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The Journal For Progressive Computing™

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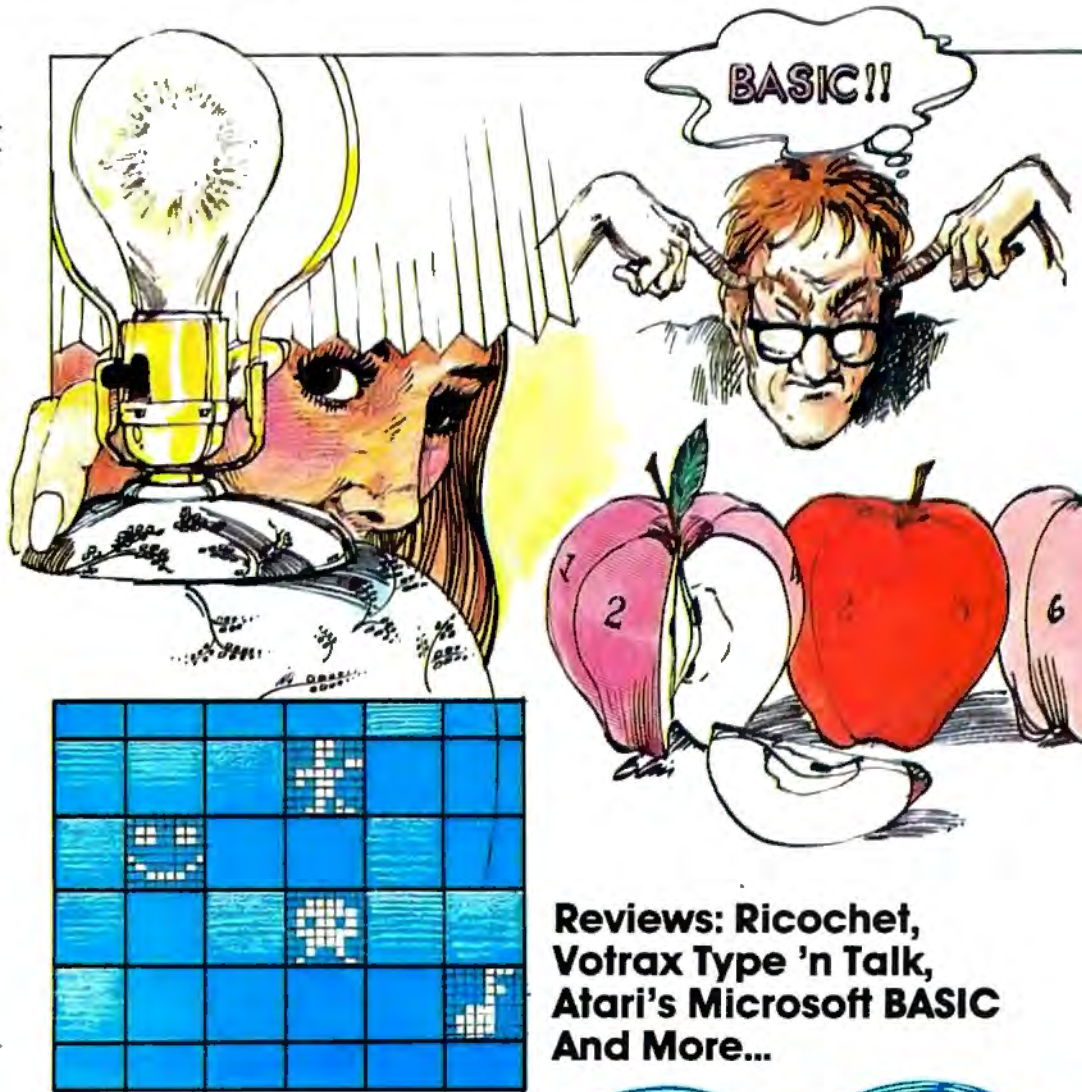
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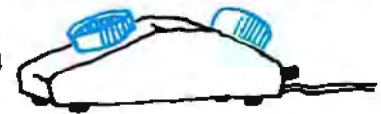
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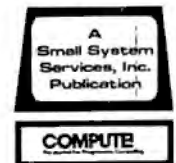
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The Editor's notes ---

Robert C. Lock
Publisher/Editor

COMPUTE!'s New Format

As we indicated last issue, the format of the magazine has been revised to allow us greater flexibility in article placement. In the front sections of the magazine you'll find general interest articles, including applications programs and games that have been developed to run on numerous computers. More advanced material, both applications and programming support, will be found in the *Journal* section of the magazine,

Each column, article, program, etc. is keyed by page number in the Table of Contents to relevant microcomputers.

On The Importance Of Feedback

On our direct mail response cards at the end of this issue, you'll find a special Editor's Feedback card. Take a look at our new format for the magazine, and *please* take a few minutes to fill out and return the card.

We've tried to accomplish the changes as a constructive enhancement, and rely on your collective opinion as well. Let us know what you think.

Two New Personal Computers For Less Than \$200.00

The Winter Consumer Electronics show was impressive. Commodore was showing a startling array of VIC-20 software. Atari introduced some new twists as well. For full details on the show and the new computers, see David Thornburg's article in this issue.

Home Applications

Being firmly convinced that the myth of the utility of home computers is truly a myth, we've been excited by the range of useful software you've been sending in. With everything from our continuing series of Energy Conservation and Analysis programs by David Pitts, to Real

Estate Investment Analysis and sophisticated financial modeling, we've been proving by example that home computers are being used for education and applications as well as recreation. Keep your efforts coming.

COMPUTE! Books

Our Book Division is now off and rolling, with the release (finally) of our first two titles, **COMPUTE!'s First Book of ATARI®** and **COMPUTE!'s First Book of PET™/CBM™**. We have three more books scheduled for release in the first and second quarters of 1982. Having learned our lesson the first time around, these won't be announced until scheduled at our printers, but we're sure you'll find them equally useful resources.

The West Coast Computer Faire

Once again we expect to see hundreds of you among the 30,000 to 40,000 attendees at the Sixth West Coast Computer Faire. Jim Warren's annual extravaganza is a looked-for meeting place for old and new friends. Stop by our booths, numbers 1543 and 1642, and say hello.

An Important Message To Our Retailers

As you've all noticed, we recently moved to a new billing system. By now, our scheduling and updating problems have been resolved. Your new invoices will be showing a message "Payments received after _____ are not reflected in this invoice." Interim shipments of back issues or **COMPUTE! Books** will be billed as shipped, and *also* reflected on your monthly statement-invoice.

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Change. ATARI Home Computers have been designed to make change and expansion easy. The ATARI computer has a modular operating system* that can be easily replaced as new technology develops. If you need it, memory expansion requires no more than inserting additional RAM modules*. And the ATARI ROM cartridge system also makes it easy to change languages. In short, your ATARI computer won't be obsolete by future developments... *because it already incorporates the future.*

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*ATARI 800™ computer only.

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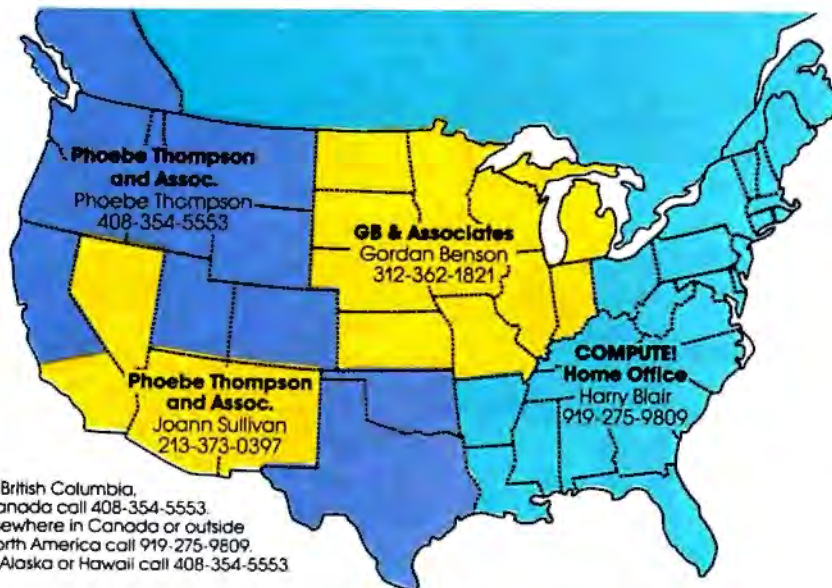
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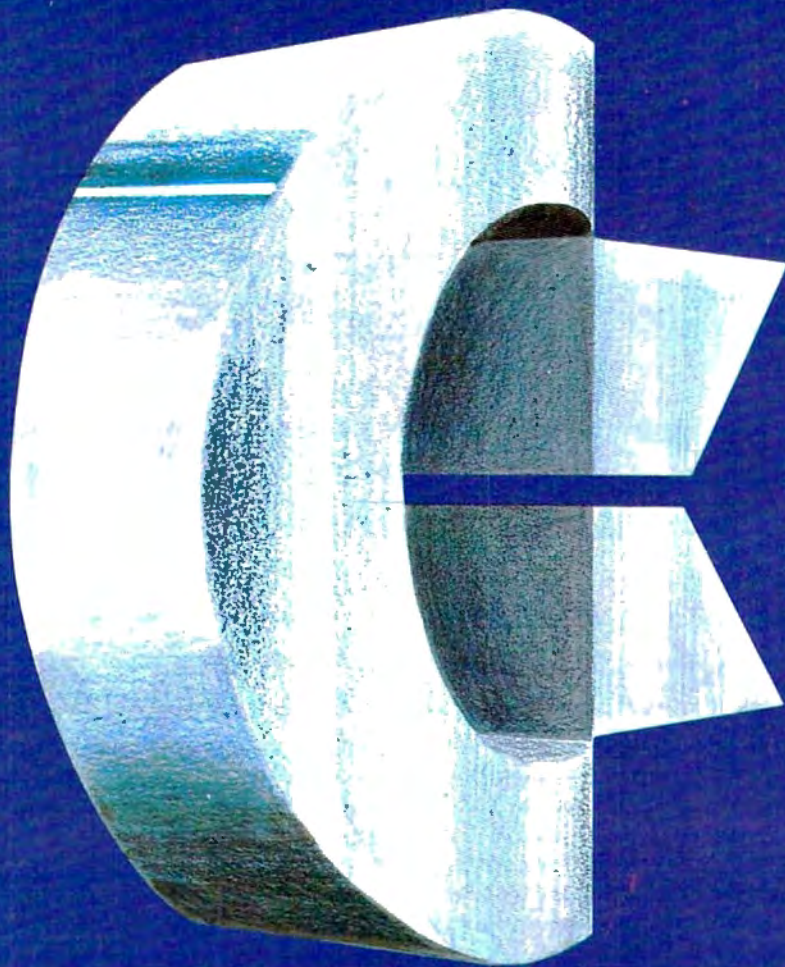
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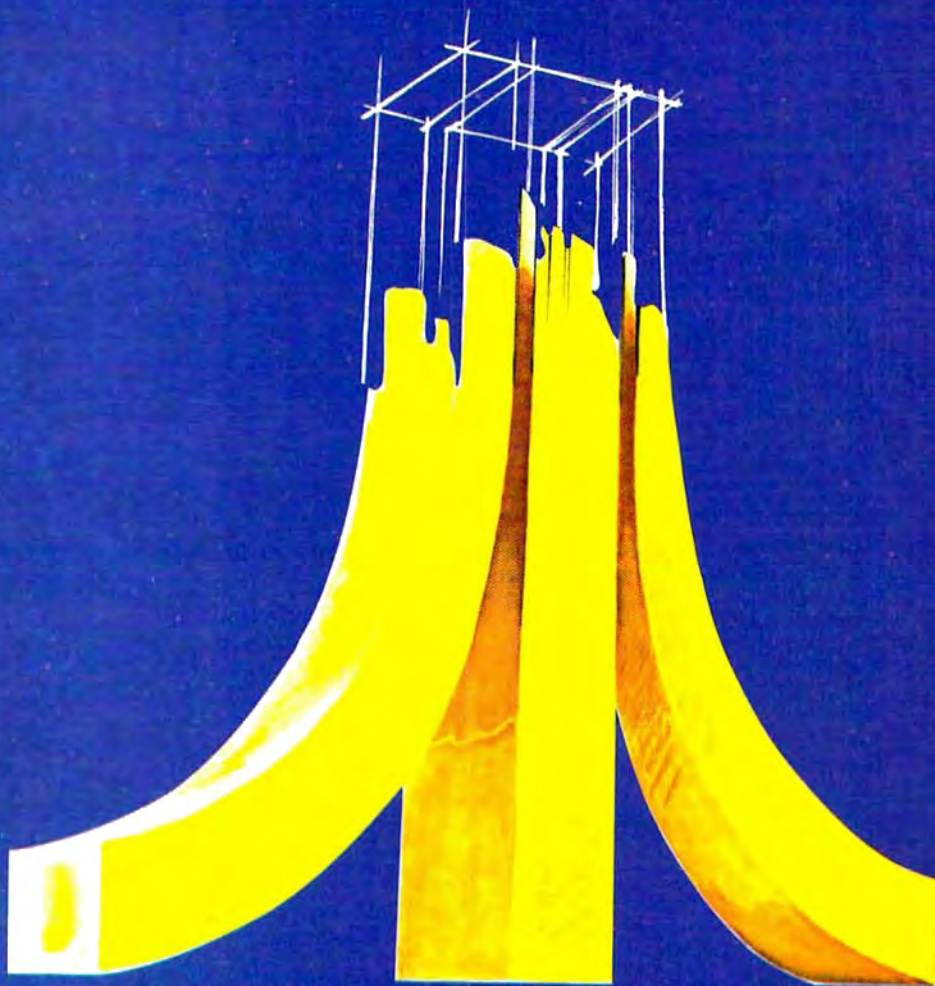
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Ask The Readers

Robert Lock, Richard Mansfield,
And Readers

If you have any questions (or answers to the questions printed below) please write to: Ask The Readers, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403.

Answers

On page 10 of **COMPUTE!** #19, a reader asked about, and you commented on, COM as an Atari BASIC keyword.

I very recently bought an Atari and as yet have not delved extensively into the programming aspects of it since most of the time it has Missile Command in the left slot, but, in other computer systems I have used with either interpreter or compiler BASIC, COM or COMMON defines common variables, either string or numeric, for programs which are to be chained instead of POKEing the information into protected memory by one program, then PEEKing it out by a subsequent one. This is usually accomplished under DOS control.

A question that I have, and perhaps another reader can answer, is how I could build an interface or two to use the Radio Shack (Tandon 40 track) drives and Centronics 737 parallel printer I have for my TRS-80 Model I with the Atari serial port. I realize this identifies me as a "Hardware Nut," but for personal satisfaction, I would rather build, than buy, an interface. William E. Allen

Our thanks to the others who sent in responses to this question.

I am writing in response to columnist Zumchak's comments in the "Ask The Readers" section of **COMPUTE!** #16.

The question of a next generation 6502 microprocessor is certainly not a dead issue. However, this is a market-driven decision. Synertek would readily undertake the development and marketing of a sequel to the 6502 if there were reasonable expectations that this would be justified by adequate business in the new part.

As to the SYM board, the SYM-2 version is laid out to accept the 6502, 6800, or 6809. There is also a plug-in module for the SYM-1 to adapt it to those processors. These new products were introduced to widen the market for the SYM, not as a move away from the 6502.

Synertek is continuing to support the 6502, as we

have in the past. New peripheral products are being designed to work with the 6502. We believe that the 6502 is one of the best 8-bit processors available. Although many applications use 1MHz parts, the 6502 is available in versions that run with clocks of 2, 3, and 4 MHz.

Dr. Michael Smolin
Director, Strategic Planning
Synertek Inc.

In his excellent article Machine Language: What's Your Sign? (**COMPUTE!** #17), Jim Butterfield discusses how the Overflow (V) flag will be set if the addition or subtraction of two signed numbers causes a "sign switch."

A rarely publicized fact is that a sign switch, or overflow, can only occur if you are adding two numbers that have the same sign (both positive or both negative) or subtracting two numbers that have opposite signs. Moreover, because a sign switch indicates that the result exceeds the legal limits of a signed number, -128 or +127, V = 1 always constitutes an error condition...

One further point of interest is that CMP, unlike SBC, does not affect the contents of the Accumulator. This allows you to compare N1 to some other number (N3) immediately, without another LDA N1 instruction.

Leo J. Scanlon

For several years I have been dealing with the CRASH of the INPUT statement on our 2001 and 4016 COMMODORE Computers when the RETURN key is depressed with no input! I have read of several fairly short routines that overcome this problem and have developed my own favorite, as have most users (Our students develop software for the Elementary School - kids, and their teachers, will crash programs).

Anyway - this evening, quite by accident, I stumbled upon a quick way to protect the RETURN key on INPUT! At least I have never heard of it. [Lines 70, 80, 160, 170, and 180 will do.] If you type in the enclosed program and RUN same, you will notice that the INPUT at line 70 (numeric) and line 160 (string) are protected under input/return (and, of course RUN/STOP)!!

When you look at the listing, I'm sure your reaction will be the same as mine was when I looked at the listing and said to myself and all within earshot, "What's going on here? I tried this years ago! It didn't work then, so why is it WORKING now???"

The key lies in the length of the input prompt - exactly 38 characters. This configuration puts the INPUT question mark at the end of the input line and the cursor all by itself on the left of the next line. Bingo - RETURN = null. The conditional picks up the pieces and we're in business.

