X	BD	8A 1E	189 138	30
STA	7884,X	9D	CC 1E	157 204	30
LDA	7840,X	BD	A0 1E	189 160	30
STA	7818,X	9D	8A 1E	157 138	30
LDA	7862,X	BD	B6 1E	189 182	30
STA	7840,X	9D	A0 1E	157 160	30
LDA	7884,X	BD	CC 1E	189 204	30
STA	7862,X	9D	B6 1E	157 182	30
DEX		CA		202	
BNE	*-25	10	E5	16	229
RTS		60		96	

We will first see where the program ends, so we PRINT PEEK(45) and PRINT PEEK(46); we should have 44 and 17, which means that the program ends at  $17 \times 256 + 44$  or address 4396 (or hex address 112C). We will add 30 characters to the program, so we POKE 45, 74.

We now have 30 bytes available for the program, so we could start POKEing: POKE 4396,162; POKE 4397,8, etc.

This is not a very easy method, so let's add some lines to the program to read and POKE. But when we add lines, we change the location, so we must recompute the address.

```

1 OC=PEEK(46)*256+PEEK(45)-30
2 FOR I=0 TO 29
4 INPUT Q%
6 POKE OC+I,Q%
8 NEXT
9 STOP

```

Now we run the program, and input the 30 bytes as they are prompted. This little routine is good enough for our purpose, since we want to write only a small program. If you make an error, just start over. But if you have longer programs, you will probably want to add embellishments to your program so you can verify and correct your input.

When the program stops with a "break in 9," your program is in and, you hope, correct (otherwise, you would run the program again). Now is the time to delete all superfluous statements. We must leave line 1, but delete lines 2, 4, 6, 8, 9, and line 100 and on. Finally, change line 70 to:

```
70 SYS OC
```

## Instant Changes

Now run the program, and you will see the difference in speed; the screen changes instantaneously.

Stop the program and PRINT OC; you should get 4284, so your program ends at 4314. Not only did we make the program faster, but we also saved 82 bytes.

You can now save the program, and when you load it again you will see that everything, machine language subroutine included, is still intact.

You can, of course, use the same method to place constants at the end of your program. That's useful if you want to write a melody or generate your own character set.

## Two Hints

When you expand the program, be sure to allocate enough space – a few extra bytes at the end won't hurt you, and they'll make it much easier for you to change the machine language without having to make more changes in your program. In this example, I would normally expand the program by at least 40 bytes.

Make sure your program is *relocatable*. That means that you should make the program less than 128 bytes long and use branch commands only, not jumps.

If you have more than one machine language routine, you should create a branch table at the start of it and call your routines by SYS OC; SYS OC+2; SYSOC+4; etc. This also makes it easier to change your code.

It is easier to place your input routine at the end of your program and use a command like RUN900 to call it. That way you won't inadvertently end up in your input routine when you test your program, and you can leave the routine until the program is correct. Be sure to place a STOP between your program and the input routine.

Finally, let's recapitulate the steps.

1. Write your machine code, and determine how much expansion you need.
2. Print the contents of memory location 45.
3. Add the length of your routine (plus a little bit extra) to the contents of 45, and POKE this value into 45, provided the sum is less than 256.
4. If the sum is 256 or more, subtract 256 from the sum and POKE it into 45; read 46 and POKE a new value (1 higher) into 46.
5. Write an input routine at the end of your program. Make sure you precede the input routine by a STOP command, and that the first instruction computes the location of your expansion area. Also, compute the location of the expansion area in your main program.
6. Input and verify your code.
7. Change your program to call machine code, test the program, and change the machine code if necessary.
8. Delete your input routine and all unnecessary instructions.
9. Save your program on tape or disk. ©

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# TI Structured BASIC

Steven M. Ruhl

*There has been a debate for years about the merits of "structured programming." In essence, this approach stresses certain rules and conventions which (according to its supporters) result in better, more easily understood program listings and more efficient programming in general. This discussion of structured programming, as applied to the TI-99/4A, should let you decide this issue for yourself.*

Structured programming can help some programmers make fewer errors, and can make complex programs easier to modify. Structured programming involves planning and organization so that a program flows logically from one step to another. Some structured programming enthusiasts even outlaw the use of the GOTO statement, since GOTO interrupts the straightforward flow of a program, and may lead to confusing design.

Structured programming also makes liberal use of REM statements, so someone reading a program listing can understand the program's logic easily.

Structured programmers often employ *modular programming* – breaking a program into a series of problems, and solving each separately. Most programs, for example, can be broken down into four parts: initialization, input, processing, and output. Let's look at each of these parts in turn. The highest-level module in a program is the most general, and it controls the modules below it; as the program progresses, each succeeding module performs more specific tasks.

We can use a simple example to illustrate structured programming. Program 1 asks for seven numbers and prints their sum. Program 2 accomplishes the same task, but it does it according to the rules of structured programming. Let's see how it works.

## Initialization

In the initialization module, the variables to be used in the program are defined in REM statements, and are initialized or dimensioned if necessary. The REM statements are indented to distinguish them from normal program statements. The blank REM lines separate program modules.

On some computers, variables must be set to zero at the beginning of a program – SUM=0, for example. The TI-99/4A, however, clears all vari-

ables each time a RUN command is entered, so we needn't worry about that phase of initialization.

If you are using array variables, they may need to be DIMed, and the initialization module is the place to do it. DIM statements, which tell the computer how much space to reserve for your array, can be executed only once for each array variable, and must be executed before any other reference is made to the array.

Since we are adding seven numbers, we dimension a seven-element array in lines 180 and 190. When an array is DIMed, the computer sets the lower limit of the array subscript to zero. In other words, DIM N(7) is really an eight-element array composed of the variables N(0), N(1), N(2), N(3), N(4), N(5), N(6), and N(7).

The OPTION BASE 1 statement in line 180 is a feature of TI BASIC that tells the computer to make the lower limit of the array subscript one rather than zero. So, by using OPTION BASE 1, we eliminate the variable N(0) from our list and end up with a seven-element array.

Note that in Program 1, the variable N was not DIMed. In such cases, the TI automatically sets the upper limit of the array subscript to 10. Program 2 would have worked just as well without lines 180 and 190, but we include them to provide the documentation structured programming requires.

## Input

Data can be passed to a program in a number of ways, including the INPUT, READ, DATA, and RESTORE statements. TI Extended BASIC offers a few other input possibilities: ACCEPT, SIZE, ERASE ALL, and VALIDATE.

In our example, a simple FOR/NEXT loop of INPUT statements is used to enter the seven numbers to be added. Structured programmers indent the lines within a FOR/NEXT loop to indicate (visually) what is being accomplished within the loop.

Once the INPUT is completed, control passes to the processing module.

## Processing

Here again, a simple FOR/NEXT loop is used to add the values of the seven variables. Program 1 includes the processing statement in its INPUT

loop, a perfectly valid way of handling the problem. The structured program separates the input and processing functions so that the tasks performed by each can be more easily understood.

## Output

The output module takes the result of the processing module and, in this case, prints it on the screen. Output also can be sent to printers, tape, or disk.

Since the purpose of most programs is to provide some kind of computed information, or *output*, many programmers begin their program design with a definition of how that output will appear on the screen or the printer. After the form of the output has been determined, the input module can be tailored to produce the kind of information needed.

In TI BASIC, for example, the colon print separator can be helpful in formatting output.

```
PRINT "HELLO": "THERE"
```

will cause the two words to be printed on separate lines:

```
HELLO
THERE
```

Multiple colons can be used to print blank lines between output. For example,

```
PRINT "HELLO": : "THERE"
```

would insert a line of space between the words when they are printed. The same process can be used in TI Extended BASIC, but spaces must be left between the colons, because Extended BASIC interprets a double colon as a multistatement line.

## Easy Modifications

One main purpose of following the rules of structured programming is to achieve clarity and understanding. It may take some rewriting to clear up any rough spots and make the documentation complete. A few months from now, you may want to use a modified version of your program to handle another task.

A clearly documented listing can save you the trouble of relying on your memory when you begin making changes. A program written in modules can also allow you to transfer these "sub-programs" to your new program without much modification.

The rules are there for you to follow if you wish. The choice is yours.

## Program 1:

### Demonstration Program

```
100 REM          ADD SEVEN NUMBERS
110 REM
120 FOR I = 1 TO 7
130 PRINT "ENTER NUMBER "; I
```

```
140          INPUT N(I)
150          SUM = SUM + N(I)
160 NEXT I
170 PRINT "SUM OF SEVEN NUMBERS "; SUM
```

## Program 2:

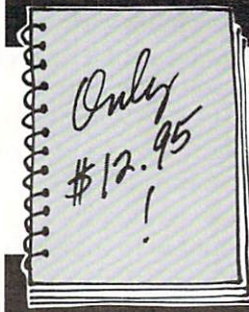
### Structured Demonstration Program

```
100 REM          INITIALIZATION MODULE
110 REM
120 REM          N(1...7) LIST OF SEVEN NUMBERS
130 REM          TO BE INPUT IN LOOP.
140 REM          SUM IS THE SUM OF THE SEVEN
150 REM          NUMBERS N(1)...N(7).
160 REM          INDEX IS USED TO CONTROL LOOPING
170 REM
180 OPTION BASE 1
190 DIM N(7)
200 REM
210 REM          INPUT MODULE
220 REM
230 FOR INDEX = 1 TO 7
240 PRINT "ENTER NUMBER "; INDEX;
250 INPUT N(INDEX)
260 NEXT INDEX
270 REM
280 REM          PROCESSING MODULE
290 REM
300 FOR INDEX = 1 TO 7
310 SUM = SUM+N(INDEX)
320 NEXT INDEX
330 REM
340 REM          OUTPUT MODULE
350 REM
360 PRINT "SUM = "; SUM
370 END
```

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# Atari Formats

Sheldon Leemon

*These programs are an excellent demonstration of Atari's deferred editing capabilities. They demonstrate a number of features which support neatly formatted output in Atari BASIC.*

---

By this time, Atari owners probably know how easy and convenient Atari's superb editing features are. You can position the cursor anywhere on the screen, insert spaces and lines, or delete spaces and lines at will. But some people may not be familiar with the use of these same functions when they are to be executed within the course of the program itself.

## Deferred Edit

A number of interesting effects can be achieved if you remember that any edit function that can be used in direct mode could also be used in deferred mode, with the aid of the Escape key. When the Escape key is pressed and then an edit command entered, the command is not immediately executed. Instead, an edit character, usually an arrow or a wedge, appears on the screen. Like any other ATASCII character, it can be put into a string, or used in a PRINT statement. When used in a PRINT statement, however, the edit character will not appear on the screen. Instead, the edit function represented by the character will be executed. For example, when you press Escape and then the Control and Clear keys, a crooked arrow ( $\curvearrowright$ ) appears. Whenever that symbol appears in a PRINT statement (e.g., 10 PRINT " $\curvearrowright$  Where did they go?"), it clears the screen.

This feature gives us an easy means of formatting output. Program 1 shows how this approach may be applied. The example involves the creation of a table containing three columns. In the first column, there is a number from 0 to 15 (X), that number divided by 32 (X/32), and the sin of the quantity Pi times the number divided by 8 ( $\text{SIN}(\text{PI} * \text{X} / 8)$ ). Negative numbers are accommodated, and trailing zeros inserted to produce a uniform appearance. (This all builds on an earlier **COMPUTE!** article, "Formatted Output For Atari BASIC," March 1981.)

## The Quick Way

Program 1 takes a direct approach to solving this problem. Because this program uses many edit

characters, REMarks remind you of the sequence of keystrokes needed to produce these characters. But you should still reread Chapter 3 and Appendix F of the *Atari BASIC Reference Manual* to completely familiarize yourself with Atari editing.

*Line 10* uses the symbols to clear the screen and move the cursor down one line. Notice how much easier it is to skip several lines of print by using down-arrows than to keep typing in PRINT:PRINT.

*Line 20* sets up a string (TC\$) that when printed will clear the tab. While not strictly necessary, this is done to show how several edit characters can be repeatedly executed by first putting them into a string, and then printing the string. Here, the tab has five default settings, so we Tab(CHR\$(127)) and then Clear Tab(CHR\$(158)) five times. This way, if the tab has to be changed later in the program, all we have to do to clear the tabs is print TC\$ and set the new tab stops.

*Line 30* prints TC\$, which clears the tab stops, and then prints the Set Tab Character (CHR\$(159)) at columns 7, 13, and 22.

*Line 40* prints the headings. Note that we can use the tab characters to print all of the column headings using only one PRINT statement.

*Line 50* sets up the FOR/NEXT loop and tabs to column 7.

*Line 60* inserts a space if X is less than 10, so that the single-digit numbers line up at the right of the column.

*Line 70* prints X and then tabs to column 13.

*Line 80* rounds X/32 to three decimal places and prints the result.

*Line 90* PEEKs memory location 85, which contains the column number of the present cursor location. This tells us where the cursor is located after print X/32. If it stops at column 14, we know that X/32 is an integer, and a decimal point is printed.

*Line 100* uses the same technique to print trailing zeros until the cursor gets to column 18.

*Line 110* tabs to column 22.

*Line 120* moves the cursor left one space to accommodate a minus sign if the output is negative.

*Line 130* prints  $\text{SIN}(\text{PI} * \text{X} / 8)$  rounded to seven decimal places. To enter this line more easily,



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10,000,000 can be entered using scientific notation (10E6).

Lines 140 and 150 duplicate the function of lines 90 and 100 to fill out the third column of print. Instead of typing in these duplicate lines, use the editing keys to change the line and column numbers of the existing lines 90 and 100, and re-enter them.

Line 160 moves the cursor to the next line and loops back for the next X.

## Using Default Settings

In the above example, we didn't really have to go to the trouble of setting the tab. The default settings of the tab are at columns 7, 15, 23, 31, and 39. The default settings of the PRINT(,) statement are at columns 12, 22, and 32. So, using a combination of the two, we could have printed the output at columns 7, 12, and 22, by first pressing the tab, and then the PRINT(,) statement. Moreover, the width of the PRINT columns is adjustable. To change width, we need only POKE location 201 with the new width. If we put the statement POKE 201,5 at the beginning of the program, the PRINT(,) statement would then produce output at columns 7, 12, 17, 22, etc., and there would be no need for us to tab at all to produce the desired format.

Finally, we return to memory location 85. Not only can we PEEK this location to find the cursor, but we can also POKE 85 to position the cursor horizontally. This statement gives us the equivalent of the TAB statement found in other BASICs. To move the cursor to column 7, we could have used a POKE 85,7 with the same result as a TAB command.

The above is offered not as a subroutine of universal applicability, but as an example of the features that the Atari offers for formatting output. The approach shown here works in this particular situation because the output is fairly uniform. When only a little straightening up is needed, a more sophisticated method would be wasted. But this routine will not work with printed output as shown (the printer does not react to screen-editing commands, although it does have its own set of control characters that might be used). And if there is a greater variation in the types of output desired, a more integrated approach would be necessary.

## Same Techniques, More Integration

Even in cases where a more organized approach is required, these techniques can be adapted to yield a fairly straightforward routine (Program 2). While basically an adaptation of the March 1981 article, it has the following important differences:

1. Decimal rounding and the addition of trailing zeros are accomplished by string manipulation rather than by mathematics. String man-

ipulation is always faster, and here the difference is noticeable.

2. Rather than pack the strings with spaces between the variables to be printed, the POKE 201 and PRINT(,) commands are used as tabs. This allows formatting to take place on both screen and printer, limits the GOSUBs needed, and avoids having to set up the whole line before printing takes place.

3. A routine is added to accommodate numbers that start with -9. The Atari always rounds down, so that -9.5 rounds to -10. This means that INT(N) would have one more digit than the integer part of N does, and this throws off the decimal-rounding routine. The code in line 100 prevents this by adding one to all negative numbers in INT(N) except -1, which would round to 0, thus dropping the minus sign and losing a column space.

4. Commas are added for four-digit numbers. If numbers bigger than seven digits are used, another comma could be added by repeating the routine with the numbers representing the digits substituted accordingly.

Here's a brief explanation. The variables set up at random in line 20 are designed to give a wide range of outputs. Lines 30-60 set up the outputs for each column, with N being the variable to be formatted, ND the number of decimal places, and RC being the *width* of the column, rather than the right column position. This width should allow two or three spaces for print tabbing – if the column width is less than the length of the output, the computer will lock up.

The formatting subroutine starts at line 100, by setting up one string for N, and another for INT(N). Line 110 directs numbers which do not need decimal-rounding around the routine at: line 120, which deletes extra decimal places; line 130, which adds a decimal point to whole numbers; and line 140, which provides trailing zeros. Line 150 adds a comma for numbers with more than four whole digits, and line 160 prints the output, tabbing to the appropriate spot, in order to line up the right-hand columns.

These, then, are some of the exciting features that the Atari computers offer, and they're not only useful for print formatting. The screen editing functions, for example, might be used for simple animation. The graphics capabilities allow you to print alternating lines of regular and reverse video, for easy-to-read tables.

## Program 1: Atari Formatting – A Table With Three Columns

```
10 ? " {CLEAR} {DOWN} ":REM -[ESC][CTRL]
   ][CLEAR];[ESC][CTRL][E]
20 DIM TC$(11):TC$=" {TAB}{CLR TAB}
   {TAB}{CLR TAB}{TAB}{CLR TAB}{TAB}
   {CLR TAB}{TAB}{CLR TAB}":REM -[ES
   C][TAB];[ESC][CTRL][TAB];REPEAT 5
   TIMES
```

```

30 ? TC$=? "(6 SPACES){SET TAB}
(6 SPACES){SET TAB}{9 SPACES}
{SET TAB}{8 SPACES}":REM -TABSET=
[ESC][SHIFT][TAB];6 SPACES;TABSET
;6 SP.;TABSET;9 SP.;T.S.
40 ? "{TAB} X{TAB} X/32{TAB}{LEFT}SI
N(PI*X/8)":REM - [ESC][TAB];[ESC]
[CTRL][C]
50 FOR X=0 TO 15:?"{TAB}";:REM -[ES
C][TAB]
60 IF X<10 THEN ? " ";
70 ? X;"{TAB}";:REM -[ESC][TAB]
80 ? (INT(X/32*1000))/1000;
90 IF PEEK(85)=14 THEN ? ".";
100 IF PEEK(85)<=17 THEN ? "0";:GOTO
100
110 ? "{TAB}";:REM -[ESC][TAB]
120 IF SIN(4*ATN(1)*X/8)<0 THEN ? "
{LEFT}";:REM -[ESC][CTRL][C]
130 ? (INT(SIN(4*ATN(1)*X/8)*1000000
0))/100000000;
140 IF PEEK(85)=23 THEN ? ".";
150 IF PEEK(85)<=30 THEN ? "0";:GOTO
150
160 ? :NEXT X

```

## Program 2:

### Atari Formatting - Integrated Approach

```

10 DIM N$(80),I$(80):POKE 82,1:GRAPH
ICS 0:POKE 752,1
20 FOR X=1 TO 20:R1=RND(0)*100:R2=(-
5*(RND(0)>0.5)+1)*RND(0)*100:Z=R1
*R2:Z1=R2/R1:Z2=R2-R1
30 N=X:RC=4:ND=0:GOSUB 100
40 N=Z:RC=10:ND=0:GOSUB 100
50 N=Z1:RC=11:ND=2:GOSUB 100
60 N=Z2:RC=12:ND=3:GOSUB 100
70 ? :NEXT X
80 END
100 N$=STR$(N):I=INT(N):I$=STR$(I+((
I<>-1) AND (SGN(N)=-1)))
110 IF ND=0 THEN N$=I$:GOTO 150
120 IF LEN(N$)>LEN(I$)+ND+1 THEN N$=
N$(1,LEN(I$)+ND+1)
130 IF LEN(N$)=LEN(I$) THEN N$(LEN(N
$)+1)="."
140 IF LEN(N$)<LEN(I$)+ND+1 THEN N$(
LEN(N$)+1)="0":GOTO 140
150 IF ((LEN(I$)>3 AND SGN(VAL(I$)>-
1)) OR (LEN(I$)>4)) THEN L=LEN(I
$)-2:I$=N$(L,LEN(N$)):N$(L)=",":
N$(LEN(N$)+1)=I$
160 POKE 201,(RC-LEN(N$)):?" ,N$":RET
URN

```



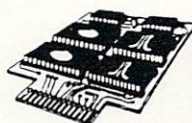
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# Joysticks For The Commodore 64

Michael A Tyborski

*The Commodore 64 is, among other things, an excellent game machine. It features advanced graphics, realistic sound, joysticks, and paddles. Learning how to use the joysticks is one of the first steps toward making full use of your 64's entertainment capabilities.*

The Commodore/Atari joystick is a very simple device consisting of four switches, as shown in Figure 1. When the control handle is moved, one or two switches close in various combinations. This provides an easy way to detect the joystick's position. There is also an independent switch called the fire button. It can be used to fire lasers, drop bombs, and select options.

## How To Read Positions

Each joystick connects to a port on a 6526 "Complex Interface Adapter" (CIA). The back joystick uses port A, and the other uses port B. These ports are at addresses 56320 and 56321 respectively. This makes joystick selection extremely simple.

Since both ports (like those on the VIC) are also part of the keyboard scanning matrix, simultaneous use of the keyboard and joysticks is prevented. Fortunately, this is a minor problem.

The direction switches connect to port bits 0-3, but the ports return a value from 0-255 decimal when read. As a result, you should AND this value with 15 when reading the joystick direction.

Similarly, the fire buttons connect to bit 4 on the ports. To read them, AND the port value with 16. This returns zero when the button is pressed, and 16 otherwise.

For example, you can quickly test the back joystick with this program:

```
10 PRINT PEEK(56320)AND15,-((PEEK(56320)
AND16)=16)
20 GOTO 10
```

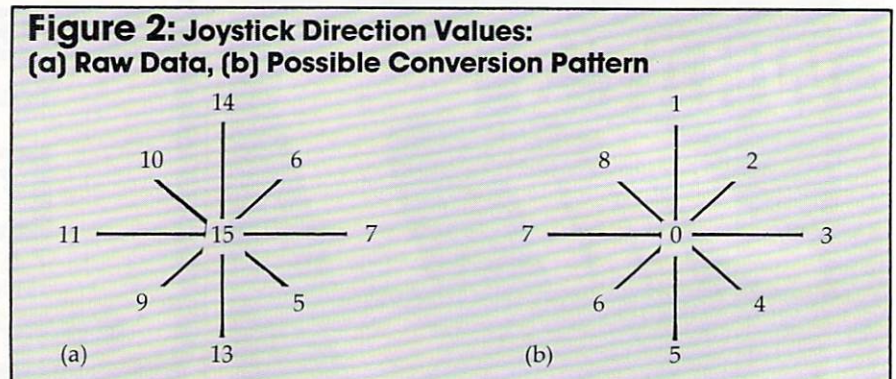
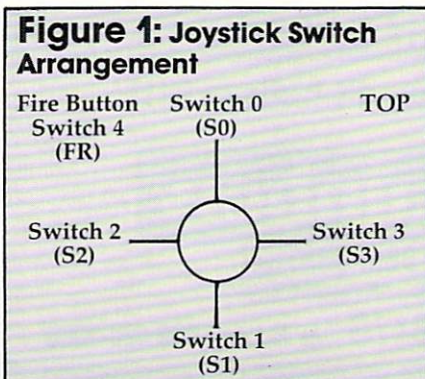
You will read values like those in Figure 2a. Although usable, they are awkward to work with.

A better program would return easy-to-use direction codes. This would require more time, but it would simplify other programming. Figure 2b shows one possible pattern. The sequential values allow an ON-GOTO or ON-GOSUB statement to control program flow.

## Joystick Read Subroutine

Now, let's tie all this together. The program below shows the necessary statements to read the 64 joystick. First, we will need to initialize a conversion array. We do this in a short initialization subroutine (lines 9000-9040). The routine also sets up the system constants: PA, JM, and FM.

Variable PA holds the joystick port base address; variables JM and FM are masks for future AND operations. These variables speed up the joystick read subroutine by eliminating floating point conversions. This is important for smooth graphic control.



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The joystick read subroutine (lines 1000-1040) performs the real work. It reads the status of the joystick selected by variable SN. It then sets variable JV to a direction code as shown in Figure 2b and tests the fire button. If the fire button is pressed, it sets variable FB to one.

The subroutine documentation explains the calling procedure. And more important, it shows which variables are reserved for joystick use.

You should eliminate the REMark statements when using lines 1000-1040. In addition, place them at the beginning of your program and the initialization routine at the end. This will speed things up a bit.

```

1000 REM JOYSTICK READ ROUTINE
1010 SN=SN AND 1:JS=PEEK(PA+SN):JV=JS
    AND JM
1020 FOR JI=1 TO 8:IF JV=JV(JI) THEN
    1040
1030 NEXT:JI=0
1040 JV=JI:FB=-((JS AND FM)=ZR):RETURN
9000 REM INITIALIZATION SUBROUTINE
9010 PA=56320:JM=15:FM=16:ZR=0
9020 FOR JI=1 TO 8:READ JV(JI):NEXT
9030 DATA 14,6,7,5,13,9,11,10
9040 RETURN
  
```

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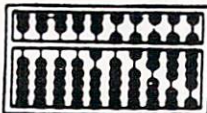
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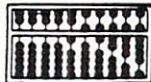
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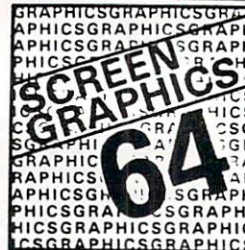


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# UNNEW For The VIC And 64

Jim Wilcox

*With this utility program on tape or disk, you'll never have to worry again if you type NEW by mistake and lose your BASIC program. Just load in UNNEW, type SYS (850), and there's your program back again. For VIC and 64.*

Now and then it happens. You type NEW and then instantly regret it. Fortunately, the VIC and 64 don't erase the program; they only reset some "pointers." The machine language program below will set the pointers back to where they were before your impetuous NEW.

The first step is to type in the program, making sure each of the DATA statements is correct. RUN the program, then type NEW. Now insert a blank tape in the datassette and the statement below without any line numbers:

```
A$ = "":FORA = 833TO938:A$ = A$ + CHR$(PEEK(A))
:NEXT:SAVEA$
```

When instructed, press PLAY and RECORD on the tape unit. Don't worry about the graphics characters while the SAVE is taking place.

Now to test the program. Type in or LOAD any BASIC program and give the NEW command. LOAD the UNNEW program and type in SYS(850). RUN or LIST the revived BASIC program to verify that it's there.

The routine resides in the cassette buffer. It may be reused (SYS 850) until another program is loaded from tape.

## UNNEW For The VIC And 64

```
100 REM UN-NEW FOR THE VIC & 64
110 FOR A=833 TO 938
120 READ B: POKE A,B: C=C+B: NEXT
130 IF C<>11380 THEN PRINT"CHECK DATA
STATEMENTS FOR ERRORS":STOP
140 END
200 DATA 85,78,78,69,87,32,83,89
210 DATA 83,40,56,53,48,41,32,32
220 DATA 32,160,3,200,177,43,208,251
```

```
230 DATA 200,152,24,101,43,160,255,200
240 DATA 145,43,133,45,200,165,44,145
250 DATA 43,133,46,160,255,200,177,45
260 DATA 72,240,11,200,177,45,133,46
270 DATA 104,133,45,24,144,237,200,177
280 DATA 45,208,243,104,24,165,45,105
290 DATA 2,133,45,144,2,230,46,133
300 DATA 47,133,49,165,46,133,48,133
310 DATA 50,169,0,133,51,133,52,165
320 DATA 55,133,53,165,56,133,54,76
330 DATA 116,196
```

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# INSIGHT: Atari

Bill Wilkinson

*This month Bill continues with the creation of the BAIT interpreter (Basic Almost InTerpreter). And he includes some comments from readers.*

## BAIT: Part 3

For those of you who may have missed Parts 1 and 2, let me give a brief description of this project. BAIT is an acronym for Basic Almost InTerpreter. It is a pseudo-BASIC actually written in Atari BASIC. It is slow. It uses one letter commands (for example, "P" for PRINT). It is simple. And its purpose is simply to give you an inkling of how a BASIC interpreter works. It is *not* a finished, usable language.

This month we will study Part 3 of this listing. We will publish only those lines which have changed from Parts 1 and 2. However, next month we will present Part 4, the last part, and we'll publish the entire listing.

Before starting on my own comments about and additions to BAIT this month, though, I would like to share some reader comments on Part 1.

First, Howard Fishman of Brooklyn, New York, pointed out that I could eliminate the question mark prompt from the INPUT statement by simply using OPEN #3,12,0,"E:" at the beginning of the program and then replacing INPUT with INPUT#3.

Sigh. How right you are, Howard. The funny thing is that I remember discovering this technique about three years ago on our Apple II version of OSS BASIC. How soon we forget. I will incorporate his suggestion in the finished version of BAIT.

Also, Howard protested my not including a facility to list BAIT programs to disk and retrieve them. Perhaps I might change my mind later, but for now I feel that adding that code is an excellent exercise for the reader.

The second letter was from Donald Biresch of Ottsville, Pennsylvania. His comment was that he wished I wouldn't "spend [my] time ... writing about creating BASIC interpreters (something ... less than 1 percent of the end user market has any interest in)." Is he right or wrong? Wrong, I hope, though I admit I have sometimes regretted starting this project, since it has proven to be a larger program than envisioned.

Still, I believe that the subject interests more than 1 percent of you, even if my readers aren't necessarily typical "end users." In particular, I think the BAIT articles are a good lead-in to a more serious study of a BASIC interpreter.

However, if Donald is correct, I apologize. Let me know how you feel.

## New Features Of BAIT

As with the previous parts, I will describe this month's changes by line number or line number range.

**1110.** We set all variables to zero.

**1515 to 1580.** These are simply some line number equates for use as the objects of GOTOS or GOSUBs. Note, though, that they help produce readable code.

**3060.** Just centralizing some error messages.

**4200 to 4250.** A complete restructuring of the "Execute Next Statement" routines. Note that multiple statements per line are now legal. Also, note that pushing the START button now serves as a program break (the BREAK key still stops BASIC itself).

**4610 to 4620.** Sometimes when you generalize things, the program gets simpler. Direct and deferred execution are now virtually identical.

**4700 to 4730.** After executing a direct line, we wipe it out of the program memory.

**4910 to 4960.** Look at all the wonderful statements we can now use! They are in order here. Thus a statement "A" will cause DO ACCEPT to be called, etc.

**8290.** More clean up.

**8400 to 8410.** Ditto. See line 3060.

**10190.** Now, we exit from the statement "DO" routines only after getting the character which terminates the statement (that is, the colon or return character).

**10250 to 10270.** Ditto. Just making PRINT's code cleaner.

**10400 to 10420.** Look how easy BEGIN (same as BASIC's RUN) is! We zero out the variables, set the current line number to zero, say we found an end of line, and let execute-next-line (at 4600) start the program execution.