John Taylor

To answer John Fry's question [in **COMPUTE!** #18]:

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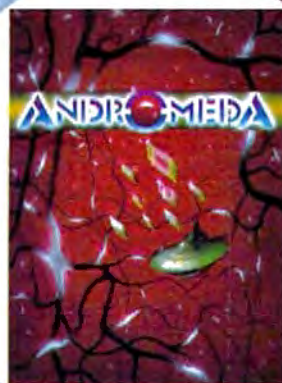
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sequential data files: you have two problems.

Statement in line 40 is wrong. It should read 40 DISK CLOSE,6 not 40 DISK CLOSE,6,A\$.

Also, don't forget to run change program to shift BASIC work space to allow for your 1 buffer (step 3 on page 24 in my system's manual).

OSI puts the buffers used for device 6 and 7 before the BASIC program. If you don't run change to tell BASIC to allow for these, it will start in this area for program storage. So your first print #6, A starts writing over your program and, thus, garbage on LIST.

Alex J. Kowalski, Jr.

I am writing with a few odds and ends, corrections/modifications to a couple of programs, and a question that "Ask the Readers" may be able to answer.

*To begin with, users of "Keyword" as revised in **COMPUTE!** #17 may have advised you by now that this very nice utility crashes when used with Upgrade (3.0 BASIC) ROMs. I found that the following line fixed the problem:*

```
215 POKE BASE + 8,46:POKE BASE + 12,230
```

While on the subject of "Keyword," it may be worth mentioning to all that this and any program that alters the interrupt vector must be turned off prior to initiating tape SAVES or LOADS. I also found that "Keyword" should be turned OFF prior to running a BASIC program to avoid printing a collection of keywords where graphics or lower case should be printed. Perhaps someone can explain this problem.

I am using an Original ROM PET with Upgrade ROMs installed. The Upgrade ROM Monitor, available all the time, is great. I have found at least one anomaly with this Monitor, however: it refuses to accept program names that are more than 15 characters long. Perhaps occasionally, an "End-of-Tape" header is recorded at the end of a machine language program SAVE using the Monitor. Are there any explanations for this out there?

*Lastly, I finally got to try the program "Basic Math for Fun and Profit" from **COMPUTE!** #9. It's a great program! I did make one significant change to it, however:*

```
922 IFZ$(T)=CHR$(13)THENZ$(T)=STR$(0):I=9
923 PRINTZ$(T);" ";
924 Y$=Z$(9)+Z$(8)+Z$(7)+Z$(6)+Z$(5)+Z$(4)+
Z$(3)+Z$(2)+Z$(1):W=VAL(Y$)
925 NEXT:GOTO357
```

(Changes at lines 922 and 925.)

R. D. Young

I would like to share some lessons learned about the VIC 20. In obtaining a TV for use with the VIC 20 I learned several items I thought would be of interest to all VIC 20 owners. Zenith TVs models L, M, N, can have a jump in the picture because of the difference in the sync rate between the VIC 20 and the TV's. This jump can be taken out by your service man by having him connect the jumper (sometimes called non standard vertical or cable standard

jumper) on the vertical output board. If your TV has a crystal controlled tuner and there is no fine tuning, you can adjust your modulator with the adjustment screw closest to the input end so you can get color on both channels 3 and 4 on the TV.

If you are having wavy lines on your TV you could be picking up RF interference signals on the wires from the TV computer switch box. If your TV has cable input capability, use of coaxial cable from the modulator to the input for cable can eliminate this interference. If your picture is not the right spot on the TV POKE 1 through 14 into 36864 will move it right and left, and 0 through 125 into 36865 will move it up and down.

Want to use your "f" keys? You can if you GET A\$ and use the ASC(A\$) to create a value 133 for f1 to 140 for f8. This CHR\$ value can then be used in the program. Jim Turrentine

Questions

I want to thank you and Dub Scroggin for the fine game program in the January 82 issue for the VIC 20. Instead of using the keyboard, I made a change in "ZAP!!" to use a joystick and it works great.

I have a problem with my recorder. I have to turn it upside down to load a program. I have taken the back off, but can't find anything loose. If I try a load it finds a program then doesn't load and prints "out of memory" or loads a scrambled up program. Any ideas? Don Dudley

The school at which I teach has just purchased the VIC 20. Software is scarce at the moment. Could you suggest or indicate programs of an educational nature that I might use in an elementary school setting?

I'm really keen on getting a good start with the VIC 20 in my school. Michael Moher

Hallo there in USA!

I've opened an Atari User Club here in West Germany. I would appreciate it if you could send me the addresses of Atari Programmers. Here in Germany you can only buy some games like Star Raiders and some more, but they are few. My Club wants to make it possible for the members to buy programs from the USA.

Also, could you send me the addresses of Atari User Clubs there in the USA?

I hope you can help me.

Knut Hermann

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Computers And Society

David D. Thornburg
Innovision
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Artists have always been among the first to explore new technologies. Many times this exploration begins before the technology leaves the laboratory. For example, long before the laser found its way into supermarket check stand scanners, it was being used as an expressive medium by artists like Robert Whitman who received major technical assistance from Bell Laboratories and the optical scientist Eric Rawson.

The collaboration between artist and technologist requires extraordinary sensitivity on the part of both people. Historically, this collaboration has also required that the artist have access to a large university or industrial research laboratory where the needed technical resources could be found.

The innovative use of movie cameras in the 1940's benefited as much from technological collaboration as does the use of computers by artists today. Whenever a new technology offers an expressive medium to the artist, some technologists are more than happy to lend their assistance when needed. But one must wonder if the need for collaboration aids or inhibits the flow of creative ideas. Some artists are happy to work with others, and some are loners – preferring the solitude of an isolated studio to the constant interchange of ideas with co-workers.

One artist who has spent many years making innovative use of technology is John Whitney. Over the span of several decades, Whitney evolved the idea that the dynamic visual media (such as motion pictures, videodisks, and real-time computer animation) open the door to the creation of visual harmonies which are the counterparts of musical harmonies. His book, *Digital Harmony: On the Complementarity of Music and Visual Art* (Byte Books, 1980) expresses this philosophy in great detail. In it, Whitney traces his own development as an artist involved with technology.

In the late 1930's, he saw the motion picture

camera as a tool which would allow him to create visual images which somehow "looked" the way music sounded. During his early experiments he learned something very important. To suggest that a motion picture camera can contribute to a new visual art makes about as much sense as suggesting that a tape recorder can contribute to the art of music.

Music Into Visual Symmetries

In the computer, on the other hand, Whitney saw a new medium – a medium of creative expression in

**...we are on the threshold
of an era when isolated
artists will ... be able
to use the computer
with as much ease as...
pastels, oils, or clay.**

which his quest for the dynamic display of visual harmonic symmetries could be satisfied.

Thus began a period in which his images were created first on a cathode ray tube and then captured on film for others to see. This work benefited from collaboration with technologists. For example, Larry Cuba assisted in the making of Whitney's film *Arabesque*. (Cuba's software talents in computer animation have probably been seen by many **COMPUTE!** readers – he created the Death Star animation sequence in *Star Wars*.)

Arabesque is occasionally shown on public television, and is a film worth seeing. Each time I have seen it I am once again impressed with its fluidity of geometric form. Not surprisingly, Whitney devotes a chapter of his book to this film.

Books of this sort are inspiring to artists and non-artists alike. It is exciting to see the art which springs out of centers of excellence, such as universities.

But it is even more exciting to realize that we are on the threshold of an era when isolated artists will themselves be able to use the computer with as much ease and familiarity as they presently use pastels, oils, or clay. While the early phases of computer-based art required a high level of technical and financial support, the implementation of easy-to-use graphics environments on low-cost computers (e.g., Atari PILOT on the Atari 400 or 800, TI LOGO on the 99/4A, and Apple Super-PILOT or LOGO on the Apple II) places this medium within the comprehension and budget of many artists.

This adoption of the computer as a new medium will not occur overnight, however. Most of



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the serious artists I know have two concerns about computers. First, for many, the cost of a \$3,000 system is prohibitive. Second, there seems to be no easy way for these people to bridge the software barrier. Artists who really want to use computers as more than playthings know that, sooner or later, they will have to become programmers. How sad it is to see these people attending evening courses at the local community college learning BASIC or (Heaven forbid!) COBOL, in the hopes that by learning how to write bubble sort routines, the computer will become less mysterious.

Most introductory programming courses don't satisfy any of these students' real needs. The fact that at least *some* artists (Whitney, for example) have been able to bridge this gap is heartening news, but this is likely to be cold comfort to those art/computer students who think a string variable refers to the color of a length of twine.

Sooner or later, artists in great numbers will start using computers on their own. Whitney's book shows us the promise of this tool and he encourages others to follow their own path with this technology.

All we need now are more practitioners. ©



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The Beginner's Page:

How Computers Remember

Richard Mansfield
Assistant Editor

Computers fascinate us for many reasons. We have only recently built this machine and it is fast and complex, but the same could be said of a jet airplane. One reason for our fascination might be that, after years of passively watching TV, we can finally take control of what appears on the screen. Beyond this, perhaps, is the fact that the computer is the thing we've built which comes closest to being a copy of our own mind.

There are significant differences, though, between the way we think and the way the computer thinks. For complex, abstract thinking, a child can easily outdo the finest computer available today. On the other hand, the computer is far faster than any human. For one thing, the computer was *designed* to be efficient when dealing with numbers. The engineers realized from the start that the computer would be much better off if it avoided using our "decimal" system.

Let's look into some reasons why thinking in decimal is less effective than *binary*, the computer's way. This will help us understand how a machine can "remember."

A computer does two major things: it solves problems (computes) and it *remembers*. To add $2+2$, the computer first remembers (stores) your instructions which contain the problem. $10\ X = 2+2$. When you type RUN, it looks for the lowest line number in its memory and solves whatever it finds. Then it remembers the answer (elsewhere in its RAM, its temporary memory cells). If there is another line number (20 PRINT X) it will put the number 4 on your screen, showing that it not only computed the problem in line 10, but also remembered the result.

How does it remember?

Let's try an experiment. Type: POKE 0,1 and notice that nothing happens (at least nothing we can see). In fact, the "lowest" cell in your computer's memory just changed. POKE is a way that you can directly change a memory cell. Each cell has its own *address*, just as if each cell were a house in a city with 65536 houses. (The addresses go from 0 to 65535.) So, when you POKE, you are replacing the

number in that cell with whatever number follows the comma in your POKE command. (If your machine does not have the maximum memory, some zones will not respond to POKE. Also, you can't expect to POKE into the ROM memory because it never changes – its contents are carved in it forever.)

Now type: ? PEEK (0) and notice that our "1" is printed (? is short for PRINT). The "1" is still in the 0 address cell and it will stay there until you POKE something else in, or the computer, in the course of performing a task, needs to use that cell to remember a number of its own. It will also "forget" if you turn off the power. But we still don't yet know just *how* this number is remembered in that cell.

Why We Count By Tens

Another name for a cell in your computer's memory is *byte*. If you have 16K of free memory (a K is 1024 bytes, called a *kilobyte*) this means that you have $16\ X\ 1024$ cells for a total of 16384 cells for your use. What are these cells? Each one is able to "remember" numbers. How high can a cell count? A byte can hold the numbers from 0 up to 255.

Nobody knows for sure, but it seems a good guess that we humans count in groups of 10's (*decimal*) because long ago, in caves, when the hunters were asked how many bison they saw that morning, the leader would likely hold up a certain number of fingers in the air. On a good day, the leader might say, "We saw many. My hands plus Joe's hands and one hand more!" The people would nod and vaguely understand the concept of 25 bison.

We tend to think that 10's are logical, even a natural, way to count. After all, so many things seem to fall into groups of tens: a dime, a quarter (four hands plus one), a dollar, a \$10 bill, etc. Nevertheless, if lobsters ran the world, it is quite possible that things would be counted in fours. If you're curious, the most "natural" number grouping (found in shells, feathers, flowers and so forth) is called the Fibonacci series. The next number in this series is equal to the sum of the two previous ones: 0, 1, 1, 2, 3, 5, 8 and so on.

So, since 10's are not natural except to creatures with that many fingers, there is no reason why a computer should count by 10's. For something that runs on electricity, the easiest way to count is by 2's (called *binary*, meaning "can be counted using only two symbols, the zero and one"). The computer finds binary counting very simple since this lets it represent numbers by merely turning something on (like a lightbulb) to stand for "1" or leaving it off to mean "0". If it had to deal with 3's, and 7's, and the rest, it would need to recognize and juggle ten different symbols, 0 through 9, like we do. This

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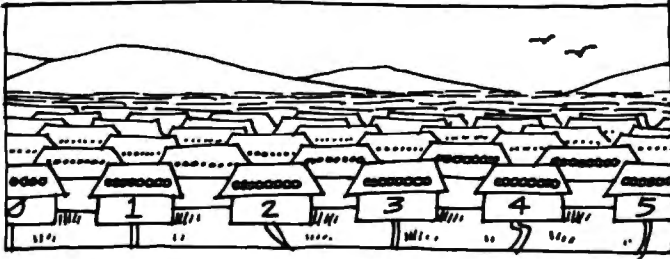


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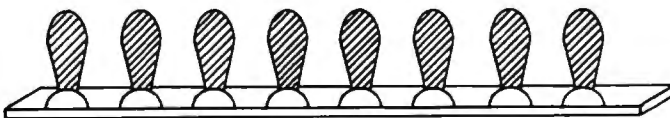
is what we mean when we say that the decimal system has ten *digits* (0-9). The binary system has only two digits, zero and one. By the way, *digit* also means *finger*.

In The City Of Bytes

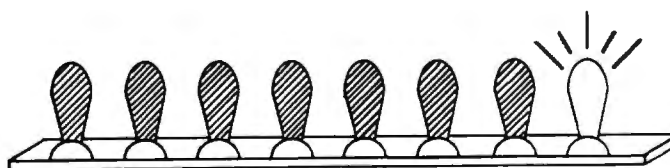


In our computers, there are thousands of rows of bytes lined up. Each of these bytes has an "address" of its own which is just its position in the city of bytes. POKE 5,1 puts the number one into the fifth byte and POKE 8001,0 changes the 8001th byte to zero. We can easily visualize bytes if we think of each one as a house with an odd decoration on the roof: a row of eight lightbulbs. Let's imagine that we have just turned on our computer and all our free bytes are "empty" – we haven't yet typed in a program or loaded anything into them from a tape or disk.

If we fly over the city of bytes, we see only darkness. Each byte contains nothing (zero) so all eight of its bulbs are off. (On the horizon we can see a glow, however, because the computer has memory up there, ROM memory, which is very active with its built-in programs.) But we are down in RAM (our free user-memory) and every house is dark. Let's observe what happens to an individual byte when different numbers are stored there; we can randomly choose byte 1504.

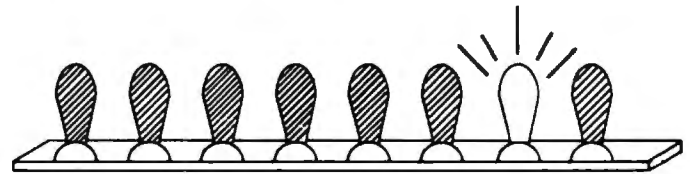


Like all the rest, this byte is dark. Each bulb is off. Observing this, we know that the byte here is holding a zero. If someone types in POKE 1504,1 – suddenly the rightmost lightbulb goes on and the byte holds a one instead of a zero:

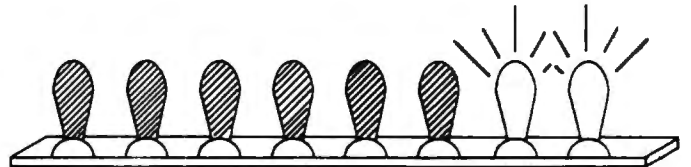


This rightmost bulb is the 1's column (just as it would be when counting by tens in our *decimal* system.) But the next bulb is in the 2's column, so

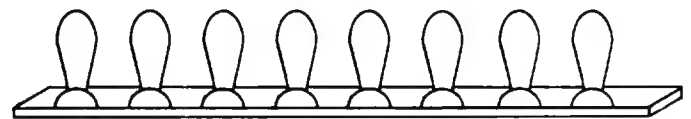
POKE 1504, 2 would be:



And three would be one and two:



In this way – by checking which bulbs are turned on and then adding them together – the computer can look at a byte and know what number is there. These lightbulbs are called *bits* which is short for *binary digit*. Each bit is in its own position and has a value twice the value of the one just before it:



128's 64's 32's 16's 8's 4's 2's 1's

The Columns

Here is a program which will show you a byte as it looks in binary. You then try to give the number in decimal. It has been designed to run on Atari, PET, or Apple. Don't type in any line which has REM in it *unless* it's followed by the name of your computer.

```

100 REM BINARY QUIZ
110 C1=20:C0=111: REM FOR ATARI ONLY
120 C1=88:C0=79: REM FOR APPLE ONLY
130 C1=209:C0=215:REM FOR COMMODORE ONLY
140 X=INT(256*RND(1)): D = X: P = 128
150 PRINT CHR$(125);: REM ATARI ONLY
160 PRINT CHR$(147);: REM COMMODORE ONLY
170 HOME: REM APPLE ONLY
180 FOR I = 1 TO 8
190 IF INT(D/P) = 1 THEN PRINT CHR$(C1);:
    D = D-P: GOTO 210
200 PRINT CHR$(C0);
210 P = P/2: NEXT I: PRINT
220 PRINT " WHAT IS THIS IN DECIMAL?"
230 INPUT Q: IF Q = X THEN PRINT
    "CORRECT": GOTO 250
240 PRINT "SORRY, IT WAS";X
250 FOR T = 1 TO 1000: NEXT T
260 GOTO 140

```


SYSRES™

THE ULTIMATE RESIDENT PROGRAM MANIPULATION SYSTEM FOR PET™/CBM™ MICROCOMPUTERS

SYSRES™ EXTENDED DOS SUPPORT COMMANDS

@ (type "N" keyboard)
 ⌘ (type "B" keyboard)
 | (original keyboard)
 > (for 'wedge' users)

These commands may be used interchangeably, to perform the following dos support functions.

Disk	Printer	Tape	Directory	Modes	Command	Function
x				3	@	Display disk status / send command
x					@N	Format (header) a new diskette
x					@I	Force initialize diskette
x					@V	Validate diskette (collect)
x					@D	Duplicate diskette
x			x	4	@C	Copy or concatenate disk file(s)*
x					@R	Rename file
x			x	3	@S	Scratch file(s)*
x					@\$	List directory**
x					@U:	Reset disk drive
x	x	x	x	6	@L	List disk file or BASIC program**

Note: Some of the disk utility command set may also be used, if an appropriate direct access channel has been opened.

* Standard command with added options.

** Added disk command.

JUST A FEW OF THE FEATURES OF SYSRES™

- Fast up/down scrolling which works!
 - Advanced repeat-key routine!
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 - Extended DOS support (requires DOS 2A or greater)!
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 - List BASIC programs, sequential and relative files without loading them into memory!
 - TRUE PROGRAM MERGE (overlay). Supports subroutine libraries!
 - Load and run machine language programs with parameter passing!
 - Supports multiple printers!
 - Automatic printer output with paging plus formatted listings with full ASCII code conversion including cursor control and special characters for non-CBM™ printers!
 - Edit text files and assembler source code without leaving BASIC!
 - Renummer part of a program or even change the order of lines!
 - Over 700 FIND/CHANGE commands including variable names ("A\$" will not match "BA\$"), pattern matching with "wild-cards", and even commands to remove spaces and REM's!
 - Three TRACE modes including trace variables!
 - Does not affect BASIC program operation!
 - One AUTO-BOOT DISKETTE works for ALL PET™ or CBM™ computers (BASIC 2.0 or greater with at least 16k of RAM). SYSRES™ requires NO ROM SPACE or extra boards, so you can take it with you if you want to use another computer. It may be put above the screen if you have RAM there. It boots automatically without disturbing any program in RAM!
 - Diskette and Extensive Manual - only \$75 (cdn) Documented Source Code (YES!) - \$150 (cdn) Custom versions are available for unique systems!
- Dealer enquiries are welcome.

SYSRES™ EXTENDED EDITOR COMMANDS

Disk	Printer	Tape	Directory	Modes	Command	Function
x			x	4	/	Quick load from disk
x			x	4	↑	Quick load from disk with auto run
x			x	2	APPEND	Append from disk to end of current program
				4	AUTO	Auto line number (allows header)
x			x	3	BLOAD	Load machine language (binary) file
x			x	3	BRUN	Load and execute machine language program
	x			776	CHANGE	Change pattern to another pattern
				2	CLOSE	Close one or all files
				1	CMD	Set output to file (does not send "READY.")
				4	DELETE	Delete a range of lines from program
	x			1	DUMP	Dump all scalar variables to screen or file
x			x	2	EXEC	Execute a file as keyboard commands
	x			240	FIND	Find occurrences of a pattern
x		x	x	3	GET	Read a sequential file into editor
				7	KEY	Define a key as a special function
				1	KEYS	Turn key functions on
				1	KILL	Disable SYSRES™
				1	KILL*	Disable SYSRES™ and unreserve memory
	x			10	LIST	Improved BASIC LIST command
x		x	x	3	LOAD	Defaults to disk drive
x			x	2	MERGE	Merge from disk into current program
	x			1	MON	Break to current machine language monitor
				1	OLD	Restore program after "NEW"
x	x	x	x	24	PUT	Send program to disk as text file
				6	RENUMBER	Renummer all or part of program
				2	RUN	Run current program, ignores screen garbage
x		x	x	3	SAVE	Defaults to disk drive, allows replace
x		x		1	SETD	Set disk device #, allows multiple drives
	x			4	SETP	Set printer channel, format mode, paging
				4	TRACE	Select 1 of 3 trace/step modes and speed
x		x	x	3	VERIFY	Compare current program against disk/tape
				1	WHY	Print position of last error
				1	WHY?	List line of break or error
x	x				*	Send output to printer
	x			1	#	Display current version of SYSRES™



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The Winter Of Our Content

A Report On The January Consumer Electronics Show

David D Thornburg
Innovision
Los Altos, CA

At a time when most of us are contemplating sugar plums, planning New Year's parties, or replacing shingles kicked loose by Santa's reindeer, a few hardy souls are preparing for a major event – the Winter Consumer Electronics Show held each January in Las Vegas.

In the area of personal computers, this year's show will be long remembered. Formal announcements by Commodore, Panasonic, Astrovision, Sharp, and Toshiba, more than justified leaving the remains of our sudden 12" rainstorm for the sunny (if somewhat cold) desert of Nevada.

Here, then, are the highlights of some of the more exciting products for 1982. As you read this, remember that many of the products displayed were prototypes, and that they may undergo some modification before going to market.

For sheer impact, Commodore stole the show with the announcement of two new color computers! Imagine a color computer with separate graphics and sound chips, two memory-mapped graphics modes, the traditional PET 40 column display, three voice music and sound effects, and cartridge programmability. Sound interesting? Got your checkbook ready? The price for the Commodore Ultimax is \$149.95. Yes, the decimal point is in the right place. For less than two-hundred dollars, you will be able to do wondrous things which previously required much more expensive hardware.

What's the catch? Well, the Ultimax doesn't have a full stroke keyboard; it uses the membrane type instead. Also it doesn't have a lot of RAM. However, you do get access to a 300 x 200 dot graphics display (two color mode), or a 160 x 200 screen (four colors at a time out of 16). Also (for you Atari and TI users), Commodore gives you access to up to 255 animated "sprites" per screen (up to 8 per line). Each sprite (or player, for Atari fans) resides in a 63 byte field and is composed of 24 x 21 dots.

The Ultimax uses the VIC peripherals (joy-

sticks, cassette, etc.).

But what about those of us who want more RAM? Well, Commodore has us in mind too. The Commodore-64 comes with 64K of RAM. Using the same chip set as the Ultimax, and equipped with a full-stroke keyboard, this gem sports a \$595 price tag.

Both new computers use the 6510 processor (a stretch 6502, I guess), the 6566 graphics controller, a 6581 sound interface device, and a 6526 PIA. Don't expect to see these chips at your local parts shop for awhile. Commodore plans to use every one they can make. While neither new computer will be on the market immediately (about June for the Ultimax – so *please* don't bug your dealer yet!), Commodore's marketing wizard, Kit Spencer, boldly predicted that Commodore would sell more computers in 1982 than were sold by all manufacturers in 1981.

While the Ultimax (with its game-like price) may lead the sales into the homes, both machines will probably penetrate the school market as well. The reason for this is that they both have a serial port capable of communicating with up to 30 other computers. Just what the teachers ordered!

Commodore wasn't the only booth sporting ear-to-ear grins. Panasonic introduced the 6802-based JR-100 – a \$199.95 compact computer which comes with 16K of RAM and an 8K BASIC. The system can be expanded to 48K RAM. While this monochrome computer has only a character-based display (32 characters by 24 lines), the user is free to define his or her own character set. A color version of this computer will be available for \$299.95 at some future date. While I was impressed by the overall physical layout of this computer, one aspect of the keyboard bothered me. The space bar was located where the right SHIFT key should be. Perhaps this will be changed by the time the product gets to market. The JR-100 was designed (and will be built) by a different group than the one respon-

DTL BASIC COMPILER

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- Improved Performance based on faster execution times
- Accepts extensions to Basic implemented in RAM or ROM
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- Provides demanding two pass syntax and logic analysis
- Security Key attaches to either cassette port

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DTL-BASIC is a Basic compiler for Commodore machines designed to convert existing programs to machine code and run them without modification. Compiled programs will run much faster and operate in exactly the same way as the un-compiled versions. Compiled code is typically 20 to 50% smaller than source code. For large programs this saving will more than offset the 4K run-time library appended to each compiled program, providing additional internal memory space.

The compiler implements true integer arithmetic as well as real arithmetic. Use of integers can lead to significant speed improvements. Special compile time options make identification and conversion of real variables to integers a simple task.

A 'Compiler' security key, which plugs into

either cassette port, is supplied together with the DTL-BASIC compiler. This key must be used in order to compile a program or to run the compiled version. In order to allow for the distribution of compiled versions of user developed programs, a second type of key known as a 'Run-Time' key is available in any required quantities. Software developers can obtain private security key sets with unique serial numbers providing comprehensive protection of their products while allowing customers to make backup copies of compiled programs.

DTL-BASIC is a disk based system requiring a 32K PET/CBM and comes complete with an in-depth user manual and a Compiler Security Key. Three versions of the compiler exist for CBM 3032, CBM 4032, and CBM 8032 machines. Please specify machine type and disk type (4040 or 8050) on which compiler is to be supplied.

<p>DTL BASIC WITH MANUAL AND SECURITY KEY \$350.00 RUN-TIME KEYS \$50.00 EACH</p>

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sible for the 6502-based hand held computer being sold by Panasonic and Quasar. The JR-100 will be sold to the home market – primarily the hobbyist and home study market at first. A full line of peripherals is planned – modems, floppy disks, etc.

Astrovision demonstrated the Bally Arcade with a plug-in expansion unit housing a full-stroke keyboard and running the language ZGRASS. This graphics language was developed (if memory serves) by Tom Defanti at the University of Illinois in Chicago. The goal is to allow artists and other non-technical types to create breathtaking real-time animations without having to learn machine language programming. The result is beautiful. Since the Z80-based Astrovision game machine has the same multi-chip display controller used in Bally's coin operated arcade games, high quality graphics is possible. What makes it practical is the ease with which figures drawn on a tablet can be saved as procedures, located anywhere on the screen, and can be magnified and rotated at will.

Astrovision seems intent on aggressively pursuing this project, but it isn't clear how effectively they will be able to compete. As with the other machines mentioned so far, don't expect to see the ZGRASS machine next week.

For those who take their graphics seriously, Toshiba was pleased to announce the T100 computer. When used with a high resolution color monitor, the user has access to 8 colors on a 640 by 200 dot array. A multi-line liquid crystal display was shown as an alternative. The packaging of this CP/M machine reminded me of the NEC PC-8000 – very stylish and business-like. Equipped with a Z80, 32K of ROM and 64K of RAM, this computer should appeal to those who are interested in doing some serious work.

Sharp had a surprise of its own. The original PC-1200 hand-held computer (available from Radio Shack for some time) has been joined by an 8-bit brother: the PC-1500. While this new machine is much faster than its predecessor, the most amazing feature was the availability of a color graphic printer. For a total price of \$550, Sharp users will have access to a computer with a pocket-sized drum plotter that lets you draw pictures with any of four automatically selected pens (red, green, blue, black). This is one product that has to be seen to be believed – and even then you won't believe it.

The PC-1500 is available now. (Of course I ordered one!)

At long last, the Casio FX-9000 desktop computer is on the market. This computer has a built-in 5" monochrome display with the ability to show graphics images with a 256x128 resolution. The sleek styling is reminiscent of the Hewlett Packard HP-85, but the price (under \$1800, fully loaded) is

more in keeping with Casio's products. The FX-9000 uses a Z80 compatible processor and gives the user access to two types of RAM. Front panel accessibility to RAM cartridges lets the user choose between 16K dynamic RAM cartridges, and 4K CMOS cartridges. The 4K byte RAM module contains its own battery, so that programs which are saved on this module can be removed and saved for instant reloading later.

Texas Instruments developed and showed a similar 4K RAM cartridge for the 99/4. Since TI also showed a new Assembler/Editor system, the ability to let users make their own cartridges is quite appealing. My, what a difference a year makes.

TI also showed a nicely designed expansion box which does much to reduce the clutter associated with fully loaded systems.

Atari's booth was almost impossible to enter. It was as if everyone who attended the show decided to check them out at the same time. The official authorized Atari Pac Man program was introduced. The action is a little different from the previous version done for the Atari computer (Jawbreaker) by OnLine Systems. Compared to the Pac Man games also shown by Magnavox, Astrovision, Texas Instruments, and others, Atari did a very nice job at software development. Coleco's hand-held version of the game was not as exciting, but then it doesn't use a color display screen either.

While my emphasis has been on hardware, it should be noted that software was on display as well. Automated Simulations displayed some of their newer programs for the Apple and Atari computers. While they are known primarily for their adventure games, Automated Simulations has developed a line of educational games (such as Jabbertalky) which are terrific.

The fact that a few dedicated people are willing to make the effort to generate educational games which teach as well as entertain should not go unrewarded! These people are doing an excellent job and are to be congratulated.

Both Activision and IMAGIC showed cartridges for the Atari video game which demonstrated exceptionally high quality graphics. Not surprisingly, these booths were well attended as well.

So much to see, and too little time! I was so busy getting all this information for you dear readers that I barely got to examine the solar-rechargeable flashlights, underwear with built-in loudspeakers, and ball point pens with built-in clocks and music synthesizers.

But that is why there are two shows a year. So until the next CES this June in Chicago, I'll just have to be content with what I saw.

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supergraphics for your cbm 8032

```

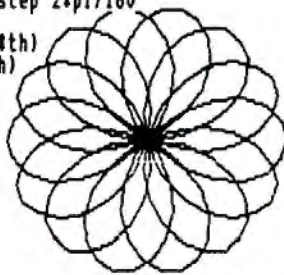
=====
* 128,000 accessible points (640 x 200)
* mix cbm text with high-res graphics
* supports hard copy to Epson MX-82

```

```

5 :frame 0,0 to 639,199
10 open 4,4:irecall "cad logo",8,1
20 k=2.1:z=50:t=7:pi=3.14159:a=4:b=4
30 for th=0 to 2*pi step 2*pi/180
40 r = z*t*sin(th/t)
50 x = 280+k*t*r*cos(a+th)
60 y = 120+r*t*sin(b+th)
70 if th(>)0 then 100
80 :move x,y
90 goto 110
100 :draw x,y
110 next th
120 :hard#4
130 close 4: end

```



```

-----
commands in row include:

```

```

dot x,y      move x,y
cplot x,y    draw x,y
test x,y,a

line x1,y1 to x2,y2
cline x1,y1 to x2,y2
dline x1,y1 to x2,y2
frame x1,y1 to x2,y2
cframe x1,y1 to x2,y2
fill x1,y1 to x2,y2
clear x1,y1 to x2,y2
displ x,y,a$ - for user
              defined shapes
gsav "filename",8
recall "filename",8

```

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Basically Useful BASIC

Tabulation

Paul Lilly
Pelham, AL

If you have ever written a program that output a wide range of numbers, you probably noticed the numbers were left justified (first digit of number printed at next print location regardless of the size of the number). Additionally, if you wanted to print a number such as \$9.20, it would be printed as 9.2, omitting the trailing zero.

So what do you do if you want to write a nice clean program that would balance your checkbook, list expenses, or otherwise output a series of numbers, right justified, in a nice straight column? Answer: use a short subroutine to measure, add trailing zeros if needed, and right justify the number when it is printed.

The Subroutine

The key to the subroutine is to convert the number to a string using the STR\$ command. After the number is a string, we can add or subtract to its length, adjust it to our desired format, and control where it is printed by using the TAB and LEN commands together.

Program 1 is an example of such a subroutine. The instructions are written starting on line 5000 so it could be inserted in most programs without interfering with the existing instructions. We also have created two variables and one string that should be reserved from the rest of the program.

RJ – the print position for the rightmost digit in the number we want to print.

N – the number we want to format and print.

N\$ – the ASCII string of N.

The subroutine can be entered at four different locations, depending on our needs.

1. If we want our number formatted with two digits to the right of the decimal point (as when dealing with dollars and cents figures), we can call the subroutine at 5010. Prior to calling the subroutine we must set N to the number we want to print, and RJ to the print location where we want the rightmost located.
2. If we call this subroutine several times throughout our program, and our print locations vary, we can call subroutine 5000. Line 5000 will set RJ to seven positions past our last print location. This will reduce the pro-

gramming steps needed in our main program. With seven positions (past last print position) we can print numbers up to 9999.99. For larger numbers, line 5000 can be changed accordingly.

3. If we do not want any decimals in our number, we can call the subroutine at 5090. Here again, N must be set to the number we want printed, and RJ to the print location of our rightmost digit, prior to calling the subroutine.

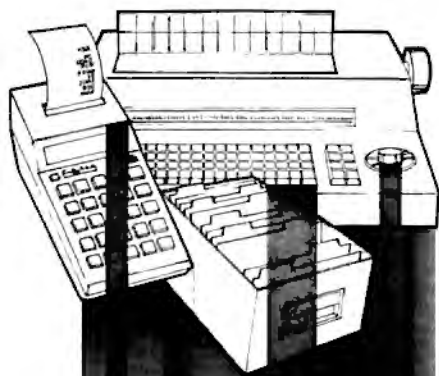
4. And, finally, if we want to print a non-decimal number, and would like to save programming steps, we can enter the subroutine at 5085 and let the subroutine figure RJ for us.