10500 to 10530. GOTO is almost as simple. Find what line number the user wants and fool execute-next-line into getting the next execution line from there.

10600 to 10650. LET is only a little more complex. It insists on a variable (10610) for a destination (10620), an equal sign (10630), and an expression (10640). Then it simply gives the destination variable the value of the expression.

10700 to 10730. IF is, I think, a little clever. It simply tells the get-next-statement code (4240 and 4250) that the next character is an end of line if the user's expression evaluates to zero. Otherwise, it does nothing, and the next statement (if any) gets executed.

10800 to 10910. ACCEPT and CALL will be implemented next month.

11000 to 11030. END simply forces an end of line character and an illegal next line number value. The direct statement test (line 4620) effectively ends the program.

11100 to 11410. FETCH, NEW, RETURN, and STORE are left for next month.

Well, there you have it. A functional, albeit minimal interpreter. If you have typed it all in properly, you might try the following program as a test of its logic.

```
1 P "N", : P "N+N", : P "N*N"
2 PN, : PN+N, : PN*N
3 LN=N+1
4 IN<20 : G 2
5 E
B
```

And, for those of you who have not followed BAIT up until now, that translates roughly into BASIC as:

```
1 PRINT "N","N+N","N*N"
2 PRINT N,N+N,N*N
3 LET N=N+1
4 IF N<20 THEN GOTO 2
5 END
RUN
```

And that's enough BAIT for this month. If you don't do anything else while waiting for next month's column, you might try writing the code to execute NEW. It will be *extremely* simple.

## BAIT

```
1110 FOR ALPHA=0 TO 26:VARIABLES(ALPHA)=
0:NEXT ALPHA
1515 DIRECT=4700:BADLINE=8400
1560 DOBEGIN=10400:DOGOTO=10500:DOLET=10
600:DOIF=10700
1570 DOACCEPT=10800:DOCALL=10900:DOEND=1
1000:DOFETCH=11100
1580 DONEW=11200:DORETURN=11300:LET DOST
ORE=11400
3060 GOTO BADLINE
```

```
<<< DELETE LINE 3070 >>>
4200 REM EXECUTE A SINGLE STATEMENT
4230 IF PEEK(53279)<>7 THEN GOSUB DOEND
4240 IF C$=":" THEN 4200
4250 IF C>=0 THEN GOTO SYNTAX
4610 CURLINE=CURLINE+1
4620 IF CURLINE>0 AND CURLINE<=MAXLINE T
HEN 4000
<<< DELETE LINE 10280 >>>
4700 REM ===COME HERE ON END OF DIRECT L
INE EXECUTE===
4710 IF LINES(0) THEN BUFFER$(INT(LINES(
0)/1000))="*"
4720 LINES(0)=0
4730 GOTO PROMPT
4910 ERR$="BAD STATEMENT NAME"
4920 ON ALPHA GOTO DOACCEPT,DOBEGIN,DOCA
LL,DODISPLAY,DOEND
4930 ON ALPHA-5 GOTO DOFETCH,DOGOTO,ERRO
R,DOIF,ERROR,ERROR
4940 ON ALPHA-11 GOTO DOLET,ERROR,DONEW,
ERROR,DOPRINT
4950 ON ALPHA-16 GOTO ERROR,DORETURN,DOS
TORE
4960 GOTO ERROR
8290 GOTO DIRECT
8400 REM BAD LINE NUMBER
8410 ERR$="BAD LINE NUMBER":GOTO 8200
10190 GOTO GETNC
10250 IF C$=":" THEN GOTO GETNC
10260 IF C$="," THEN PRINT,:GOTO GETNC
10270 PRINT:RETURN
<<< DELETE 4630 >>>
<<< DELETE 4640 >>>
10400 REM ===EXECUTE BEGIN===
10410 FOR ALPHA=0 TO 26:VARIABLES(ALPHA)
=0:NEXT ALPHA
10420 CURLINE=0:C=-1:RETURN
10500 REM ===EXECUTE GOTO===
10510 GOSUB EXEXP
10520 IF LINES(EVAL)=0 THEN ERR$="NO SUCH
LINE":GOTO 8200
10530 CURLINE=EVAL-1:RETURN
10600 REM ===EXECUTE LET===
10610 GOSUB GETNC:IF NOT ALPHA THEN GOTO
SYNTAX
10620 DESTVAR=ALPHA
10630 GOSUB GETNC:IF C$<>=" THEN GOTO S
YNTAX
10640 GOSUB EXEXP:VARIABLES(DESTVAR)=EVA
L
10650 RETURN
10700 REM ===EXECUTE IF===
10710 GOSUB EXEXP
10720 IF NOT EVAL THEN C=-1:C$=""
10730 RETURN
10800 REM ===EXECUTE ACCEPT===
10900 REM ===EXECUTE CALL===
10910 GOTO ERROR
11000 REM ===EXECUTE END===
11010 PRINT"===END AT LINE";CURLINE;"===
"
11020 C=-1:CURLINE=C:C$=""
11030 RETURN
11100 REM ===EXECUTE FETCH===
11200 REM ===EXECUTE NEW===
11300 REM ===EXECUTE RETURN===
11400 REM EXECUTE STORE===
11410 GOTO ERROR
```

# Machine Language Saver

John O. Battle

*Here is an easy way to save machine language programs to tape or disk from your VIC-20 or Commodore 64.*

You've just written the ultimate character movement routine for your latest video game, and, of course, it's written in machine language for speed. Now you want to save it for future use. (You certainly don't want to type the routine in and debug it again!) But how do you get it onto tape or disk? The BASIC command SAVE works only for programs written in BASIC. You could load in a machine language monitor program and use its SAVE feature, but suppose you don't have a monitor, or that loading the monitor would overwrite the routine you want to save.

Here's the solution. ML Saver is a BASIC program which loads in a short machine language routine of its own. This routine allows you to easily save other machine language programs to tape or disk. And, since it is in machine language itself, it is very fast.

To use the program, simply type in and RUN the BASIC program. Since the numbers in the DATA statement in lines 1000-1300 make up a machine language program, they must be typed in *exactly*, no errors allowed. The program is self-prompting - simply press the letter T (for save to tape) or D (for disk) when asked. Then enter the beginning address for the save and press RETURN.

The program will next ask for the final address in the block of memory to be saved. If you press RETURN without entering an ending address, the program will ask instead for the total number of bytes you wish to save (beginning with the byte at the starting address). If your final address is not greater than your starting address, you will be asked to enter both addresses again.

Finally, the program will allow you to specify a filename for the saved program. This name can be no more than ten characters long.

In order to LOAD a machine language routine that was put on tape or disk by ML Saver, you use the standard BASIC command LOAD, but you must follow the device number with a comma and a one. For example:

```
TAPE LOAD "filename",1,1
DISK LOAD "filename",8,1
```

The one at the end of the LOAD command tells the computer to load the routine into the same memory locations from which it was saved. Without it, the auto-relocating feature of the VIC and 64 LOAD command would cause the routine to be stored beginning at the normal start-of-BASIC location.

```
40 POKE 52,29:POKE 56,29: REM USE THIS LI
   NE FOR THE VIC-20 ONLY
50 PRINT "{CLEAR}{09 DOWN}{RIGHT}{REV}MAC
   HINE LANGUAGE SAVE{REV}"
60 FOR I=7424 TO 7489
70 READ X
80 POKE I,X :NEXT I
90 FOR I=1 TO 3000:NEXT I
100 PRINT "{CLEAR}{10 DOWN}{06 RIGHT}"
110 PRINT "{REV}T{OFF}APE OR {REV}D{OFF}IS
   K"
120 GET D$:IF D$="" THEN 120
130 IF D$="T" THEN PRINT "{UP}TAPE SELECTED
   ":LF=1:DN=1:SA=2
140 IF D$="D" THEN PRINT "{UP}DISK SELECTED
   ":LF=15:DN=8:SA=15
150 IF D$<>"T" AND D$<>"D" THEN PRINT "{UP}
   ":GOTO 120
160 POKE 7661,LF
170 POKE 7662,DN
180 POKE 7663,SA
200 PRINT "{DOWN}STARTING ADDRESS FOR":INPU
   T"SAVE";S
210 S1=INT(S/256)
220 S2=S-S1*256
230 POKE 251,S2
240 POKE 252,S1
245 A$=""
250 PRINT "{DOWN}FINAL ADDRESS OF":INPUT"SA
   VE";A$
260 IF A$="" THEN 300
270 F=VAL(A$)
280 GOTO 320
300 PRINT "{02 UP}NUMBER OF BYTES TO BE":I
   NPUT"SAVED";N
310 F=S+N-1
320 F1=INT(F/256)
330 F2=F-F1*256
335 IF F<S THEN PRINT "{07 UP}":GOTO 200
340 POKE 7659,F2
350 POKE 7660,F1
400 INPUT "{DOWN}PROGRAM NAME";N$
410 NL=LEN(N$)
420 IF NL<10 THEN 460
430 PRINT "{DOWN}NAME TOO LONG"
440 GOTO 400
460 POKE 7648,NL
470 FOR I=1 TO NL
480 POKE 7648+I,ASC(MID$(N$,I,1))
490 NEXT I
500 IF D$="D" THEN PRINT "{DOWN}PRESS ANY ~
   KEY TO SAVE"
505 IF D$="T" THEN PRINT "{DOWN}REWIND TAPE
   AND PRESS ANY KEY{DOWN}"
510 GET A$
```

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```

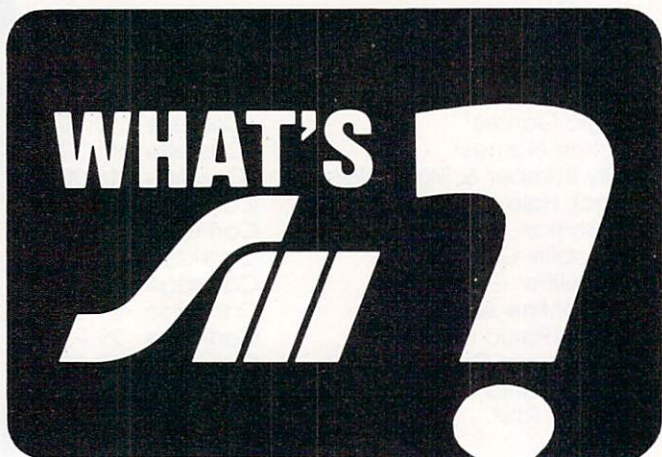
520 IF A$="" THEN 510
530 SYS 7472
560 END
1000 DATA 169,192,32,144,255,173,237,29,174
,238,29,172,239,29,32,186,255,173

1100 DATA 224,29,162,225,160,29,32,189,255,
96,234,234,234,234

1200 DATA 169,0,32,144,255,96,234,234,234,2
34,234,234,234,234,234,234

1300 DATA 32,0,29,169,251,174,235,29,172,23
6,29,32,216,255,32,32,29,0

```



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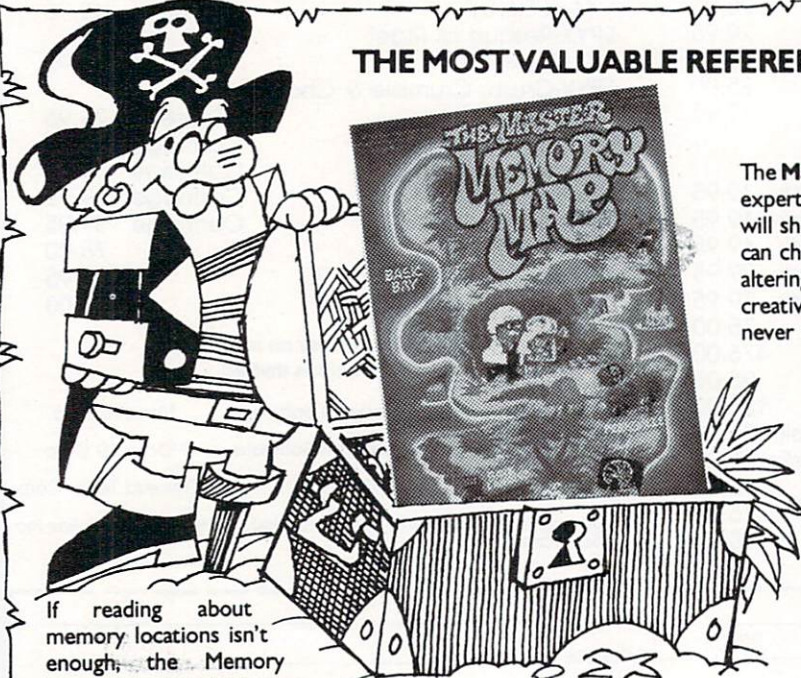
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# Automatic Atari DATA Statements

Richard Dorfner

*Use these handy routines to merge machine language programs with BASIC. Never again will you need to manually convert machine language to DATA statements. Your Atari, using the auto-return mode, will do it for you.*

---

Writing programs in BASIC is fine if you don't need great speed. But if you must have a subroutine that operates very quickly, then BASIC is not the answer. One solution is to whip out your assembler and write a machine language subroutine to get the job done. If you want to incorporate it into BASIC, you then need to transform all of these hexadecimal digits into a more useful form, namely DATA statements made up of decimal digits. This can be tedious. After once staying up into the wee hours of the morning, I decided there had to be a better way. Fortunately, there is.

## Storage Technique

Before getting to the solution, we should first look at the storage technique used by the Editor Assembler cartridge. When the ASM saves the object code onto the disk, it first writes six bytes onto the beginning of the file. The first two are simply used to delimit the beginning of the header. The next two bytes determine the starting address. The last two bytes determine the ending address.

The difference between these two numbers represents the number of bytes to be POKEd into place – which presents a problem. What if there are several “chunks” of machine code to be POKEd into place? ASM handles this by writing another set of starting and ending addresses. This takes up four bytes. With this information, we can now begin the construction of a program which writes DATA statements using the object code file.

Actually, the program to create the DATA statements is rather simple. It fills an array with ten numbers at a time, getting the numbers directly from the object code file. The fun part

is when it turns this information into a DATA statement.

To do this, we format a line of code on the screen in a manner that will be accepted by the BASIC interpreter. The next step is to write CONT on a line below the DATA statement.

Why? Well, for one thing, we're going to stop the program and send all the information that we wrote on the screen under program control to the BASIC interpreter, so we must somehow start it up again.

To accomplish this minor miracle, we first, under program control, position the cursor above the items on the screen and then type POKÉ 842,13:STOP. What happens next is that the operating system begins to send what's on the screen to the BASIC interpreter automatically. As soon as the line with DATA on it is reached, the BASIC interpreter takes it in and shoves it into its proper place in the listing. The next thing to be sent to the interpreter is the CONTInue statement. When BASIC sees this, it executes the command because there is no line number in front of it. It's an immediate mode command.

After the CONTInue statement is hit, the program starts executing on the next line of the BASIC program from where it stopped. In Program 1, this is line 280, which shuts off the automatic input feature.

This program will continue running until it runs out of data in the object code file. When this happens, the program dumps out all of the numbers held by DAT(1-10). This is done to avoid losing data, which might occur due to an End Of File error.

After all of the data has been READ in and LISTed to either the disk or cassette, the computer very kindly announces the file name under which the DATA statements were listed. This name will always be “D or C:DATASTAT.LST”. It also includes an initial DATA statement which tells POKÉIT how many bytes are to be POKEd into place.

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## POKEIT

Program 2, POKEIT, must be loaded from wherever you have it saved. To use it, you also have to ENTER "Device.DATASAT.LST" which was saved by the other program. After you type RUN, POKEIT begins to read the first item of information. This number that it gets is the number of bytes to be POKEd into place altogether.

It then reads the next six bytes. The first two of these are thrown away. The third and fourth bytes are used to calculate the starting memory location to POKE to. The fifth and sixth bytes are used to calculate the ending address to be POKEd.

The program starts to read and POKE until it runs out of memory locations to POKE to. And then compares the number of bytes it has POKEd to the total number of bytes it is required to POKE. If it has not yet completed its job, it's because there is another "chunk" of code to be placed in a starting and stopping set of addresses and cycles through the program once more. It will continue to do this until it has run out of data, at which point it will automatically jump to the machine language subroutine.

## Program Description

Here's a play-by-play report on what Programs 1 and 2 are doing.

### Program 1.

Line no.	
60	Gets the device and the file name that it will be working with.
70	Opens that file.
80-100	Initialize the array DAT to 0.
110-150	Are a WHILE loop which gets values for X and puts them in the array DAT(I).
170	Clears the screen.
180	Increments the line counter which will be used to give the DATA statement a line number.
190-250	Format the screen to look like a line of BASIC.
260	Positions the cursor above what was just written on the screen.
270	Turns on the automatic line-entering feature and stops the program so that it can take effect.
280	Turns it off. This is the line which BASIC will return to once it gets the CONTinue statement.
290	Checks to see if the trap flag was set. The only way it can get set is if the machine gets an End Of File error. If TR has been set, then it goes to line 325; otherwise, it goes to line 80.
310	Sets TR to 1 whenever it is reached.
325-370	Put the number of bytes read from the file into the first DATA statement and automatically enters it into the basic program.
380	Changes the file name to DATASAT.LST.
390	LISTs the DATA statements to the device named in FILE\$.
400	Tells the user by what file name the DATA statements were saved.

### Program 2.

Line no.	
80	Gets the number of bytes to be read and the first two useless bytes saved from the file.
100-120	Calculate the starting and ending address which will be POKEd to.
140-170	Do the actual POKeing of the information held by the DATA statements.
180	Tests if all the information has been read. If it hasn't, then it goes back to line 100 and starts the process all over again.
190	Forces the machine to take the machine language plunge.
300-320	Get the starting address of the machine language subroutine for when the machine decides to go there.

### Program 1: DATA Statements From Machine Code

```
10 REM DATA STATEMENTS FROM MACHINE
   CODE FILES
40 DIM DAT(10),FILE$(14)
50 POKE 710,0:POKE 709,14:REM make m
   y B$W T.V. look nice
60 ? CHR$(125):? :? "INPUT DEVICE:FI
   LENAME ";;INPUT FILE$:J=0:LINE=10
   000
70 OPEN #6,12,0,FILE$
80 FOR I=1 TO 10
90 DAT(I)=0:REM Initialize DAT to 0
100 NEXT I
110 I=0
120 I=I+1:J=J+1:TRAP 310:REM Begin t
   he while loop
130 GET #6,X:REM Get a byte
140 DAT(I)=X:REM Put it in DAT(I)
150 IF I=10 THEN GOTO 170:REM Done t
   en yet? If so GOTO 170
160 GOTO 120:REM Otherwise go get th
   e next byte
170 ? CHR$(125):REM Clear the screen
180 LINE=LINE+10:REM Increment the l
   ine counter
190 POSITION 2,4
200 ? LINE;"DATA";:REM Print the lin
   e number and then DATA
210 FOR I=1 TO 9
220 ? DAT(I);",,":REM Follow DATA wi
   th the various data items separa
   ted with commas
230 NEXT I
240 ? DAT(10):REM Finish the DATA st
   atement with a data item but don
   't put in a comma
250 ? :? "CONT":REM Skip a few lines
   then print CONT
260 POSITION 2,0:REM Position the cu
   rsor above it all
270 POKE 842,13:STOP :REM Then turn
   on the auto-entry feature and st
   op the program
280 POKE 842,12:REM When it has ente
   red the data statement, come bac
   k here and turn the feature off
290 IF TR=1 THEN GOTO 325:REM If the
   trap has occurred, goto 325
300 GOTO 80:REM Otherwise goto 80
310 TR=1:REM Set the trap flag to 1
320 GOTO 170
325 CLOSE #6:REM close the file sinc
```



```

e we're all done with it
330 ? CHR$(125):REM then clear the screen
340 POSITION 2,4
350 ? 10005;"DATA";J-1:? :? :? "CONT
":REM Print a data statement telling
how many bytes were read
360 POSITION 2,0:POKE 842,13:STOP :R
EM Now enter it as a line of BAS
IC
370 POKE 842,12:REM and turn the aut
o-entry feature off
380 FILE$(3,14)="DATASTAT.LST":REM c
hange the filename to DATASTA.LS
T
390 LIST FILE$,10005,LINE:REM Then l
ist it to the device under the n
ame of DATASTAT.LST
400 PRINT "FILE LISTED UNDER":PRINT
FILE$:REM and let the user know
what to call it

```

## Program 2: POKEIT

```

10 REM POKE IT IN PLACE
40 DIM FILE$(15)
50 POKE 709,14:POKE 710,0:REM MAKES
MY B&W T.V. LOOK NICE

```

```

80 READ NUMBEROFBYTES,JUNK1,JUNK2
90 TRAP 190
100 READ STARTLO,STARHI,LASTLO,LA
STHI
110 START=STARTLO+256*STARHI:REM CA
LCULATE THE STARTING ADDRESS
120 LAST=LASTLO+256*LA
STHI:REM CALCULATE THE LAST ADDRESS
130 GOSUB 300:REM IS THIS THE FIRST
ADDRESS TO BE CALCULATED?
140 FOR I=START TO LAST
150 READ X
160 POKE I,X
170 NEXT I
180 IF (LAST-START)<>NUMBEROFBYTES T
HEN GOTO 100:REM GOT ALL OF THE
DATA YET? IF NOT GO GET THE NEXT
"CHUNK"
190 X=USR(BEGINNING)
200 END
300 IF FLAG<>1 THEN BEGINNING=START:
REM HAVE WE FOUND A BEGINNING AD
DRESS ALREADY? IF NOT THIS IS IT
310 FLAG=1:REM SET FLAG TO 1 TO INDI
CATE WE HAVE ALREADY SET THE ENT
RY POINT OF THE MACHINE CODE SUB
ROUTINE
320 RETURN

```

# Atari Fast Shuffle

James E. Korenthal

What's all this fuss about rearranging a few numbers? I've seen so many articles in various magazines about shuffling numbers in increasingly exotic ways that I'm thoroughly mixed up.

Here's the technique that I've been using for years. It's simple and fast, and it gives you an equal probability of any given permutation showing up. The program is written in Atari BASIC, but will work on, or can easily be converted to, any other BASIC. It's set up to shuffle 52 cards, represented as numbers from 0-51 in an array called DECK (with subscripts running from 0-51).

```

10 REM INITIALIZE
20 N=51:DIM DECK(N):REM SHUFFLE N+1 N
UMBERS
30 FOR J=0 TO N:DECK(J)=J:NEXT J:REM

```

```

FILL THE DECK
40 REM SHUFFLE THE DECK
50 FOR J=N TO 1 STEP -1:REM LOOP BACK
WARDS THROUGH DECK
60 K=INT(RND(0)*(J+1)):REM PICK POSIT
ION TO SWAP
70 TEMP=DECK(J):DECK(J)=DECK(K):DECK(
K)=TEMP
80 NEXT J:REM AND THAT'S ALL THERE IS
TO IT!
90 FOR J=0 TO N:PRINT DECK(J);" ";NE
XT J

```

You can easily set up the shuffling loop as a one-line subroutine, and then use a GOSUB when it's time to shuffle. Also, as long as you haven't changed the numbers in the array to be shuffled, you don't have to reinitialize (line 30 in the program) before shuffling.

# VIC Contractor

Peter Lear

*Using these two programs, you can make expansion memory invisible to the VIC so unexpanded programs can be run without removing the cartridge. There's also a short program to access the 3K expansion area usually lost when an 8 or 16K cartridge is employed.*

Do you have some extra memory for your VIC that you don't always need? Are you tired of yanking out that cartridge and putting it back? Do you fear that your edge connector might eventually wear itself out? Here's the solution. Use these methods to "mask" cartridges from your VIC.

1. *The 3K expansion.* This is easy, because all that happens is that an empty memory block is filled. To forget this memory, just type in the following:

```
POKE 44,16:POKE 4096,0:NEW
```

2. *The 8K, 16K or 24K expanded VIC.* This is not as easy because not only has empty memory been filled in, but the VIC's screen has also moved. BASIC now begins at 4608 (\$1200), and the screen is where BASIC once was, 4096 (\$1000). Finally, the color locations for the screen now start at 37888 (\$9400). To fix all these alterations so that the VIC is unexpanded, type in Program 1. Save a copy before running it (otherwise you will need to type it again to use it). To get the memory back, just do a cold start with SYS64802.

3. *The 3K in addition to 8K or 16K or 24K expanded VIC.* With this setup, you cannot see the 3K cartridge as BASIC memory. To make this arrangement into a nonexpanded VIC, just use Program 1. The 3K block will still be accessible for machine language. As with the other cartridge arrangements, you also have access to any filled-in memory blocks solely for machine language. Some applications require that the 3K block be part of BASIC. Program 2 accomplishes this. Rather than type in the whole thing, just modify Program 1.

For some VIC owners with expansion boards, these programs are not necessary since the boards themselves have switches which do the same thing. But these programs are useful for VIC

owners whose boards do not provide such switches and for those without boards.

Note: Super Expander owners should change the following lines of Program 2:

```
130 POKE51,120:POKE52,29:POKE55,120:POKE56,29:POKE646,6  
150 PRINT"6519 BYTES FREE"
```

(This allows the function key labels to be protected.)

## Program 1: Reset To Unexpanded VIC

```
100 POKE36866,150:POKE648,30:POKE36869,240  
110 FORJ=217TO228:POKEJ,158:NEXT  
120 FORJ=229TO250:POKEJ,159:NEXT  
130 POKE51,0:POKE52,30:POKE55,0:POKE56,30:  
POKE646,6  
140 PRINT"{CLEAR}**** CBM BASIC V2 ****"  
150 PRINT"3583 BYTES FREE"  
155 POKE243,154:POKE244,150:POKE642,16:POKE644,30  
160 FORI=4096TO5000:POKEI,0:NEXT  
170 POKE44,16:POKE46,16:POKE48,16:POKE50,16:NEW
```

## Program 2: Reset To VIC With 3K Expansion

```
100 POKE36866,150:POKE648,30:POKE36869,240  
110 FORJ=217TO228:POKEJ,158:NEXT  
120 FORJ=229TO250:POKEJ,159:NEXT  
130 POKE51,0:POKE52,30:POKE55,0:POKE56,30:  
POKE646,6  
140 PRINT"{CLEAR}**** CBM BASIC V2 ****"  
150 PRINT"6655 BYTES FREE"  
155 POKE243,110:POKE244,150:POKE642,4:POKE643,120:POKE644,29  
160 FORI=1024TO1028:POKEI,0:NEXT  
170 POKE44,4:POKE46,4:POKE48,4:POKE50,4
```

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# Custom Characters On Atari

Charles Delp

*Custom character graphics is an easy way to program game animation, but sometimes it results in uneven motion. Smoother animation can be achieved by using custom characters to create the fixed playfield, and then using player/missile graphics to animate the players. The three programs here show you how.*

One of the easiest ways to put colorful, high resolution playfields or special symbols on the screen is with character graphics, employing custom characters. A good example of custom character graphics is demonstrated by the game Gold Miner (**COMPUTE!**, July 1982).

Gold Miner also demonstrates one of the major drawbacks of using character graphics to animate a game: players can move only in large, character-sized jumps. When smoother action is desired, a better solution is to draw the fixed playfields using custom characters and then animate the players using player/missile graphics.

The advantages of using character graphics rather than bit mapped graphics to draw fixed playfields are:

1. Much less memory is required to achieve the same resolution.
2. More colors are available.
3. Less time is required to draw to screen memory.
4. Color fill is faster and easier.

The major disadvantage of using character graphics to draw fixed playfields is that only two colors (character color and background color) are available within any one character. Figure 1 shows the resolution, memory requirements, and colors available for various Atari BASIC character and bit mapped graphics modes.

## How Characters Are Defined

Atari characters are defined by 64 pixels arranged in eight columns by eight rows. From right to left, the values of the columns are 1, 2, 4, 8, 16, 32, 64 and 128. If a particular pixel is turned on, the value

of that column is added to the row total; if the pixel is turned off, zero is added to the row total. The total value of all the "on" pixels in a row forms a byte of data which defines that row. Each of the eight rows is defined by a byte of data, for a total of eight bytes per character. (See Figure 2 for a specific example.) Note how the row bytes are arranged in memory from the character start address (CHADD).

## Character Editor

Program 1 is a character editor utility which will be a help in developing the DATA statements required to define each character. Draw the character using the joystick. Erase errors by holding the trigger button while drawing over the error. Press C (Clear character) at any time to clear the screen for another character. Press D (Demonstrate character) to see the character in all three of the character graphics modes, as well as the DATA statement required to produce the character. Press P (Print data) to print a hard copy of the character DATA statement. Press E (Enter data) to enter the character data as a program line beginning at line 9000. When all characters have been entered, typing LIST"D:CHAR",9000,9999 will save the data to disk or LIST"C",9000,9999, to cassette. The data may be merged into your graphics program using the ENTER command (see chapter 5, *Atari Basic Reference Manual*).

## Locating The Custom Character Set In Memory

First, look at the memory map in Figure 3. The standard Atari character set is located in ROM beginning at address 57344 (CHORG). The location and size of screen memory including the display list will depend on how much RAM is installed in your computer and which graphics mode is called by your program. The new character set must be defined and stored in RAM in a location which does not interfere with screen memory, the display list, the player/missile display memory, or the BASIC program. The proce-

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dure described below and illustrated in Figure 3 will keep everything nicely separated.

1. Find MEMTOP on your computer by entering the following line: PRINT PEEK (106) \* 256.
2. Decide whether your program using the custom characters will be written in graphics mode 0, 1, or 2. For your information, the bottom of screen memory, including display list, will be located at MEMTOP - X

where X = 992 for graphics mode 0  
X = 674 for graphics mode 1  
X = 424 for graphics mode 2

3. The starting address of the custom character set, CHBASE, must be located on a 1K memory boundary, so CHBASE should start 2K below MEMTOP (1K for screen memory, 1K for the character set); therefore, CHBASE = MEMTOP - 2048.
4. If player/missile graphics are to be used, PMBASE must be located on a 2K boundary (for single line resolution), so P/M Base should start 4K below MEMTOP (1K for screen memory, 1K for the character set, 2K for P/M Display Area); therefore, PM BASE = MEMTOP - 4096.

## Developing A Custom Character Set

Normally a character set consists of 128 different characters in graphics mode 0, and 64 different characters in graphics modes 1 and 2. However, a character set need not be full and may contain only as many characters as needed to meet the requirements of your program. The first character in the set must always be a space (DATA statement filled with zeros).

Program 2 demonstrates how to set up and use a custom character set containing only custom characters. To keep things simple, the set contains only eight characters.

**Lines 10-30** Initialize and find CHBASE

**Lines 50-70** Clear space in memory for the custom character set

**Lines 90-130** POKE the new characters into memory beginning at CHBASE

**Lines 200-280** Contain the character data

**Lines 300-360** Print the characters on the screen

The simplest way to print the custom characters to the screen is with the PRINT #6 statement; however, the custom characters are not shown on the keyboard, so the following correlation must be performed:

*Note:* Refer to Table 9.6 – The Internal Character Set, in the *Atari BASIC Reference Manual*, page 55.

1. Assign a character number to each of your custom characters, beginning with zero for your first character, number 1 for your second character, number 2 for your third character, etc.

2. Correlate your character numbers, one for one, with the Atari internal character set numbers in Table 9.6.

3. To print your custom character, enter the corresponding Atari character in your print statement. For example, the Atari character number 4 is the dollar sign (\$). PRINT #6; "\$" will print your custom character number 4 on the screen.

It is necessary to skip the third character of your set. (See line 220 of Program 2.) The third character corresponds to the Atari internal character quotation mark ("). It is not possible to print a quotation mark to screen using the PRINT #6 statement.

The color of a character is selected by its form in the print statement. If the custom character corresponds to an Atari alphabetical letter, the color is determined by entering the corresponding Atari letter in the print statement in upper- or lowercase, or inverse upper- or lowercase. Four colors are available for characters corresponding to Atari alphabetical letters.

If the custom character corresponds to an Atari number, punctuation mark, etc., the color is determined by entering the corresponding Atari number in the print statement in standard or inverse video. No upper- or lowercase numbers and punctuation marks are possible, so only two colors are available for these characters when using the PRINT #6 method. (See the table for character color information.)

The PRINT #6 method of putting custom characters on the screen has some serious drawbacks. The method used in Program 3 may not be as easy to understand, but has fewer limitations, particularly for drawing entire playfields.

## Mixing Standard And Custom Characters

In addition to colorful playfields, most games print numbers and specific letters on the screen to display such things as score, time, fuel, hits, etc. The standard Atari character set already contains these characters, so it would be pointless to develop custom characters for this purpose. The solution is to develop a custom character set containing all the necessary standard numbers and letters, but to replace all unneeded standard characters with custom characters.

The procedure for developing a mixed character set is described below:

Note: Refer to Table 9.6 in the *Atari BASIC Reference Manual*, page 55.

1. Determine which standard characters will be needed in your program.
2. Form a string variable which contains the unneeded standard characters. The string may include any unneeded characters with numbers between zero and 127 for graphics 0, or between zero and 63 for graphics 1 and 2. The only exception in either case is the quotation mark, for reasons explained before. (Try putting a quotation mark in your string.) An example string:  

```
CHNEWS$="!#*<BFGJLMPQZ"
```
3. Copy the standard character set from CHORG (57344) to CHBASE by PEEK and POKE statements.
4. Modify the unneeded standard characters into custom characters by POKEing custom character data into the character address (CHADD) of each character in the string. (See Program 3 for specific details of the procedure.)

## Printing Complete Playfields

Program 2 places the custom characters on screen with PRINT #6 statements. A better, though more difficult, method is plotting the character on the screen using color data to designate which character is to be plotted and in what color the character will appear. The color data to define a character contains two elements: the character number (the Atari internal character set number from table 9.6), and a plus or minus offset which determines the color of the character. The offsets may be obtained from Figure 9.7 on page 56 of the *Atari BASIC Reference Manual*. The easiest way to explain this concept is with examples.

**Example 1:** Suppose you want to display the standard character "K" in Graphics mode 1 with color 0:

1. From table 9.6, the internal character number for "K" is 43. Note that the "K" is from column 2.
2. From table 9.7, the offset to produce a column 2 character in color 0 is +32.
3. The color data to plot "K" in color 0 would be  $43 + 32 = 75$ .
4. 210 ...  