The Method

Suppose we enter at line 5000 with N set to the number we would like printed. Line 5000 will set RJ to six print positions past our current (last printed) print position. Line 5010 will strip away any more than two digits right of the decimal point (it is still possible at this point to have only one or no digits right of the decimal). Let's look at lines 5040 and 5050. These statements look for the decimal (".") to determine if N\$ has a decimal point, and how many digits (one or two) are to the right of it. Line 5040 finds the decimal point one position back from the rightmost character, meaning there is only one digit to the right of the decimal point. Therefore, the statement adds the necessary trailing zero, then jumps ahead to 5070.

Line 5050 finds the decimal point two positions back from the rightmost character, meaning there are already two digits to the right of the decimal point. In this case, no modification is needed to N\$, so the statement simply jumps ahead to 5070. Now the only possible configuration left for N\$ is for it to have no decimal in it. In this case line 5060 tacks on the required ".00", to maintain the standard format. Now let's go back to 5030. If N equaled 0-9, the LENth of N\$ would be only two and would bomb the program at 5050. So, since any string with less than a length of three can't have a decimal point in it anyway, 5030 will catch it and route it around 5040 and 5050. (By the way, the STR\$ command (at least in my machine) puts a leading space in front of the ASCII representation of the number, thus the number 1 has a string LENth of two.)

That brings us to line 5070, which strips the leading space so it doesn't interfere with our print position calculations. Finally on line 5075 we TAB the difference between RJ and LEN(N\$), and print our number. Line 5085 is where we would enter if we wanted to print integers. Line 5090 would strip the number to an integer, then change it to a string. Line 5095 would jump back to where we remove



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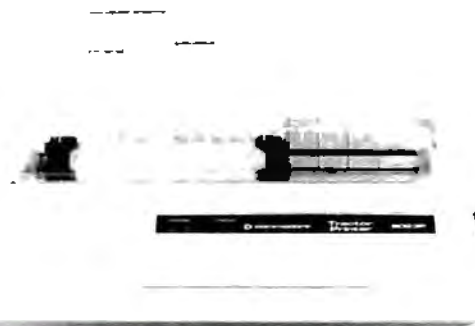
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the leading space and print the number.

Considerations

Line 5075 uses the semicolon after printing N\$ to suppress the LF/CR. This is because you may want to print several numbers on one line. Once you have printed the last number on a line, have the main program execute a PRINT command so you will get your carriage return. If you only want to print one number per line and no further printing will be done after the number, you may remove the semicolon from line 5075.

Also, be careful not to set RJ to a number smaller than N\$ would be after the modifications were made to it, otherwise you will not space properly with the TAB command on line 5075 and, possibly, generate an error that will bomb your program.

Program 2 will show a comparison between two different interest rates, of 15 different loan amounts. The user is asked to enter two rates, principal for first comparison, increment of principal for succeeding comparisons, and the term of the loan in months. The program will output the results neatly.

Figure 1.

Sample Run #1

```
INITIAL PRINCIPAL
? 50000

INCREMENT PRINCIPAL BY
? 2000

INTEREST RATE 1
? 10

INTEREST RATE 2
? 14

TERM OF LOAN IN MONTHS
? 360
```

FOR 360 MONTHS

LOAN	10 %	14 %
50000	438.79	592.44
52000	456.34	616.13
54000	473.89	639.83
56000	491.44	663.53
58000	508.99	687.23
60000	526.54	710.92
62000	544.09	734.62
64000	561.65	758.32
66000	579.20	782.02
68000	596.75	805.71
70000	614.30	829.41
72000	631.85	853.11
74000	649.40	876.80
76000	666.95	900.50
78000	684.51	924.20

Program 1. Microsoft Version (Apple, PET, etc.)

```
5000 RJ=POS(RJ)+7
5010 N=INT(N*100+.5)/100
5020 N$=STR$(N)
5030 IFLEN(N$)<3GOTO5060
5040 IFMID$(N$,LEN(N$)-1,1)=". "THENN$=N$+"0";
      GOTO5070
5050 IFMID$(N$,LEN(N$)-2,1)=". "GOTO5070
5060 N$=N$+",00"
5070 N$=RIGHT$(N$,LEN(N$)-1)
5075 PRINTTAB(RJ-LEN(N$));N$;
5080 RETURN
5085 RJ=POS(RJ)+6
5090 N$=STR$(INT(N))
5095 GOTO5070
```

Program 2. Microsoft Version

```
100 PRINT:PRINT"INITIAL PRINCIPAL":INPUTLA
110 PRINT:PRINT"INCREMENT PRINCIPAL BY":INPUTLI
120 PRINT:PRINT"INTEREST RATE 1":INPUTI1
125 IFI1<10RI1>100GOTO120
130 PRINT:PRINT"INTEREST RATE 2":INPUTI2
135 IFI2<10RI2>100GOTO130
140 PRINT:PRINT"TERM OF LOAN IN MONTHS":INPUTNM
150 PRINT:PRINT:PRINT:PRINT:PRINT
160 PRINT"      FOR":NM;"MONTHS"
170 PRINT:PRINT"LOAN      ":I1;"%      ":I2;"%";
      PRINT
180 FORJ=LATOLA+(14*LI)STEPLI
190 I3=I1/1200:I4=I2/1200
200 P1=J*(I3/(1-(1/(1+I3)^NM)))
210 P1=INT(P1*100+.5)/100
220 P2=J*(I4/(1-(1/(1+I4)^NM)))
230 P2=INT(P2*100+.5)/100
240 N=J:GOSUB5085
250 PRINTTAB(8);:N=P1:GOSUB5000
260 PRINTTAB(16);:N=P2:GOSUB5000
270 PRINT:NEXTJ
280 END
```

Program 3. Atari Version

```

5000 RJ=PEEK(85)+7
5010 N=INT(N*100+0.5)/100
5020 GOSUB 5100:N#=STR$(N)
5030 IF LEN(N$)>3 THEN 5060
5040 IF N$(LEN(N$)-1,LEN(N$)-1)="." THEN
  N$(LEN(N$)+1)="0":GOTO 5070
5050 IF N$(LEN(N$)-2,LEN(N$)-2)="." THEN
  5070
5060 N$(LEN(N$)+1)=".00"
5070 POKE 85,RJ-LEN(N$):? N$:
5080 RETURN
5085 GOSUB 5100:RJ=PEEK(85)+6
5090 N#=STR$(INT(N))
5095 GOTO 5070
5100 TRAP 5110:DIM N$(15):TRAP 40000
5110 RETURN

```

Program 4. Atari Version

```

100 PRINT :PRINT "INITIAL PRINCIPAL":INP
UT LA

```

```

110 PRINT :PRINT "INCREMENT PRINCIPAL BY
":INPUT LI
120 PRINT :PRINT "INTEREST RATE 1":INPUT
I1
125 IF I1<1 OR I1>100 THEN 120
130 PRINT :PRINT "INTEREST RATE 2":INPUT
I2
135 IF I2<1 OR I2>100 THEN 130
140 PRINT :PRINT "TERM OF LOAN IN MONTHS
":INPUT NM
150 PRINT :PRINT :PRINT :PRINT :PRINT
160 PRINT "    FOR ";NM;" MONTHS"
170 PRINT :PRINT "LOAN    ";I1;"%    ";
I2;"%":PRINT
180 FOR J=LA TO LA+(14*LI) STEP LI
190 I3=I1/1200:I4=I2/1200
200 P1=J*(I3/(1-(1/(1+I3)^NM)))
210 P1=INT(P1*100+0.5)/100
220 P2=J*(I4/(1-(1/(1+I4)^NM)))
230 P2=INT(P2*100+0.5)/100
240 N=J:GOSUB 5085
250 POKE 85,8:N=P1:GOSUB 5000
260 POKE 85,16:N=P2:GOSUB 5000
270 PRINT :NEXT J
280 END

```

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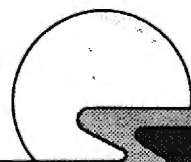
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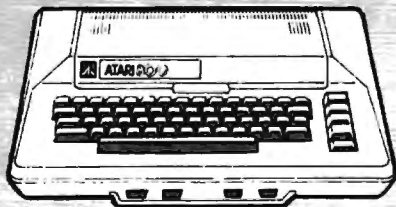
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Twenty Questions Revisited

Elizabeth Deal
Malvern, PA

Editor's Note: In the September, 1981 Computers And Society column, David Thornburg presented a fascinating program called Twenty Questions. Both versions (Microsoft BASIC and Atari BASIC) are repeated at the end of this article. Here, Liz Deal, a long time contributor to COMPUTE!, presents an unedited transcript of her young son and a friend exploring the intrigues of Twenty Questions. — RCL

In **COMPUTE!** #16, pgs. 12 and 16, there appeared a program called "Twenty Questions." Robert Lock asked for readers' response to the program. I think the reactions of two ten-year old boys might amuse you.

They liked the game, went through many rounds, obviously had some goal in mind, kept changing the rules and conclusions, and gave up feeling somewhat cheated at the end.

They religiously took turns between the typing and thinking tasks every few minutes, supplementing their typing with some loud thinking. I began recording several minutes into the game and noted words present on the screen. The kids' conversation is preceded by P and R to identify who is saying what. What they typed on the screen and what PET answered is in capital letters (shown on one line). Draw your own conclusions from a sample of two people.

·
·
·

RIGHT? NO
WRONG? NO

R: It's supposed to be an object

P: Ok

BIKE? YES

R: Is it an animal?

ANIMAL? NO

VEHICLE? YES

P: Is it a vehicle?

R: Yeah, try it, that's what it was before

IS IT A PERSON? NO

P: Is it an object? o-b-j-e...

R: I know how to spell it

IS IT AN OBJECT? NO

P: If it's not an object it's not anything...

R: I know

IS IT A NAME?

P: Name not an object, erase it

IS IT A VEHICLE? YES

R: That's what we should have tried before... again?

P: Try vehicle again, it's a lucky question

R: What if it's not?

IS IT A VEHICLE? YES

R: I bet it's always vehicle, let's try this VEHICLE? YES

R: It's going to be always vehicle

P: Let's try vegetable

VEGETABLE? YES

R: I think if it begins with V is right.

Try viking v-i-k-i-n-g

IS IT VIKING? NO

P: Let's see what happens if we go for all twenty...try one word and question mark on it

PAPER? NO

INVENTION? NO

IS IT AMPLIFIER? NO

GLUESTICK? NO

BIG BRICK? NO

HORSE? YES

P: aha...

R: I like horses, they are my favorite animal

CAT? NO

DOG? NO

ANIMAL? NO

P: Put shark

R: No can't be anything that's animal. I'll try tape, we haven't tried that yet

TAPE? YES

P: Try table

TABLE? YES

R: First guess again. This is good!

P: No it is not...it's like trying to eat a live pig without fork and a knife

DOG? NO

P: Do animal instead of certain word

ANIMAL? NO

TAPE? YES

P: Tape again, don't do it again, try t words

TREE? YES

P: Let's try c's

R: No cat didn't work... try h

HOUSE? YES

SNAK? NO

HOUSE? YES

R: I told you to put house before...

P: Well, I can do my own words...from my mind...

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R: Try gas
 P: Gas isn't an object...it's a thing...well, it's an object in a way
 R: We have to spell 'em right
 ROCKET? NO
 R: Try shuttle
 P: No, it's a name
 PIG? NO
 R: Can't be an animal?!
 P: I have to devise something in my head...
 (total silence several seconds, followed by
 STOP key somebody forgot to turn off)
 LIST
 P: OK, looking for the words...
 R: Don't they have...
 P: ...don't worry, we'll find the words...(reached
 end of listing)...all they have is that?!! Not
 fair! No words. Only goes to 410. Where
 did it get the words? Has to have memory
 where to get the words...
 R: Let's do something else.

My PET will *think* when this conversation occurs:

ME: IS IT AN ANIMAL?
 PET: NOPE
 ME: IS IT A HORSE?
 PET: I TOLD YOU IN PREVIOUS QUESTION IT'S NOT AN ANIMAL, STUPID

Program 1: Microsoft Version

```
100 REM *TWENTY QUESTIONS
110 PRINT CHR$(147);"WELCOME TO THE GAME
115 PRINT"OF TWENTY QUESTIONS. BY
120 PRINT "ASKING QUESTIONS WHICH HAVE
130 PRINT "YES OR NO ANSWERS, TRY TO
140 PRINT "GUESS THE OBJECT WHICH HAS
150 PRINT "BEEN SELECTED."
155 PRINT
160 PRINT "BE SURE TO END EACH QUESTION WITH A
170 PRINT "QUESTION MARK."
180 PRINT
190 PRINT
195 B$="AEIOUY"
200 C=0
210 REM *ROUND
220 C=C+1
230 REM *QUESTION
240 PRINT "ENTER QUESTIONS #";C
250 INPUT A$
260 IF RIGHT$(A$,1)="?" THEN 290
270 PRINT "THAT ISN'T A QUESTION.
275 PRINT "PLEASE ASK A QUESTION."
280 GOTO 230
290 YES=0:NO=1
300 FOR I=1 TO 6
310 IF MID$(A$,LEN(A$)-1,1)=MID$(B$,I,1) THEN YES=1:NO=0
320 NEXT I
```

```
330 FOR PAUSE=1 TO 50:RND(1):NEXT PAUSE
340 IF YES THEN PRINT "YES"
350 IF NO THEN PRINT "NO"
360 PRINT
370 IF C<20 THEN 210
380 PRINT "END OF TWENTY QUESTIONS."
390 PRINT "PRESS RETURN TO START AGAIN."
400 GET A$:IF A$="" THEN 400
410 RUN
420 END
READY.
```

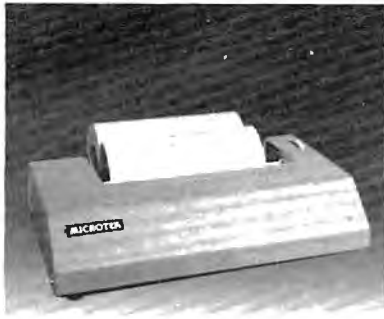
Program 2: Atari Version

```
100 REM *20 QUESTIONS
105 DIM A$(40),B$(6)
110 PRINT "WELCOME TO THE GAME OF TWENTY
Y"
120 PRINT "QUESTIONS. BY ASKING QUESTIONS WHICH"
130 PRINT "HAVE YES OR NO ANSWERS, TRY TO GUESS"
140 PRINT "THE OBJECT WHICH HAS BEEN SELECTED."
150 PRINT
160 PRINT "BE SURE TO END EACH QUESTION WITH A"
170 PRINT "QUESTION MARK."
180 PRINT
190 PRINT
195 B$="AEIOUY"
200 C=0
210 REM *ROUND
220 C=C+1
230 REM *QUESTION
240 PRINT "ENTER QUESTION #";C
250 INPUT A$
260 IF A$(LEN(A$))="?" THEN 290
270 PRINT "THAT ISN'T A QUESTION. PLEASE ASK A QUESTION."
280 GOTO 230
290 YES=0:NO=1
300 FOR I=1 TO 6
310 IF A$(LEN(A$)-1,LEN(A$)-1)=B$(I,I) THEN YES=1:NO=0
320 NEXT I
330 FOR PAUSE=1 TO 50:RND(0):NEXT PAUSE
340 IF YES THEN PRINT "YES"
350 IF NO THEN PRINT "NO"
360 PRINT
370 IF C<20 THEN 210
380 PRINT "END OF TWENTY QUESTIONS."
390 PRINT "PRESS RETURN TO START AGAIN."
400 INPUT A$
410 RUN
420 END
```

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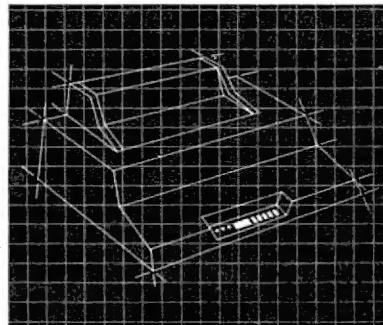
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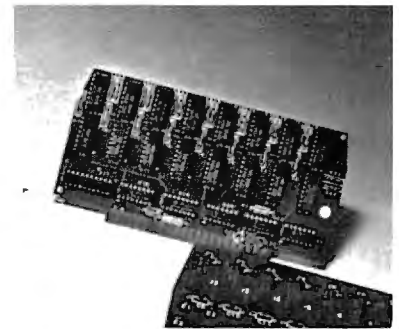
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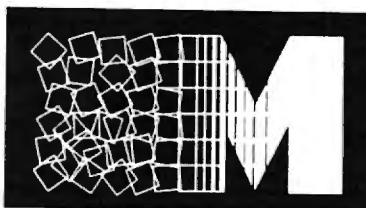
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COMPUTE!'s Listing Conventions

Many of the programs which are listed in **COMPUTE!** use special keys (cursor control keys, color keys, etc.) To make it easy to tell *exactly* what should be typed in when copying a program into the computer, we have established the following listing conventions.

For The Atari

All the editing and cursor control characters are spelled out and surrounded by brackets in the program listings: {CLEAR} for "clear screen." Other characters, such as CTRL-T (the "ball" character) will be listed as the "normal" character, but it will be within brackets: {T}. A series of identical control characters will be indicated by a number within the brackets: {3DOWN} means type ESC CURSOR-DOWN three times; {12R} would mean type CTRL-R twelve times. Remember to press the ESC (escape) key before each cursor control key. If you should see {ESC} itself in a program listing, you would press ESC *twice*.

Two of the control characters, {=} and {-}, should be shifted. Any reverse field text will be enclosed within vertical lines. (In other words, any time you see a vertical line within a program listing in **COMPUTE!**, press the Atari logo key {A}.)

Atari Conventions

- {CLEAR}= SHIFT-< (Clear Screen)
- {UP}= CTRL-minus (Cursor Up)
- {DOWN}= CTRL-equals (Cursor Down)
- {LEFT}= CTRL-plus (Cursor left)
- {RIGHT}= CTRL-asterisk (Cursor right)
- {BACK S}= BACK S (Back space)
- {DELETE}= CTRL-DELETE (Delete character)

- {DEL LINE}= SHIFT-DELETE (Delete Line)
- {INSERT}= CTRL-INSERT (Insert character)

- {INS LINE}= SHIFT-INSERT (Insert line)
- {ESC}= ESC (ESCAPE key pressed twice)
- {TAB}= TAB (Tab key)
- {CLR TAB}= CTRL-TAB (Clear tab setting)
- {SET TAB}= SHIFT-TAB (Set tab stop)
- {BELL}= CTRL-2 (Ring buzzer)

For PET/CBM/VIC

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

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen.

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

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

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

For The Apple

Programs listed as "Microsoft" are written for the PET/CBM,

Apple, OSI, etc. Although the programs are general in nature, you may need to make a few changes for them to run correctly on your Apple. Microsoft BASIC programs written for the PET/CBM sometimes contain special cursor control characters. The following table shows equivalent Apple words. Notice that these Apple commands are *outside* quotations (and even separate from a PRINT statement). PRINT"[RVS]YOU WON" becomes INVERSE: PRINT"YOU WON":NORMAL

- {CLEAR[(Clear Screen) HOME
- {HOME] (Home cursor) VTAB 0:HTAB 0
- {DOWN] (Cursor down)
 - POKE 37,PEEK(37)+(PEEK(37)<23)
- {UP] (Cursor up)
 - POKE 37,PEEK(37)-(PEEK(37)>0))
- {LEFT] (Cursor left) PRINT CHR\$(8);
- {RIGHT] (Cursor right)
 - POKE 36,PEEK(36)+(PEEK(36)>(PEEK(32)
 +PEEK(33)))
- {RVS] (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the PRINT statement ends with a semicolon.)
 - INVERSE
- {OFF] (Inverse video off) NORMAL

Shifted characters can represent either graphics characters or uppercase letters. If within text, just use the non-shifted character, otherwise substitute a space. Some "generalized" programs contain a POKE such as POKE 59468,14. Omit these from the program when typing it in. One final note: you will probably want to insert a question mark or colon within an INPUT prompt. PET/CBM and many other BASICs automatically print a question mark:

```
INPUT "WHAT IS YOUR NAME?";N$
      becomes
INPUT "WHAT IS YOUR NAME?";N$
```

All Commodore Machines

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

VIC Conventions

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

8032/Fat 40 Conventions

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



Energy Workbook

David E. Pitts
Houston, TX

If your heating or cooling costs have increased by 30% or more last year like mine, then you are probably considering installing some energy saving measures such as: storm windows, a clock thermostat, more insulation, caulking, or weatherstripping. Since everyone's home is different and there is a wide diversity of climatic conditions in the United States, it is difficult to determine which of the many choices is the best investment. The program described here utilizes the characteristics of the house together with the estimated climate to determine a projected savings for the homeowner for a wide variety of energy improvements at locations within the contiguous 48 states. The homeowner may utilize this savings, together with the projected cost and the economic outlook, to determine if the payout period meets his criteria for a successful investment.

The energy workbook program allows for a wide variety of fuels for both heating and cooling: oil, natural gas, electricity, wood, liquid petroleum gas, and coal. The savings due to installing storm windows, changing thermostat settings, caulking and weatherstripping, or adding ceiling or floor insulation are calculated for the homeowner. The required inputs are shown in Table 1. Repetitive calculations involving future energy cost can easily be made using the program, thus improving the homeowner's estimate of the accrued energy savings.

The program was written in Microsoft BASIC on an OSI 4PMF using simple I/O so that the program could be easily converted to other systems such as PET, Apple, and TRS-80. Atari owners will have to modify the program by adding PRINTs to the prompted INPUT statements, adding dimension statements for each string variable and changing the string concatenation and splitting as per page 39 of their user's guide. *[Atari owners: make the changes in the lines indicated in Program 2. — Ed.]* The program is based on an algorithm from the Federal Energy Administration (Reference 1) which divides the 48 contiguous states into climatic regions for cooling and heating for average housing, fuel, and climatic conditions. If the user's situation is unusual in terms of home construction, altitude, etc. additional advice from government offices or utility companies may be advisable.

String variables are used to read the table of states, cities, and heating (H) and cooling (C) factors. Commas are used for delimiters separating the states from the cities and their factors. Because of this, cities comprised of two or more words have had the interior blanks removed. Statements 20-45 decode the city and factors from the string B\$(I). The heating zone and the cooling zone each range from zero to five, with five being the most severe winter climate and zero being the most severe summer climate. The heating and cooling zones are used to calculate a heating factor and a cooling factor. The fuel factors FH(I) and FC(I) are read from the data statements for the fuel chosen by the user and a heating index (HI) or cooling index (CI) is calculated by the product of the heating (or cooling) factor times the fuel factor times the price per fuel unit.

The fuel index (FI) is calculated by the sum of the heating index and cooling index. The annual heating fuel cost is taken from the total energy cost for the heating season times .85 to account for use of other uses of fuel (e.g. hot water heating). The annual cooling cost is calculated from total cooling season fuel cost times .6 to account for other use such as lighting. These ratios can be checked by determining average off season to average in season usage. The appropriate ratios should be used in statements 175 and 200. The ratios in my home were .56 and .88 for cooling and heating respectively, quite close to the Energy Administration's estimate.

Annual heating saving due to changing the thermostat setting is calculated from the product of the number of degrees turned down times the annual heating cost (HS) times a savings factor (Y) calculated in lines 240-247. Additional savings due to setting back the nighttime temperature are calculated using a similar procedure, but with an added factor .3 (due to the reduced time the set back temperature is in effect). Cooling seasons savings are calculated from the annual cooling cost times .02 times the number of degrees the thermostat is turned up. The annual savings from caulking and weatherstripping is calculated from a draft factor times the total floor area times the fuel index. The draft factor is the sum of the factors for windows,

for fast development of fast, tight programs...
step beyond FORTH, to
RPL



High speed, low memory requirements, and user-friendly development tools are no longer mutually exclusive. Reverse Polish Language, a FORTH-like language now available for the PET and CBM computers, is faster than FORTH, easier to debug than BASIC, and more space-efficient than any other language known, including assembly language. Here's what **Loren Wright**, MICRO magazine's PET Vet, says about it:

"RPL is generally faster and more conservative of memory than FORTH . . . RPL will serve well the need for a language that is faster than BASIC yet easier to program than assembly language. The package is well-thought-out and well-documented."

RPL uses the ordinary Commodore BASIC screen editor for program entry and editing. And the full power of BASIC, in both immediate and program modes, remains available to the user throughout a development session. The RPL Compiler and Symbolic Debugger reside in the top 8K of memory, ready to be invoked at any time, directly from BASIC, via the commands "compile" and "debug". RPL source code is saved to disk or cassette just like BASIC source, and is compiled memory-to-memory for quick compilation turnaround and instant source accessibility. RPL supports separate compilation of program modules through the use of the compiler's "global symbol" features, which also permit the development of true "subroutine libraries".

The language itself is concise and straightforward, making it much easier to learn and master than most other computer languages. A total of only 47 special keywords and symbols provide the following capabilities:

- Nestable, multi-line IF . . . THEN . . . ELSE constructs.
- Nestable FOR . . . NEXT loops.
- Named subroutines and functions of arbitrary length.
- Compile-time constants and code ORGability.

- Full 16-bit integer arithmetic and logical manipulations.
- Built-in character-string handling.
- Stack-management directives including n-index, n-rotate.
- GET, INPUT, and PRINT operators
- Forward and backward symbolic references, including GOTO.
- Easy access to machine language.
- Predefined arrays with numeric and/or string contents.
- Local and global symbols.

. . . and much more. The 60-page RPL manual is clear and well-organized, making the language easy to learn and easy to use: **Loren Wright** says that **"the documentation is about the best I have ever seen."**

The Samurai RPL Symbolic Debugger is a screen-oriented, object-level debug facility using a soft-key-driven command syntax for ultra-ease of use. Features included are:

- Full visibility into both stacks at all times.
- Single-stepping, with source-level next-step display.
- Breakpointing in both auto-single-step and "go" modes.
- Address specification using expressions with symbols.
- Stack-edit capability on both stacks.
- Debugger video usage is transparent to target program.
- Extra run-time error-checking during debugging only.

. . . and, of course, much more. Here's what **Robert Baker**, author of the PET-pourri column in Kilobaud Micro-computing, says about it:

"RPL offers an unbeatable combination of speed, memory space efficiency, and ease of use. It is well-designed, well-implemented, and well-documented, and it deserves the serious consideration of every PET/CBM programmer. The Samurai RPL Symbolic Debugger, in particular, must be seen to be believed."

The compiler includes a special option making it very easy for you to create "execute-only" object modules from which all development-utility software and memory allocations have been excluded. The price you pay for the compiler also includes an unlimited license to resell the RPL "run-time library" (not the compiler) in conjunction with "execute-only" application object modules of your own.

The Samurai RPL Compiler is now available at the special introductory price of \$49.95, which includes the manual in a nice 3-ring binder and First Class postage within the continental U.S. Media supplied is of top quality, and is not copy-protected (this permits you to make backups for yourself without hassles). Compiler and debugger together are **\$80.91, complete**. Manuals are available separately at \$10.00 and \$4.00, respectively, and will be credited toward software purchase. Please specify machine type, memory size, ROM version, and media type (cassette, 4040, or 8050 diskette) when ordering.

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CARD GAMES

- BACCARAT (Atari only)** Price: \$18.95 Cassette/\$22.95 Diskette
This is the European card game which is the favorite of the Monte Carlo set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.
- GIN RUMMY (Apple only)** Price: \$18.95 Cassette/\$22.95 Diskette
This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIKES graphics are superb. What else can be said?
- POKER PARTY (Available for all computers)** Price: \$17.95 Cassette/\$21.95 Diskette
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of those players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32 K or larger Apple II.
- GO FISH (Available for all computers)** Price: \$14.95 Cassette/\$18.95 Diskette
GO FISH is a classic children's card game. The opponent is a friendly computer with user tags that are simple enough for small children to easily master. The Apple and Atari versions employ high resolution graphics for the display of hands. A must for children!

THOUGHT PROVOKERS

- MANAGEMENT SIMULATOR (Atari, North Star, OSBORNE and CP/M only)** Price: \$19.95 Cassette \$23.95 Diskette
This program is both an excellent teaching tool as well as a tantalizing intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufactures three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.
- FLIGHT SIMULATOR (Available for all computers)** Price: \$17.95 Cassette/\$21.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real aircraft. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-loops and similar acrobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.
- VALDEZ (Available for all computers)** Price: \$18.95 Cassette/\$19.95 Diskette
VALDEZ is a computer simulation of seafarer navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modeled mathematically. The simulation also contains a model for the tidal patterns in the harbor, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor. See the software review in 80 Software Critique and Personal Computer.
- BACKGAMMON 2.0 (Atari, North Star, OSBORNE and CP/M only)** Price: \$14.95 Cassette/\$18.95 Diskette
This program lets you and the computer compete against each other. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating seasons of backgammon play.
- CHESS MASTER (North Star and TRS-80 only)** Price: \$19.95 Cassette/\$23.95 Diskette
This complete and very powerful program provides five levels of play. It includes casting, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language by SOFTWARE SPECIALISTS of California. Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in onComputing.
- SUPER SUB CHASE (Atari only)** Price: \$19.95 Cassette/\$20.95 Diskette
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them tank towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.
- FOREST FIRE! (Atari only)** Price: \$18.95 Cassette/\$19.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not possessing valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very successful and challenging. No two games have the same setting and there are 3 levels of difficulty.
- BLACK HOLE (Apple only)** Price: \$14.95 Cassette/\$18.95 Diskette
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.
- SPACE EVACUATION! (Apple, Atari and TRS-80 only)** Price: \$18.95 Cassette/\$19.95 Diskette
Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as a combiner's survey of the exciting elements of classic space games with the mystery challenge of ADVENTURE.
- MONARCH (Atari only)** Price: \$11.95 Cassette/\$18.95 Diskette
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K Atari.
- CHOMPELO (Atari only)** Price: \$11.95 Cassette/\$18.95 Diskette
CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisonous portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capabilities, and is hard to beat. The package will run on a 16K system.
- SPACE LANES (Available for all computers)** Price: \$18.95 Cassette/\$19.95 Diskette
SPACE LANES is a simple but exciting space transportation game which involves up to four players (including the computer). The object is to form and expand space transportation companies in a competitive environment. The goal is to amass more net worth than your opponent. The economics include stock purchases and company mergers. Watch your wealth grow!

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (AppleII) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 5 1/4" CP/M floppy disks, for systems running under MBASIC (for example, Akos, Xerox 820 and many others) 5 1/4" CP/M diskettes are available for the North Star and Osborne computer systems.

*ATARI, PET, CBM, NORTH STAR, CP/M, IBM, OSBORNE and XEROX are registered trademarks and/or trade marks.
**Atari, PET, TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exception: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER TRS-80 diskettes are not supplied with either DOS or BASIC.
***For most North Star disk-based systems, DYNACOMP presently does not support the new North Star Advantage.
****For Altair systems having MicroVSI BASIC.

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- STARTER 3.2 (Available for all computers)** Price: \$11.95 Cassette/\$15.95 Diskette
This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move without limit! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase 5 O 5 is recovered! The Klingons get even! See the software reviews at A N A I O G, 80 Software Critique and Game Merchandising.
- LIL' MEN FROM MARS (Atari only)** Price: \$19.95 Cassette/\$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (several) game which narrows much of the Atari's power. Requires one joystick.
- SPACE TILT (Apple and Atari only)** Price: \$18.95 Cassette/\$24.95 Diskette
Use the game peddler to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Second player! Not when the ball gets smaller and smaller! A built-in timer allows you to measure your skill against others in the ball-forming action game.
- ESCAPE FROM VOLANTUM (Atari only)** Price: \$18.95 Cassette/\$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTUM! To escape you must maneuver your space ship around obstacles and later blast the dragon (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new dragon appears. Sometimes you can smash through the door by repeatedly chopping away at it. Other times it is impervious. At the higher levels of play more obstacles and dragons appear, adding to the excitement! Uses high resolution graphics and sound. Runs in 16K.
- ALPHA FIGHTER (Atari only)** Price: \$13.95 Cassette/\$17.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO; in fact, it's a UFO! get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.
- THE KINGS OF THE EMPIRE (Atari only)** Price: \$18.95 Cassette/\$19.95 Diskette
The emperor has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.
- INTRUDER ALERT (Atari only)** Price: \$18.95 Cassette/\$19.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Dreadnaught" having just stolen its plans. The dreadnaughts have been alerted and are directed to destroy you at all costs. You must find and enter your trap to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.
- MIDWAY (Atari only)** Price: \$14.95 Cassette/\$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.
- TRIPLE BLOCKADE (Atari only)** Price: \$14.95 Cassette/\$18.95 Diskette
TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joystick, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety".
- GAMES PACK I (Available for all computers)** Price: \$18.95 Cassette/\$19.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSESHOE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.
- GAMES PACK II (Available for all computers)** Price: \$18.95 Cassette/\$19.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, TOTTO, ACEY-DUCEY, LIFE, WUMPLUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS. Why pay \$7.95 or more per program when you can buy a DYNACOMP collection for just \$10.95!
- MOON PROBE (Atari and North Star only)** Price: \$11.95 Cassette/\$15.95 Diskette
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.
- SPACE TRAP (Atari only, 16K)** Price: \$14.95 Cassette/\$18.95 Diskette
This graphic "shoot 'em up" arcade game places you near a black hole. You control your spaceship using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.
- CHIRP INVADERS (PET/CBM only)** Price: \$14.95 Cassette/\$18.95 Diskette
CHIRP INVADERS is an addictive game using motion graphics. A Federation space station must be reached before the Chirps conquer the Earth. Strategic obstacles, moving actors, and the attacking Chirps must all be avoided for a successful journey. Good luck.

ADVENTURE

- CRANSTON MANOR ADVENTURE (North Star and CP/M only)** Price: \$19.95 Diskette
At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making the game the top in its class. Play can be stopped at any time and the status stored on diskette. Not available in 5 1/4" CP/M format.
- GUMBALL RALLY ADVENTURE (North Star only, 48K)** Price: \$21.95 Diskette
Take part in this outdoor race from the east coast to the west coast. The goal is to find your way to the finish line while maintaining the highest possible speed. You may choose one of five cars available at the garage. The chance will affect your speed and range. Remember to take spare parts and don't get caught speeding!
- UNCLE HARRY'S WILL (North Star only, 48K)** Price: \$24.95 Diskette
Uncle Harry has died and has left you everything. However, he has neglected to mention where everything is! Instead, he will contain a puzzle which contains clues. You will have to travel all over the United States both by car and on foot to solve the puzzle, and there are over 300 locations to probe. Be careful and watch out for red herrings!

SPEECH SYNTHESIS

DYNACOMP is now distributing the new and revolutionary TYPE-N-TALK™ (TNT) speech synthesizer from VOICERS. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!