```
220 Color 75
```

```
230 Plot 5,7
```

```
240 ...
```

The program lines above will print a "K" in color 0 at X=5, Y=7.

**Example 2:** Suppose you want to display your custom character number 19 in graphics mode 2

with color 3. Your character number 19 corresponds to the standard character ";":

1. From table 9.6, the internal character number for ";" is 27 from column 1.
2. From table 9.7, the offset to produce a column 1 character in color 3 is +128.
3. The color data to plot your custom character in color 3 would be  $27 + 128 = 155$ .
4. 150 ...  

```
160 Color 155
```

```
170 Plot 7,1
```

```
180 ...
```

The program lines above will print your custom character in color 3 at X=7, Y=1.

A complete playfield may be drawn using the color/plot method by implementing a nested row, column loop which reads the color numbers from DATA statements and plots the characters to the screen (see lines 550 through 610 of Program 3 for a method).

Program 3 is a full screen, graphics 2, fixed playfield demonstration using 31 custom characters:

- Lines 30-80 Initialize, define string, and find CHBASE.
- Lines 110-130 Move standard character set down to CHBASE.
- Lines 150-210 Modify the characters in the string into custom characters. Line 160 locates the correct addresses to modify. The -32 is an offset to change ASCII to Atari internal character numbers.
- Lines 301-331 Custom character data.
- Line 420 Select split screen mode; kill cursor.
- Line 510-530 Change character set pointer; select colors.
- Lines 550-610 Read color data and plot characters on screen.
- Line 630 Print standard characters in text window.
- Lines 650-680 Flicker engine exhaust.
- Lines 700-709 Color data for ten rows of 20 characters.

**Figure 1: Atari Display Mode Facts**

Graphics Mode	Graphics Type	Resolution H x V	Colors Available (Including Background)	Bytes of Memory/Screen
0	Character	320 x 192	2	960
1	Character	160 x 192	5	480
2	Character	160 x 96	5	240
5	Bit Mapped	80 x 48	4	960
7	Bit Mapped	160 x 96	4	3840
8	Bit Mapped	320 x 192	2	7680

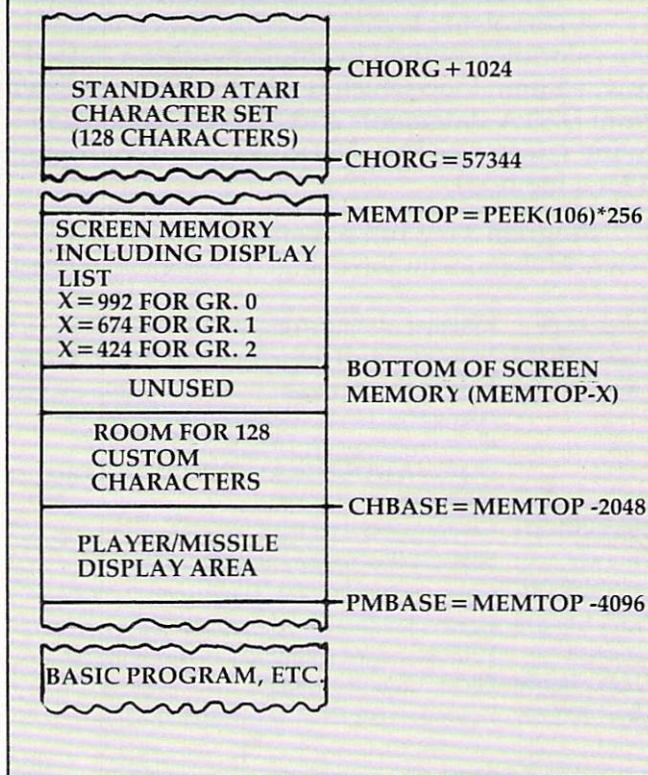
**Character Color Information**

Character Type	Color Register
Uppercase alphabetical	0
Lowercase alphabetical	1
Inverse uppercase alphabetical	2
Inverse lowercase alphabetical	3
Numbers, punctuation marks, etc.	0
Inverse numbers, punctuation marks, etc.	2

### Figure 2: Typical Custom Character

Row Byte Memory Location	Rows	Column Values	
CHADD	Byte 1 = 24	128 64 32 16 8 4 2 1	8+16
CHADD+1	Byte 2 = 36		4+32
CHADD+2	Byte 3 = 66		2+64
CHADD+3	Byte 4 = 255		1+2+4+8+16+32+64+128
CHADD+4	Byte 5 = 0		0
CHADD+5	Byte 6 = 27		1+2+8+16
CHADD+6	Byte 7 = 24		8+16
CHADD+7	Byte 8 = 64		64

### Figure 3: Memory Map



```

210 ?
220 ? "{5 SPACES}87654321"
230 ? "{4 SPACES}{0}{8 R}{E}"
240 ? "{4 SPACES}:(8 SPACES): 1"
250 ? "{4 SPACES}:(8 SPACES): 2"
260 ? "{4 SPACES}:(8 SPACES): 3
      {3 SPACES}C = CLEAR CHAR"
270 ? "{4 SPACES}:(8 SPACES): 4
      {3 SPACES}D = DEMO CHAR"
280 ? "{4 SPACES}:(8 SPACES): 5
      {3 SPACES}P = PRINT DATA"
290 ? "{4 SPACES}:(8 SPACES): 6
      {3 SPACES}E = ENTER DATA"
300 ? "{4 SPACES}:(8 SPACES): 7"
310 ? "{4 SPACES}:(8 SPACES): 8"
320 ? "{4 SPACES}{Z}{8 R}{C}"
499 REM MAIN LOOP
500 X=7:Y=6
510 K=PEEK(764)
512 IF STRIG(0)=0 THEN 700
513 IF K=18 THEN 1000
514 IF K=58 THEN 2000
515 IF K=10 THEN 3000
516 IF K=42 THEN 5000
518 POSITION X,Y:?" "
520 FOR DELAY=1 TO 15:NEXT DELAY
530 POSITION X,Y:?"■"
540 FOR DELAY=1 TO 15:NEXT DELAY
550 ST=STICK(0)
560 IF ST=15 THEN 510
570 IF ST=6 OR ST=14 OR ST=10 THEN Y
    =Y-1
580 IF ST=5 OR ST=9 OR ST=13 THEN Y=
    Y+1
590 IF ST=5 OR ST=6 OR ST=7 THEN X=X
    +1
600 IF ST=9 OR ST=10 OR ST=11 THEN X
    =X-1
610 IF X>14 THEN X=14
620 IF X<7 THEN X=7
630 IF Y>13 THEN Y=13
640 IF Y<6 THEN Y=6
650 GOTO 510
700 POSITION X,Y:?"■"
710 FOR DELAY=1 TO 15:NEXT DELAY
720 POSITION X,Y:?" "
730 FOR DELAY=1 TO 15:NEXT DELAY
732 IF K=18 THEN 1000
734 IF K=58 THEN 2000
736 IF K=10 THEN 3000
738 IF K=42 THEN 5000
740 GOTO 550
999 REM CLEAR CHAR
1000 POKE 764,255
1010 GOTO 200
1999 REM DEMO CHAR
2000 BYTE=0:BIT=0
2005 GOSUB 4000

```

### Program 1: Character Editor

```

5 CLR :? "{CLEAR}":OPEN #1,4,0,"K":
  OPEN #6,4,0,"S":SETCOLOR 2,9,2:SE
  TCOLOR 4,9,2:POKE 752,1
10 DIM C$(1),STORE(8):N=0
20 GOSUB 6000
40 ? :? :? "PLUG JOYSTICK INTO JACK
  1"
50 ? "DRAW CHARACTER WITH JOYSTICK"
60 ? "HOLD TRIGGER BUTTON TO ERASE":
  ? :?
70 ? :? :? "{8 SPACES}PLEASE WAIT .
  . ."
90 CHBASE=(PEEK(106)-8)*256:CHORG=57
  344
100 FOR I=0 TO 1023:POKE CHBASE+I,PE
  EK(CHORG+I):NEXT I
105 C$="&"
110 CHADD=CHBASE+(ASC(C$)-32)*8
120 POKE 756,CHBASE/256
200 ? "{CLEAR}":POKE 752,1:GOSUB 600
  0
205 FOR I=0 TO 7:STORE(I)=0:NEXT I

```



```

2008 REM DETERMINE DATA VALUES
2010 FOR Y=0 TO 7
2020 FOR X=7 TO 0 STEP -1
2030 LOCATE (X+7),(Y+6),PIX
2035 POSITION (X+7),(Y+6):PUT #6,PIX
2040 IF PIX=160 THEN PIX=1
2050 IF PIX=32 THEN PIX=0
2060 IF X=7 THEN BIT=PIX
2070 IF X=6 THEN BIT=PIX*2
2080 IF X=5 THEN BIT=PIX*4
2090 IF X=4 THEN BIT=PIX*8
2100 IF X=3 THEN BIT=PIX*16
2110 IF X=2 THEN BIT=PIX*32
2120 IF X=1 THEN BIT=PIX*64
2130 IF X=0 THEN BIT=PIX*128
2140 BYTE=BYTE+BIT
2150 NEXT X
2160 STORE(Y)=BYTE
2165 BYTE=0
2170 NEXT Y
2180 POSITION 2,16:? "DATA ";
2190 FOR Y=0 TO 6
2200 STORE=STORE(Y)
2210 ? STORE;",";
2220 NEXT Y
2230 STORE=STORE(7)
2240 ? STORE;
2242 FOR J=0 TO 7:STORE=STORE(J)
2244 POKE CHADD+J,STORE:NEXT J
2248 REM ALTER DISPLAY LIST
2250 A=PEEK(560)+PEEK(561)*256
2260 POKE A+25,6:POKE A+26,6:POKE A+
27,7:POKE A+28,PEEK(A+29):POKE
A+29,PEEK(A+30):POKE A+30,PEEK(
A+31)
2265 REM PRINT CHAR TO SCREEN
2270 POSITION 2,18:? "{3 SPACES}GR 0
: & & & & & & & & & &";
2280 POSITION 0,20:? #6;"GR 1: & & &
& & &";
2290 POSITION 0,21:? #6;"GR 2: & & &
& & &";
2345 POKE 764,255
2350 GOTO 500
2999 REM PRINT DATA TO PRINTER
3000 TRAP 3100
3005 POKE 559,0
3030 GOSUB 3200
3040 LPRINT "DATA ";S0;",";S1;",";S2
;",";S3;",";S4;",";S5;",";S6;","
;S7
3050 POKE 559,34
3060 POKE 764,255
3070 GOTO 200
3100 GOSUB 4000
3110 POKE 559,34
3120 POSITION 2,17
3130 ? " PRINTER NOT CONNECTED"
3140 ? "{9 SPACES}- OR -"
3150 ? "{3 SPACES}PRINTER TURNED OFF"
3160 FOR DELAY=1 TO 400:NEXT DELAY
3165 GOSUB 4000
3170 POKE 764,255
3180 GOTO 200
3200 S0=STORE(0):S1=STORE(1):S2=STOR
E(2):S3=STORE(3):S4=STORE(4):S5
=STORE(5):S6=STORE(6):S7=STORE(
7)
3210 RETURN
3999 REM CLEAR DATA SUB
4000 POSITION 2,16
4010 FOR Y=16 TO 19
4020 ? "{37 SPACES}"

```

```

4030 NEXT Y
4040 POSITION 0,20:? "{19 SPACES}"
4050 POSITION 0,21:? "{19 SPACES}"
4200 RETURN
4999 REM ENTER DATA INTO PROGRAM
5000 POKE 559,0
5010 GOSUB 3200
5020 GOSUB 5200
5030 ? 9000+N;" DATA ";S0;",";S1;","
;S2;",";S3;",";S4;",";S5;",";S6
;",";S7
5040 GOSUB 5210
5050 N=N+1
5060 POKE 764,255
5070 POKE 559,34
5080 GOTO 200
5200 ? CHR$(125):? :RETURN
5210 ? :? :? "CONT":POSITION 0,0:POK
E 842,13:STOP
5220 POKE 842,12:? CHR$(125):? :RETU
RN
6000 ? "{10 SPACES}CHARACTER EDITOR"
6010 ? "{10 SPACES}{16 M}"
6020 RETURN

```

## Program 2: Custom Characters

```

10 N=0
20 MEMTOP=PEEK(106)*256
30 CHBASE=MEMTOP-2048
40 REM CLEAR MEMORY FOR NEW CHARACTE
R SET
50 FOR I=CHBASE TO CHBASE+1024
60 POKE I,0
70 NEXT I
80 REM POKE NEW CHARACTER SET INTO M
EMORY
90 READ A
100 IF A=999 THEN 300:REM 999 IS END
OF DATA FLAG
110 POKE CHBASE+N,A
120 N=N+1
130 GOTO 90
190 REM DATA STATEMENTS FOR SPACE,6
CHARACTERS AND FLAG. FIRST CHARA
CTER MUST BE A SPACE
195 REM LINE 220 IS A SPACE TO SKIP
THE QUOTATION MARKS
200 DATA 0,0,0,0,0,0,0,0
210 DATA 32,33,35,35,35,35,255,255
220 DATA 0,0,0,0,0,0,0,0
230 DATA 112,112,112,112,248,248,248
,248
240 DATA 248,252,254,254,86,6,255,25
5
250 DATA 0,0,32,32,32,32,112,240
260 DATA 41,38,32,32,32,32,32,32
270 DATA 0,0,0,0,0,32,32,48
280 DATA 999
290 REM SET GRAPHICS MODE
300 GRAPHICS 2
310 REM TELL COMPUTER WHERE TO FIND
NEW CHARACTER SET
320 POKE 756,CHBASE/256
324 REM PRINT NEW CHARACTERS
325 POSITION 9,7
330 ? #6;"%"
335 POSITION 9,8
340 ? #6;"&#"
345 POSITION 9,9
350 ? #6;"!$"
360 GOTO 360

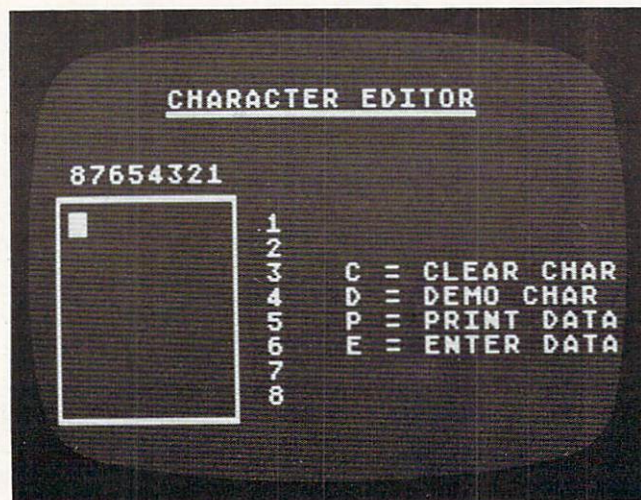
```

### Program 3: Fixed Playfield Demonstration

```

10 CLR
20 REM N = NUMBER OF CHARACTERS IN C
  HNEW$ STRING
30 N=31:CHORG=57344
40 REM DEFINE STRING
50 DIM CHNEW$(N)
60 CHNEW$="!#%&'()*+,-./;<=>?@BGHJK
  MNPQVW"
70 REM FIND CHBASE
80 CHBASE=(PEEK(106)-8)*256
90 ? :? " PLEASE WAIT, 760 NUMBERS
  TO MOVE"
100 REM COPY STANDARD CHARACTER SET
  FROM CHORG TO CHBASE
110 FOR I=0 TO 511
120 POKE CHBASE+I,PEEK(CHORG+I)
130 NEXT I
140 REM READ AND POKE CUSTOM DATA IN
  TO THE CHARACTERS IN STRING CHNE
  W$"
150 FOR I=1 TO N
160 CHADD=CHBASE+(ASC(CHNEW$(I))-32)
  *8
170 FOR J=0 TO 7
180 READ A
190 POKE CHADD+J,A
200 NEXT J
210 NEXT I
300 REM CUSTOM CHARACTER DATA
301 DATA 0,0,0,128,0,0,0,0
302 DATA 0,0,0,0,0,0,0,16
303 DATA 0,0,0,0,1,0,0,0
304 DATA 8,0,0,0,0,0,0,0
305 DATA 0,0,0,0,0,0,31,127
306 DATA 0,0,0,0,0,0,255,255
307 DATA 0,0,0,0,0,0,248,254
308 DATA 0,0,0,0,7,15,31,31
309 DATA 1,7,31,24,255,255,219
310 DATA 255,231,255,0,255,255,255,2
  19
311 DATA 128,224,248,24,255,255,255,
  219
312 DATA 0,0,0,0,224,240,248,248
313 DATA 31,31,15,7,1,1,3,2
314 DATA 219,255,255,255,127,16,32,6
  4
315 DATA 219,255,255,255,255,24,60,6
  0
316 DATA 219,255,255,255,254,8,4,2
317 DATA 248,248,240,224,128,128,192
  ,64
318 DATA 6,5,6,12,127,0,0,0
319 DATA 128,0,0,0,0,0,0,0
320 DATA 60,126,126,126,60,60,60,60
321 DATA 1,0,0,0,0,0,0,0
322 DATA 96,160,96,48,254,0,0,0
323 DATA 24,24,24,24,24,0,0,0
324 DATA 128,192,240,240,248,252,254
  ,255
325 DATA 129,195,231,255,255,255,255
  ,255
326 DATA 128,192,192,224,224,224,248
  ,255
327 DATA 1,3,7,31,63,63,127,255
328 DATA 1,3,7,7,15,31,63,255
329 DATA 255,255,255,255,255,254,249
  ,7
330 DATA 252,251,247,207,191,127,255
  ,255
331 DATA 255,255,255,255,255,255,255
  ,255
400 REM PUT PLAYFIELD ON SCREEN
420 GRAPHICS 2:POKE 752,1
500 REM TELL COMPUTER WHERE TO FIND
  NEW CHARACTER SET
510 POKE 756,CHBASE/256
530 SETCOLOR 0,3,6:SETCOLOR 1,8,6:SE
  TCOLOR 2,1,10:SETCOLOR 3,0,10
540 REM PLOT CHARACTERS USING COLOR
  DATA
550 FOR ROW=0 TO 9
560 FOR COLUMN=0 TO 19
570 READ CHAR
580 COLOR CHAR
590 PLOT COLUMN,ROW
600 NEXT COLUMN
610 NEXT ROW
620 REM PRINT STANDARD NUMBERS AND L
  ETTERS IN TEXT WINDOW
630 ? :? "FUEL:2568 STARDATE:174 A
  LTITUDE:390";

```



This simple utility program allows you to design your own Atari custom characters.



An example of the game playfields you can create with custom characters. This screen was generated by one of the following sample programs.

```

640 REM BLINK ENGINE EXHAUST
650 FOR LUM=0 TO 8 STEP 2
660 SETCOLOR 0,3,LUM
670 NEXT LUM
680 GOTO 650
699 REM CHARACTER COLOR DATA
700 DATA 0,129,0,0,0,0,131,0,132,0,1
33,0,0,132,0,0,0,0,131
701 DATA 0,0,0,133,0,0,0,0,6,7,8,0,1
29,0,0,129,0,133,0,0
702 DATA 0,133,0,0,132,0,9,10,11,11,
11,12,13,129,0,0,131,0,129,0
703 DATA 0,0,132,0,0,0,14,15,27,27,2
7,28,29,0,133,0,0,0,0,132
704 DATA 202,133,0,132,0,133,30,31,6
4,64,64,98,103,0,129,0,206,202,1
32,0
705 DATA 215,203,202,0,0,0,129,133,7
2,72,72,0,133,0,206,203,215,215,
205,0
706 DATA 215,215,215,205,133,0,206,2
03,215,202,133,0,0,208,215,215,2
15,215,215,202
707 DATA 215,215,209,214,215,215,215
,215,215,215,215,209,214,215,215
,215,215,215,215,215
708 DATA 215,215,215,215,215,215,215
,215,215,215,215,215,215,215,215
,215,215,215,215,215
709 DATA 215,215,215,215,215,115,99,
111,114,101,26,21,16,19,23,215,2
15,215,215,215

```

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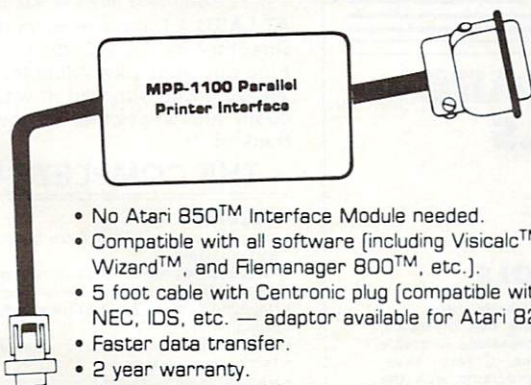
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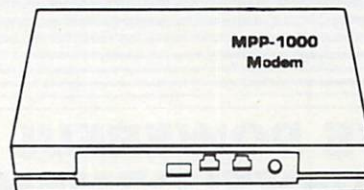


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# Sinclair/Timex Screen Splitter

Harold Miller

*This short, clever technique allows you to put text on screen and then clear the screen below at will, leaving your messages intact.*

After you've owned your Sinclair/Timex computer for a few minutes, you know that the bottom two lines on the screen are not available to you. Your computer needs them to send you report codes and to display the program line you are editing.

Here's a way to reserve as many lines as you need at the top of the screen for your own words. You can put instructions, reminders, warnings, and other messages there. Then, instead of using CLS in your program, you can use the USR command (a call to a six-byte machine language routine) to clear the screen of all but those top lines.

The machine language routine is easy to add to any program in the form of a REM statement that *must* be the first line in your program:

```
1 REM T?LN GSTAN
```

The six keystrokes after REM are: graphic T/?/func-

tion LN/G/graphic S/function TAN.

Before you can use this routine, you must POKE into it information on how many lines you want to protect at the top of the screen:

```
POKE 16515, 24-N
```

where N is the number of protected lines (and 24-N is the number of lines that are cleared).

Then, each time you want to clear only the lower portion of the screen, use:

```
RAND USR 16514
```

To see how easily this works, add these lines *after* the REM line and RUN:

```
10 FOR I=0 TO 20
20 PRINT AT I,0;I
30 NEXT I
40 PRINT AT 21,0;"N=?"
50 INPUT N
60 POKE 16515,24-N
70 PRINT AT 21,0;"PRESS ENTER TO CLEAR"
80 PAUSE 4E4
90 RAND USR 16514
```

Here is the assembly listing of the machine language subroutine:

Location	Decimal	Hex	Opcode	Comment
16514	6	06	ld b,N	loads N into the B register
16515	N <sub>D</sub>	N <sub>H</sub>		N <sub>H</sub> ≤ 24
16516	205	CD	call 0A2C	calls CLS routine in ROM, but skips 0A2A and 0A2B, which is ld b,24
16517	44	2C		
16518	10	0A		
16519	201	C9	ret	

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# VIC Power Spirals

Bruce Jordan

Computer art in the form of "spiro-graphic" designs. Spiro is an excellent demonstration of the high resolution color graphics capability of the VIC 20 Superexpander module. You'll see almost anything - from geodesic domes to impossible bottles.

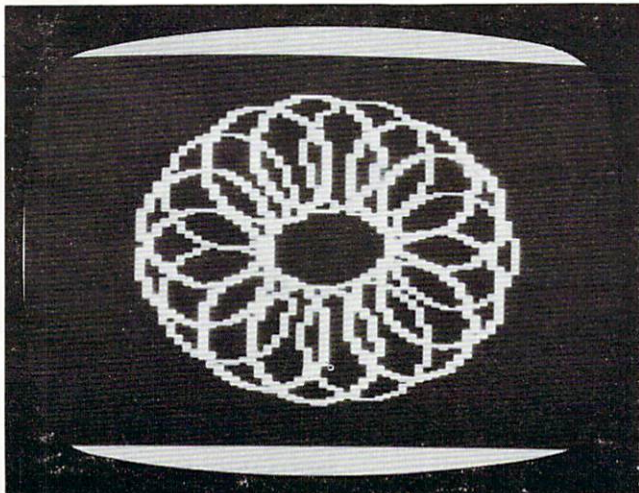
"Spiro" works by choosing a screen location based on a value of a circular function; then, it uses the CIRCLE command of the Superexpander to draw a circle (I call them spiros) around the screen location. Next, the program loops back to the function, takes a new value, and the process is repeated until the design is complete.

When the program is run, it asks for information that gives you control over the final design.

## Creating Your Design

The first thing that Spiro asks you is "How many spiros?" This determines how many times the spiro will be repeated across the screen. The higher the number, the more complex the design will be. Try 30 to start with.

Second, it asks "Alternate?" This allows you to create a design consisting of two different spiros. If you type Y, Spiro will ask you for the height and width of each of the two spiros to be used in your design. But if you type N, you will be asked for the height and width of a single spiro. Try N, and then 200 for the height and 150 for the width.



One of the designs possible with a VIC-20 and "Power Spirals."

The last thing you are asked is which graphics mode you want your design to be drawn in. If you type 1, the design will be drawn in the multi-color mode. If you choose 2, the design will be drawn in the high-resolution mode, and in black and white.

After the design is finished, you can return to the beginning of the program by typing R. This lets you alter your design by changing the parameters. If you type F after your design is complete, the program will automatically list the plotting function to allow for quick and easy editing.

Changing the plotting function will radically alter how your design will look. Depending on what function you use, you can wind up with anything from a geodesic sphere to a sort of improbable bottle that has its insides opening outwards to become its outsides! The best thing about Spiro is that it's unpredictable. Below is a list of some of the possible plotting functions. Try these, or make up your own and see what you get.

## Plotting Functions For Spiro

1.  $X=511+200*\text{COS}(A)$ ,  $Y=511+250*\text{SIN}(A)$
2.  $X=511+200*\text{COS}(A)$ ,  $Y=511+250*\text{SIN}(A)^3$
3.  $X=511+200*\text{COS}(A)^3$ ,  $Y=511+250*\text{SIN}(A)^3*\text{COS}(A)$
4.  $X=511+150*\text{SIN}(A)+200*\text{COS}(A)$ ,  $Y=511+325*\text{SIN}(A)$
5.  $X=511+200*\text{SIN}(A)*\text{COS}(A)$ ,  $Y=511+250*\text{SIN}(A)$

```
10 PRINT "{CLEAR}"
20 INPUT "HOW MANY SPIROS";Z
30 INPUT "ALTERNATE";A$
40 IFA$="N"THEN90
50 INPUT "#1 HEIGHT";H1
60 INPUT "#1 WIDTH";W1
70 INPUT "#2 HEIGHT";H2
80 INPUT "#2 WIDTH";W2:GOTO110
90 INPUT "HEIGHT OF SPIRO";H1
100 INPUT "WIDTH OF SPIRO";W1
110 INPUT "GRAPHICS MODE";G
120 IFG=1THENP=3:K=0
130 IFG=2THENP=0:K=1
140 GRAPHIC G:COLOR K,4,P,7
150 A=0:DA=2*PI/Z
160 I=1:DI=1
170 GOSUB 280
180 CIRCLE I,X,Y,W1,H1
190 IF A$="Y" THEN GOSUB 350
200 A=A+DA:IF A=2*PI THEN 230
210 I=I+DI:IFI=>4THEN160
220 GOTO170
230 GETB$:IFB$=""THEN230
240 IFB$="R"THEN260
250 IFB$="F"THEN270
```

```

260 GRAPHIC 0:COLOR 1,2,0,4:GOTO 20
270 GRAPHIC 0:COLOR 1,2,0,4:LIST 280-290
280 X=511+200*COS(A)
290 Y=511+250*SIN(A)
300 IFX<=0THENX=0
310 IFX=>1023THENX=1023
320 IFY<=0THENY=0
330 IFY=>1023THENY=1023
340 RETURN
350 L=I:IFL<=2THENL=L+1:GOTO370
360 IFL=>3THENL=1
370 CIRCLE L,X,Y,W2,H2
380 RETURN

```

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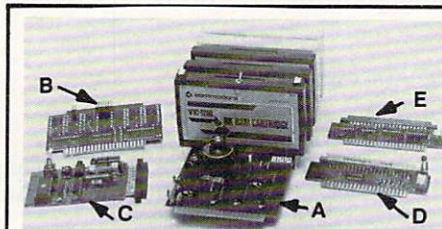
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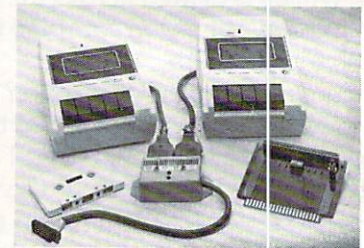
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Recently scoring a rating of 10 out of a possible 10 this game was praised as "one of the best I've seen on any computer" by a prominent reviewer in a leading magazine. The idea is to shoot a centipede before it overruns you, the problem being every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

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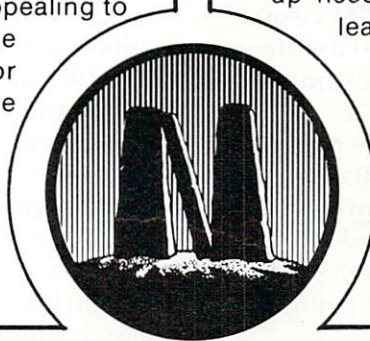
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### **Commodore 64**

#### **(CG602) 3D-64, Man \$19.95**

This available on the expanded "Vic 20" game, has been completely rewritten for the 64 and uses sprites, sounds, and other features not available on the "Vic". This one requires a joystick.



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# Using The Atari Timer

Stephen Lewy

*Because FOR/NEXT loops are not accurate timers, the solution is to incorporate Atari's internal counters into programs where you want something delayed or timed reliably.*

---

Have you ever written a program and wanted a specific time delay? What did you do? Some of us figured a FOR/NEXT loop was the answer, so we set to work with our stopwatches until we found that the following takes about three seconds to write "STOP":

```
10 PRINT "BEGIN"  
20 FOR X=1 TO 1000  
30 NEXT X  
40 PRINT "STOP"
```

Then we went along and wrote our programs and found that our three-second delay had become five, six, or even ten seconds. Why? Because the Atari FOR/NEXT loops take longer as you add lines of code to the program.

There is a better way. Yes, machine language routines are great for timing on the Atari, especially if you know how to use locations 536 to 558 (\$218 to \$22E). But it can be most disconcerting if you allow some of those registers to drop to zero unchecked.

## Accurate Delays

BASIC programmers, there is a way. Use memory locations 18, 19, and 20. (In the May 1981 issue of **COMPUTE!**, Richard Bills shows how to use these locations for timing in "Real-Time Clock on the Atari.")

These timers work like the mileage gauge on a car's speedometer: one counter counts up and then sets the one next to it which, in turn, sets the next one. Each counter on the speedometer goes up when the one to its right hits ten. In the computer, they count up to 255 before going back to zero.

Register number 20 counts at the rate of 60 numbers per second up to number 255, then increments register 19 by one and starts over. When register 19 reaches 255, it increments register 18 by one. If you POKE zero into all three registers, it will take about 1092 seconds before a one appears in register 18 (more than 18 minutes). The table gives some times (it assumes all three registers began with zero). Notice that it would take more

than 77 hours for memory location 18 to reach 255.

Well, how does all this help? Let's look at our short program again. We can rewrite it this way:

```
10 PRINT "BEGIN": POKE 20,0  
20 IF PEEK(20)<180 THEN 20  
30 PRINT "STOP"
```

This routine will continue to take three seconds no matter how long your program. Well, not exactly; since it is written in BASIC, the longer the program, the longer the routine will take. But the influence of the program length will usually be negligible.

Included here are three programs which demonstrate a much more functional use of this timer. Type in Program 1, leaving out the REM statements. This program tells the user the time interval between the pressing of RETURN after typing RUN and the pressing of RETURN a second time. Notice that if you press another key the computer goes back to line 130.

This short program demonstrates several useful concepts. First, the computer is looking for a particular input, in this case the RETURN key (ATASCII 155). Second, line 150 PEEKs at registers 18, 19, 20. Notice we POKEd location 20 last on line 110 and PEEKed at it first on line 150. Third, line 160 contains the important formula for converting the information in locations 18, 19, 20 to seconds. Why 4.267? Because 256 divided by 60 numbers per second equals 4.267. Fourth, lines 170 to 190 convert the total number of seconds to minutes and seconds.

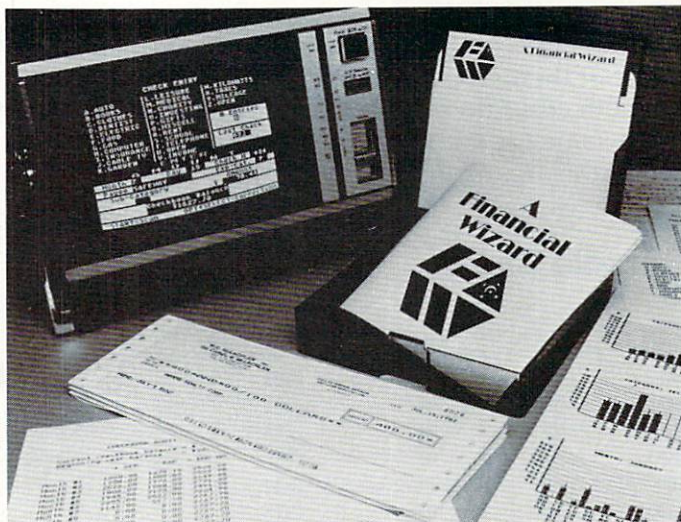
Program 2 is a bit more useful. It is a timed math quiz in which the user is allowed eight and one half seconds to answer. Line 55 is used to check if a key has been pressed. If no key has been pressed, then the program goes back to check how much time has elapsed. Once a key is pressed, the computer GETs the ATASCII code and calls it A1. At lines 70 and 80, A1 is converted to its CHR\$ and placed in its proper place in ANS\$. If A1 equals 155 (ATASCII code for the RETURN key), then the program moves to line 200, where the value of ANS\$ is put into variable ANS.

The final illustration, Program 3, is also a math quiz. In this case the user is given unlimited time. This program combines elements of both programs 1 and 2.



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Of course the usefulness and effectiveness of a program is of primary importance. However, enhancing the dullness of applications programs with some of Atari's charms, is a great asset. A Financial Wizard, a personal finance program by Computari's Bill McLachlan, is an excellent example of an applications program that integrates many of the Atari's features into a well conceived and executed program."

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This Atari timing device should be beneficial whether you wish to impose a time limit, simply time answers, or have users compete against each other or themselves. The timer has applications for both educational programming and games. With some experimentation you should be able to adapt this timing device for use with your own programs.

## Sample Times

LOC.20	LOC.19	LOC.18	TIME MIN:SEC
60	0	0	0:01
60	1	0	0:05
0	2	0	0:08
100	2	0	0:10
0	3	0	0:12
100	4	0	0:18
21	14	0	1:00
42	28	0	2:00
84	56	0	4:00
176	112	0	8:00
0	255	0	18:08
0	60	2	40:40
0	0	16	291:17
0	0	100	1820:35
0	0	150	2730:52
0	0	255	4642:29

## Program 1: Atari Timer

```

10 REM PROGRAM 1
15 REM
20 REM THIS PROGRAM DEMONSTRATES HOW
30 REM TO USE ATARI TIMER:
40 REM ADDRESS 18,19,20
50 REM IT FIGURES HOW LONG IT TAKES
60 REM YOU TO PRESS THE <RETURN> KEY.
70 REM RUN THE PROGRAM THEN PRESS
80 REM <RETURN>
90 REM PROGRAM RUNS BETTER WITHOUT TH
  E
95 REM REMARK STATEMENTS OR GOTO 100
100 OPEN #1,4,0,"K:"
110 FOR Z=18 TO 20:POKE Z,0:NEXT Z
130 GET #1,D:IF D=155 THEN 150
140 GOTO 130
150 A=PEEK(20):B=PEEK(19):C=PEEK(18)
160 SEC=INT((4.267*256*C)+(B*4.267)+(
  A/60))
170 MIN=INT(SEC/60)
180 M=MIN*60
190 SEC=SEC-M
200 PRINT MIN;" MINUTES ";SEC;" SECON
  DS"

```

## Program 2: Timed Math Quiz

```

1 REM PROGRAM 2
2 REM
3 REM THIS IS A TIMED MATH QUIZ
4 REM CHANGE LINE 50 TO A=1
5 REM ALLOWS 4 1/4 SECOND
6 REM A=2 ALLOWS 8 1/2 SECONDS
7 REM A=3 ALLOWS 12 3/4 SECONDS, ETC.
10 OPEN #1,4,0,"K:" : DIM ANS$(10)
15 PRINT :Q1=INT(RND(0)*20):Q2=INT(RN
  D(0)*20):X=1
20 PRINT Q1;" + ";Q2;"=";
25 POKE 18,0:POKE 19,0:POKE 20,0

```

```

45 A=PEEK(19):B=PEEK(20)
50 IF A=2 THEN 100:REM 8 1/2 SECONDS
55 IF PEEK(764)=255 THEN 45
60 GET #1,A1:IF A1=155 THEN 200
70 ANS$(X,X)=CHR$(A1)
80 PRINT ANS$(X,X);:X=X+1:GOTO 45
100 PRINT :PRINT "TIME'S UP"
110 PRINT "THE ANSWER IS ";Q1+Q2
115 FOR W=1 TO 400:NEXT W
120 ANS$=" ":GOTO 15
200 ANS=VAL(ANS%):PRINT
210 IF ANS=Q1+Q2 THEN PRINT :PRINT "C
  ORRECT":GOTO 115
220 PRINT :PRINT "SORRY":PRINT :GOTO
  110

```

## Program 3: Revised Math Quiz

```

1 REM PROGRAM 3
2 REM
3 REM THIS PROGRAM COMBINES ELEMENTS
4 REM OF PROGRAMS 1 AND 2.
5 REM IT GIVES MATH QUIZ AND TELL HOW
6 REM LONG IT TOOK YOU TO DO EACH
7 REM PROBLEM.
10 OPEN #1,4,0,"K:" : DIM ANS$(10)
15 PRINT :Q1=INT(RND(0)*20):Q2=INT(RN
  D(0)*20):X=1
20 PRINT Q1;" + ";Q2;"=";
25 POKE 18,0:POKE 19,0:POKE 20,0
60 GET #1,A1:IF A1=155 THEN 190
70 ANS$(X,X)=CHR$(A1)
80 PRINT ANS$(X,X);:X=X+1:GOTO 60
110 PRINT "THE ANSWER IS ";Q1+Q2
115 FOR W=1 TO 1000:NEXT W
120 ANS$=" ":GOTO 15
190 A=PEEK(20):B=PEEK(19):C=PEEK(18)
200 ANS=VAL(ANS%):PRINT
210 IF ANS=Q1+Q2 THEN PRINT :PRINT "C
  ORRECT":GOTO 230
220 PRINT :PRINT "SORRY"
230 SEC=INT((4.267*256*C)+(B*4.267)+(
  A/60))
240 MIN=INT(SEC/60)
250 M=MIN*60
260 SEC=SEC-M
270 IF MIN<>0 THEN 290
280 PRINT "THAT TOOK YOU ";SEC;" SECO
  NDS":GOTO 300
290 PRINT "THAT TOOK YOU ";MIN;" MINU
  TES":PRINT "AND ";SEC;" SECONDS"
300 GOTO 115

```

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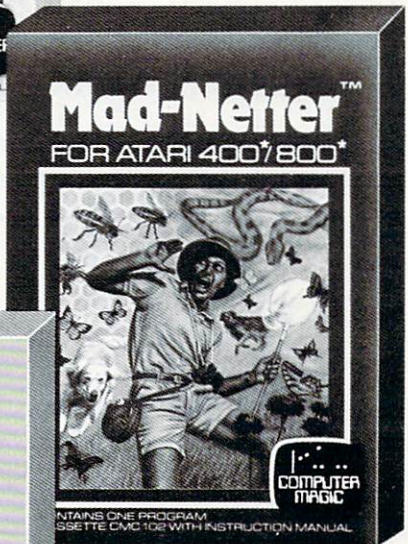
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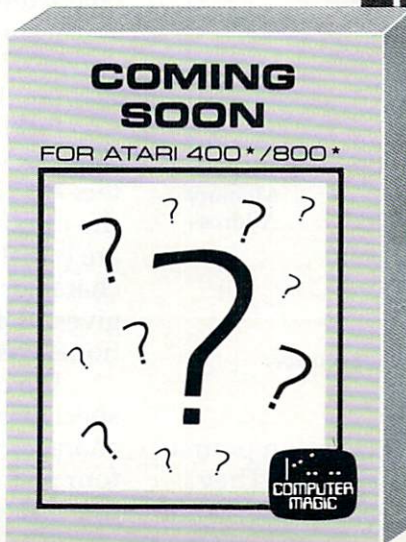


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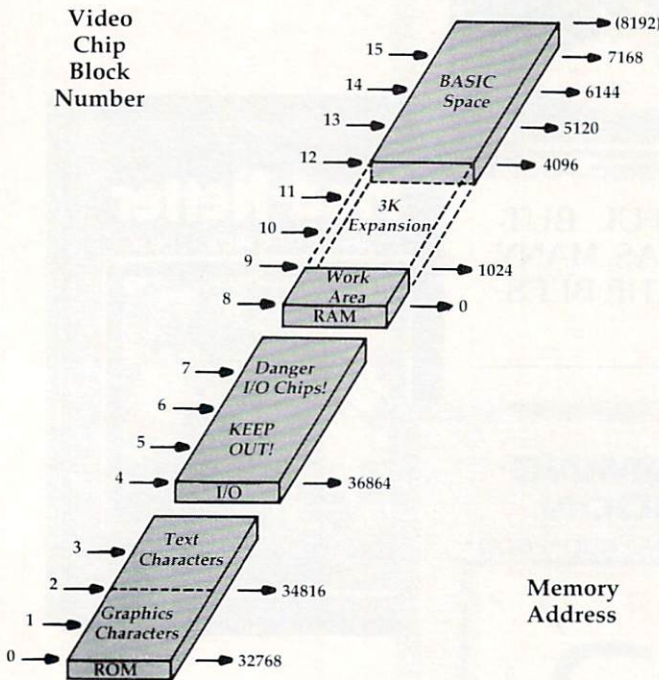
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# Visiting The VIC-20 Video

Jim Butterfield, Associate Editor

*This is the second part in our exploration of the VIC-20 video, in which the traveler discovers that a character set is less important for its footage than its mileage.*

It's worthwhile making an observation about the "minimum VIC" configuration here. We know that the video chip sees memory in an unusual way:



How the video chip sees memory.

Some users have memory expansion permanently connected to their VIC machines. They don't want to plug and unplug the memory units.

Yet some programs call for a "minimum VIC with only 5K." A few POKES can reconfigure any machine to this minimum configuration.

First, we set the Limit-of-BASIC:

```
POKE 55,0:POKE 56,30:CLR
```

And then put the screen into place (Block 15.5):

```
POKE 36869,240:POKE 36866,150:PRINT CHR$(147)
```

This takes care of the high end of memory. It's not always necessary, but we can also set up the low end:

```
POKE 4096,0:POKE 43,1:POKE 44,16:NEW
```

## Small Character Sets

A full character set, 256 characters, takes up 2048 bytes of memory; there are eight bytes for each character. We have tried copying over the whole set. On a small VIC, it takes up a lot of our available RAM and starts to cramp our program space. Can we omit some of the characters and save space? Yes, we can.

Our program may not need the reverse video characters. If so, there's a savings of 1024 bytes. Be careful: reverse video is used for flashing the cursor. If you give it up, the cursor may not work in quite the same way.

But there's more. Which are the characters that we use the most? Well, the alphabetic characters A to Z, the space character, of course, and the numbers 0 to 9. What luck! These characters are bunched together within the first 58 of the character set, including a few spares. 58 times 8 gives us 464 bytes of storage – not bad for a functional character set.

We could do better than this if we had a specialized display that could work from very few characters. For example, a game might use only four characters: a ball, a ninepin, a "gutter," and the all-important space character to give us blank

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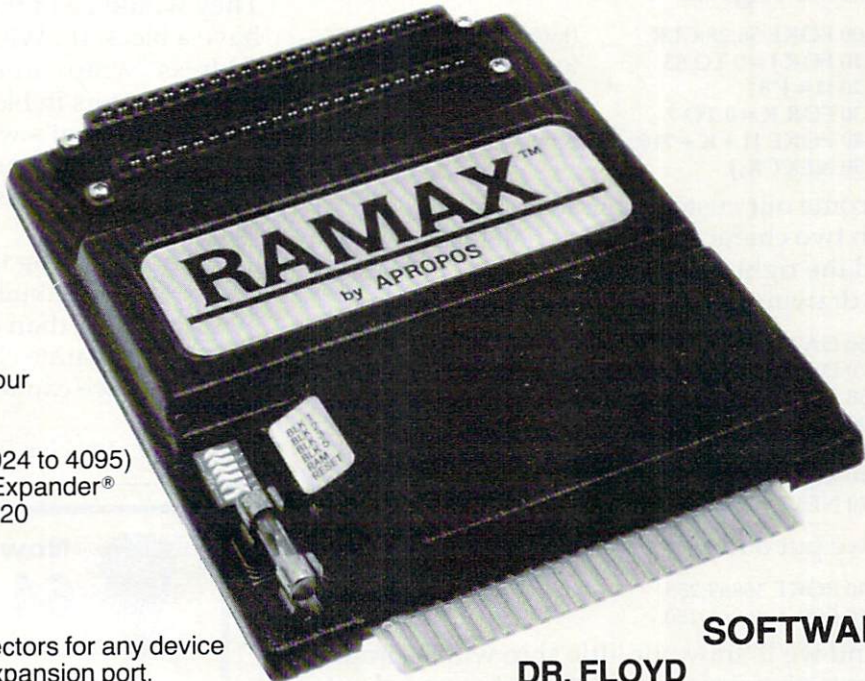
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space. Even so, we might be tempted to go the whole alphanumeric set – to display scores, instructions, and the like.

A little arithmetic shows us a convenient arrangement. The character set must start on a block boundary. Screen memory may start on a half-block boundary. If we put them one behind the other, this would give us 512 bytes for the character set, enough for 64 characters.

In fact, let's try this, with the partial character set at block 15 and the screen at its usual block 15.5. We can write a simple graphics demonstration program.

## A Little Program

```
100 POKE 56,28:CLR      (lower Limit-of-BASIC)
110 FOR J=0 TO 63      (copy 64 characters)
120 J1=J*8             (8 bytes per character)
130 FOR K=0 TO 7      (copy each byte)
140 POKE J1+K+7168,PEEK(J1+K+32768)
150 NEXT K,J
```

Here come our custom characters. We'll draw a ship in two characters: the left half in the character 27 and the right half in character 28. The "pixels" of the drawing are in the DATA statements:

```
160 DATA 0,0,4,4,127,63,31,0
170 DATA 0,0,192,192,252,248,240,0
180 FOR J=27 TO 28 (two specials)
190 J1=J*8
200 FOR K=0 TO 7
210 READ X:POKE J+K+7168,X
220 NEXT K,J
```

Now we put our new character set in gear:

```
230 POKE 36869,255
240 POKE 36866,150
```

And we'll draw our little ship with a simple demonstration program. Note that screen character 27 corresponds to ASCII character 91.

```
300 PRINT CHR$(147);"SHIP GRAPHIC"
310 FOR J=2 TO 18 (left to right)
320 PRINT CHR$(19)
330 PRINT TAB(J);CHR$(32);CHR$(91);CHR$(92)
340 FOR K=1 TO 99
350 NEXT K,J
360 GET X$:IF X$="" GOTO 300
```

The program ends here. Restore the regular character set:

```
370 POKE 36869,240
```

Run the program. After the initial pause for generating the new character set, a ship will move across the screen. You can adjust its speed by changing the value of 99 in line 340. The program will terminate if you hold down any key.

If you press RUN/STOP, the program will break with the custom character set still in place. You'll notice the lack of a cursor; apart from that, you can type most alphanumeric characters without problems. You might like to look around to find out which keys now represent left and right

halves of the ship. When you are finished playing, type CONT to allow the program to continue, and then terminate by holding a key down.

You may notice that the program does not restore the 512 bytes that it takes for the character generator. So the character set is protected, and you can try going back to it if you wish with a POKE 36869,255. Eventually, you may wish to make the program complete by adding line 380, with a POKE 56 and a CLR. I'll leave you to work out the proper details.

Here's a question that may cross your mind: if the character generator starts at block 15, where would the video chip go for the reverse characters? They would be in the next block, but we don't have a block 16. What happens? The video chip address "wraps around," and we go to block 0. The characters in block zero are not reversed, of course, and that's why the cursor doesn't flash.

We can do some good work with a very small character set. It doesn't necessarily have to be big to be useful.

Another thing that we have spotted in this episode: we can build effective graphic pictures by using more than one character. Our program used two separate characters which together drew a ship, but we can use three, four, six, or more as needed.

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# PET Relative File Field Separator

T. A. Zucal

*A few lines of BASIC and a small machine language routine solve some speed and syntax problems faced when accessing relative records. For PET/CBMs with 4.0 BASIC and disk.*

Often relative files can become more efficient if each record is broken down into fields. When of a fixed length, these fields are easily handled at reasonable speed. But when you attempt to bring fields of variable length in from the file, the coding can get messy. It is necessary to use the LEN() function to count bytes, always remembering to add the extra byte for the field delimiter. In addition, this method will not adequately handle commas or colons.

An alternative is to use one string for the entire record, and then to separate the fields using the MID\$( ) function in conjunction with the field delimiters. But this method works only if the record length is 80 bytes or less. This is not too bad, but again commas and colons present problems. A third alternative is to use GET#, which will handle colons and commas, but is extremely slow.

## Solving The Problem

All of this can be bypassed with a minor addition to the machine code of Jim Butterfield's "String Thing" (**COMPUTE!**, November 1982) and a couple of lines of BASIC. This method will handle all characters at a reasonable speed and with no confusion.

The BASIC loader program moves the machine language code to high memory and works with any size memory. You should copy for later use the SYS memory locations which the loader displays on screen. However, the test program will also adjust itself to any size machine. The delimiter used in this version is the backslash – the slash located above the "I" on graphic keyboards. If you prefer, you can choose any other character by changing the 92 in DATA line number 270 to the PETASCII value of the character desired.

The test program will create a relative file with two records. Record #1 is used by the field

separator routine; record #2 is used by the byte count and GET# methods. Each record is exactly the same number of bytes to permit a fair speed test.

When this test is run on all three options, you will notice that the Field Separator Method is approximately 12 jiffies faster than byte counting and 85 jiffies faster than the GET# method. However, the GET# is the only other method which will handle colons and commas without a hassle. So, this method will save you one minute for every 42 records read and will handle all types of input. Even if your fields don't contain the problem characters, you still save 20 seconds for every 100 records.

## Program 1: Loader For Field Separator Routine

```
120 REM ** FIELD SEPARATOR FOR RELATIVE FI
    LES
125 REM
130 PRINT"{CLEAR}{02 DOWN}NOW LOADING"
135 REM *** FIND CURRENT TOP OF MEMORY
140 MM=PEEK(52)+PEEK(53)*256
145 REM *** CALCULATE & SET NEW TOP OF MEM
    ORY
150 M=MM-129:GOSUB315
155 POKE52,L%:POKE53,H%
160 REM *** LOAD PROGRAM FROM DATA
165 FORI=MM-128TOMM-53
170 READA%
175 REM *** ADJUST DATA FOR MEMORY SIZE
180 IFI=MM-110THENM=MM-52:GOSUB315:A%=L%
185 IFI=MM-109THENA%=H%:LS%=L%:HS%=H%
190 IFI=MM-68THENA%=L%
195 IFI=MM-67THENA%=H%
200 IFI=MM-63THENM=MM-51:GOSUB315:A%=L%
205 IFI=MM-62THENA%=H%
210 IFI=MM-59THENA%=LS%
215 IFI=MM-58THENA%=HS%
220 IFI=MM-54THENM=MM-79:GOSUB315:A%=L%
225 IFI=MM-53THENA%=H%
230 POKEI,A%
235 POKE32862,A%
240 NEXTI
245 DATA160,2,177,42,153,134,0,200
250 DATA192,6,208,246,152,72,160,0
255 DATA152,153,204,127,200,192,51,208
260 DATA248,104,168,162,1,32,198,255
265 DATA32,228,255,201,13,240,15,164
270 DATA139,145,137,200,132,139,201,92
275 DATA240,7,196,136,208,234,76,204
```



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```

280 DATA255,152,72,172,204,127,165,139
285 DATA153,205,127,200,140,204,127,104
290 DATA168,76,177,127
295 PRINT"{CLEAR}"
300 PRINT"FIELD SEPARATOR LOADED"
305 PRINT"{DOWN}CALL WITH SYS"PEEK(52)+256
    *PEEK(53)+1
310 END
315 H%=M/256:L%=M-H%*256:RETURN

```

## Program 2: Test Of Separator Routine

```

100 REM ** FIELD SEPARATOR TEST PROGRAM
105 REM ** STRING MUST BE FIRST VARIABLE
110 A$="ABCDEFGHIJKLMNO PQ"
115 A$=A$+A$+A$+A$+A$
120 A$=A$+A$+A$
125 REM ** FOR RELATIVE FILES STRING IS SA
    FE SET AT MAXIMUM, (255) AS ABOVE

130 REM ** SET UP RELFILE WITH 2 RECORDS
135 REM ** BOTH RECORDS HAVE SAME CHARACTE
    R COUNT
140 PRINT"{CLEAR}{03 DOWN}CREATING RELATIV
    E FILE, 'RELFIL'"
145 DOPEN#1,"RELFIL",D0,L254
150 P$="RECORD1**FIELD-1\THIS IS FIELD #2\
    FIELD #3\PET/CBM ++++\FIELD #5\"
155 P$=P$+"###FIELD 6###\YOU CAN HAVE UP T
    O\50 FIELDS BUT ARE LIMITED\"
160 P$=P$+"TO 254 CHARACTERS, PLUS\THE RET
    URN AT THE END."
165 RECORD#1,1
170 PRINT#1,P$
175 R$=CHR$(13)
180 P$="RECORD1**FIELD-1"+R$+"THIS IS FIEL
    D #2"+R$+"FIELD #3"+R$+"PET/CBM +
    +++"
185 P$=P$+R$+"FIELD #5"+R$+"###FIELD 6###"
    +R$+"YOU CAN HAVE UP TO"+R$
190 P$=P$+"50 FIELDS BUT ARE LIMITED"+R$+"
    TO 254 CHARACTERS, PLUS"+R$
195 P$=P$+"THE RETURN AT THE END."+R$+"END
    "

200 RECORD#1,2
205 PRINT#1,P$
210 DCLOSE#1
215 REM
220 DIMF$(50)
225 REM ** JUMP TO MENU FOR TESTING
230 GOTO320
235 REM ** THE FOLLOWING IS THE ACTUAL USA
    GE ROUTINE
240 ML=PEEK(52)+1+256*PEEK(53)
245 DT=ML+76
250 DOPEN#1,"RELFIL"
255 TM=TI
260 RECORD#1,1
265 SYSML
270 PRINT"{CLEAR}{DOWN}STRING THING METHOD
    RUNNING{DOWN}"
275 NF=PEEK(DT)+1:POKEDT+NF,PEEK(139)+1
280 FORI=1TONF
285 F$(I)=MID$(A$,PEEK(DT+I-1)+1,PEEK(DT+I
    )-PEEK(DT+I-1)-1)
290 PRINTF$(I)
295 NEXTI
300 REM ** END OF ACTUAL ROUTINE
305 PRINT"{DOWN}THE TIME FOR INPUT, SEPARA
    TION, AND PRINTING OF THE ABO
    VE WAS";
310 PRINT"{REV}"TI-TM"{OFF}JIFFIES."
315 DCLOSE#1

```

```

320 PRINT"{DOWN}TO TIME THESE OPTIONS HIT ~
    NUMBER DESIRED"
325 PRINT"{REV}BUT WAIT FOR DRIVE TO STOP ~
    FOR FAIR TEST{OFF}"
330 PRINT"{DOWN} 1-GET#"
335 PRINT" 2-BYTE COUNTING"
340 PRINT" 3-STRING THING WITH FIELD SEPAR
    ATOR"
345 PRINT" 4-QUIT"
350 GETR$:IFR$=""THEN350
355 IFVAL(R$)<1ORVAL(R$)>4THEN320
360 ONVAL(R$)GOTO370,440,240,495
365 REM ** STANDARD GET#
370 PRINT"{CLEAR}{DOWN}STANDARD GET#{DOWN}
    "
375 DOPEN#1,"RELFIL"
380 TM=TI
385 I=1
390 Q$=""
395 RECORD#1,2
400 GET#1,R$:IFR$=CHR$(13)THEN410
405 Q$=Q$+R$:GOTO400
410 IFQ$="END"THEN420
415 PRINTQ$:F$(I)=Q$:Q$="" :I=I+1:GOTO400
420 PRINT"{DOWN}THE TIME WAS{REV}"TI-TM"{O
    FF}JIFFIES FOR GET#."
425 DCLOSE#1
430 GOTO320
435 REM ** BYTE COUNT
440 PRINT"{CLEAR}{DOWN}BYTE COUNT METHOD N
    OW RUNNING{DOWN}"
445 DOPEN#1,"RELFIL"
450 TM=TI
455 BY=1:I=1
460 RECORD#1,2,(BY)
465 INPUT#1,F$(I)
470 BY=BY+LEN(F$(I))+1
475 IFF$(I)<>"END"THENPRINTF$(I):I=I+1:GOT
    O460
480 PRINT"{DOWN}THE TIME WAS{REV}"TI-TM"{
    OFF}JIFFIES AND THE COMMA CAUSED
    A PROBLEM"
485 DCLOSE#1
490 GOTO320
495 STOP

```

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# MACHINE LANGUAGE

Jim Butterfield, Associate Editor

## Part II

# NUMERIC OUTPUT

*This is the second in a three-part series on techniques of handling numeric displays or printouts in machine language.*

Preparing decimal output can be done in a number of ways. The methods for converting binary integers to decimal can be summarized by direction: right-to-left or left-to-right. In both cases, there is usually a need to perform division. And don't forget that each digit must be converted to ASCII before it is output.