Low price \$379 DYNACOMP's price \$319.95 plus \$5.00 for shipping and handling

- TALK TO ME (TNT Atari only, 248K)** Price: \$14.95 Cassette/\$18.95 Diskette
This program presents a superb tutorial on speech synthesis using the Atari 800 and TYPE-N-TALK™ TALK TO ME will illustrate normal word generation as well as phoneme generation. The documentation includes many helpful programming tips. TALK TO ME has been demonstrated on network (CBS) TV.

MISCELLANEOUS

- CRYSTALS (Atari only)** Price: \$5. 99 Cassette/\$13.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics is mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K Atari.
- NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY**
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.
Price: \$9.95 each/\$7.95 each (4 or more)
The complete collection may be purchased for \$149.95

BUSINESS and UTILITIES

MAILMASTER (Atari diskette only) Price: \$39.95 Diskette
MAILMASTER is a versatile software package for managing and manipulating mail lists and mail data bases. Each disk can hold over 700 customer entries containing name, address, three-letter key words and a phone number. The display is shown so that entries may be added and edited with ease. The status (e.g., disk space left, options, etc.) is shown at all times. Labels may be printed 1.2 or 3 up, and all sorting (top code and alphabet) is performed by a fast machine language program.

PERSONAL FINANCE SYSTEM (Atari and North Star only) Price: \$39.95 Diskette
PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS can also calculate your taxes by year, and display information on expenditures by any of 26 user defined codes by month or by year. PFS will maintain monthly bar graphs of your expenses by category. This powerful package requires only one disk drive, minimal memory (16K Atari, 32K North Star) and will store up to 400 records per disk (and over 1000 records per disk by making a few simple changes to the program). You can record checks plus cash expenses so that you can finally get your money gone and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort. PFS also maintains an account record network (CRS) TVI.

FAMILY BUDGET (Apple and Atari only) Price: \$34.95 Diskette
FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries as any of 21 different expense accounts as well as to payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

INTELINK (Atari only) Price: \$49.95 Diskette
The software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., the SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a very smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed, batch processing. All this adds up to saving both connect time and your time.

TEXT EDITOR II (CP/M) Price: \$29.95 Diskette/\$33.45 Disk
This is the second release version of DYNACOMP's popular TEXT EDITOR. I and contains many new features. With TEXT EDITOR II you may build text files in chunks and assemble them for later display. Blocks of text may be appended, inserted or deleted. Files may be saved on disk/diskette in right justified/centered format to be later printed by either TEXT EDITOR II or the CP/M ED facility. Further, ASCII CP/M files (including BASIC and assembly language programs) may be read by the editor and processed. In fact, text files can be built using ED and later formatted using TEXT EDITOR II. All in all, TEXT EDITOR II is an inexpensive, easy to use, but very flexible editing system.

PAYTIVE (Apple II plus diskette, two drives required) Price: \$49.95
This is an extremely flexible employee payroll system with extraordinarily good human engineering features. PAYTIVE prints checks and completes the required federal, state and local forms for up to 148 employees. The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and they also can be used as any combination. PAYTIVE includes many other features and comes extremely well documented with a 200 page manual. The manual may be purchased separately for \$30, and that payment letter applied to the software purchase.

SHOPPING LIST (Atari only) Price: \$13.95 Cassette/\$14.95 Diskette
SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

TAX OPTIMIZER (North Star only) Price: \$39.95 Diskette
The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, average, maximum and alternate minimum tax). The user may immediately observe the tax effect of crucial financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

UTIL (Apple only, 48K) Price: \$19.95 Diskette
UTIL is a disk-oriented utility system which permits examining and changing of the contents of DOS 3.2 and 3.3 diskettes at the bit (table or byte) level. With UTIL, you can easily examine the contents of a diskette sector by sector, restructure the sector pointers, reallocate sectors (e.g., bad sectors may be "hidden"), and perform many other sophisticated operations. For the experienced programmer.

TURNKEY AND MENU (Atari only) Price: \$17.95 Diskette
TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) Price: \$38.95 Diskette
STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume feature charts. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days x 16 ticks. Included are stock dividend and split adjustment capabilities. A very professional package!

SHAPE MAGICIAN (Apple II, 48K, diskette only) Price: \$29.95
At last! An ability for painlessly creating graphics shapes for the Apple. Create, edit and save up to 30 shapes which can then be used to develop arcade games or to simply enhance your programs. Add this professional touch!

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) Price: \$39.95 Cassette/\$43.95 Diskette
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to any accuracy according to the number of points used in the calculation. These filters may optionally be smoothed with a Hamming function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter function. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) Price: \$19.95 Cassette/\$23.95 Diskette
This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is smoothing of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) Price: \$19.95 Cassette/\$23.95 Diskette
This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) Price: \$24.95 Cassette/\$28.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage, as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is stored and a color plot interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of \$49.95 (three cassettes) and \$59.95 (three diskettes).

REGRESSION I (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data, curve and residual plotting; a statistical analysis (e.g., standard deviation, correlation coefficient, etc.) and much more. In addition, new file may be used without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
PARAFIT is designed to handle those cases in which the parameters are included (greatly nonlinearity) in the fitting function. The user simply inserts the functional form, including the parameters (A1), (A2), etc. as one or more BASIC statement lines. Data, results and residuals may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) Price: \$24.95 Cassette/\$28.95 Diskette
MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may incorporate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for \$51.95 (three cassettes) or \$63.95 (three diskettes).

ANOVA (Not available on Atari cassette or for PET/CBM) Price: \$39.95 Cassette/\$49.95 Diskette
In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2²-factorial design. For those unfamiliar with ANOVA, the user may incorporate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)
DYNACOMP is the exclusive distributor for the software listed in the popular texts BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine:

Volume 1
Collection #1 Chapters 2 and 3 - Data and function plotting, complex variables and functions.
Collection #2 Chapter 4 - Extended matrix and vector operations.
Collection #3 Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.), series approximation.
Price per collection: \$14.95 Cassette/\$18.95 Diskette

Volume 2
Collection #1 Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2 Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.)
Collection #3 Chapter 3 - Functional approximations by iteration and recursion.
Collection #4 Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5 Chapter 5 - Table interpolation, differentiation and integration (Newton, Lagrange, spline).
Collection #6 Chapter 6 - Methods for finding the real roots of functions.
Collection #7 Chapter 7 - Methods for finding the complex roots of functions.
Collection #8 Chapter 8 - Quadratic residues.
Price per collection: \$14.95 Cassette/\$18.95 Diskette

All eight collections are available for \$99.95 (eight cassettes) and \$129.95 (eight diskettes). Because the texts are a vital part of the documentation, BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 are available from DYNACOMP.

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

See reviews in KILBOAUD and Dr. Dobbs.

SOFTNET (Apple II 48K, diskette only) Price: \$129.95
SOFTNET may be used to create models of liquid pipeline systems to evaluate their flow performance. Up to 130 nodes with up to 130 connecting elements may be simulated, and models may be combined to form yet larger models. If you are involved in water distribution systems, chemical fluid flow problems, building plumbing, or similar situations, this is an ideal analysis tool.

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) Price: \$25.95 Cassette/\$29.95 Diskette
ACAP is the analog circuit designer's answer to LOGIC SIMULATOR. With ACAP you may analyze the response of an active or passive component circuit (e.g., a transistor amplifier, band pass filter, etc.). The circuit may be probed at equal steps in frequency, and the resulting complex (i.e., real and imaginary) voltages at each component juncture examined. By plotting the magnitude of these voltages, the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations. ACAP may be checked in as many as 1000 steps. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

LOGIC SIMULATOR (Apple only, 48K RAM) Price: \$24.95 Cassette/\$28.95 Diskette
With LOGIC SIMULATOR you may easily test your complicated digital logic design with respect to gross set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, JK and D flip-flops, and one-shots. The response of the system is available every clock cycle. Inputs may be checked in as many as 1000 steps. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

NUMBERCRUNCHER (TRS-80 only) Price: \$49.95 Cassette/\$73.95 Diskette
This program is the most complete numerical analysis system available for the TRS-80. It can handle up to 255 data sets, each set having a character name. It includes complete data editing facilities and convenient data input/output capability. The analysis available are: multiple linear regression and correlation determination of residuals, data transformations and extensive graphics operations, including a test menu, and more. The supporting documentation is extremely well written and well organized, and includes appendices which describe the numerical procedures used in the program.

STATSORT (TRS-80 only) Price: \$39.95 Cassette/\$43.95 Diskette
STATSORT consists of several menu selected programs which allow the user to create (build, edit, merge), format and print files, (machine) sort them on any field, and summarily analyze (maximum, minimum, average, variance, standard deviation) tabulated data. STATSORT is well documented and easy to use. The cassette version can also be employed to create a data type which can be read by the Radex Shack Advanced Statistical Package.

STATTEST (TRS-80 only) Price: \$19.95 Cassette/\$23.95 Diskette
This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the difference in means, variances and proportions. STATTEST will also perform data analysis as well as do linear regression. This menu-driven statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

EDUCATION

HODGE PODGE (Apple only, 48K AppleII or Integer BASIC) Price: \$14.95 Cassette/\$18.95 Diskette
Let HODGE PODGE be your child's teacher. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1 to 7. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education. See the excellent reviews of this very popular program in INFOWORLD and SOFTALK.

TEACHER'S AIDE (Atari only) Price: \$13.95 Cassette/\$17.95 Diskette
TEACHER'S AIDE consists of three basic modules contained in one program. The first module provides addition and subtraction exercises of varying levels of difficulty. The second module consists of multiplication problems in which the student may be tested both on the final answer and/or the subtotal answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems; one particularly nice feature of the division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate the procedure by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill, but rather a learning experience.

PHARMACOLOGY UPDATE (PET only) Price: \$149.95 Cassette/\$153.95 Diskette
The DYNACOMP's five educational software are entry for the medical professions (more are coming)! PHARMACOLOGY UPDATE was written by a B.M. as a masters project, with the aid of a practicing pharmacologist and an electronics instructor. This package comes in two parts. The first part is a 200 page manual which is divided into 10 sections, each of which contains provides both concise information and probing questions. The second part consists of 10 programs that are keyed to the text and which test the degree of your understanding of the text material. This package has great educational value for the beginning student as well as the professional interested in an efficient way to review and update his or her knowledge.

ORDERING INFORMATION

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

Shipping and Handling Charge Delivery
Within North America: Add \$2.00 All orders (excluding books) are sent First Class
Outside North America: Add 15% (Air Mail)

Quantity Discounts
Discount 10% when ordering 3 or more programs. Dealer discount schedules are available upon request.
CP/M Disk
Add \$2.50 to the listed diskette price for each 5" floppy disk (384K soft sector CP/M format). Program run under Microsoft MBASIC or BASIC.

5 1/4" CP/M Disk
All software available on 5 1/4" CP/M disks is also available on 5 1/4" disks, North Star and Osborne formats.
Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

DYNACOMP, Inc. (Dept. E)

1427 Monroe Avenue
Rochester, New York 14618
24 hour order phone: (716)442-8731 recording
Office phone (9AM-5PM EST): (716)442-8960

New York State residents please add 7% NYS sales tax.



ABOUT DYNACOMP

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



The Most Spectacular Extravaganza Ever... For Apple Users

At Applefest '82 hundreds of manufacturers, distributors and dealers will showcase the entire spectrum of Apple-compatible products including computers, components, peripherals, plug-in cards, publications, gifts, magazines, services, accessories and software for home, office and school.

Hands-on centers and multimedia presentations will demonstrate the newest applications for business, education and entertainment.

Seminars and workshops, conducted by the world's leading Apple authorities, will detail new uses to make your Apple more enjoyable and more useful than you ever imagined.

You'll meet thousands of other Apple owners and find the newest of everything for your Apple under one roof... and for sale at super show prices.

So if you use an Apple... or are thinking about buying one, you won't want to miss a minute of Applefest '82.

Ticket & Hotel Information

Send your check and a note indicating the specific show you wish to attend. Tickets and hotel information will be mailed back to you. Tickets can also be purchased at the show. Make all checks payable to Northeast Expositions Inc. 824 Boylston Street, Chestnut Hill, Mass. 02167 Tel: 617 739 2000.

Applefest/Boston

Fri-Sun May 14-16, 1982
Hynes Auditorium
Show Hours: 11AM to 6PM Daily
Admission: \$6 per day or \$10 for 2 days,
\$15 for 3 days

Applefest/Chicago

Fri-Sun Nov 5-7, 1982
Arlington Park Racetrack/Exposition Center
Arlington Heights, Ill.
Show Hours: 1PM to 10PM Daily
Admission: \$5 per day or \$8 for 2 days, \$12 for 3 days

Applefest/Houston

Fri-Sun Nov 19-21, 1982
Albert Thomas Convention Center
Show Hours: 1PM to 10PM Daily
Admission: \$5 per day or \$8 for 2 days, \$12 for 3 days

Applefest/San Francisco

Fri-Sun Dec 3-5, 1982
Moscone Center
Show Hours: 1PM to 10PM Daily
Admission: \$5 per day or \$8 for 2 days, \$12 for 3 days