No matter which way we do the job, we need to plan the output format. A one-byte number might require three decimal digits to be printed (e.g., 255), but a two-byte number might need five digits (e.g., 65535). It's often a good idea to plan to output a fixed number of digits, since numbers may need to be printed neatly into columns or onto specific parts of the screen. We might also find it desirable to suppress leading zeros on a number so that 00307 becomes 307, with leading spaces.

### Right-To-Left

The method goes something like this: divide by ten. The remainder is the rightmost digit. If the quotient is non-zero, repeat. Thus, a binary value of 287 is calculated: divide by 10, remainder 7; divide quotient 28 by 10, remainder 8; divide quotient 2 by 10, remainder 2. The quotient becomes zero at this point, so we have the three digits - 2, 8, and 7.

The digits come out backwards, however. In the above example, we can't print the 7 the moment we calculate it, since we must work out two earlier digits. That's not a problem, since the digits can be placed into a buffer area - or on the stack, for that matter.

Right-to-left is attractive because it automatically finds the number of digits that need to be printed; the procedure stops when a quotient of zero is reached. You can immediately spot numbers that are too big. It's also very easy to insert leading spaces to fill out the number to any desired

length. You'll need a good divide-by-ten routine, of course.

### Left-To-Right

This method takes a little more effort to set up, but generates digits in the "normal" order, which allows you to output them directly. Zero suppression adds a little extra code.

We must start by assuming the number of digits that we wish to output. Let's say, for example, that we expect up to three digits. We would follow roughly the following procedure:

Set FACTOR to 100;

Divide the number by FACTOR;

The quotient is the next digit;

Take the remainder, set FACTOR to 10, and repeat;

Then set FACTOR to 1 and repeat; or for that matter, the remainder from the last calculation will be your last digit.

To convert 287, we divide by 100; the quotient of 2 is our first digit. Take the remainder (87) and divide by 10; the quotient of 8 is the next digit. Finally, the remainder of 7 is our last digit whether or not we divide it by 1.

We can achieve this without a formal division routine; repeated subtraction will work efficiently enough for most purposes. We might change our algorithm to read:

Set FACTOR to 100;

Set COUNTER to 0;

If the number is greater than or equal to FACTOR, then subtract FACTOR from the number, add 1 to COUNTER, and repeat this step;

COUNTER now contains the first digit; you may print it.

Now set FACTOR to 10, COUNTER to 0, and repeat.

Our example of 287 would have 100 subtracted from it until it reached 87. The counter would have counted 2 subtractions, so we can

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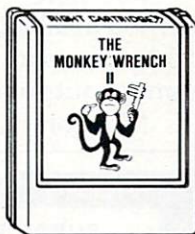
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send the digit 2 to output.

The various factors (1000, 100, 10, 1, or whatever is needed) may be stored in a table for quick reference rather than calculated. Using true division would be faster than our subtraction algorithm. But since we'll never need to subtract more than nine times for each digit (and since we're likely to spend much more time delivering the output digit to its destination), it's not much of a worry.

Mathematics fiends will tell you that the left-to-right procedure may be easily extended to generate decimal fractions. Useful, but only if you are using binary numbers with fractional parts in the first place.

## An Example

Let's do some very quick code to output a dozen numbers from memory in decimal. We'll use the left-to-right method. Zero suppression won't be used. Address FFD2 will be used for output (PET/CBM/VIC/C64 compatible).

```

OUTPUT LDX #000      (number counter)
        STX COUNT
NXNUM  LDA $0350,X   (get mem value)
        LDY #002     (2+1 digits)
        LOOP CMP TABLE,Y
        BCC DONE
        SBC TABLE,Y
        INC COUNT
        BNE LOOP
DONE   PHA           (add seven)
        LDA COUNT
        ORA #030
        JSR $FFD2
        LDA #000
        STA COUNT
        PLA
        DEY
        BPL LOOP
        LDA #00D
        JSR $FFD2
        INX
        CPX #00A
        BCC NXNUM
        RTS
TABLE  .BYTE        1,10,100
    
```

It's fun to do this in a practical example. Let's POKE it from BASIC:

```

100 DATA 162,0, 142,144,3, 189,80,3
110 DATA 160,2, 217,132,3, 144,8
120 DATA 249,132,3, 238,144,3
130 DATA 208,243, 72, 173,144,3, 9,48
140 DATA 32,210,255, 169,0, 141,144,3
150 DATA 104,136, 16,225, 169,13
160 DATA 32,210,255, 232, 224,10
170 DATA 144,210, 96, 1,10,100
200 FOR J=848 TO 902:READ X
210 T=T+X:POKE J,X
220 NEXT J
230 IF T<>6199 THEN STOP
300 SYS 848
    
```

It will take a few moments to POKE the program in place; after that, the decimal numbers

come out with blinding speed (especially if you have cleared the screen so that there is no need for scrolling). The numbers, by the way, are the same values as in the DATA statements in line 100 and part of 110.

But there's more.

These are the conventional methods, and they have a number of variations that we haven't mentioned.

But there's a very fast and radically different method available on the 6502. It uses Decimal mode in an unusual way to generate decimal number output super fast.

More on that the next time around.

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*Machine Language For Beginners* is a general tutorial for all users of computers with 6502 microprocessors – with examples for the Commodore 64, VIC-20, Atari 400/800/1200XL, Apple II, and PET/CBM. The numerous machine language programs will work on all these computers.

As a bonus, *Machine Language For Beginners* includes something that all fledgling machine language programmers will need to get started – an assembler. The "Simple Assembler," written in BASIC for the various computers, takes the tedium out of entering and assembling short machine language programs. The book even explains how to use the built-in machine language monitors on several of the computers. And it includes a disassembler program and several monitor extensions.

This book fills the need for a solid, but understandable, guide for personal computing enthusiasts. Mansfield is Senior Editor of **COMPUTE!**. His monthly column, "The Beginner's Page," has been one of **COMPUTE!**'s most popular features.

In the **COMPUTE!** tradition, *Machine Language For Beginners* has been written and edited to be straightforward, clear, and easily understood. It is spiral-bound to lie flat to make it easier to type in programs.

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# Atari Reset Run

Thomas A Marshall

You can easily disable your BREAK key, but here's how to prevent accidental crashes caused by the system RESET key. This short routine also illustrates some uses of the "dynamic keyboard" technique.

This "RESET RUN" program was developed from a need to disable the system reset button. My two-year-old son kept stopping his alphabet teaching program by hitting the system reset button. I had disabled the break key with POKE 16,64: POKE 53774,64 (back on with POKE 16,192:POKE 53774,192).

The program changes the system reset button vector so that the program merely reruns when the reset button is pressed. The program uses Atari's ability to vector (point) to where the computer should go when the system reset key is pressed. This is accomplished by POKEing the address of our machine language program at memory locations 12 and 13. The least significant byte goes to memory location 12, and the most significant byte goes to memory location 13. The program also uses Atari's ability to read from the screen with a POKE 842,13. With this POKE, the cursor will do continual RETURNS down the screen.

The trick is to place a RUN statement on the screen so that the cursor will do a RETURN on it. Then a POKE 842,12 in the BASIC program will turn off the returning action. This *dynamic programming* technique has many applications.

I decided to use this technique to convert the DATA statements into a single string and then delete the DATA statements. In this string form, the three lines can be easily entered at the beginning of any program. There are other ways to accomplish a program rerun, but the advantage of RESET RUN is that the machine language code is relocatable.

To place the RUN statement on the screen, the machine language program first hides all the action by setting the character color and intensity the same as the background (lines 100 and 110). It then clears the screen (lines 120 and 130), sets the cursor row position (lines 140 and 150), reads

"RUN two up arrows" and places it on the screen (lines 160 to 210). Finally, it turns on the dynamic programming with POKE 842,13 (lines 220 and 230), and jumps to the BASIC cartridge.

The BASIC program POKEs the disk boot initialization vector locations 12 and 13 with the address of the R\$ string where the machine language routine resides and turns off Atari's dynamic programming feature with the POKE 842,12. At the end, the GRAPHICS 0 statement returns the character intensity to normal. If you do *not* want the program to delete the DATA statements, *do not* type in lines 330 to 370, and in line 320 type "RUN" instead of "GOTO 330".

Note that once the system reset button is pressed, you cannot immediately use the SAVE command. When any disk operation is attempted, an ERROR 130, nonexistent device, results. To save the program, the initialization vector has to be reset with POKE12,64: POKE13,21. (If you have typed in the program, simply type GOTO 10 and press return.) Then press the system reset button and SAVE"D:filename". Also, note that if you immediately list the program after the initial run and then press the system reset button, the program will crash. In any case, it is always advisable to save any program prior to running it.

## Reset Run

```
0 DIM R$(60)
1 GOTO 250
2 I=ADR(R$):H=INT(I/256):L=I-H*256:POKE 12,L:POKE 13,H:POKE 842,12:GRAPHICS 0
5 ? "HI THERE, ATARI ENTHUSIAST!":END
10 POKE 12,64:POKE 13,21: ? "NOW PRESS THE SYSTEM RESET BUTTON": ? "AND SAVE THIS PROGRAM":END
100 DATA 169,148
110 DATA 141,197,2
120 DATA 169,125
130 DATA 32,164,246
140 DATA 169,2
150 DATA 133,84
160 DATA 169,0
170 DATA 32,164,246
180 DATA 169,28
```



```

190 DATA 32,164,246
200 DATA 169,28
210 DATA 32,164,246
220 DATA 169,13
230 DATA 141,74,3
240 DATA 76,0,160
250 DIM INSTR$(3):INSTR$="RUN"
260 S=LEN(INSTR$):FOR I=1 TO 16:READ
T:R$(I,I)=CHR$(T):NEXT I
270 K=0:FOR I=17 TO 17+5*(S-1) STEP
5:RESTORE 160
280 FOR J=0 TO 4:READ T:R$(I+J,I+J)=
CHR$(T):NEXT J
290 K=K+1:R$(I+1,I+1)=INSTR$(K,K):NE
XT I
300 FOR I=22+5*(S-1) TO 39+5*(S-1):R
EAD T:R$(I,I)=CHR$(T):NEXT I
310 ? CHR$(125):POKE 766,1:POSITION
2,5:?"1 R$(1,";I-1;")=";CHR$(34
);R$;CHR$(34):POKE 766,0
320 ? "POKE 842,12:GOTO 330":POKE 76
6,0:POSITION 0,0:POKE 842,13:END

330 IMAX=90:GOLINE=340:LMAX=360
340 IMIN=IMAX+10:IMAX=IMAX+140:IF IM
AX>=LMAX THEN IMAX=LMAX:GOLINE=3
70
350 ? CHR$(125):? :FOR I=IMIN TO IMA
X STEP 10:?" I:NEXT I
360 ? "POKE 842,12:?" :? :GOTO";GOLIN
E:POSITION 0,0:POKE 842,13:END
370 ? CHR$(125):? :? "370":?"POKE 8
42,12:?" :RUN":POSITION 0,0:POKE
842,13:END

```

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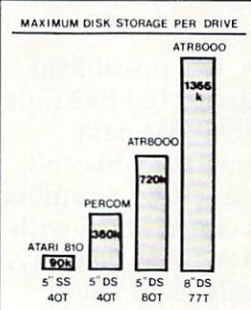
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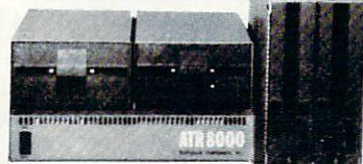


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# Soft-16 For Commodore 64

Douglas D. Nicoll

*This program, "USR(PEEK)", demonstrates several interesting concepts about managing the memory of the 64. BASIC programs can be run essentially without BASIC, and you can switch between ROM and RAM during a program RUN to access an additional 16K of RAM for data storage. You'll also see how to use the USR() statement.*

An inexpensive 16K RAM expansion for the Commodore 64? Run BASIC programs without BASIC or the kernal? Well, almost. The 6510 has the capability of exchanging RAM data banks with the three ROM banks (BASIC [AB] \$A000-\$BFFF; characters [D] \$D000-\$DFFF; and kernal [EF] \$E000-\$F000). It switches between ROM and RAM with the use of a control port located at \$0001. Bit zero in \$0001 controls EF, bit one controls AB, and bit two controls D. Setting the bit to one switches in ROM (the normal state), and zero switches in RAM memory.

In normal BASIC operation, it is possible to POKE values to AB and EF locations, but PEEKing these locations will show *only* the ROM data. POKES and PEEKs to D work fine, but you can't PEEK the character ROM without setting a number of switches so the system won't crash. Thus, without the ability to PEEK the hidden RAM memory, AB and EF locations are effectively eliminated from use in BASIC programs.

USR(PEEK) is a valuable machine language utility program that opens up the hidden RAM for use in BASIC programs, giving the user 16K more memory cells for data storage. The program is loaded into \$C001-\$C0E4, and uses \$C000 as a temporary storage cell. The vector for the USR() function is set (POKE 785,1:POKE 786,192). BASIC programs are loaded normally, and any RAM location can be PEEKed by using  $X = \text{USR}(N)$ , where X is any variable and N is any number from 1 to 65535. Any number less than 0.5 will set X to -1, 0.5 to 1.9 evaluate as 1, and all other decimal numbers are truncated to the integer. If a negative number is given for N, the value returned is for

ABS(N). If a number is greater than 65535, then X is -1. If N is between 53248 and 57343, X is the value of data stored in character ROM (D).

## Automatic Switching

How does USR(PEEK) work? The statement  $X = \text{USR}(N)$  in a BASIC program loads N into the floating point accumulator and sends the computer to the machine language program pointed to by the USR vector. The machine language program evaluates the number in the FP accumulator, switches out BASIC and kernal ROM, loads the desired RAM data into the FP accumulator, switches BASIC and kernal ROM back in, and finally sets up the FP accumulator so that X contains the values on return to the BASIC program. When character ROM is desired, it is switched in for the manipulation.

The techniques used to dynamically switch between RAM and ROM have many other uses for hybrid programmers (people who use both BASIC and machine language). For example, machine language programs can be loaded under BASIC or kernal ROM and run with BASIC programs - this leaves more space for BASIC programs and variable storage. It is possible to envision loading a BASIC program editor under BASIC ROM and calling it for renumbering, searching, etc.

Type in the program and, after saving a copy, RUN it to see a demonstration of how easy it is to use. Then eliminate lines 10-540 and save it with the name USR(PEEK). To use with your programs, LOAD and RUN USR(PEEK) and then LOAD and RUN your own BASIC programs that can be constructed to utilize the additional 16K of RAM data storage.

```
1 GOSUB1000:REM SET UP USR(PEEK)
10 PRINT"{CLEAR}USR(PEEK) AT CHARACTER ROM"
20 V$="{HOME}{24 DOWN}"
30 H$="{+}{39 RIGHT}"
40 UC=53248:LC=55296:GC=53760
50 H=0:V=10:L=83*8+UC:GOSUB500
60 H=8:V=10:L=3*8+UC:GOSUB500
70 H=14:V=5:L=85*8+UC:GOSUB500:H=14:V=14:
   L=74*8+UC:GOSUB500
```



```

80 H=22:V=10:L=54*8+UC:GOSUB500
90 H=30:V=10:L=52*8+UC:GOSUB500
100 PRINTLEFT$(V$,5);LEFT$(H$,18);"SC{UP}U
    {02 DOWN}{LEFT}J{UP}64";LEFT$(V$,22)
110 PRINT"PRESS ANY KEY TO CONTINUE";
120 GETA$:IFA$=""THEN120
130 PRINT{CLEAR}USR(PEEK) INTO BASIC HIDD
    EN RAM"
140 PRINTLEFT$(V$,5);"INPUT 10 NUMERS(0-25
    5) TO STORE IN $A000TO $A00A : "
150 FORI=1TO10
160 PRINT"NUMBER ";I;" : ";:INPUT"";X
170 IFINT(X)<>XORX<0ORX>255THENPRINT"INVAL
    ID ENTRY...":GOTO160
180 POKE40959+I,X:NEXT
190 PRINT{CLEAR}USR(PEEK) INTO HIDDEN BAS
    IC RAM"
200 PRINT:PRINT:PRINT"LOCATION PEEK US
    R(PEEK)"
205 PRINT"-----"
210 FORI=1TO10:PRINTI+40959,PEEK(I+40959),
    USR(I+40959):NEXT
220 PRINTLEFT$(V$,22);"PRESS ANY KEY TO CO
    NTINUE ";
230 GETA$:IFA$=""THEN230
240 PRINT{CLEAR}USR(PEEK) INTO KERNAL HID
    DEN RAM"
250 PRINTLEFT$(V$,5);"INPUT 10 NUMERS(0-25
    5) TO STORE IN $F000TO $F00A : "
260 FORI=1TO10
270 PRINT"NUMBER ";I;" : ";:INPUT"";X
280 IFINT(X)<>XORX<0ORX>255THENPRINT"INVAL
    ID ENTRY...":GOTO160
290 POKE61439+I,X:NEXT
300 PRINT{CLEAR}USR(PEEK) INTO HIDDEN KER
    NAL RAM"
310 PRINT:PRINT:PRINT"LOCATION PEEK US
    R(PEEK)"
320 PRINT"-----"
330 FORI=1TO10:PRINTI+61439,PEEK(I+61439),
    USR(I+61439):NEXT
340 END
500 FORJ=LTOL+7:X$="" :X=USR(J)
510 FORI=7TO0STEP-1:IFX=>2↑ITHENX=X-2↑I:X$
    =X$+"{WHT}{REV}{OFF}":GOTO530
520 X$=X$+"{RIGHT}"
530 NEXTI:IFJ=LTHENPRINTLEFT$(V$,V);
540 PRINTLEFT$(H$,H);X$:NEXT:RETURN
1000 POKE785,1:POKE786,192:REM USR VECTOR
1010 FORI=49153TO49380:READX:POKEI,X:NEXT
1015 RETURN
1020 DATA173,97,0,201,144,208,3,76,188,192,
    56,201,128,176,3,76,163,192,201,145
1030 DATA144,3,76,163,192,73,128,141,97,0,5
    6,169,16,237,97,0,240,13,170,24
1040 DATA78,98,0,110,99,0,202,224,0,208,244
    ,173,98,0,141,78,192,173,99,0
1050 DATA141,77,192,173,1,0,141,0,192,120,7
    3,7,141,1,0,173,255,255,141,98,0
1060 DATA173,0,192,141,1,0,88,173,98,0,201,
    0,208,3,76,140,192,162,8,173,98,0
1070 DATA24,42,176,5,202,224,0,208,247,106,
    141,98,0,73,128,141,102,0,138
1080 DATA9,128,141,97,0,169,0,141,99,0,141,
    100,0,141,101,0,96,169,0,141,97,0
1090 DATA141,99,0,141,100,0,141,101,0,141,1
    02,0,169,128,141,98,0,96,169,129
1100 DATA141,97,0,169,128,141,98,0,141,102,
    0,169,0,141,99,0,141,100,0,141,101,0
1110 DATA96,56,173,98,0,201,224,144,3,76,22
    3,192,201,208,176,3,76,223,192,169,4
1120 DATA141,72,192,173,97,0,32,26,192,169,
    7,141,72,192,96,173,97,0,76,11,192

```



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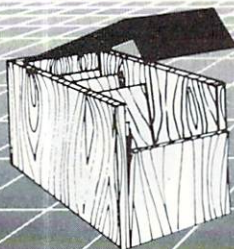
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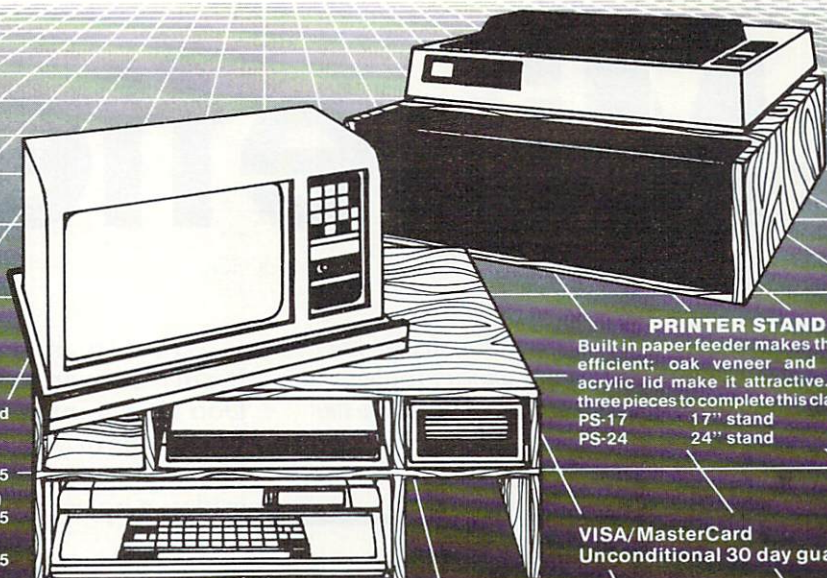
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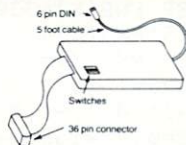
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# Minefield

Sean Igo

Your job is to get your trucks in quickly, defuse the bombs (especially the flashing ones which are about to go off), and get out as fast as you can. This game has four skill levels, and there are versions for VIC, 64, Apple, and PET.

In this game, you drive a truck around to gather and defuse time bombs before they explode – all the while avoiding mines and bomb craters.

## Playing The Game

You find yourself in the center of a small minefield with several bombs, represented by circles, and a generous number of mines, shown as X's. Your truck is a diamond. To defuse the bombs, just run over them with the truck.

When the bombs first appear, they are innocent-looking little circles. After a short time – the rate varies from bomb to bomb – they turn reverse-field. This means *watch it*. Soon they begin to blink and you have only a few blinks to defuse them before they explode. Any mines (or heroic defusing teams) caught in the explosion will be instantly lost. Bombs caught in the explosion will explode, whether they were ready to or not.

## Notes For VIC-20, C-64, And Apple Versions Of "Minefield"

The VIC version will run on any VIC with at least a 3K expansion. Both the VIC and 64 versions are designed to be used with a joystick although the 64 also can be played using certain keys on the keyboard (see the instructions within the program). Since the Apple computer doesn't have a realtime clock, a loop is incremented and checked in this version to provide the necessary delay before the bombs explode. The familiar "I," "K," "J," and "M" keys are used in the Apple version to move the truck around the screen.

Your truck can move in only four directions. It can "wrap around" all four edges of the screen. Don't run it into the mines or the craters (\*) left by the bombs or your truck will be destroyed. Once you begin moving, your truck cannot stop until it is blown up or until the current minefield is cleared of bombs.

## Skill Levels And Scoring

Minefield has four skill levels. Skill levels differ only in the number of trucks you get. Level 0, the easiest, has four trucks. Level one has three. Level two has two and level three has one.

Scoring: 10 points for a normal bomb  
20 points for a reverse-field bomb  
30 points for a blinking bomb  
-10 points at the end of an explosion for every bomb that went off. This is incentive to defuse more than one or two bombs in the later explosions.

## Program 1: Minefield – PET/CBM Version

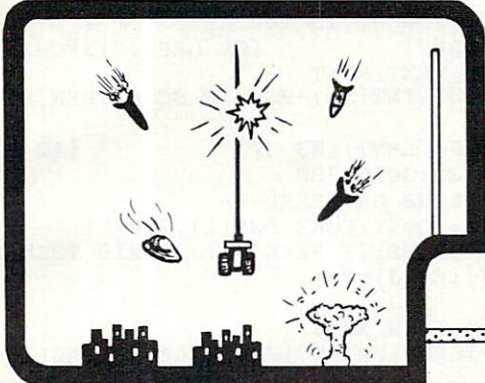
```
10 REM *** MINEFIELD FOR 40 COLUMN PETS
***
50 GOSUB 1130
60 REM ---INITIALIZE VARIABLES---
70 DIM BT(37),B3(37),B4(37),BP(37),BS(37)
,XM(4),YM(4),BC(25)
80 DEF FNY(X)=INT((X-32768)/40)
90 DEF FNX(X)=(X-40*FNY(X))-32768
100 DEF FNS(X)=32768+PX+40*PY
110 DEF FNP(X)=33051+INT(34*RND(1))+40*INT
(15*RND(1))
120 DEF FNN(X)=PEEK(FNS(X))
130 FORJ=1 TO 4:READ XM(J),YM(J):NEXT
140 DATA 0,1,-1,0,1,0,0,-1
150 SC=0:BT=1680:NB=4:NW=0
160 PRINT"{CLEAR}";:POKE 59468,12
170 PRINT"{REV}MINE****] SCORE: 0"
180 PRINT"{REV}*****] {RIGHT}HI SCORE:";
HS
190 PRINT"{REV}***FIELD] {RIGHT}WAVE: 1"
200 PRINT"{REV} ] {RIGHT}";:IF NL<>1
THEN FORJ=1 TO NL-1:PRINT"Z";:NE
XT
210 FORJ=32768 TO 32927:IFPEEK(J)=32 THEN ~
POKE J,160
220 NEXT
230 XP$="U]I{DOWN}{04 LEFT}UU]II{DOWN}{06
LEFT}UUU]III{DOWN}{07 LEFT}@@*@@
@{DOWN}{07 LEFT}JJJ]KKK"
235 XP$=XP$+"{DOWN}{06 LEFT}JJ]KK{DOWN}{04
LEFT}J]K"
240 S$="{HOME}{24 DOWN}"
250 Q$="{40 RIGHT}"
260 XR$="{DOWN}{04 LEFT} {DOWN}{06
LEFT} {DOWN}{07 LEFT} * ~
{DOWN}{07 LEFT} "

```

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## LASER COMMAND by Bob Burnett



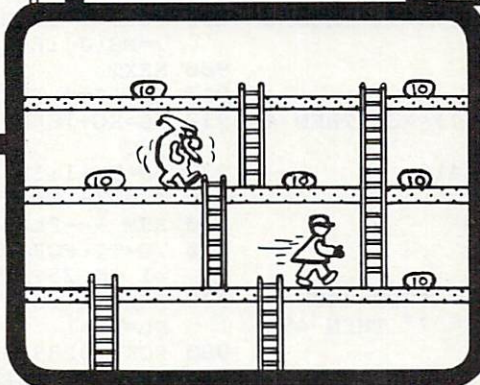
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## SHIFTY (c) by Kavan



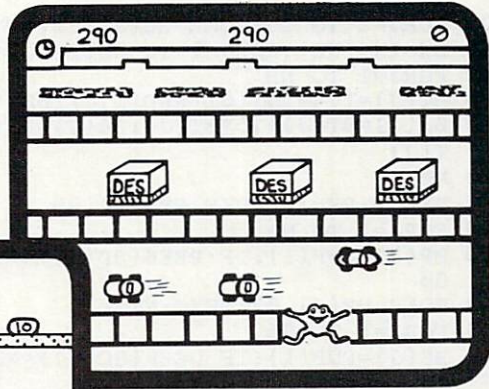
Watch the maze change as you pass thru the revolving doors. This is a really cute one. Machine language. VIC-20 w/8K expander, cassette. Joystick and keyboard. **\$20.00**

## BONZO (c) by Kavan



One of the most popular games in Europe. You control BONZO as he climbs the ladders and picks up point blocks. Watch out for the alien guards. Excellent graphics & sound. 100% machine code. VIC-20 w/8K expander, cassette. Joystick or keyboard. **\$20.00**

## HOPPER by Thomas Kim



Rated a Five Star game by Creative Computing. Avoid the cars, buildings, logs and other obstacles to bring the frog home. Machine language. VIC-20, cassette and joystick. **\$20.00**

## SPACE TRADER by Doug Caruthers

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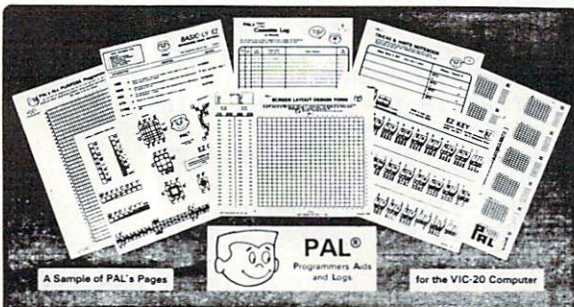
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The intention of this program is to serve as a mathematical and pedagogic aid for studying complicated equations and functions by their graphs. Plots graphics in high resolution within an x-axis range defined by you. You can also "blow up" parts of a graph in detail by a specified range.

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### VIC REL

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The purpose of this cartridge is to simplify control of, for example, burglar alarms, garage doors, door locks, heating elements, lamps, radios, remote controllers, valves, pumps, telephones, accumulators, irrigation systems, electrical tools, stop watches, ventilators, humidifiers, etc., etc. This cartridge contains 6 relay outputs and 2 inputs of type optocoupler. For the VIC-20 and Commodore 64.