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120 INPUT"COST PER UNIT FOR HEATING FUEL(CENTS)";S:S=S/100
125 HI=S*FH(J)*HF:REM HEAT INDEX
126 PRINT:PRINT:INPUT"CHOOSE # FOR COOLING FUEL";J
127 INPUT"COST PER UNIT FOR COOLING FUEL(CENTS)";S:S=S/100
130 CI=S*FC(J)*HC:FI=HI+CI:REM COOL AND FUEL INDEX
135 PRINT:PRINT:PRINT:PRINT
145 PRINT"INPUT # OF SQUARE FT OF SINGLE GLASS WINDOWS, DO NOT"
150 INPUT"COUNT STORM WINDOWS OR SLIDING GLASS DOORS";X
170 X=INT(X*100*FI*.65)/100
175 PRINT"ANNUAL SAVINGS DUE TO STORM WINDOWS= $";X:X=.85:GOSUB800
180 PRINT:PRINT"IS HEATING FUEL USED FOR OTHER PURPOSES, E.G. COOKING ";
190 INPUTB$:IFASC(B$)=78THENX=1
200 INPUT"ANNUAL HEATING FUEL COST (DOLLARS)";HS:HS=HS*X:PRINT:PRINT:X=.6
210 PRINT"IS COOLING FUEL USED FOR OTHER PURPOSES, E.G. LIGHTING";
220 INPUTB$:IFASC(B$)=78THENX=1
230 INPUT"ANNUAL COOLING FUEL COST (DOLLARS)";CS:CS=CS*X
240 PRINT:PRINT:Y=.05:FORI=1TO3:IFI=HTHEN247
245 Y=Y-.01:NEXT:IFH=4THENY=.025
246 IFH=5THENY=.02
247 GOSUB800
250 PRINT"THE FOLLOWING SECTION EVALUATES THE SAVINGS OBTAINED BY TURNING"
255 PRINT"THE THERMOSTAT DOWN IN WINTER OR UP IN SUMMER FROM THE SETTING"
256 PRINT"YOU HAVE BEEN USING.":PRINT:PRINT:PRINT"HEATING":PRINT
260 INPUT"DEGREES TURNED DOWN DURING DAY";X:S=INT(100*Y*HS*X)/100
265 PRINT"SAVINGS = $";S:PRINT"ADDITIONAL DEGREES TURNED DOWN DURING NIGHT";
270 INPUTX:I=INT(100*Y*HS*X*.3)/100:PRINT"SAVINGS= $";I
280 S=S+I:PRINT"ANNUAL TOTAL HEATING SAVINGS = $";S:PRINT:PRINT"COOLING":PRINT
285 INPUT"DEGREES THERMOSTAT TURNED UP DURING COOLING";X
290 I=INT(100*CS*X*.02)/100:PRINT"SAVINGS = $";I
300 PRINT:PRINT"TOTAL ANNUAL SAVINGS = $";S+I:GOSUB800
310 PRINT:PRINT:PRINT"ANNUAL SAVINGS FROM CAULKING AND WEATHERSTRIPPING"
315 PRINT"CHECK DRAFTS HOLDING CANDLE NEAR CRACK ON WINDY DAY"
320 PRINT"CHOOSE ONE OF FOLLOWING":PRINT"          1) WINDOWS WITH GOOD FIT"
340 PRINT"          2) SOME LEAKAGE":PRINT"          3) RATHER DRAFTY"
350 INPUTY:PRINT:PRINT"CHOOSE ONE OF FOLLOWING":PRINT"          1) DOORS FIT GOOD"
360 PRINT"          2) SOME LEAKAGE":PRINT"          3) DRAFTY":INPUTI
370 PRINT:PRINT:PRINT"CHOOSE ONE OF FOLLOWING":PRINT
380 PRINT"          1) CAULKING AND WEATHERSTRIPPING GOOD":PRINT"          2) NEEDREPAIR"
390 PRINT"          3) NO CAULKING OR WEATHERSTRIPPING":INPUTS
400 INPUT"FLOOR AREA OF HOUSE - SQ FT";X
410 X=X*(Y+I+S-3)/100*FI:X=INT(X*100)/100:PRINT
420 PRINT"ANNUAL SAVINGS FOR CAULKING AND WEATHERSTRIPPING= $";X:GOSUB800
440 PRINT:PRINT:PRINT"ANNUAL SAVINGS FROM CEILING INSULATION":PRINT:PRINT
450 Y=38:INPUT"CEILING R VALUE";X:IFH<3THENY=26
455 IFH=3THENY=30
460 IFH=4THENY=33
465 INPUT"FIRST FLOOR AREA OF HOUSE (SQ FT)";F
470 R=Y:GOSUB900:I=R:R=X:GOSUB900:X=R:X=INT(100*(X-I)*F*FI)/100
475 IFX<0THENX=0
480 PRINT"ANNUAL SAVINGS BY BRINGING CEILING R UP TO";Y;" = $";X:GOSUB800
550 INPUT"IS THE HOUSE ON PILLARS OR HAVE AN UNHEATED BASEMENT";B$
555 IFASC(B$)=78THEN799
560 PRINT"CHOOSE FOUNDATION FACTOR FROM LIST BELOW":PRINT
565 PRINT"          FACTOR          FOUNDATION CHARACTERISTICS":PRINT
570 PRINT"          0.5 BUILDING WITH TIGHT CRAWL SPACE"
580 PRINT"          0.5 BUILDING WITH TIGHT BASEMENT (UNHEATED)"
590 PRINT"          0.8 STONE WALL BASEMENT (UNHEATED)"
600 PRINT"          0.8 2 FT OR MORE OF BASEMENT WALL EXPOSED (UNHEATED)"
610 PRINT"          0.8 CRAWL SPACE SKIRTED"
620 PRINT"          1.0 BUILDING ON PILLARS WITH NO SKIRTS"
625 PRINT:INPUT"FLOOR FACTOR FROM ABOVE TABLE";J
627 Y=11:IFH>1THENY=13:IFH>2THENY=19:IFH>3THENY=22
628 R=Y:GOSUB900:Q=R:INPUT"CURRENT R FACTOR FOR FLOOR";R

```

LETTER PERFECT

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LJK DISK UTILITY APPLE \$29.95

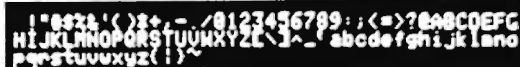
This menu driven program allows the user to manipulate a variety of different file types. Binary, Text, and Source files may be easily converted into each other. The program may be used with **APPLESOFT***, **VISCALC***, and other programs. These program files may be readily adapted for multiple use including editing with **LETTER PERFECT** word processings.

APPLE & ATARI INTRODUCTORY PRICE DATA BASE MANAGEMENT \$99.95

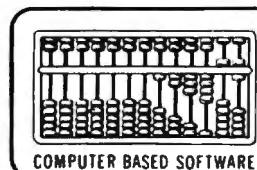
MAIL MERGE/UTILITY \$29.95 ATARI

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```

630 GOSUB900:X=J*(R-Q)*F*FI:PRINT:PRINT:X=INT(X*100)/100:IFX<0THENX=0
640 PRINT"ANNUAL SAVINGS BY INCREASING FLOOR R VALUE TO ";Y;" =";X
645 GOSUB800
799 RESTORE:PRINT:PRINT:GOSUB800:PRINT:PRINT:L=96:GOTO14
800 PRINT"=====
801 RETURN
828 R=Y:GOSUB900:I=R
899 REM CONDUCTION FACTOR SUBROUTINE
900 IFR<11THEN920
901 IFR<12THENR=.077:RETURN
902 IFR<15THENR=.066:RETURN
903 IFR<20THENR=.048:RETURN
904 IFR<24THENR=.042:RETURN
905 IFR<28THENR=.036:RETURN
906 IFR<34THENR=.031:RETURN
910 R=.025:RETURN
920 R=.5-.0385*R:RETURN
1000 DATACALIFORNIA,LOSANGELES 1 4 SANFRANCISCO 3 4 SACRAMENTO 1 3
1010 DATA COLORADO,DENVER 3 4 DURANGO 4 4 ASPEN 4 5
1020 DATAALABAMA,MONTGOMERY 1 2 BIRMINGHAM 1 3 HUNTSVILLE 2 3
1030 DATAARIZONA,PHOENIX 1 3 FLAGSTAFF 3 3,CONNECTICUTT,HARTFORD 3 5
1040 DATANEW MEXICO,ROSWELL 2 3 ALBUQUERQUE 3 3 SANTAFE 3 4
1050 DATAUTAH,SALTLAKECITY 3 4 MOAB 4 4,IDAHO,BOISE 3 5 POCATELLO 4 4
1070 DATAMONTANA,BILLINGS 4 5,OREGON,PORTLAND 2 5 BAKER 3 5
1090 DATAWASHINGTON,SEATTLE 3 5,NEVADA,RENO 3 3 LASVEGAS 1 3
1110 DATANORTH DAKOTA,GRANDFORKS 5 5,OKLAHOMA,OKLAHOMACITY 2 3
1120 DATASOUTH DAKOTA,SIOUXFALLS 4 4 PIERRE 4 5
1130 DATANEBRASKA,OMAHA 3 4,KANSAS,WICHITA 2 4 TOPEKA 3 4
1160 DATATEXAS,DALLAS 1 3 HOUSTON 1 2 BROWNSVILLE 0 1 AMARILLO 2 3
1170 DATALOUISIANA,NEWORLEANS 1 2 SHREVEPORT 1 3
1180 DATAARKANSAS,LITTLEROCK 1 3 FAYETTEVILLE 2 3
1190 DATAMISSOURI,SPRINGFIELD 2 3 STLOUIS 2 4 KANSASCITY 3 4
1200 DATAIOWA,DESMOINES 3 4 SIOUXCITY 4 4,VERMONT,MONTPELIER 4 5
1210 DATAMINNESOTA,MINNEAPOLIS 4 5 DULUTH 5 5,NEW HAMPSHIRE,CONCORD 4 5
1220 DATAWISCONSIN,MADISON 4 4 EAUCLAIRE 4 5,RHODE ISLAND,PROVIDENCE 3 5
1230 DATAILLINOIS,CHICAGO 3 4 SPRINGFIELD 2 4,VIRGINIA,RICHMOND 2 4
1240 DATAMICHIGAN,DETROIT 3 4 GRANDRAPIDS 4 5 SAULTST.MARIE 5 5
1270 DATAINDIANA,INDIANAPOLIS 3 4 EVANSVILLE 2 4,WYOMING,CASPER 4 5
1290 DATATENNESSEE,MEMPHIS 2 3 KNOXVILLE 2 4 CHATTANOOGA 2 3
1300 DATAMISSISSIPPI,JACKSON 1 2 TUPELO 1 3,KENTUCKY,LOUISVILLE 2 4
1320 DATAWEST VIRGINIA,CHARLESTON 3 4,MASSACHUSETTS,BOSTON 3 5
1330 DATAFLORIDA,MIAMI 0 1 JACKSONVILLE 1 2,OHIO,COLUMBUS 3 4
1340 DATAGEORGIA,SAVANNAH 1 3 ATLANTA 2 3,MAINE,PORTLAND 4 5
1350 DATASOUTH CAROLINA,CHARLSTON 1 3,NEW JERSEY,NEWARK 2 4
1360 DATANORTH CAROLINA,RALEIGH 2 3 ASHEVILLE 2 4 WILMINGTON 1 3
1390 DATAPENNSYLVANIA,PITTSBURGH 3 4,MARYLAND,BALTIMORE 2 4
1410 DATANEW YORK,NEWYORK 3 4 ALBANY 4 5,DELAWARE,WILMINGTON 2 4
1480 DATAERROR
1500 DATAOIL/GALLON,1,0,NATGAS/CUFT,120,150,ELECTRICITY/KWH,30,15
1510 DATAWOOD/CORD,.01,0,LPG/CUFT,50,60,LPG/LBS,6,7,LPG/GALLON,1.3,1.5
1520 DATACOAL/TON,.006,0
2000 END

```

Program 2.

Change these lines for Atari:

```

0 DIM B$(20),C$(20),D$(20),BB$(4*10),BBL
(4),X(10),Y(10),FK(10),FC(10)
14 ? :? :? :? "STATE (DON'T ABBREVIATE)"
;:INPUT B$:FOR I=1 TO L:READ C$
15 IF B$(1,7)=C$(1,7) THEN B$=C$:READ D$
20 NEXT I:FOR I=1 TO 4:BBL(J)=0:NEXT I:I
=1:Y=LEN(D$):J=1
25 X=ASC(D$(I,I)):IF X=32 THEN 45
30 BBL(J)=BBL(J)+1:BB$((J-1)*10+1,(J-1)*
10+BBL(J))=CHR$(X):GOTO 55

```

```

45 I=I+1:XC(J)=VAL(D$(I,I)):I=I+2:Y(J)=VAL(D$(I,I))
60 POKE 85,15:?: I:POKE 85,20:?: 88$(I-1)*10+1,(I-1)*10+BBL(I)):POKE 85,35:?: B$:NEXT I
65 ? :? :? "CHOOSE # FOR NEAREST CITY"::INPUT I:H=X(I):C=Y(I):REM ZONES
85 NEXT I
90 HC=X:X=0:FOR I=0 TO 5:IF H=I THEN 100:REM HF & CF ARE HEAT & COOL FACTORS
95 X=X+0.5:NEXT I
110 FOR I=1 TO 8:READ B$,A,B:FH(I)=A:FC(I)=B:PRINT "      ";I:B$:NEXT I

115 ? :? :? "CHOOSE # FOR HEATING FUEL(CENTS)"::INPUT S:S=S/100
126 ? :? :? "CHOOSE # FOR COOLING FUEL"::INPUT J
127 ? "COST PER UNIT FOR COOLING FUEL(CENTS)"::INPUT S:S=S/100
150 ? "COUNT STORM WINDOWS OR SLIDING GLASS DOORS"::INPUT X

200 ? "ANNUAL HEATING FUEL COST (DOLLARS)"::INPUT HS:HS=HS*X:?:?:X=0.6
230 ? "ANNUAL COOLING FUEL COST (DOLLARS)"::INPUT CS:CS=CS*X
245 Y=Y-0.01:NEXT I:IF H=4 THEN Y=0.025
260 ? "DEGREES TURNED DOWN DURING DAY"::INPUT X:S=INT(100*X*HS*X)/100
285 ? "DEGREES THERMOSTAT TURNED UP DURING COOLING?"::INPUT X
400 ? "FLOOR AREA OF HOUSE-SQ FT"::INPUT X
450 Y=38:?: "CEILING R VALUE"::INPUT X:IF HK3 THEN Y=26
465 ? "FIRST FLOOR AREA OF HOUSE (SQ FT)"::INPUT F
550 ? "IS THE HOUSE ON PILLARS OR HAVE AN UNHEATED BASEMENT"::INPUT B$
625 ? :? "FLOOR FACTOR FROM ABOVE TABLE"::INPUT J
628 R=Y:GOSUB 900:Q=R:?: "CURRENT R FACTOR FOR FLOOR"::INPUT R

```

Figure 1. Sample Run

ITEMS NEEDED FOR ENERGY WORKBOOK

- 1) STATE
- 2) CITY
- 3) HEATING FUEL COST (E.G. .37 CENTS/CU FT)
- 4) COOLING FUEL COST (E.G. 5.14 CENTS/KWH)
- 5) SQUARE FT OF SINGLE GLASS WINDOWS IN HOUSE
- 7) ANNUAL HEATING AND COOLING FUEL COST
- 8) CHECK FOR LEAKAGE AROUND WINDOWS AND DOORS WITH CANDLE
- 9) FLOOR AREA OF HOUSE - SQ FT
- 10) CEILING R VALUE - USE TABLE PROVIDED WITH INSTRUCTIONS
- 11) FIRST FLOOR AREA - SQ FT
- 12) FLOOR R VALUE IF BASEMENT IS UNHEATED OR HOUSE IS ON PILLARS

STATE(DON'T ABBREVIATE)? TEXAS

1	DALLAS	TEXAS
2	HOUSTON	TEXAS
3	BROWNSVILLE	TEXAS
4	AMARILLO	TEXAS

CHOOSE # FOR NEAREST CITY? 2

1	OIL/GALLON
2	NATGAS/CUFT

3 ELECTRICITY/KWH
 4 WOOD/CORD
 5 LPG/CUFT
 6 LPG/LBS
 7 LPG/GALLON
 8 COAL/TON

CHOOSE # FOR HEATING FUEL? 2
 COST PER UNIT FOR HEATING FUEL(CENTS)? .45

CHOOSE # FOR COOLING FUEL? 3
 COST PER UNIT FOR COOLING FUEL(CENTS)? 6.

INPUT # OF SQUARE FT OF SINGLE GLASS WINDOWS, DO NOT
 COUNT STORM WINDOWS OR SLIDING GLASS DOORS? 190
 ANNUAL SAVINGS DUE TO STORM WINDOWS= \$ 116.7

IS HEATING FUEL USED FOR OTHER PURPOSES, E.G. COOKING ? Y
 ANNUAL HEATING FUEL COST (DOLLARS)? 175.

IS COOLING FUEL USED FOR OTHER PURPOSES, E.G. LIGHTING? Y
 ANNUAL COOLING FUEL COST (DOLLARS)? 800.

=====

THE FOLLOWING SECTION EVALUATES THE SAVINGS OBTAINED BY TURNING
 THE THERMOSTAT DOWN IN WINTER OR UP IN SUMMER FROM THE SETTING
 YOU HAVE BEEN USING.

HEATING

DEGREES TURNED DOWN DURING DAY? 5
 SAVINGS =\$ 37.18
 ADDITIONAL DEGREES TURNED DOWN DURING NIGHT? 5
 SAVINGS=\$ 11.15
 ANNUAL TOTAL HEATING SAVINGS =\$ 48.33

COOLING

DEGREES THERMOSTAT TURNED UP DURING COOLING? 5
 SAVINGS =\$ 48

TOTAL ANNUAL SAVINGS =\$ 96.33

=====

ANNUAL SAVINGS FROM CAULKING AND WEATHERSTRIPPING
 CHECK DRAFTS HOLDING CANDLE NEAR CRACK ON WINDY DAY
 CHOOSE ONE OF FOLLOWING

- 1) WINDOWS WITH GOOD FIT
- 2) SOME LEAKAGE
- 3) RATHER DRAFTY

? 2

CHOOSE ONE OF FOLLOWING

- 1) DOORS FIT GOOD
- 2) SOME LEAKAGE
- 3) DRAFTY

? 2

CHOOSE ONE OF FOLLOWING

- 1) CAULKING AND WEATHERSTRIPPING GOOD
- 2) NEEDREPAIR
- 3) NO CAULKING OR WEATHERSTRIPPING

? 2

FLOOR AREA OF HOUSE - SQ FT? 2000

ANNUAL SAVINGS FOR CAULKING AND WEATHERSTRIPPING= \$ 56.7

=====

ANNUAL SAVINGS FROM CEILING INSULATION

CEILING R VALUE? 19

FIRST FLOOR AREA OF HOUSE (SQ FT)? 2000

ANNUAL SAVINGS BY BRINGING CEILING R UP TO 26 = \$ 22.68

=====

IS THE HOUSE ON PILLARS OR HAVE AN UNHEATED BASEMENT? Y

CHOOSE FOUNDATION FACTOR FROM LIST BELOW

FACTOR	FOUNDATION CHARACTERISTICS
0.5	BUILDING WITH TIGHT CRAWL SPACE
0.5	BUILDING WITH TIGHT BASEMENT (UNHEATED)
0.8	STONE WALL BASEMENT (UNHEATED)
0.8	2 FT OR MORE OF BASEMENT WALL EXPOSED (UNHEATED)
0.8	CRAWL SPACE SKIRTED
1.0	BUILDING ON PILLARS WITH NO SKIRTS

FLOOR FACTOR FROM ABOVE TABLE? 1.

CURRENT R FACTOR FOR FLOOR? 7

ANNUAL SAVINGS BY INCREASING FLOOR R VALUE TO 11 = \$ 290.11

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Two Short Programs Of CAI For Teaching BASIC

R. Hiatt
Dept. of Chemistry
Brock University
St. Catharines, Ontario

While much is written about, and many programs are produced for, CAI in diverse subjects and disciplines, there seems to be very little about CAI applied to learning about computation itself.

To be sure, the computer itself is the best CAI for individual self-paced effort. But for the classroom, demonstration programs are useful. By CAI, however, I don't mean simple routines that are merely examples, but rather, programs that make their point by manipulation and/or simulation of a process. I venture to present two examples.

1. PEEKPROG – A BASIC program that PEEKs itself.

At some point in teaching a course in BASIC, it seems useful to PEEK out to the screen a page or so of a program. This can be in response to a question as to why conserving line numbers conserves memory space, or a similar query suggesting that a brief digression into actual program storage would be illuminating. (In my experience, it is wise to postpone any mention of bits, bytes, hex or ASCII until this kind of curiosity evinces itself.)

While it's easy enough to PEEK out a page from immediate mode, (for I=2049 to 2304: Print PEEK (I) " "; NEXT), and fill the screen with numbers, this is more astounding than useful. It takes a trained eye to discern any pattern at all.

Program 1 organizes the PRINT PEEK – so that each line number starts off a new line on the screen. By keeping the program short and the line numbers below 256 it is possible to pseudo list the whole program and have the line numbers easily recognizable (Figure 1). The line terminators can be pointed out, as can the linking bytes and the

program terminator.

BASIC tokens can be mentioned, and the students can practice their ASCII by reading the REM statement, etc.

The program itself illustrates READ...DATA – partly because the questions seem to arise about the time we're dealing with that subject, and partly because it seemed an easy way to control the position of carriage returns in the loop.

Actually, this turned up something about the Apple that I hadn't realized; that is, each time a DATA statement is edited, an additional space, actually another byte with value 32, is inserted between this DATA token and the first byte of the data. This, of course, changes the length of the program and the byte at which a new print line is wanted. In other words, the datum just corrected has been made erroneous by the process of correction. The only way out seems to be to retype the line.