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```

265 XR$=XR$+"{DOWN}{06 LEFT}      {DOWN}{04
    LEFT}
270 REM ---SET UP NEXT WAVE---
280 BG=0:NW=NW+1:IF NW>11 THEN 310
290 NB=NB+1.5:IF NW=1 THEN 330
300 IF NW<6 THEN BT=BT-180
310 PRINT"{HOME}{02 DOWN}{REV}";TAB(15);NW

320 POKE FNS(1),32:FORJ=1 TO NB:POKEBP(J),
    32:NEXT
325 FORJ=1 TO 25:POKE BC(J),32:NEXT
330 BN=INT(NB):FORJ=1 TO NB:BS(J)=1:NEXT
340 FORJ=1 TO NB
350 BT(J)=(.4+INT(61*RND(1))/100)*BT
360 B3(J)=BT(J)+.5*BT(J):B4(J)=B3(J)+.25*B
    T(J)
370 NEXT
380 PX=19:PY=15:POKE FNS(1),90
390 FORJ=1 TO NB
400 BP(J)=FNP(1):IF PEEK(BP(J))<>32 THEN 4
    00
410 POKE BP(J),87:NEXT:NN=0
415 FORJ=1 TO 25
416 BC(J)=FNP(1):IF PEEK(BC(J))<>32 THEN 4
    16
417 IF PEEK(BC(J)+1)=87 THEN 416
419 POKEBC(J),86:NEXT
420 GET R$:IF R$<>" " THEN 420
430 DR=0:TX=TI
440 REM ---GET COMMANDS---
450 GET R$:IF R$<"2" OR R$>"8" THEN 490
460 IF R$="3" OR R$="5" OR R$="7" THEN 490
470 DR=VAL(R$)/2
480 REM ---MOVE TRUCK---
490 IF DR=0 THEN 600
500 POKE FNS(1),32:PX=PX+XM(DR):PY=PY+YM(D
    R)
510 IF PX<0 THEN PX=39
520 IF PX>39 THEN PX=0
530 IF PY<4 THEN PY=24
540 IF PY>24 THEN PY=4
550 X=FNN(1)
560 IF X=32 THEN POKE FNS(1),90:GOTO 600
570 IF X=42 OR X=86 THEN 960
580 GOTO 890
590 REM ---UPDATE BOMBS---
600 NN=NN+1:IF NN>INT(NB)THEN NN=1
610 IF BS(NN)=0 THEN 600
620 TG=TI-TX
630 IF TG>B4(NN) THEN N1=NN:GOTO 720
640 IF BS(NN)>2 THEN 690
650 IF TG>BT(NN) THEN BS(NN)=2
660 IF TG>B3(NN) THEN BS(NN)=3
670 IF BS(NN)=1 THEN 450
680 IF BS(NN)=2 THEN POKE BP(NN),215:GOTO
    450
690 IF BS(NN)=3 THEN POKE BP(NN),87:BS(NN)
    =4:GOTO 450
700 IF BS(NN)=4 THEN POKE BP(NN),215:BS(NN)
    =3:GOTO 450
710 REM ---BOMB EXPLODES---
720 TQ=TI:PD=0
725 X$="{OFF}"+LEFT$(S$,FNY(BP(N1))-2)+LEF
    T$(Q$,FNX(BP(N1))-1)
730 BS(N1)=0:N2=0:PRINTX$;XP$;
740 FORJ=1 TO NB:X=PEEK(BP(J)):IF BS(J)=0
    THEN 760
750 IF X<>87 AND X<>215 AND X<>218 THEN N2
    =J
760 NEXT:IF FNN(1)<>90 AND FNN(1)<>218 THE
    N PD=1
770 PRINTX$;XR$;

780 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
    <>0 THEN POKE BP(J),87-128*(BS(J)
    >1)
790 NEXT:BN=BN-1
800 IF PD=1 THEN 960
810 IF BN=0 THEN 840
820 IF N2=0 THEN TX=TX+(TI-TQ):GOTO 450
830 N1=N2:GOTO 725
840 PRINT"{HOME}{02 DOWN}{REV}";TAB(20);
850 FORJ=1 TO 20:PRINT"{REV}COMPLETED{09
    LEFT}";:FORK=1 TO 100:NEXT
860 PRINT"{REV}      {09 LEFT}";:FORK=1
    TO 100:NEXT:NEXT
870 SC=SC-10*(INT(NB)-BG):IF SC<0 THEN SC=
    0
880 PRINT"{04 LEFT}{03 UP}      {10
    LEFT}";SC:GOTO 280
885 REM ---BOMB GATHERED---
890 BG=BG+1:TQ=TI:POKE FNS(1),218
895 FORJ=1 TO NB:IF PEEK(BP(J))=218 THEN A
    J=BS(J):BS(J)=0
900 NEXT
910 IF AJ=4 THEN AJ=3
920 SC=SC+10*AJ:PRINT"{HOME}{REV}";TAB(16)
    ;SC
930 BN=BN-1:IF BN=0 THEN 840
940 TX=TX+(TI-TQ):GOTO 450
950 REM ---PLAYER DESTROYED---
960 TQ=TI:FORJ=1 TO 20:POKE FNS(1),42:FORK
    =1 TO 25:NEXT:POKE FNS(1),170
970 FORK=1 TO 25:NEXT:NEXT:POKE FNS(1),32:
    NL=NL-1
980 POKE 32897+NL,160:DR=0:PX=19:PY=15
990 IF NL=0 THEN 1045
1000 IF BN=0 THEN 840
1010 GET R$:IF R$<>" " THEN 1010
1020 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
    <>0 THEN POKE BP(J),87-128*(BS(J)
    >1)
1030 NEXT
1040 POKE FNS(1),90:TX=TX+(TI-TQ):GOTO 450
1045 IF SC>HS THEN HS=SC:PRINT"{HOME}{DOWN}
    {REV}";TAB(19);HS
1050 FORJ=1 TO 1500:NEXT:PRINT"{HOME}{02
    DOWN}{REV}";TAB(20);"GAME OVER{
    DOWN}{09 LEFT}PLAY AGAIN?";
1060 PRINT"(Y/N){04 LEFT}";
1080 PRINT"{REV}Y/{OFF}N{03 LEFT}";
1081 FORJ=1 TO 99:NEXT
1082 PRINT"{OFF}Y{REV}/N{03 LEFT}";
1083 FORJ=1 TO 99:NEXT
1084 GET R$:IF R$="Y" THEN 1110
1090 IF R$<>"N" THEN 1080
1100 PRINT"{CLEAR}LATER ON!":END
1110 GOSUB 1130:GOTO 150
1120 REM ---INSTRUCTIONS---
1130 PRINT"{CLEAR}{REV}M I N E F I E L D":P
    OKE 59468,14
1140 PRINT"DO YOU NEED INSTRUCTIONS (Y/N)"
1150 GET R$:IF R$="N" THEN 1410
1160 IF R$<>"Y" THEN 1150
1170 PRINT"{CLEAR}{REV}M I N E F I E L D"
1180 PRINT"{DOWN}THE OBJECT OF THIS GAME IS
    TO PICK UP"
1190 PRINT"AS MANY BOMBS AS YOU CAN BEFORE
    THEY"
1200 PRINT"EXPLODE. TO PICK UP A BOMB, JUST
    RUN"
1210 PRINT"OVER IT WITH YOUR TRUCK."
1220 PRINT"BOMBS WILL EXPLODE AFTER A SHORT
    TIME."
1230 PRINT"IF A BOMB TURNS REVERSE-FIELD, B
    E CARE-"

```



# VIC-20\*

## SOFTWARE SPECIALS



# CBM-64\*

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```

1240 PRINT"FUL WITH IT. IF IT STARTS TO BLI
NK, IT"
1250 PRINT"WILL VERY SHORTLY EXPLODE-WATCH ~
OUT!"
1260 PRINT"BOMBS WILL CHAIN-REACT; ONE BOMB
CAUGHT"
1270 PRINT"IN ANOTHER'S EXPLOSION WILL ALSO
BLOW"
1280 PRINT"UP. IF YOU ARE CAUGHT IN A BOMB'
S "
1290 PRINT"EXPLOSION, YOU WILL BE BLOWN UP.
"
1300 PRINT"ALSO, DO NOT RUN INTO BOMB CRATE
RS (*)"
1310 PRINT"OR MINES (X) OR YOU'LL BE TOTALL
ED."
1320 PRINT"THE CONTOLS ARE: 8 TO GO UP"
1330 PRINT" 4 TO GO LEFT"
1340 PRINT" 6 TO GO RIGHT"
1350 PRINT" 2 TO GO DOWN"
1360 PRINT"YOUR TRUCK CANNOT STOP ONCE YOU
BEGIN"
1370 PRINT"MOVING. IT CAN WRAP-AROUND BOTH ~
THE"
1380 PRINT"THE TOP AND SIDES OF THE SCREEN.
"
1390 PRINT"{DOWN}PRESS RETURN TO CONTINUE";
1400 GET R$:IF R$<>CHR$(13) THEN 1400
1410 PRINT"{CLEAR}SELECT SKILL SETTING (0-3
)"
1420 GET R$:IF R$<"0" OR R$>"3" THEN 1420
1430 NL=4-VAL(R$):RETURN

```

## Program 2: Minefield - VIC Version

```

45 POKE36879,8
50 GOSUB1410
60 REM ---INITIALIZE VARIABLES---
70 DIM BT(37),B3(37),B4(37),BP(37),BS(37)
,XM(4),YM(4),BC(25)
80 DEF FNY(X)=INT((X-FNV(X))/22)
85 DEF FNV(X)=4*(PEEK(36866)AND128)+64*(P
EEK(36869)AND128)
90 DEF FNX(X)=(X-22*FNY(X))-FNV(X)
95 DEF FNC(X)=37888+4*(PEEK(36866)AND128)
98 DEF FND(X)=FNC(X)-FNV(X)
100 DEF FNS(X)=FNV(X)+PX+22*PY
110 DEF FNP(X)=FNV(X)+178+INT(18*RND(1))+2
2*INT(11*RND(1))
120 DEF FNN(X)=PEEK(FNS(X))
130 FORJ=1 TO 4:READ XM(J),YM(J):NEXT
140 DATA 1,0,-1,0,0,-1,0,1
150 SC=0:BT=(FNV(1)+360):NB=4:NW=0
160 PRINT"{CLEAR}";CHR$(142);
170 PRINT"{REV}{WHT}MINE****]SCORE: 0"
180 PRINT"{REV}{WHT}*****]HI SCORE:";HS
;
190 PRINT"{HOME}{02 DOWN}{REV}***FIELD]WAV
E: 1"
200 PRINT"{REV}{WHT} ]{RIGHT}";:IF
NL<>1 THEN FORJ=1 TO NL-1:PRINT"Z
";:NEXT
210 FORJ=FNV(1)TO FNV(1)+109:IFPEEK(J)=32
THEN POKE J,160:POKEJ+FND(1),1
220 NEXT
230 XP$="{RED}{DOWN}{08 RIGHT}{07 LEFT}U]I
{DOWN}{03 LEFT}U]I{DOWN}{07 LEFT}
{04 RIGHT}{LEFT} @*@{DOWN}{03
LEFT}J]K"
240 S$="{HOME}{22 DOWN}"
250 Q$="{WHT}{22 RIGHT}"
260 XR$="{WHT} {DOWN}{04 LEFT} {"
DOWN}{06 LEFT} {DOWN}{07
LEFT} * {DOWN}{05 LEFT} ~
270 REM ---SET UP NEXT WAVE---
280 BG=0:NW=NW+1:IF NW>11 THEN 310
290 NB=NB+1.5:IF NW=1 THEN 330
300 IF NW<6 THEN BT=BT-99
310 PRINT"{HOME}{02 DOWN}{REV}";TAB(15);NW
320 POKE FNS(1),32:FORJ=1 TO NB:POKEBP(J),
32:NEXT
325 FORJ=1 TO 25:POKE BC(J),32:NEXT
330 BN=INT(NB):FORJ=1 TO NB:BS(J)=1:NEXT
340 FORJ=1 TO NB
350 BT(J)=((.4+INT(61*RND(1)))/100)/.75)*BT
360 B3(J)=BT(J)+.3*BT(J):B4(J)=B3(J)+.20*B
T(J)
370 NEXT
380 PX=11:PY=11:POKE FNS(1),90:POKE(FNS(1)
+FND(1)),1
390 FORJ=1 TO NB
400 BP(J)=(FNP(1)):IFPEEK(BP(J))<>32 THEN ~
400
410 POKE BP(J),87:POKEBP(J)+FND(1),1:NEXT:
NN=0
415 FORJ=1 TO 25
416 BC(J)=FNP(1):IF PEEK(BC(J))<>32 THEN 4
16
417 IF PEEK(BC(J)+1)=87 THEN 416
419 POKEBC(J),86:POKEBC(J)+FND(1),5:NEXT
420 GET R$:IF R$<>" " THEN 420
430 DR=0:TX=TI
440 REM ---GET COMMANDS---
445 DR=2
450 POKE37154,127:R=NOTPEEK(37151)AND60-((
PEEK(37152)AND128)=0)
453 IFPEEK(37152)=119THENR=1
454 POKE37154,255:R=R*2
455 DR=INT(R):IFR<>0THENDR=INT(LOG(DR)/LOG
(2)):IFDR=5THENDR=2
460 IFPEEK(37152)=119THENDR=2
470 IFR=0THEN600
475 IFDR>4THENDR=0
480 REM ---MOVE TRUCK---
500 POKE FNS(1),32:PX=PX+XM(DR):PY=PY+YM(D
R)
510 IF PX<0 THEN PX=21
520 IF PX>21 THEN PX=0
530 IF PY<5 THEN PY=22
540 IF PY>22 THEN PY=5
550 X=FNN(1)
560 IF X=32 THEN POKE FNS(1),90:POKE(FNS(1)
)+FND(1),1:GOTO 600
570 IF X=42 OR X=86 THEN 960
580 GOTO 890
590 REM ---UPDATE BOMBS---
600 NN=NN+1:IF NN>INT(NB)THEN NN=1
610 IF BS(NN)=0 THEN 600
620 TG=INT(TI*1.03)-TX
630 IF TG>B4(NN) THEN N1=NN:GOTO 720
640 IF BS(NN)>2 THEN 690
650 IF TG>BT(NN) THEN BS(NN)=2
660 IF TG>B3(NN) THEN BS(NN)=3
670 IF BS(NN)=1 THEN 450
680 IF BS(NN)=2 THEN POKE BP(NN),215:POKEB
P(NN)+FND(1),1:GOTO 450
690 IF BS(NN)=3 THEN POKE BP(NN),87:POKEBP
(NN)+FND(1),1:BS(NN)=4:GOTO 450
700 IF BS(NN)=4 THEN POKE BP(NN),215:POKEB
P(NN)+FND(1),1:BS(NN)=3:GOTO 450
710 REM ---BOMB EXPLODES---
720 TQ=TI:PD=0
725 X$="{OFF}"+LEFT$(S$,FNY(BP(N1))-2)+LEF
T$(Q$,FNX(BP(N1))-1)

```

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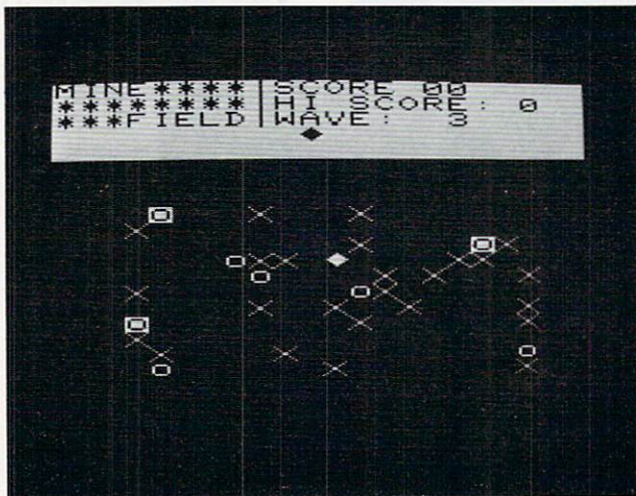
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```

730 BS(N1)=0:N2=0:PRINTX$;XP$;
740 FORJ=1 TO NB:X=PEEK(BP(J)):IF BS(J)=0T
HEN760
750 IFX<>87ANDX<>215ANDX<>218THENN2=J
760 NEXT:IFFNN(1)<>90ANDFNN(1)<>218THENPD=
1
770 PRINTX$;XR$;
780 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
<>0 THEN POKE BP(J),87-128*(BS(J)
>1)
790 NEXT:BN=BN-1
800 IF PD=1 THEN 960
810 IF BN=0 THEN 840
820 IF N2=0 THEN TX=TX+(TI-TQ):GOTO 450
830 N1=N2:GOTO 725
840 PRINT"{HOME}{02 DOWN}{REV}";TAB(20);
850 FORJ=1 TO 11:PRINT"{02 RIGHT}{REV}COMP
LETED{11 LEFT}";:FORK=1 TO 100:NE
XT
860 PRINT"{REV}          {11 LEFT}";:FORK
=1 TO 100:NEXT:NEXT
870 SC=SC-10*(INT(NB)-BG):IF SC<0 THEN SC=
0
880 PRINT"{HOME}{REV}";TAB(14);SC;:GOTO 28
0
885 REM ---BOMB GATHERED---
890 BG=BG+1:TQ=TI:POKE FNS(1),218:POKE(FNS
(1)+FND(1)),1
895 FORJ=1 TO NB:IF PEEK(BP(J))=218 THEN A
J=BS(J):BS(J)=0
900 NEXT
910 IF AJ=4 THEN AJ=3
920 SC=SC+10*AJ:PRINT"{HOME}{REV}";TAB(14)
;SC
930 BN=BN-1:IF BN=0 THEN 840
940 TX=TX+(TI-TQ):GOTO 450
950 REM ---PLAYER DESTROYED---
960 TQ=TI:FORJ=1 TO 20:POKE FNS(1),42:FORK
=1 TO 25:NEXT:POKE FNS(1),170
970 FORK=1 TO 25:NEXT:NEXT:POKE FNS(1),32:
NL=NL-1
980 POKE FNV(1)+75+NL,160:DR=0:PX=11:PY=11
990 IF NL=0 THEN 1045
1000 IF BN=0 THEN 840
1010 GET R$:IF R$<>" " THEN 1010
1020 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
<>0 THEN POKE BP(J),87-128*(BS(J)>1)
1030 NEXT
1040 POKE FNS(1),90:TX=TX+(TI-TQ):GOTO 450
1045 IF SC>HS THEN HS=SC:PRINT"{HOME}{DOWN}
{REV}";TAB(17);HS;

```



"Minefield," VIC-20 version.

```

1050 FORJ=1 TO 1500:NEXT:PRINT"{HOME}{WHT}{
04 DOWN}{REV}";"GAME OVER{DOWN}{
WHT}{09 LEFT}PLAY AGAIN?";
1060 PRINT"(Y/N){04 LEFT}";
1080 PRINT"{REV}Y/{OFF}N{03 LEFT}";
1081 FORJ=1 TO 99:NEXT
1082 PRINT"{OFF}Y{REV}/N{03 LEFT}";
1083 FORJ=1 TO 99:NEXT
1084 GET R$:IF R$="Y" THEN 1110
1090 IF R$<>"N" THEN 1080
1100 PRINT"{CLEAR}{WHT}LATER ON!":END
1110 GOSUB1410:GOTO 150
1400 GET R$:IF R$<>CHR$(13) THEN 1400
1410 PRINTCHR$(14);"{CLEAR}S{WHT}ELECT SKIL
L SETTING (0-3)"
1420 GET R$:IF R$<"0" OR R$>"3" THEN 1420
1430 NL=4-VAL(R$):RETURN

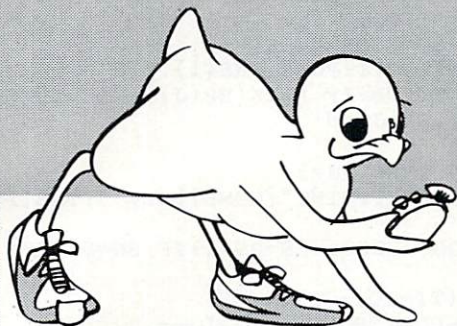
```

### Program 3: Minefield - 64 Version

```

30 REM MINEFIELD FOR C-64
45 POKE53280,0:POKE53281,0
50 GOSUB 1130
60 REM ---INITIALIZE VARIABLES---
70 DIM BT(37),B3(37),B4(37),BP(37),BS(37)
,XM(4),YM(4),BC(25)
80 DEF FNY(X)=INT((X-1024)/40)
90 DEF FNX(X)=(X-40*FNY(X))-1024
100 DEF FNS(X)=1024+PX+40*PY
110 DEF FNP(X)=1307+INT(34*RND(1))+40*INT(
15*RND(1))
120 DEF FNN(X)=PEEK(FNS(X))
130 FORJ=1 TO 4:READ XM(J),YM(J):NEXT
140 DATA 0,-1,0,1,-1,0,1,0
150 SC=0:BT=1680:NB=4:NW=0:D=54272
160 PRINT"{CLEAR}";:POKE 53272,21
170 PRINT"{REV}{WHT}MINE****] SCORE: 0"
180 PRINT"{REV}{WHT}*****] [RIGHT]HI SCO
RE: ";HS
190 PRINT"{REV}{WHT}***FIELD] [RIGHT]WAVE: ~
1"
200 PRINT"{REV}{WHT}          ] [RIGHT]";:IF ~
NL<>1 THEN FORJ=1 TO NL-1:PRINT"Z
";:NEXT
210 FORJ=1024 TO 1183:IFPEEK(J)=32 THEN PO
KE J,160:POKEJ+D,1
220 NEXT
230 XP$="{RED}U]I{DOWN}{04 LEFT}UU]II{
DOWN}{06 LEFT}UUU]III{DOWN}{07 LE
LEFT}@@@*@@@{DOWN}{07 LEFT}JJJ]KK
K"
235 XPS=XP$+"{RED}{DOWN}{06 LEFT}JJ]KK{
DOWN}{04 LEFT}J]K"
240 S$="{HOME}{24 DOWN}"
250 Q$="{WHT}{40 RIGHT}"
260 XR$="{WHT}          {DOWN}{04 LEFT}
{DOWN}{06 LEFT}          {DOWN}{07
LEFT} *          {DOWN}{07 LEFT}
"
265 XR$=XR$+"{DOWN}{06 LEFT}          {DOWN}{04
LEFT}
"
270 REM ---SET UP NEXT WAVE---
280 BG=0:NW=NW+1:IF NW>11 THEN 310
290 NB=NB+1.5:IF NW=1 THEN 330
300 IF NW<6 THEN BT=BT-180
310 PRINT"{HOME}{02 DOWN}{REV}";TAB(15);NW
320 POKE FNS(1),32:FORJ=1 TO NB:POKEBP(J),
32:NEXT
325 FORJ=1 TO 25:POKE BC(J),32:NEXT
330 BN=INT(NB):FORJ=1 TO NB:BS(J)=1:NEXT
340 FORJ=1 TO NB
350 BT(J)=(.4+INT(61*RND(1)))/100)*BT
360 B3(J)=BT(J)+.5*BT(J):B4(J)=B3(J)+

```



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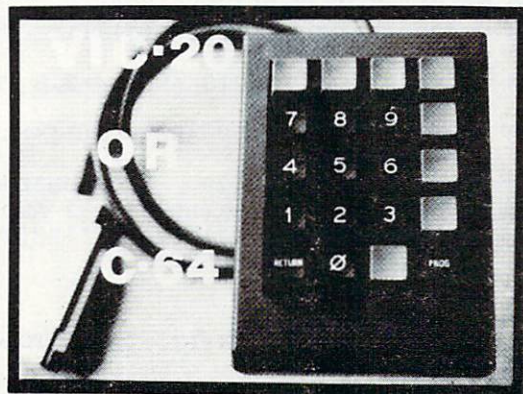
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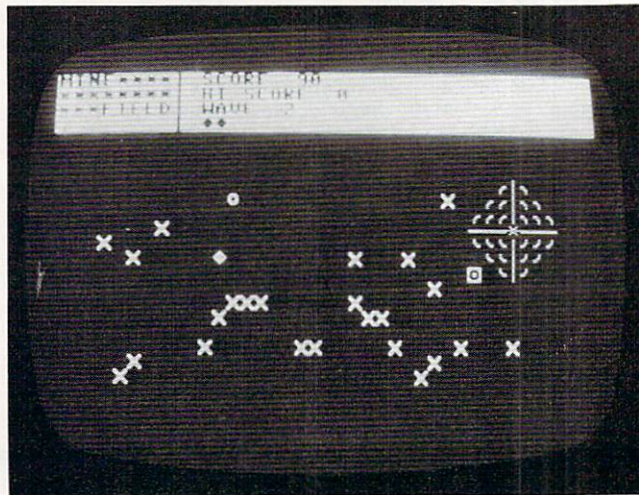
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```

T(J)
370 NEXT
380 PX=19:PY=15:POKE FNS(1),90:POKEFNS(1)+
D,1
390 FORJ=1 TO NB
400 BP(J)=FNP(1):IF PEEK(BP(J))<>32 THEN 4
00
410 POKE BP(J),87:POKEBP(J)+D,8:NEXT:NN=0
415 FORJ=1 TO 25
416 BC(J)=FNP(1):IF PEEK(BC(J))<>32 THEN 4
16
417 IF PEEK(BC(J)+1)=87 THEN 416
419 POKEBC(J),86:POKEBC(J)+D,5:NEXT
420 GET R$:IF R$<>" " THEN 420
430 DR=0:TX=TI
440 REM ---GET COMMANDS---
450 R=(15-(PEEK(56321)AND15))*2
460 IFR<>0THENDR=LOG(R)/LOG(2)

470 IFR=0THEN490
480 REM ---MOVE TRUCK---
490 IF DR=0 THEN 600
500 POKE FNS(1),32:PX=PX+XM(DR):PY=PY+YM(D
R)
510 IF PX<0 THEN PX=39
520 IF PX>39 THEN PX=0
530 IF PY<4 THEN PY=24
540 IF PY>24 THEN PY=4
550 X=FNN(1)
560 IF X=32 THEN POKE FNS(1),90:POKEFNS(1)
+D,1:GOTO 600
570 IF X=42 OR X=86 THEN 960
580 GOTO 890
590 REM ---UPDATE BOMBS---
600 NN=NN+1:IF NN>INT(NB)THEN NN=1
610 IF BS(NN)=0 THEN 600
620 TG=TI-TX
630 IF TG>B4(NN) THEN N1=NN:GOTO 720
640 IF BS(NN)>2 THEN 690
650 IF TG>BT(NN) THEN BS(NN)=2
660 IF TG>B3(NN) THEN BS(NN)=3
670 IF BS(NN)=1 THEN 450
680 IF BS(NN)=2 THEN POKE BP(NN),215:POKEB
P(NN)+D,1:GOTO 450
690 IF BS(NN)=3 THEN POKE BP(NN),87:POKEBP
(NN)+D,1:BS(NN)=4:GOTO 450
700 IF BS(NN)=4 THEN POKE BP(NN),215:POKEB
P(NN)+D,1:BS(NN)=3:GOTO 450
710 REM ---BOMB EXPLODES---
720 TQ=TI:PD=0
725 X$="{OFF}" +LEFT$(S$,FNY(BP(N1))-2)+LEF
T$(Q$,FNX(BP(N1))-1)
730 BS(N1)=0:N2=0:PRINTX$;XP$;
740 FORJ=1 TO NB:X=PEEK(BP(J)):IF BS(J)=0 ~
THEN 760
750 IF X<>87 AND X<>215 AND X<>218 THEN N2
=J
760 NEXT:IF FNN(1)<>90 AND FNN(1)<>218 THE
N PD=1
770 PRINTX$;XR$;:GR=129 :GOSUB2000
780 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
<>0 THEN POKE BP(J),87-128*(BS(J)>1)
790 NEXT:BN=BN-1
800 IF PD=1 THEN 960
810 IF BN=0 THEN 840
820 IF N2=0 THEN TX=TX+(TI-TQ):GOTO 450
830 N1=N2:GOTO 725
840 PRINT"{HOME}{02 DOWN}{REV}";TAB(20);
850 FORJ=1 TO 20:PRINT"{REV}COMPLETED{09
LEFT}";:FORK=1 TO 100:NEXT
860 PRINT"{REV} {09 LEFT}";:FORK=1
TO 100:NEXT:NEXT
870 SC=SC-10*(INT(NB)-BG):IF SC<0 THEN SC=0
880 PRINT"{04 LEFT}{03 UP} {10
LEFT}";SC:GOTO 280
885 REM ---BOMB GATHERED---
890 BG=BG+1:TQ=TI:POKE FNS(1),218
895 FORJ=1 TO NB:IF PEEK(BP(J))=218 THEN A
J=BS(J):BS(J)=0
900 NEXT
910 IF AJ=4 THEN AJ=3
920 SC=SC+10*AJ:PRINT"{HOME}{REV}";TAB(16)
;SC
930 GR=33:GOSUB2000:BN=BN-1:IF BN=0 THEN 8
40
940 TX=TX+(TI-TQ):GOTO 450
950 REM ---PLAYER DESTROYED---
960 GR=129:GOSUB2000
961 TQ=TI:FORJ=1 TO 20:POKE FNS(1),42:FORK
=1 TO 25:NEXT:POKE FNS(1),170
970 FORK=1 TO 25:NEXT:NEXT:POKE FNS(1),32:
NL=NL-1
980 POKE 1153+NL,160:DR=0:PX=19:PY=15
990 IF NL=0 THEN 1045
1000 IF BN=0 THEN 840
1010 GET R$:IF R$<>" " THEN 1010
1020 FORJ=1TONB:IF PEEK(BP(J))=32 AND BS(J)
<>0 THEN POKE BP(J),87-128*(BS(J)>1)
1030 NEXT
1040 POKE FNS(1),90:TX=TX+(TI-TQ):GOTO 450
1045 IF SC>HS THEN HS=SC:PRINT"{HOME}{DOWN}
{REV}";TAB(19);HS
1050 FORJ=1 TO 1500:NEXT:PRINT"{HOME}{WHT}{
03 DOWN}{REV}";TAB(20);"GAME OVER
{DOWN}{WHT}{09 LEFT}PLAY AGAIN?";
1060 PRINT"(Y/N){04 LEFT}";
1080 PRINT"{REV}Y/{OFF}N{03 LEFT}";
1081 FORJ=1 TO 99:NEXT
1082 PRINT"{OFF}Y{REV}/N{03 LEFT}";
1083 FORJ=1 TO 99:NEXT
1084 GET R$:IF R$="Y" THEN 1110
1090 IF R$<>"N" THEN 1080
1100 PRINT"{CLEAR}{WHT}LATER ON!":END
1110 GOSUB 1130:GOTO 150
1120 REM ---INSTRUCTIONS---
1130 PRINT"{CLEAR}{REV}{WHT}M I N E F I E L
D":POKE 53272,23
1140 PRINT"{WHT}DO YOU NEED INSTRUCTIONS (Y
/N)"
1150 GET R$:IF R$="N" THEN 1410
1160 IF R$<>"Y" THEN 1150
1180 PRINT"{CLEAR}{WHT}{DOWN}THE OBJECT OF ~

```



A mine explodes in the Commodore 64 version of "Minefield."

```

THIS GAME IS TO PICK UP"
1190 PRINT"{WHT}AS MANY BOMBS AS YOU CAN BE
FORE THEY"
1200 PRINT"{WHT}EXPLODE. TO PICK UP A BOMB,
JUST RUN"
1210 PRINT"{WHT}OVER IT WITH YOUR TRUCK."
1220 PRINT"{WHT}BOMBS WILL EXPLODE AFTER A ~
SHORT TIME."
1230 PRINT"{WHT}IF A BOMB TURNS REVERSE-FIE
LD, BE CARE-"
1240 PRINT"{WHT}FUL WITH IT. IF IT STARTS T
O BLINK, IT"
1250 PRINT"{WHT}WILL VERY SHORTLY EXPLODE-W
ATCH OUT!!"
1260 PRINT"{WHT}BOMBS WILL CHAIN-REACT; ONE
BOMB CAUGHT"
1270 PRINT"{WHT}IN ANOTHER'S EXPLOSION WILL
ALSO BLOW"
1280 PRINT"{WHT}UP. IF YOU ARE CAUGHT IN A ~
BOMB'S "
1290 PRINT"{WHT}EXPLOSION, YOU WILL BE BLOW
N UP."
1300 PRINT"{WHT}ALSO, DO NOT RUN INTO BOMB ~
CRATERS (*)"
1310 PRINT"{WHT}OR MINES (X) OR YOU'LL BE T
OTALLED."
1320 PRINT"{WHT}THE CONTOLS ARE: 1 TO GO UP
1330 PRINT"{WHT}          CTRL TO GO
LEFT"
1340 PRINT"{WHT}          2 TO GO RI
GHT"
1350 PRINT"{WHT}          _ TO GO DO
WN"
1355 PRINT"{WHT}OR YOU CAN USE A JOYSTICK I
N PORT 1."
1360 PRINT"{WHT}YOUR TRUCK CANNOT STOP ONCE
YOU BEGIN"
1370 PRINT"{WHT}MOVING. IT CAN WRAP-AROUND ~
BOTH THE"
1380 PRINT"{WHT}THE TOP AND SIDES OF THE SC
REEN."
1390 PRINT"{DOWN}{WHT}P{WHT}RESS RETURN TO ~
CONTINUE";
1400 GET R$:IF R$<>CHR$(13) THEN 1400
1410 PRINT"{CLEAR}S{WHT}ELECT SKILL SETTING
(0-3)"
1420 GET R$:IF R$<"0" OR R$>"3" THEN 1420
1430 NL=4-VAL(R$):RETURN
1900 END
2000 REM SOUND OF EXPLOSION
2010 QW=54272
2020 FORS=QWTOQW+24:POKES,0:NEXT
2025 POKEQW+24,47
2030 POKEQW+5,64+7 :POKEQW+6,240
2050 POKEQW+4,GR :POKEQW+1,36:POKEQW,85
2060 FORT=1TO250:NEXT
2070 FORT=15TO0STEP-1 :POKEQW+24,INT(T):NEX
T
2080 RETURN

```

#### Program 4: Minefield – Apple Version

```

80 REM MINEFIELD FOR APPLE
90 GOSUB 2000
100 REM SETUP VARIABLES
105 NT = 3
110 DIM BO(23),XL%(23),MO(23)
125 H = 20:U = 12
130 HOME : GOSUB 600: REM HEADINGS
139 REM SET UP ARRAYS
140 FOR X = 6 TO 19:BP = INT ( RND ( 1
) * 25 + 5):BO(X) = BP: NEXT
150 FOR X = 6 TO 19
160 MP = INT ( RND ( 1 ) * 30 + 5):MO(X)
= MP: IF MO(X) = BO(X) THEN 160
165 NEXT
170 REM PRINT SCREEN
180 FOR X = 6 TO 19:VTAB (X): HTAB (B
O(X)): PRINT "0";:VTAB (X): HTAB
(MO(X)): PRINT "X";: NEXT
190 REM SET UP ARRAY FOR POSITION
200 FOR I = 0 TO 7:XL%(I) = 1024 + 128
* I:XL%(I + 8) = 1064 + 128 * I:X
L%(I + 16) = 1104 + 128 * I: NEXT
210 U = 12:H = 20:NB = 10
215 HTAB (H):VTAB (U): PRINT "+";
220 REM GET COMMANDS
225 TI = TI + 1:GOSUB 800
230 P = PEEK ( - 16384) - 128: IF P <
73 OR P > 77 THEN 230
235 B$ = CHR$( P )
245 ODDU = U:OLDH = H
250 IF B$ = "I" THEN U = U - 1
260 IF B$ = CHR$( 3) THEN END
270 IF B$ = "M" THEN U = U + 1
280 IF B$ = "K" THEN H = H + 1
290 IF B$ = "J" THEN H = H - 1
300 IF H < 1 THEN H = 39
310 IF H > 39 THEN H = 1
320 IF U < 6 THEN U = 22
330 IF U > 22 THEN U = 6
333 REM PICK UP BOMBS
335 IF PEEK (XL%(U - 1) + H - 1) = 20
7 THEN POKE XL%(U - 1) + H - 1,42
:NB = NB - 1:SC = SC + 10:BO(U-1)=0
336 IF PEEK (XL%(U - 1) + H - 1) = 79
THEN POKE XL%(U - 1) + H - 1,42:
NB = NB - 1:SC = SC + 20:BO(U - 1)= 0
340 REM CHECK FOR COLLISION
345 IF NB < 0 THEN W = W + 1:TI = TI -
25:GOTO 130
350 K = PEEK (XL%(U - 1) + H - 1): IF
K = 207 OR K = 224 OR K = 160 OR K
= 32 OR K = 176 OR K = 42 OR K =
79 OR K = 238 THEN 360
355 VTAB (ODDU): HTAB (OLDH): PRINT "
";:NT = NT - 1:GOSUB 1000:W = W +
1:GOTO 130
360 REM UPDATE BOMBS
380 REM SCORE
390 VTAB (2): HTAB (6): PRINT W;: HTAB
(18): PRINT SC;:IF HS < SC THEN HS=SC
400 VTAB (3): HTAB (25): PRINT HS;:VTAB
(2): HTAB (40): PRINT NT;
410 IF NT < 1 THEN W = W + 1:GOTO 700
580 REM MOVE TRUCK
585 VTAB (ODDU): HTAB (OLDH): PRINT "
";:VTAB (U): HTAB (H): PRINT "+";
590 GOTO 220
600 HTAB (16): FLASH : PRINT "MINEFIEL
D": NORMAL :VTAB (2): PRINT "WAVE
";:"SCORE " " ;:"NUMBER OF
TRUCKS "
:VTAB (3): HTAB (13): PRINT "HIGH
SCORE";: RETURN
700 VTAB (4): HTAB (4): FLASH : PRINT
"PLAY AGAIN?";: NORMAL
710 VTAB (4): HTAB (17): PRINT "Y OR N";
730 GET A$: IF A$ = "Y" THEN SC = 0:NT
= 3:TI = 0:W = 0:GOTO 130
740 IF A$ = "N" THEN HOME : INVERSE :
PRINT "LATER ON": NORMAL : END
760 GOTO 700
800 IF TI > 100 THEN X = INT ( RND ( 1
) * 14 + 6): IF BO(X - 1) < > 0 AND
BO(X) < > 0 AND XL%(X - 1) > 6 THEN

```

```

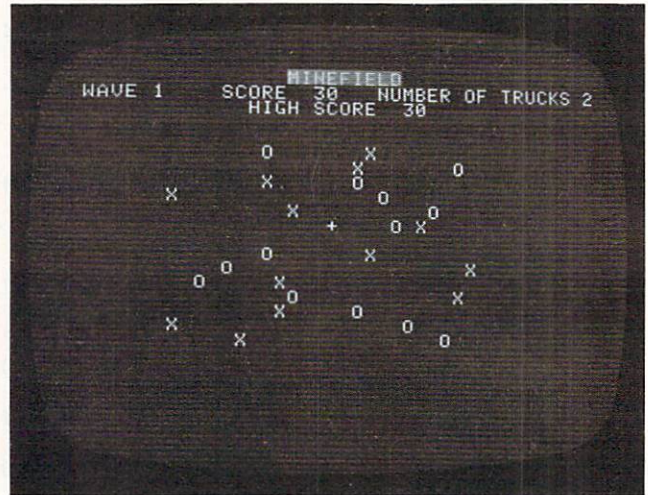
POKE XL%(X - 1) + BO(X) - 1,79
810 IF TI > 300 AND BO(X - 1) < > 0 AND
BO(X) < > 0 THEN POKE XL%(X - 1)
+ BO(X),160: POKE XL%(X - 1) + BO
(X) - 1,188: POKE XL%(X - 1) + BO(X)
+ 1,188
820 IF TI > 300 AND BO(X - 1) > 5 < 30
AND BO(X) < > 0 THEN POKE XL%(X -
1) + BO(X) - 1,160: POKE XL%(X -
1) + BO(X) + 1,160: POKE XL%(X - 1)
+ BO(X) - 2,188: POKE XL%(X - 1)
+ BO(X) - 2,188: POKE XL%(X - 1) +
BO(X) - 2,160: POKE XL%(X - 1) + B
O(X) + 2,160
825 IF TI > 325 THEN TI = 0: GOTO 130
830 RETURN
1000 REM EXPLOSION
1010 FOR G = 1 TO 3: POKE XL%(U - 1 -
G) + (H - 1 - G),239: POKE XL%(U -
1 + G) + (H - 1 - G),220: POKE XL%
(U - 1 - G) + (H - 1 + G),220: POKE
XL%(U - 1 + G) + (H - 1 + G),239: NEXT
1020 FOR G = 1 TO 3: POKE XL%(U - 1 -
G) + (H - 1 - G),224: POKE XL%(U -
1 + G) + (H - 1 - G),224: POKE XL%
(U - 1 - G) + (H - 1 + G),224: POKE
XL%(U - 1 + G) + (H - 1 + G),224: NEXT
1025 GOSUB 3000
1030 RETURN
2000 HOME : PRINT " THE OBJECT OF MINE
FIELD IS TO COLLECT AS MANY BOMBS
AS POSSIBLE BEFORE THEY EXPLODE. I
F THE BOMBS(O) FLASH THEN THEY WIL
L SOON EXPLODE. YOU GET THREE TRUC

```

```

KS(+) PER GAME.
2010 PRINT "POINTS ARE AWARDED AS FOLLOWS:
2020 PRINT "TEN POINTS FOR A NORMAL BOMB (O)"
2030 PRINT "TWENTY POINTS FOR A FLASHI
NG BOMB ": FLASH : PRINT "O": NORMAL
2040 PRINT "POINTS ARE DEDUCTED IF YOU
ARE EXPLODED."
2050 PRINT "USE THE I J K AND M KEYS T
O MOVE YOUR TRUCK"
2060 FOR T = 1 TO 15000: NEXT
2070 RETURN
3000 FOR SR = 1 TO 60:XF = PEEK ( - 1
6336): NEXT : RETURN

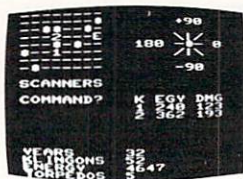
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"Minefield," Apple version.

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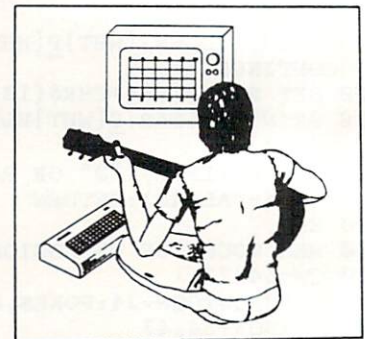
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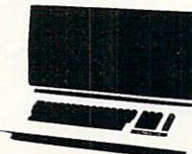
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# Relocation Calculator

Linton S. Chastain

*This automatic analysis of the effects of switching jobs might reveal some hidden economic factors in making career choices. The program will work with either standard or Extended BASIC and either 16 or 32K.*

Those of you who have been asked to relocate or may be considering relocating for your own reasons, might be interested in this program called "Salary Comparison." The program, which requires 5055 bytes to run, compares your present salary and cost with the new salary and cost. It gives you the bottom line of either a profit or loss based on the input of the old and new salaries and costs. You have a choice of outputting the old and new salaries and costs with results to the screen or printer.

The input for your old salary and cost should be readily available from your paycheck stubs and household budget. The input for the new salary can be obtained through calculations based on payroll formulas or from interpolations based on percentages of deductions of your old salary, or you may be able to obtain the input needed from the payroll department. The input for the new OUTGO can be obtained from national tax accountants, realtors, and the chamber of commerce in the new location. You can also use an almanac and indexing of the old to the new cost.

The more accurate the inputs, of course, the more accurate the results. (Recall the old computer saw: "Garbage in, garbage out.") Regardless of whether or not you decide to take the new position, at least you have an idea of what it will cost. Your decision may well be a more objective one and, in the long run, a more satisfying one.

```
40 A=0:B=0:C=0:D=0:E=0:F=0:G=0:H=0:I=
0:J=0:K=0:L=0:M=0:N=0:O=0:P=0:Q=0:
R=0:AA=0:AB=0:U=0:V=0:Y=0:Z=0:AC=0
:AD=0:AE=0:AF=0:AJ=0:AK=0:AL=0:AM=
0:AN=0:AO=0:AP=0:AQ=0:AR=0:AZ=0:AT
=0:AU=0:AV=0:AW=0:AY=0:W=0:X=0
70 CLS:PRINT"INCOME COMPARISON":PRIN
T:PRINT"COMMAND LIST # 1"
80 PRINT" 1-INPUT SALARY"
90 PRINT" 2-INPUT OUTGO"
100 PRINT" 3-DISPLAY SALARIES"
110 PRINT" 4-DISPLAY OUTGOES"
120 PRINT" 5-DISPLAY DIFFERENCE"
130 INPUT"ENTER COMMAND BY NUMBER";S:
IFS<1 OR S>5 THEN70
140 ON S GOTO150,505,370,760,910
150 PRINT
160 PRINT:PRINT"ENTER THE FOLLOWING D
ATA AS REQUESTED"
180 PRINT"-SALARY A ;B"
190 PRINT"-FED TAX C ;D"
200 PRINT"-FICA E ;F"
210 PRINT"-STATE TAX G ;H"
220 PRINT"-SAVING BOND I ;J"
230 PRINT"-LIFE INS. K ;L"
240 PRINT"-GP. INS. M ;N"
250 PRINT"-SAVING O ;P"
260 PRINT"-LTD Q ;R"
280 INPUT"SALARY A";A:INPUT"SALARY B"
;B
290 INPUT"FED TAX C";C:INPUT"FED TAX
D";D
300 INPUT"FICA E";E:INPUT"FICA F";F
310 INPUT"STATE TAX G";G:INPUT"STATE
TAX H";H
320 INPUT"SAVING BOND I";I:INPUT"SAVI
NG BOND J";J
330 INPUT"LIFE INS. K";K:INPUT"LIFE I
NS. L";L
340 INPUT"GP. INS. M";M:INPUT"GP. INS
. N";N
350 INPUT"SAVING O";O:INPUT"SAVING P"
;P
360 INPUT"LTD Q";Q:INPUT"LTD R";R
365 GOTO70
370 AA=A-(C+E+G+I+K+M+O+Q):AB=B-(D+F+
H+J+L+N+P+R)
375 INPUT"INPUT PRINT TO CRT(1) OR PR
INT TO PRINTER(2)";S:PX=S
376 IFS<1 OR S>2 GOTO375
377 IFPX=2 THENPP=-2 ELSE PP=0
380 CLS:PRINT#PP,"SALARY COMP. INCOME
1 INCOME 2"
385 PRINT#PP,CHR$(10)
390 PRINT#PP,"SALARY";TAB(13);A;TAB(2
3);B
400 PRINT#PP,"FED TAX";TAB(13);C;TAB(
23);D
410 PRINT#PP,"FICA";TAB(13);E;TAB(23)
;F
420 PRINT#PP,"STATE TAX";TAB(13);G;TA
B(23);H
430 PRINT#PP,"SAV. BOND";TAB(13);I;TA
B(23);J
440 PRINT#PP,"LIFE INS.";TAB(13);K;TA
B(23);L
450 PRINT#PP,"GP. INS.";TAB(13);M;TAB
(23);N
460 PRINT #PP,"SAVING";TAB(13);O;TAB(
23);P
470 PRINT#PP,"LTD";TAB(13);Q;TAB(23);
R
480 PRINT#PP,"-----"
-----"
490 PRINT#PP,"DIF.";TAB(13);AA;TAB(23
);AB
495 PRINT#PP,CHR$(10)
500 INPUT"HIT ENTER TO CONTINUE";R$:I
```

```


FR$=INKEY$ THEN 70
505 PRINT
510 PRINT:PRINT"ENTER THE FOLLOWING D
ATA AS REQUESTED"
530 PRINT"-PROP. TAXES U ;V"
540 PRINT"-CAR & HOME INS. W ;X"
550 PRINT"-FOOD Y ;Z"
560 PRINT"-CLOTHING AC ;AD"
570 PRINT"-MORTGAGE AE ;AF"
580 PRINT"-WATER AG ;AI"
590 PRINT"-N. GAS AJ ;AK"
600 PRINT"-ELECTRICITY AL ;AM"
610 PRINT"-MED. & DENT. AN ;AO"
620 PRINT"-GAS VEHICLES AP ;AQ"
630 PRINT"-EDUCATION AR ;AZ"
650 INPUT"PROP. TAXES U";U:INPUT"PROP
. TAXES V";V
660 INPUT"CAR & HOME INS. W";W:INPUT"
CAR & HOME INS. X";X
670 INPUT"FOOD Y";Y:INPUT"FOOD Z";Z
680 INPUT"CLOTHING AC";AC:INPUT"CLOTH
ING AD";AD
690 INPUT"MORTGAGE AE";AE:INPUT"MORTG
AGE AF";AF
700 INPUT"WATER AG";AG:INPUT"WATER AI
";AI
710 INPUT"N. GAS AJ";AJ:INPUT"N. GAS
AK";AK
720 INPUT"ELECTRICITY AL";AL:INPUT"EL
ECTRICITY AM";AM
730 INPUT"MED. & DENT. AN";AN:INPUT"M
ED. & DENT. AO";AO
740 INPUT"GAS VEHICLES AP";AP:INPUT"G
AS VEHICLES AQ";AQ
750 INPUT"EDUCATION AR";AR:INPUT"EDUC
ATION AZ";AZ
755 GOTO70
760 AT=U+W+Y+AC+AE+AG+AJ+AL+AN+AP+AR:
AU=V+X+Z+AD+AF+AI+AK+AM+AO+AQ+AZ
770 CLS:PRINT#PP,"SALARY COMP. OUTGO
1{3 SPACES}OUTGO 2"
780 PRINT#PP,CHR$(10):PRINT#PP,"PROP.
TAXES";TAB(13);U;TAB(23);V
790 PRINT#PP,"C & H INS.";TAB(13);W;T
AB(23);X
800 PRINT#PP,"FOOD";TAB(13);Y;TAB(23);Z
810 PRINT#PP,"CLOTHING";TAB(13);AC;TA
B(23);AD
820 PRINT#PP,"MORTGAGE";TAB(13);AE;TA
B(23);AF
830 PRINT#PP,"WATER";TAB(13);AG;TAB(2
3);AI
840 PRINT#PP,"N. GAS";TAB(13);AJ;TAB(
23);AK
850 PRINT#PP,"ELECT.";TAB(13);AL;TAB(
23);AM
860 PRINT#PP,"MED.&DENT.";TAB(13);AN;
TAB(23);AO
870 PRINT#PP,"GAS VEH.";TAB(13);AP;TA
B(23);AQ
880 PRINT#PP,"EDUC.";TAB(13);AR;TAB(2
3);AZ
885 PRINT#PP,"-----
-----"
890 PRINT#PP,"TOTALS";TAB(13);AT;TAB(
23);AU
900 INPUT"HIT ENTER TO CONTINUE";R$:I
FR$=INKEY$ THEN 70
910 CLS:PRINT#PP,CHR$(10):PRINT#PP,"S
ALARY COMP. INCOME 1 INCOME 2"
920 PRINT#PP,CHR$(10):PRINT#PP,"NET I
NCOME";TAB(13);AA;TAB(23);AB
930 PRINT#PP,"OUTGO";TAB(13);AT;TAB(2
3);AU

```

```

940 PRINT#PP,"-----
-----"
950 AV=AA-AT:AW=AB-AU
960 PRINT#PP,"NET MONEY";TAB(13);AV;T
AB(23);AW
970 AY=AW-AV
980 IF AW>AV THEN PRINT#PP,CHR$(10):
PRINT#PP,"A PROFIT OF ";AY;"DOLLARS"
990 IF AW<AV THEN PRINT#PP,CHR$(10):P
RINT#PP,"A LOSS OF ";AY;"DOLLARS"
1010 INPUT"HIT ENTER TO CONTINUE";R$
1020 IFR$=INKEY$ THEN70

```



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# CAPUTE!

Modifications Or Corrections To Previous Articles

## VIDEO 80 For Atari

Brad Brooks points out that the 80-column software from the April issue (p. 170) can be restarted after a SYSTEM RESET without having to power up again. Simply type ?USR(9013). You'll get an ERROR 9 message, but this does not affect program operation.

## Match-Em

This game for the TI in the April 1983 issue (p. 123) has a minor flaw. Hitting the same key twice will register as a valid match. Our thanks to reader James Alessio, for suggesting the following fix:

```
1085 IF A2=A1 THEN 1030
```

## TI Air Defense

The confusing characters at the beginning of line 1950 of the TI version of this game (page 46 of the April issue) should be replaced with the command PRINT.

## Atari CRAB

This Atari BASIC cross-reference program from the April issue (p. 188) has problems when handling inverse video characters or USR codes in quotes. To prevent this, reader David Butler suggests adding the following line:

```
245 IF C=15 THEN GOSUB GC FOR J=I TO C:GET #I,G:NEXT J:GOSUB GC
```

Also, some printers add a carriage return after LPRINT;. To correct this, David offers the following modifications:

```
390 OPEN #I,8,Z,"P":PRINT #I;"XREF FOR "  
;A$  
420 D=INT(LN/H):M=LN-H*D:IF NOT M THEN PRINT #I:PRINT #I  
430 PL=PEEK(X+T):FOR J=5 TO PL-T:PRINT #I  
;CHR$(PEEK(X+J));:NEXT J  
440 PRINT #I;" ";:IF NOT M THEN PRINT #I  
460 PRINT #I:PRINT #I:PRINT #I:D-L+I;" VARIABLES"
```

## Apple Subroutine Capture

In the text for the EXEC file (Program 1, page 171) of this article from the March issue, be sure that the word "RUN" appears (without a line number) as the last line in the file or the program will not operate properly.

## VIC Data Acquisition

In the program on page 248 of the May 1983 issue, the POKE 37166,128 in line 20 should be replaced with POKE 37166,64.

## ZX-81/TS-1000 Data Management

Line 2065 of this program from the March 1983 issue (p. 230) should read:

```
2065 IF N$(S,1 TO 30)=S$(1,1 TO 30) THEN  
GOTO 2140
```

## Color Computer Version Of Vehicle Cost Performance

In line 770 (February 1983, p. 164), the WRITE#1 should be PRINT#1. In line 1160 the CLD should be CLS. In line 1250, the "GALLONS";Y should be "GALLONS",Y.

## Commodore Maze Generator Enhancement

The maze generating program by Charles Bond reprinted in the February issue (p. 106) has a shortcoming. The fixed order of the elements in the A(3) coordinate array generates mazes that almost invariably spiral counterclockwise around the screen. Neil Murray suggests stirring in a little randomness by adding the following line:

```
115 FOR I=3 TO 1 STEP -1:K=INT(RND(I)*I):  
SV=A(K):A(K)=A(I):A(I)=SV:NEXT I
```

## Automatic Commodore Program Selector

The programs which accompany this article from the March 1983 issue (p. 156) require modification to work with the VIC-20 and 1540/1541 disk drive. All output to the screen should be adjusted for the 22-column display. Line 290 of Program 1 and line 470 of Program 2 should be changed to:

```
PRINT "{4 DOWN}RUN":PRINT "RUN":PRINT "  
{HOME}{7 DOWN}";
```

In Program 3, delete line 420 and make the following changes:

```
210 DIM AE$(150)  
240 PRINT:PRINT:PRINT "READING{2 SPACES}D  
RIVE 0"  
250 PRINT "{DOWN}PROGRAMS FOUND: 0"  
290 IF C$=CHR$(220) THEN 410  
350 PRINT "{UP}"TAB(17)AN-A0  
440 MM=9:PRINT "{CLR}{RVS}PROGRAM MENU #"  
STR$(MN+1)"{OFF}{DOWN}"  
460 PRINT TAB(3)"{RVS}"RIGHT$(STR$(I),1)  
"{OFF}"MID$(AE$(MN*9+I),3,16)"  
{DOWN}"  
470 NEXT:PRINT "{RVS}MAKE A CHOICE OR  
{OFF}"  
480 PRINT "{RVS}PRESS 'RETURN' {OFF}"  
590 PRINT "RUN":PRINT "RUN":PRINT "{HOME}  
{7 DOWN}";
```

For the Commodore 64 with 1541 drive, delete line 420 and make the following changes to Program 3:

```
210 DIM AE$(150)  
290 IF C$=CHR$(199)THEN 410
```

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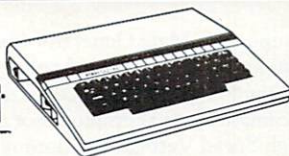
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**February 1981:** Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on CIP, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

**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, Tiny-mon: 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.

**May 1982:** VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacts, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

**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.

**January 1983:** Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon64, Perfect Commodore INPUTs, Atari Autonumber, Copy VIC Disk Files, Commodore 64 Architecture.

**February 1983:** How The Pros Write Computer Games, 12 Joysticks Compared, Slalom (a game in 3-D for multiple computers), Super Shell Sort For PET, Atari SuperFont Plus, Creating Graphics On The VIC, Joysticks And Sprites On The 64, Bi-Directional VIC Scrolling, Commodore 64 Video: A Guided Tour, The Atari Cruncher, Easy Apple Editing, VIC Custom Characters For Games.

**Home and Educational COMPUTING!** (Fall 1981 and Summer 1981 - count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters, Alternate Screens, Automatic Line Numbers, Using The Joystick (Spacewar Game), Fast Tape Locator, Window, VIC Memory Map.

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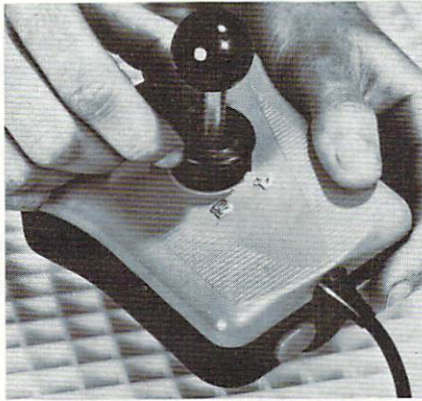
## Arcade-Style Joystick

Newport Controls has released its Prostick II arcade-style replacement joystick for Atari 400 and 800, Commodore VIC-20, and various other videogame/computer applications.

The Prostick II is as durable and responsive as its predecessor, the Prostick Model 150. However, the case has been redesigned for easy hand-held operation, and the solid steel, short-throw control shaft with an arcade-style ball on the top gives the user precise, fast action.

The Prostick II includes a switchable 4-way/8-way gateplate. Setting the gateplate indicator to the 4-way position allows only horizontal and vertical motion, improving response for maze-type games. Setting the gateplate indicator to the 8-way position offers the regular precise 8-position action.

In addition, the Prostick II comes equipped with two "soft-touch" firing buttons which have



Newport Controls' Prostick II features a switchable gameplate, allowing 4-way or 8-way movement.

been moved to the top end of the base, allowing either right- or left-hand play.

The \$24.95 Prostick II is backed by a five-year limited warranty.

Newport Controls  
15425 Los Gatos Boulevard  
Los Gatos, CA 95030  
(408)358-3439

## Personal Fantasy Adventure

A combination adventure, strategy, and arcade game, *In Search*

*Of The Most Amazing Thing*, has been released by Spinnaker Software. The game is designed to create an environment in which children are encouraged to experiment and discover, to negotiate with aliens, not destroy them.

The user begins his quest for *The Most Amazing Thing* by seeking the advice of Old Smoke Bailey, who explains the rules and outlines the hazards ahead. As the game progresses, the child learns decision making, note taking, map reading, trading and bargaining, music writing,



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and drawing in his search for The Most Amazing Thing.

The game, written by Tom Snyder, comes with Jim Morrow's novel, *The Adventures of Smoke Bailey*, which was written as an accompaniment.

The \$39.95 program is available for the Apple, Atari, and Commodore 64 computers.

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

## Space Game For Atari

First Star Software has released *Astro Chase*, a game by Fernando Herrera, the first winner of the Atari Star Award. *Astro Chase* is available for the Atari 400/800, and will be converted for use on other computers.

The game features high-resolution graphics, seven ani-

ated intermissions, 34 levels of play and Single Thrust Propulsion, a feature that allows a pilot to lock his craft on course and then fire independently in any direction. Suggested retail price is \$29.95.

First Star Software  
22 East 41st St.  
New York, NY 10017  
(212)532-4666

## Commodore 64 To RS232 Interface Cable

Connecticut microComputer has introduced the ADA 6410, an RS232 interface cable for the Commodore 64.

The cable plugs into the 64's RS232 port, and provides voltage conversion to drive standard RS232 printers, terminals, and mainframes. The unit includes a six-foot cable, and all electronics are completely enclosed. Power



The ADA 6410 RS232 interface cable for the Commodore 64.

is received from the computer. There is no special software needed. Address # 2 is used.

The ADA 6410 retails for \$79.

Connecticut microComputer  
36 Del Mar Drive  
Brookfield, CT 06804  
(203)775-4595

## Keyboards For The Timex/Sinclair

Two companies have developed keyboards for the Timex/Sinclair

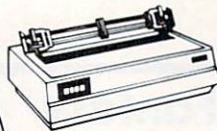
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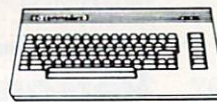
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computers.

KOPAK Creations has introduced the \$99.95 KOPAK Keyboard. Its features include: Sinclair/Timex markings on keys, five single-stroke keys, shift lock, a full-size space bar, additional ENTER and extra shift keys, sculptured keys, an optional numeric keypad, and an optional aluminum case.

KOPAK Creations, Inc.  
448 West 55th Street  
New York, NY 10019  
(212)757-8698

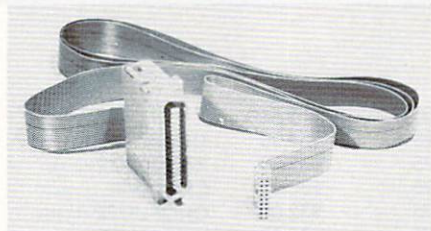
The E-Z Key 60 keyboard is described as a "tactile feel" keyboard that plugs into the same connectors as the existing keyboard. It includes 60 keys, molded legends on key tops, keys for edit, delete, single and double quotes, colon, semicolon function, and stop, two shift keys, a numeric keypad, and an optional mounting base.

The E-Z Key 60 sells for \$84.95.

E-Z Key  
Suite 75A  
711 Southern Artery  
Quincy, MA 02169  
(617)773-1187

## Parallel Interface Cables For TI

TENEX Computer Marketing Systems has developed an interface cable making the Texas Instruments 99/4A computer compatible with several Centronics standard printers such as the Okidata and Smith-Corona TP-1. The parallel output from the TI's



TI/CEN parallel interface cable for the TI-99/4A.

RS232 Interface is modified within the connector housing of the new TI/CEN cable. The cable is priced at \$37.95.

TENEX Computer Marketing Systems  
Box 6578  
South Bend, IN 46660  
(219)277-7726

## Color Author For TRS-80

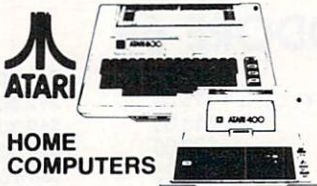
Radio Shack is introducing a courseware development system for the TRS-80 Color Computer 32K disk system.

Color Author allows educators with no previous experience to create instructional materials for delivery on the computer. The menu-driven system guides the user through the lesson-creating process. Lessons may contain tutorial text, questions, and graphics. The instructor creates lesson frames



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one at a time by filling in a form on the screen.

Display features include normal and double-sized text, reverse video, underlining, boldface and special graphics characters.

*Color Author* offers three delivery modes – instruction, review, and test. Student records can be kept and printed out for each mode.

Tandy Corporation/Radio Shack  
1800 One Tandy Center  
Fort Worth, TX 76102

## Speech Synthesizer For Timex/Sinclair

The Parrot, a plug-in speech module for Timex/Sinclair computers, has been introduced by R.I.S.T. The Parrot is supplied with cassette software allowing the user to select, string together, and pronounce all 64 allophones in the English language, generating words, sentences and sound effects.

The Parrot plugs directly into the Sinclair ZX80/81 and the Timex/Sinclair 1000, and is piggyback expandable so other modules can be plugged in behind it. It includes an audio output jack for any 4 or 8 ohm speaker and volume control. The \$89.95 Parrot also includes a power-input jack to provide additional power if modules other than The Parrot are being used.



The Parrot is a 3" by 3" by 1 1/2" speech module for Timex/Sinclair computers.

R.I.S.T. Inc.  
P.O. Box 499  
Fort Hamilton Station  
Brooklyn, NY 11209  
(212)259-4934

## Mail List For Commodore 64

A mailing list management program for the Commodore 64 is available from RAK Electronics. *Commodore 64 Maillist* constructs, sorts, maintains, and prints a mailing list of more than 300 names. The computer and cassette deck are the only requirements, but the system will work with a disk drive and printer.

*Maillist* is available on tape for \$14.95 or disk for \$17.95,

plus a \$2 shipping charge with each order.

RAK Electronics  
P.O. Box 1585  
Orange Park, FL 32073

## Data Base Manager For Apple

*Multi-Trieve*, a data base management system for the Apple II+ and Apple IIe, has been released by Multisoft. Instead of displaying data in a traditional way, one record per screen, *Multi-Trieve* displays records in the form of a table, with field left/right justification, column headings, decimal point alignment, and running totals for numeric fields.

The horizontal scroll can shift a table to the right or left to view the fields that are outside of the physical boundaries of the screen.

*Multi-Trieve* supports the 80-column Text Card on Apple IIe, significantly increasing the number of fields (columns) that can be seen at any given time. *Multi-Trieve* is menu-driven, and it includes file Search/Edit, indexes, sorting at data entry, file reorganizing, multiple fields in selection criteria, and the ability to split a single-diskette file into two diskettes.

*Multi-Trieve* offers three printing methods, either in normal or condensed character set:


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The International Council for Computers in Education at the University of Oregon has published a resource guide on computers for the handicapped. The \$7 guide, titled *Computer Technology for the Handicapped in Special Education and Rehabilitation: A Resource Guide*, is a comprehensive bibliography of 191 annotated references on computers for the handicapped. The references, drawn from books, periodicals, reports, and conference proceedings, cover a broad range of topics on physical and developmental handicaps.

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## Family Game For Atari

Avalon Hill has released a computer version of its popular *Facts In Five* game. *Computer Facts In Five* is a game of knowledge which pits players against time

and each other. It includes options for solitaire play, doubles play, and party play.

In each round of the game, five subject categories are selected from a list of more than 1000. Five letters are associated with each category, and the players supply answers that start with the designated letters.


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*Computer Facts In Five* is available for the 48K Atari 800. Retail price is \$26.

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MCE Inc.  
157 South Kalamazoo Mall  
Kalamazoo, MI 49007  
(800) 421-4157

## Micro Math Educational Programs

*Micro Math*, a new series of educational math programs for 12-16 year olds, has been launched by PM International.

Part of the more extensive *Master Math* package, *Micro Math* is intended for use on the Sinclair ZX81, Timex 1000, Commodore PET, and VIC-20 in schools and colleges as a computer-assisted learning aid and at home as a self-tuition course.

A random number generator originates problems, and the student is prompted to answer.

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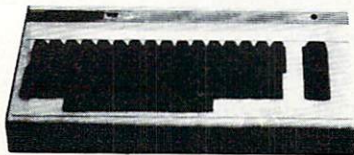
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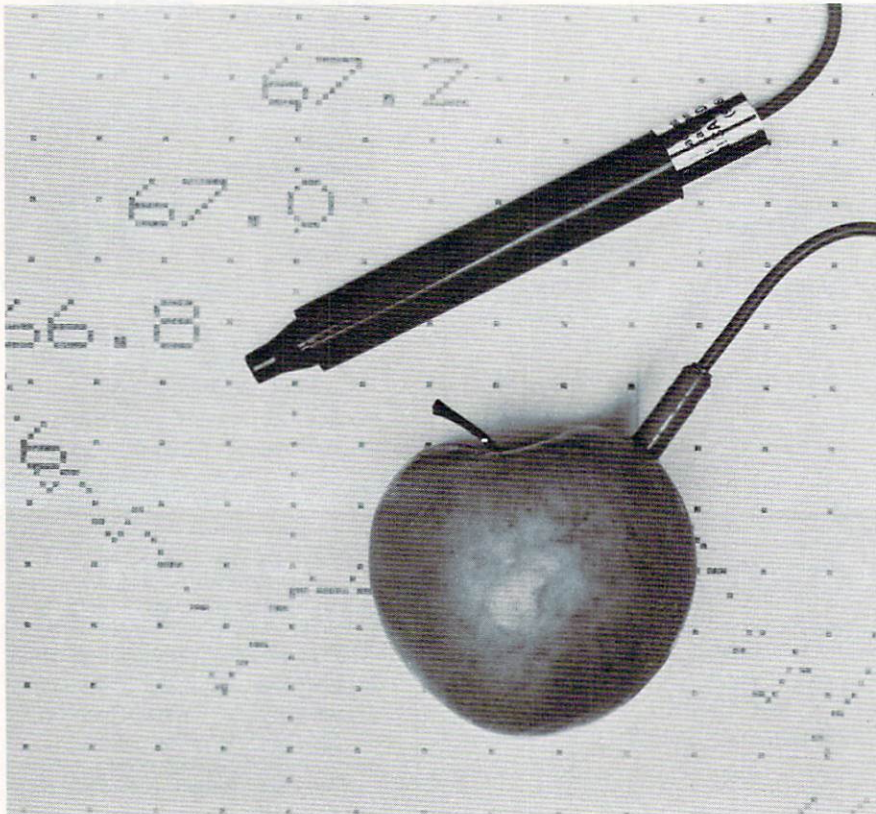
marking pen and attaches to the Apple II computer by a 6-foot cable. The system software is on a DOS 3.3-compatible, 5.25-inch diskette.

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## Everything You Always Wanted To Know About Home Computers

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PolyGram Records recently released *Everything You Always Wanted To Know About Home Computers*, an album narrated by Steve Allen and Jayne Meadows. The album is accompanied by a 16-page instruction booklet with a glossary, computer literacy quiz, diagrams, and a simulated computer keyboard with sample programs.

The album answers such questions as: Why do I need a computer? How hard is it to use? What can I do with one? How does a computer do all that? And just what do the arcane terms of computer language mean?

*Everything You Always Wanted To Know About Home Computers* was written by Arnold

Friedman, Department Chairman of Computer Studies in the Great Neck Public Schools Adult Program of Great Neck, New York. Friedman directs a private school for computer studies and has written computer programming textbooks, magazine articles, and audio-visual materials for classroom use.

*PolyGram Records*  
810 Seventh Avenue  
New York, NY 10019  
(212)399-7067

or

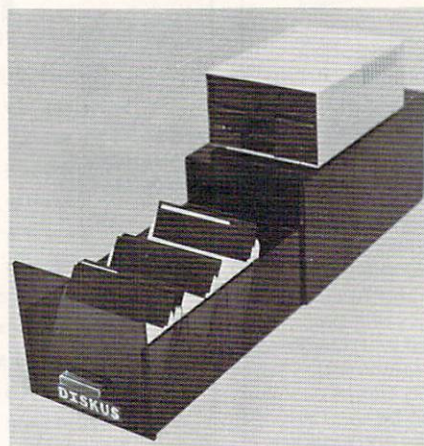
8255 Sunset Blvd.  
Los Angeles, CA 90046  
(213)650-8300

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## Diskette Storage

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The *Diskus*, a storage unit for up to 125 diskettes, is now available from Diskus. Five disk compartments are separated by removable clear inserts. Index tab dividers are also included.



*The Diskus storage file.*

The unit is compatible with most disk drives and computer desk setups. Made of a dark, see-through acrylic, the storage unit permits easy access, allowing the user to have a consolidated disk library close at hand. The price is \$75.95.

*Diskus*  
7051 Hanna Ave.  
Canoga Park, CA 91304

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## Folklife Club Software Available To Commodore Users

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The Folklife Terminal Club, a Commodore users group, has announced it is making its software library available to other users of Commodore equipment. The club's archives contain more than 5000 public domain programs. The programs are stored on diskettes and are usable on various configurations of PET, CBM, and VIC computers. The software itself is free. There is a copying and mailing fee of \$10 per diskette. The first diskette that should be ordered is the *Catalog Disk*, which contains an Automatic Disk Cataloging Program, a listing of all the available programs and complete instructions.

*Folklife Club*  
Box 2222  
Mt. Vernon, NY 10551

---

## Math Concepts For Atari

---

Mind Movers has released a mathematics program called *Secret Formula*. Users discover and understand math concepts and relationships through a sequenced developmental program for all ability levels.

The user controls the level of difficulty, and can create his own program. The program can be used by individuals or by small groups for interaction and competition.

*Secret Formula* is available for the Atari 800 with 48K and requires a disk drive and BASIC cartridge. The cost is \$59.95.

*Mind Movers Inc.*  
4286 Redwood Hwy., Suite 245  
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(415)499-8281

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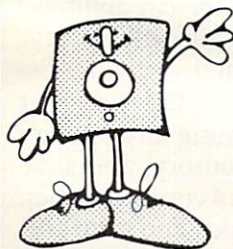
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## New Epson FX-80 Printer

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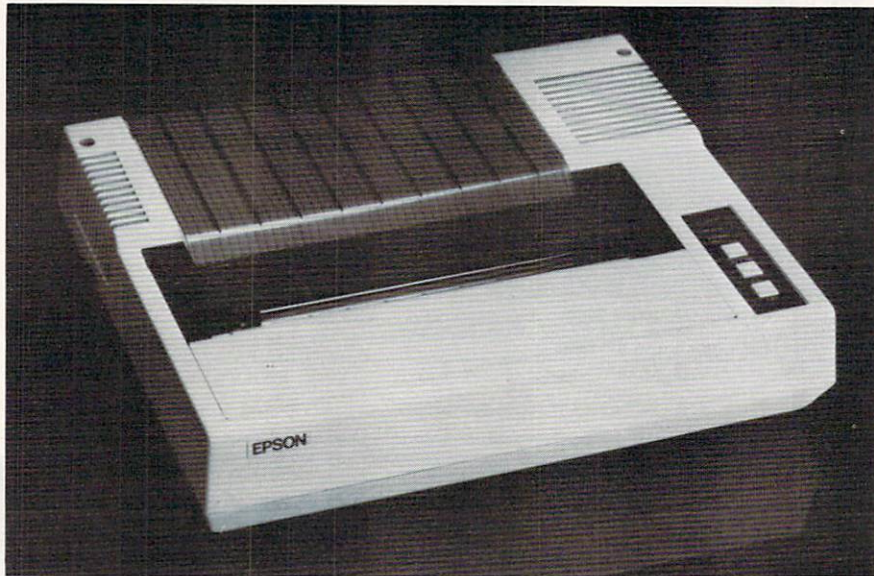
The FX-80, a high-performance bi-directional printer with a printing speed of 160 characters per second, is now available from Epson America.

The FX-80 offers a software-selectable choice of elite (12 cpi) or pica (10 cpi) print spacing. In addition, users can send their own special fonts from their

spacing, pin- and friction-feeds, and a standard parallel communications interface, with serial or IEEE 488 interfaces also available as options.

Four different printing densities – normal, emphasized, bold, and double-emphasized – are available.

The short-form tear-off bar will aid in the production of computer-generated paychecks and other pre-printed forms. The tear-off bar separates the paper from the printer one-inch from



Epson's dot-matrix printer.

computer system to the printer, downloading the font into the printer's memory. This feature will be of particular help to those using math, engineering, foreign language, or medical applications.

The FX-80 also features a one-to-one graphics ratio – the dot-matrix has the same scale vertically as horizontally; accurate graphics, including true circles, can be drawn with the dot-addressable graphics capability. Also incorporated into the new printer is a 2K-byte buffer, which allows buffered printing on longer productions.

The new Epson printer provides 9x9 dot-matrix characters with full descenders and is downward compatible with the Epson MX Series of printers. Also featured is proportional

the last printed line.

The Epson FX-80 printer retails for \$699.

Epson America, Inc.  
3415 Kashiwa Street  
Torrance, CA 90505  
(213)539-9140

---

## Statistical Graphs For The Timex/Sinclair

---

Practical Computer Products has announced the release of their statistical aid, *Graphpak*, for the Timex/Sinclair 1000. The program presents numerical information in a visual format: bar graphs, line graphs, pie charts, and area graphs (rectangles divided to show percentages).

*Graphpak* plots scientific data and assists in business and family financial planning. It is a 10K BASIC program which is listable. Available on cassette for \$14.95. Shipping and handling is included, but California residents should include 6% sales tax. Send an SASE for details.

Practical Computer Products  
21111 Strathmoor Lane  
Huntington Beach, CA 92646

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## EPROM Programmer For Atari

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Creative Firmware of Dallas, Texas, recently introduced a low-cost EPROM development system for Atari computers. This system includes the following items:

1. The Memory-Maker EPROM Programmer comes in kit form and permits programming of 2716 and 2532 EPROMs. The machine language software is available for either cassette- or disk-based systems and includes EPROM blank checking, programming, and verifying. Also included are the capabilities to read most 2K and 4K ROMs, edit any loaded software, list this software to the screen or printer, examine any portion of computer memory, and save any portion of computer memory to disk or tape. The save and load functions are compatible with DOS binary files. Assembly time for this kit is approximately one hour. The kit includes all parts, including power supply and zero-insertion force socket. The case is optional.
2. For those desiring to program 2732 or 2732A EPROMs, the Creative Firmware 2732/2732A Programming Adapter kit. This unit drops into the zero-insertion force socket on the Memory-Maker and permits switch selection of 2732 or 2732A EPROMs. It contains its own zero-insertion

force socket. Assembly time for this kit is approximately 15 minutes.

3. A Cartridge EPROM Board kit. This unit permits up to 8K of EPROM space on a board which plugs into the Atari cartridge slots. This board takes one or two 2716, 2532, 2732, or 2732A EPROMs. The connector is gold-plated. This kit can be assembled in 15 minutes.

Pricing for the above items:

- \* Memory-Maker EPROM Programmer: \$79
- \* Custom Memory-Maker case: \$15
- \* 2732/2732A Programming Adapter: \$17.50
- \* Cartridge EPROM Board: \$14.89

These kits are available from:

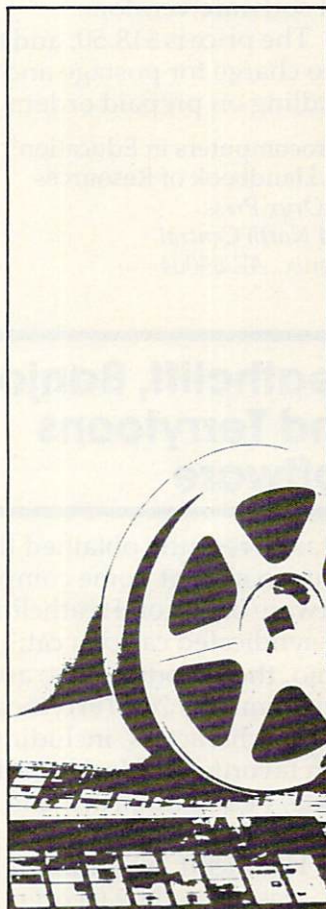
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## Microcomputers In Education

The Oryx Press announces publication of *Microcomputers in Education: A Handbook of Resources*. The book, edited by Katherine Clay, is a guide to the literature, materials, and resources on the use of microcomputers in schools.

*Microcomputers in Education* covers materials published from the beginning of the microcomputer revolution in 1976 to March 1982. The major portion of the book is an annotated bibliography of books, journal articles, and microfiche covering the state of the art, from Philosophy and Futures/Trends to Computer Literacy, Classroom Applications, Teacher/Administrator Education, and more. Included is a section on references and

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resources, including bibliographies, glossaries, sources of funding, and book reviews. In addition, there is an appendix covering sources of information and assistance such as computer journals, user groups, associations, microcomputer centers, and software vendors.

The price is \$18.50, and there is no charge for postage and handling on prepaid orders.

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The Oryx Press

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## Heathcliff, Banjo, And Terrytoons Software

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Datasoft recently obtained the rights to market home computer software based on Heathcliff, the syndicated cartoon cat; Banjo, the Woodpile Cat; and approximately 200 Terrytoons cartoon characters, including such favorites as Heckle and Jeckle, Pearl Pureheart, and Deputy Dog.

Heathcliff, now nine years old, was created by George Gately. Along with a cast of supporting characters, Heathcliff is now also a Saturday morning TV star. Datasoft expects to introduce its Heathcliff product in the second quarter of this year.

*Banjo the Woodpile Cat*, the first film done by Don Bluth Productions, was aired last year on ABC-TV. The film presents the whimsical story of Banjo, a country cat who wanders off to the big city. Although Banjo discovers excitement and adventure, and learns the value of friendship, he is only too glad to return home. Datasoft plans to introduce Banjo software during the spring, possibly in April.

The Terrytoons software should be introduced around mid-year.

Datasoft, Inc.  
16 East 52 Street  
New York, NY 10022  
(212)355-5049

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# CALENDAR

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**June 7-11, University of Rochester, Rochester, NY.** The third annual Rochester Forth Applications Conference. This year's conference will focus on Forth and robotics. Other sessions will cover Forth and education, VLSI design, graphics, and finite state machines. For more information, contact Diane Ranocchia, Institute for Applied Forth Research, Inc., 70 Elmwood Ave., Rochester, NY 14611; (716) 235-0168.

**June 20 - July 15, Rutgers University, Rutgers, NJ.** Computers in Education '83 - a three-day conference and a four-week summer institute. The conference, which will discuss "Necessary Direction for Computer Education; Navigational Aids for the 80s," begins June 27. The summer institute offers 40 professional development courses ranging from one to twelve days. Continuing Education Units and Graduate Credit are available. Preregistration is necessary.

Additional information is available from Dr. Mitchell E. Batoff, Director, CE '83, Institute for Professional Development, 245 Nassau St., Suite D, Princeton, NJ 08540; (609) 924-8333.

**June 27, Stanford University, Stanford, CA.** International Institute on Microcomputers in Education, sponsored by Interactive Sciences, Inc., and Stanford University's School of Education. Five-week course offers exposure to computer technology and a discussion of ways to integrate computers into the schools. For more information, write the School of Education, Stanford University, Stanford, CA 94305; (415) 497-2102.

**June 27-29, New York Hilton, NY.** Videotex '83, an international conference and exhibition on the technology, current use and projections for videotex. For information, write Pam Fendel, London Online, Inc., 1133 Avenue of the Americas, 33rd Floor, New York, NY 10036; (212) 692-9003.

**July 20-22, Eugene Conference Center, Eugene, OR.** "The Computer: Extension of the Human Mind II" will explore the classroom applications of computers and will discuss current research on computers in education. For information, contact Jude Ridge, College of Education, University of Oregon, Eugene, OR 97403; (503) 686-3405.

**August 10-12, Madison, WI.** The second annual Microcomputers and High Technology Conference in Vocational Education. Beginning and advanced classes on programming, PILOT, CAD, courseware design, and demonstrations of vocational education programs not in use. For information, contact Dr. Judith Rodenstein, Vocational Studies Center, University of Wisconsin-Madison, 1025 W. Johnson St., 964 Educational Science Building, Madison, WI 53706; (608)263-4367.

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**COMPUTE!** welcomes notices of upcoming events and requests that the sponsors send a short description, their name and phone number, and an address to which interested readers may write for further information. Please send notices at least three months before the date of the event, to: *Calendar*, P.O. Box 5406, Greensboro, NC 27403.

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*New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.*

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NOTE: The last line in the March ad in COMPUTE should have read "Free Soundbox t-shirt with order, while supplies last." Our apologies.

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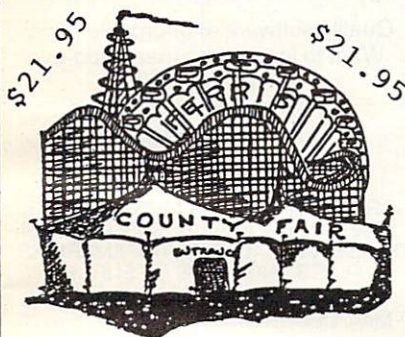
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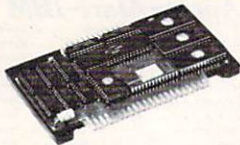
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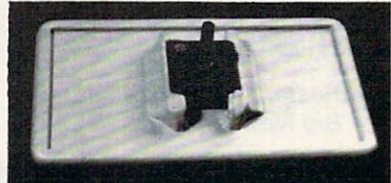
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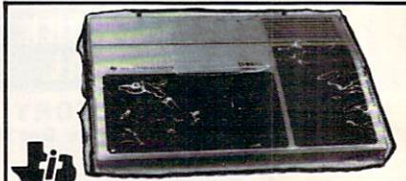
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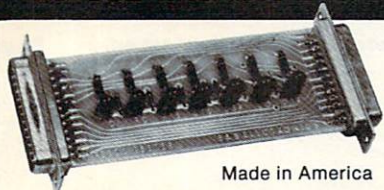
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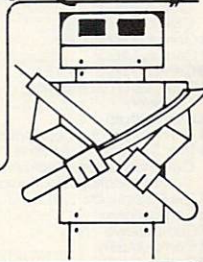
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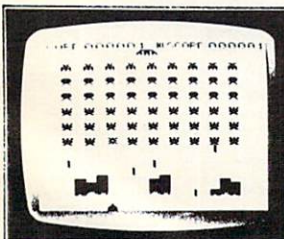


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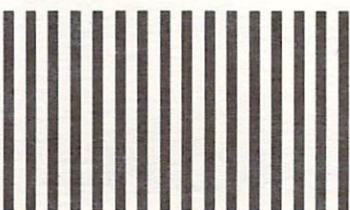
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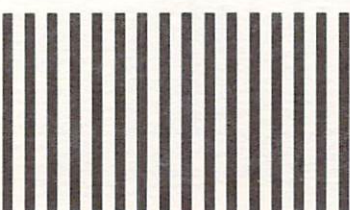
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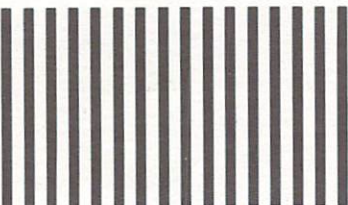
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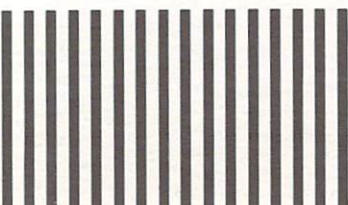
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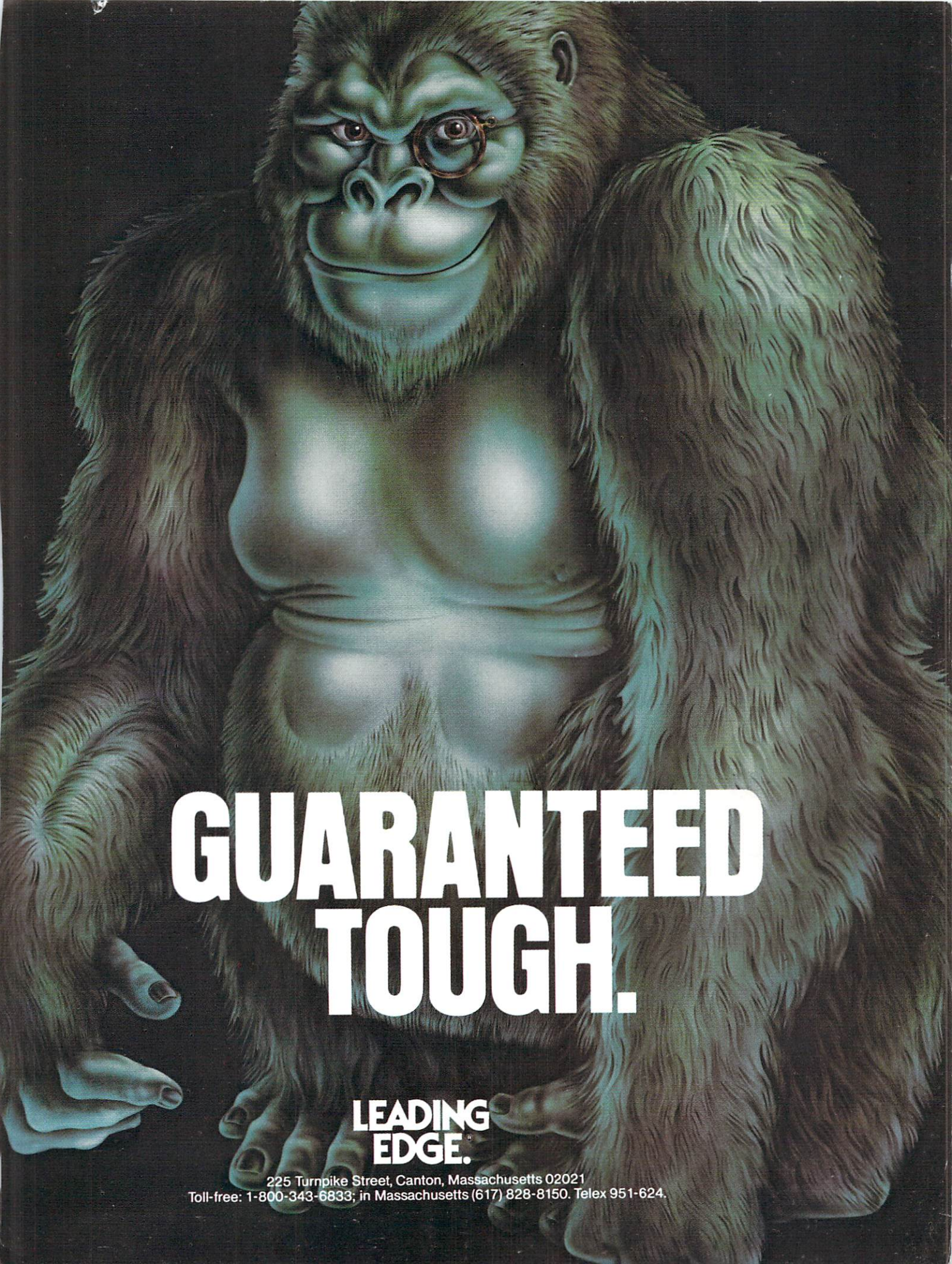
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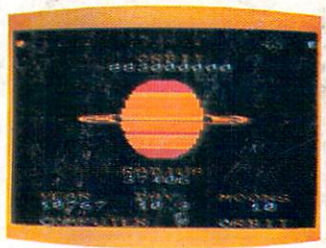
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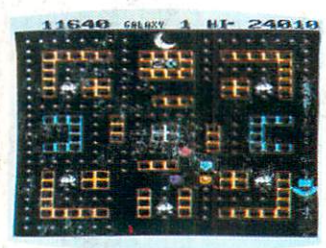
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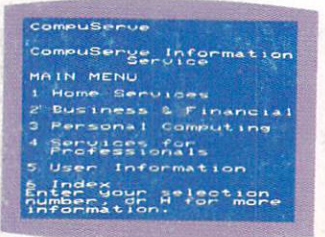


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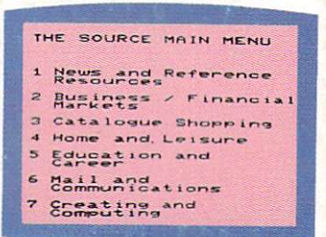


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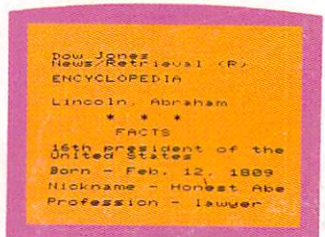
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**COMPU SERVE™**



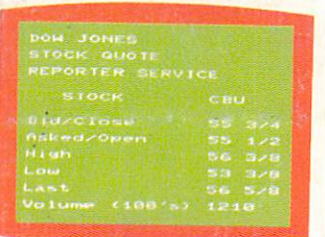
**THE SOURCE™**



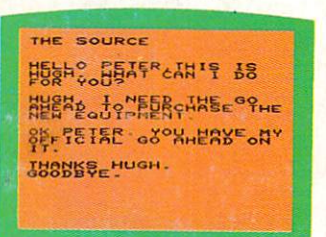
**ENCYCLOPEDIA**



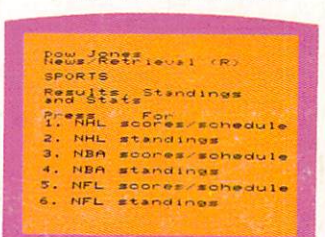
**SHOP AT HOME**



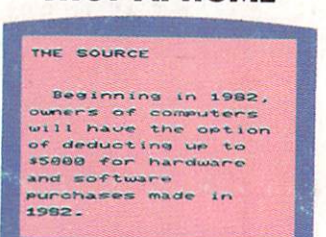
**DOW JONES  
NEWS/RETRIEVAL**



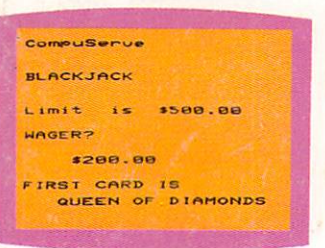
**ELECTRONIC  
MAIL**



**WIRE SERVICE  
NEWS**



**TAX ADVICE**



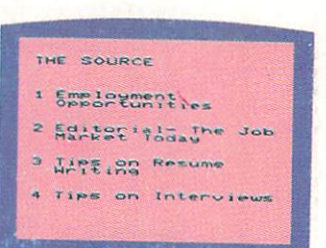
**GAMES**



**TRAVEL  
INFORMATION**



**COMMODORE  
INFO. NETWORK**



**EMPLOYMENT  
OPPORTUNITIES**



The screens at the top of the page show a few examples of how versatile the VIC 20™ or Commodore 64™ can be with the addition of Commodore software. The screens below them give you a few examples of how much

more versatile they can be with the addition of a Commodore VICMODEM. For around \$100, the Commodore VICMODEM will turn your VIC 20 or Commodore 64 computer into a telecomputer. To make matters even better, Commodore includes a few little extras (such as a free hour's time on the two most popular telecomputing services) that add up to a value of \$197.50\* A nice return on

an investment of about \$100. Most computer companies think it's reasonable to ask as much as \$500 for a modem that'll give you telecomputing capabilities such as ours. However, with a VICMODEM priced at around \$100, we think we're being a lot more reasonable. Don't you agree?

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