2. READ/RESTORE – (Program 2) is a routine that simulates a small portion of program which reads data into two arrays, one numeric and the other string. The displayed portion of the program, (lower screen, Figure 2), consists of two FOR I = ... READ A (I) ..., separated by a RESTORE, the whole followed by a FOR I = ...READ A\$(I)... . Two pseudo cursors are employed, one flashing the current value of I at the end of the FOR I ... NEXT I loop, the other acting as a data pointer.

Action is controlled by the instructor, via the programmed "invisible GET"; i.e. IF PEEK - 16384 < 128 THEN The first (any) key depression causes a datum to be "READ"; its index and value appear in the table. This second key depression moves the data pointer and movements "I".

Progression of the program being entirely in the hands of the instructor, there is unlimited time to point out the salient features, to comment on indices, the differences between numeric and string data, etc., and to run the program two or three times for emphasis.

For Atari Users...

Program 3 will provide a dump of an Atari BASIC program, similar to Program 1. To merge it with another program, LIST it to tape or disk (with LIST"C:" or LIST"D:BDUMP"), load the program to be viewed, and then use ENTER"C:" or ENTER"D:BDUMP". Start the routine with GOTO 20000.

Program 4 is called "BASIC in Action." It is a display of a BASIC program (the "Atarized" version of Figure 1) as it RUNs. Just type it in and RUN it. A program will be listed at the bottom of the screen with an arrow pointing to the first line. When you press a key, the line will be executed. The action of the program, including the DATA statement pointer,

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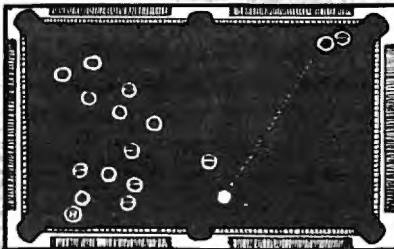
By Charles Bachand from Analog
Two-player game with 128 variations! Your objective is to travel through space further and faster than your opponent. All the while, you must dodge various densities of tiny asteroids and comets. To further impede your progress, you must avoid your opponent's (and your own) boomerang missiles! Selectable playing time from 3 to 5 minutes.

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POOL 1.5



By Hoffman, St Germain & Morock from IDS
The pressure is on: if you can just get enough english on the ball to bank it into the corner pocket . . . In POOL 1.5, you can! A remarkable action-simulation of the real thing, this program allows full control of your "cue-stick" for aim and control. Play four different types of pool at your choice of table speed, with "instant replay" of any shot! HI-RES color graphics are used throughout this real-time game.

48K Disk...\$34.95

CYPHER BOWL



From ArtSci
The most impressive 2-player football game we've seen for the Atari. Using five players per side instead of 11 keeps the game manageable while providing all the action you can handle. Each player uses a joystick to call formations and plays -- 256 possibilities -- then the players are maneuvered after the ball is kicked. Skill improvements come gradually and you can plan on many hours of excitement & enjoyment with CYPHER BOWL.

16K tape or disk...\$49.95

**MISSION: ASTEROID
HI-RES ADVENTURE #0**

From On-Line
An introduction to HI-RES adventures, it is designed to acquaint beginning adventurers with this exciting genre of games. An asteroid is about to hit earth. Your job as a novice astronaut is to blow it up before it destroys earth. On your way you must cut through red tape impeding your plan, learn to fly the rocket, and follow a flight plan that will put you in striking distance.

40K disk...\$24.95

RICOCCHET

DeKoven & Connelley from Mind Toys
A unique new approach to computer gaming. RICOCHET combines diabolical strategy with fast action to yield a game that satisfies your intellect as well as your senses. You have 6 playing pieces to move around, plus 2 ball launchers. Each turn consists of either repositioning the pieces or launching a ball. Points are scored each time the ball ricochets. Simple? Deceptively so. Easy to master? Definitely not! 1 or 2 players.

32K disk...\$19.95



HOCKEY

From Gamma Software
A high-speed video action game for 2, 3, or 4 players. You use joysticks to control the players. The offensive player with the puck and the nearest defensive player are automatically assigned to a joystick; Players not so controlled become "smart" players who play automatically. The action is fast and furious, the color graphics and sound are realistic. Perfect for family entertainment.

16K disk or tape...\$29.95

LUNAR LANDER



By Wall, Moncrief & Jessee from A.I.
Grab your joystick and sweat out the touch-down of your LEM. Choose from four lunar landscapes, with many choices for landing sites. Select a more difficult site and get more points -- If you can land successfully. You have complete control of your LEM via main engines and small side thrusters, and five successful landings are heralded with a patriotic event. Great fun!

24K tape (disk compatible)...\$14.95

REAR GUARD

By Neil Larimer from Adventure Int.
A space battle between your cruiser and wave-after-wave of enemy ships. You can destroy them with your energy darts or you can ram them -- as long as your shields are intact. The action takes place on a continuous horizontal landscape. You control the altitude and speed of your craft as you pursue the enemy. Skill level 1 is exciting, and there are four more levels available.

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variables, strings, DIMensioning, and FOR/NEXT loops are visually and audibly demonstrated.

Figure 1.

```

20 8
10 0 178 32 80 69 69 75 32 80 82 79 71 8
 2 65 77 0 27 8
20 0 135 65 0 41 8
30 0 129 73 208 50 48 52 57 193 65 0 53
 8
40 0 173 73 209 66 196 54 48 0 62 8
50 0 135 66 58 186 0 76 8
60 0 186 226 40 73 41 34 32 34 59 0 83 8
70 0 130 73 0 89 8
80 0 128 0 115 8
100 0 131 32 50 50 51 50 44 50 48 53 49
44 50 48 55 48 44 50 48 55 55 0 141 8
110 0 131 32 50 48 57 49 44 50 49 48 51
44 50 49 49 50 44 50 49 50 54 0 167 8
120 0 131 32 50 49 51 51 44 50 49 51 57
44 50 49 54 53 44 50 49 57 49 0 183 8
200 0 131 32 50 50 50 49 55 44 50 51 48 48
 0 0 0

```

Figure 2.

```

40 for I = 1 to 3: Read A(I): Next I
50 Restore
60 For I = 4 to 6: Read A(I): Next I
70 For I = 1 to 5: Read A$(I): Next I
80 Data 76, 40, 67
90 Data "SUE", "ANN", "JOE", "KIM", "JIM"

```

Program 1.

```

10 REM PEEK PROGRAM
20 READ A
30 FOR I = 2049 TO A
40 IF I < B THEN 60
50 READ B: PRINT
60 PRINT PEEK (I) " "
70 NEXT I
80 END
100 DATA 2232,2051,2070,2077
110 DATA 2091,2103,2112,2126
120 DATA 2133,2139,2165,2191
200 DATA 2217,2300

```

Program 2.

```

10 REM DATA READ-RESTORE DISPLAY
20 GOTO 50
30 IF PEEK ( - 16384) < 128 THEN 30
40 POKE - 16368,0: RETURN
50 DIM A(10),A$(10)
60 B$(0) = "INDEX":B$(1) = "DATA":C$ = CHR$ (34):B$ = C$ + "," + C$
70 HOME
80 PRINT TAB( 6)"A(I)" TAB( 25)"A$(I)"
90 PRINT B$(0) TAB( 10)B$(1) TAB( 20)B$(0) TAB( 30)B$(1)
100 VTAB 15
110 PRINT "40 FOR I = 1 TO 3 : READ A(I) : NEXT I"
120 PRINT "50 RESTORE"
130 PRINT "60 FOR I = 4 TO 6 : READ A(I) : NEXT I"
140 PRINT "70 FOR I = 1 TO 5 : READ A$(I) : NEXT I"
150 PRINT : PRINT "80 DATA 76,40,67"
160 PRINT : PRINT "90 DATA "C$"SUE"B$"ANN"B$"JOE"B$"KIM"B$"JIM"C$
199 REM START THE DISPLAY
200 V1 = 1871:V2 = 1621:VT = 3:A1 = 1:B = 3: GOTO 220
210 V1 = 1143:V2 = 1621:VT = 6:A1 = 4:B = 6
220 FOR I = A1 TO B: POKE V1,I + 112
230 VT = VT + 1:V2 = V2 + 3: POKE V2,96
240 GOSUB 30: READ A(I)
250 VTAB VT: PRINT " I: SFC( 7)A(I): GOSUB 30
260 POKE V2,160: NEXT I: POKE V1,160: IF I > 4 THEN 300
270 POKE 1971,96: FOR I = V2 TO V2 - 5 STEP - 1
280 POKE I,160: POKE I - 1,96: FOR J = 1 TO 300: NEXT : NEXT : GOSUB 30:
290 POKE 1971,160: RESTORE : GOTO 210
300 V2 = 1875:V1 = 1271:VT = 3
310 FOR I = 1 TO 5:V2 = V2 + 6:VT = VT + 1

```



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Over 150,000 computer owners and novices attended the 1981 National Computer Shows and Office Equipment Expositions, and more than a quarter of a million are expected to be at the 1982 shows.

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Third Avenue

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September 16-19, 1982
11 AM to 6 PM Daily

DIRECTIONS: HWY 94 to
11th St Exit to Third Ave.

THE MID-WEST COMPUTER SHOW

Chicago
(Arlington Heights)
Arlington Park Racetrack
Exhibition Center

Thursday-Sunday
November 5-7, 1982
11 AM to 6 PM Daily

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TO RTE 53 EXIT AT
EUCLID AVE EAST

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Boston
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Prudential Center

Thursday-Sunday
November 11-14, 1982
11 AM to 6 PM Daily

DIRECTIONS: TAKE MASS
PIKE TO PRUDENTIAL
CENTER EXIT

THE SOUTHEAST COMPUTER SHOW

Atlanta
Atlanta Civic Center

Thursday-Sunday
December 9-12, 1982
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DIRECTIONS: TAKE MASS
395 PIEDMONT AVE NE
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```

320 POKE V1,I + 112: POKE V2,96: GOSUB 30: READ A$(I)
330 VTAB VT: HTAB 22: PRINT I SPC( 8)A$(I): GOSUB 30
340 POKE V2,160: NEXT
350 POKE V1,160
400 END
500 DATA 76,40,67
510 DATA "SUE","ANN","JOE","KIM","JIM"

```

Program 3.

```

20000 REM ATARI BASIC LINE DUMP
20010 REM TYPE GOTO 20000
20020 CLR
20030 BEGIN=PEEK(136)+256*PEEK(137)
20040 LINE=PEEK(BEGIN)+256*PEEK(BEGIN+1)

20050 IF LINE=20000 THEN PRINT "LAST LINE":END
20060 PRINT LINE,
20070 LENGTH=PEEK(BEGIN+2)
20080 FOR I=1 TO LENGTH
20090 PRINT PEEK(BEGIN+2+I);" ";
20100 NEXT I
20110 PRINT :PRINT "-----"
20120 BEGIN=BEGIN+LENGTH
20130 GOTO 20040

170 ? " 70 DATA SUE,ANN,JOE,KIM,JIM"
180 ? " 80 END";
190 REM START THE DISPLAY
200 FOR I=1 TO 8
210 POSITION 2,14+I+(I)*5)
220 PRINT "(ESC)(RIGHT)";
240 GET #1,A
250 ON I GOTO 260,290,300,400,410,600,600,600
260 POSITION 2,1:FOR J=1 TO 6:?"A";J;"
  >=?":SOUND 0,PEEK(53770),10,8
265 FOR W=1 TO 50:NEXT W:NEXT J:SOUND 0,0,0,0
270 ? "A$=";CHR$(34);CHR$(34);"(LEFT)";:
  FOR J=1 TO 15:?"(INSERT)";:SOUND 0,J,8,8:FOR W=1 TO 30:NEXT W:NEXT J
275 ? :?"T$=";CHR$(34);CHR$(34);"(LEFT)";:
  FOR J=1 TO 3:?"(INSERT)";:SOUND 0,J,8,8:FOR W=1 TO 30:NEXT W:NEXT J
280 SOUND 0,0,0,0:GOTO 600
290 FOR J=1 TO 10:POSITION 6,21:?"IDATA
  1(4 LEFT)";:SOUND 0,50,12,8:FOR W=1 TO 20:NEXT W:SOUND 0,0,0,0:?"DATA":NEXT J
295 GOTO 600
300 OFF=0
310 FOR J=1 TO 3:READ T$
320 POSITION 2,9:?"I=";J+3*OFF:POSITION 19,17+OFF:?"I READ T"
330 POSITION 8+3*(J+OFF*3),21:?"T$":READ T$
340 POSITION 2,10:?"T=";T$
345 GET #1,A:POSITION 8+3*(J+OFF*3),21:?"T$
350 POSITION 19,17+OFF:?"READ T":POSITION 26,17+OFF:?"IA(I)=T"
360 FOR K=1 TO 15:POSITION 9+K,10:?" ";T$;:GOSUB 50:NEXT K:?"(2 LEFT) "
370 FOR K=1 TO J+OFF*3:POSITION 24,10-K:?"T$;:GOSUB 50:?"(2 LEFT) ";:NEXT K
380 POSITION 24,J+OFF*3:?"T$;:POSITION 7,J+OFF*3:FOR K=1 TO 17:?"(DELETE)";:POKE 53279,0:NEXT K

```

Program 4.

```

10 GRAPHICS 0:POSITION 12,0:?"I BASIC I
  n Action I"
20 POKE 752,1
30 OPEN #1,4,0,"K:"
40 DIM L$(40),T$(20):GOTO 100
50 REM CLICK/PAUSE SUBROUTINE
60 POKE 53279,0:FOR W=1 TO 10:NEXT W:RETURN
100 POSITION 2,14:?"(37 R)":?
110 ? " 10 DIM A(6),A$(3*5),T$(3)"
120 ? " 20 RESTORE"
130 ? " 30 FOR I=1 TO 3:READ T:A(I)=T:NEXT I"
140 ? " 40 FOR I=4 TO 6:READ T:A(I)=T:NEXT I"
150 ? " 50 FOR I=1 TO 5:READ T$:
  A$(I*3-2,I*3)=T$:NEXT I"
160 ? " 60 DATA 76,40,67,29,14,33"

```

```

390 GET #1,A:POSITION 26,17+OFF:?"(I)=
T"
395 NEXT J:POSITION 2,9:?"I=";J+OFF*3:G
OTO 600
400 OFF=1:GOTO 310
410 FOR J=1 TO 5:POSITION 2,9:?"I=";J
420 POSITION 19,19:?"IREAD T$I":READ T$
:POSITION 7+J*4,22:?"T$
430 READ T$:POSITION 6,8:?"T$:GET #1,A
440 POSITION 19,19:?"READ T$":POSITION
6,20:?"I A$(I*3-2,I*3)=T$I":POSITION 7+J
*4,22:?"T$
450 FOR U=15 TO 0 STEP -1:SOUND 0,10+20*
RND(1),10,U:NEXT U
470 POSITION 3+J*3,7:?"T$
480 GET #1,A:POSITION 6,20:?"A$(I*3-2,I
*3)=T$":NEXT J:POSITION 2,9:?"I=";J:GOT
O 600
600 POSITION 2,14+I+(I>5):?" ";
610 NEXT I
620 POSITION 2,10:POKE 752,0:END
1000 DATA 1761,76,1401,40,1671,67,1291,2
9,1141,14,1331,33
1010 DATA ISUE1,SUE,IAN1,ANN,1JOE1,JOE,
IKIMI,KIM,1JIMI,JIM

```

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Infinite Precision Multiply

G. H. Watson
Newark, DE

$123 \times 456 = 56088$. Right? Sure! Just ask a young student and he/she will quickly work out something similar to:

```

  123
x 456
-----
 738
 615
 492
-----
56088

```

If you are near a microcomputer, you may verify this result by entering ?123*456 <CR>.

How about 123123×456456 ? At this point your young student may balk and suggest "Let's let the computer do it!" Unfortunately the computer may also balk at such a request. Entering ?123123*456456 <CR> into a PET yields the following result: 5.62002321E+10. With some further encouragement the student may work out 56200232088 as the correct product. Why the difference?

In PET BASIC most numbers are represented in floating-point format, which allows convenient handling of real numbers which may be positive or negative, integer, fractional, or mixed, and of greatly varying magnitude. The format in the PET is such that numbers have nearly nine digits of precision. This means that 123456789 may be represented exactly in this format, but something will have to be done for 1234567891. That something is called scientific notation — 1234567891 will be handled as 1.23456789E+09, where E+09 means that the decimal would be moved 9 spaces to the right. On the PET enter X=1234567891 <CR> and then enter ?X <CR>. Notice that the trailing digit "1" has been dropped; it would have been the tenth digit and only nine digits of precision are possible.

Scientific notation has great utility and nine digits of precision will be plenty for many cases of numerical calculation. Occasionally, though, you may run up against a calculation which requires infinite precision — you need the answer exactly (no lost digits). Recently I needed to know the exact product of several large numbers. Working the problem by hand and finding several errors, I

decided to write a short infinite precision multiply routine to check my answer. INFINI-MULT is the resulting BASIC program.

Using strings to represent the numbers is the trick for extending the precision. By operating on each string with the string function MID\$(,,), each digit of the number may be isolated and an arithmetic operation performed. Only single digit operations are performed in INFINI-MULT. The microcomputer is doing only second grade arithmetic — addition and multiplication of two numbers between zero and nine.

The result of the operation on two single-digit numbers may be a double-digit number. Here enters the carry digit. Most of the errors I make when doing arithmetic by hand involve the carry digit. Care must also be taken when programming for the carry digit. The subroutine at line 500 separates the double-digit number P into the carry digit C and adds the remaining digit onto the string D\$ from the left. For example, if P=25 and D\$="456" then line 500 will return with C=2 and D\$="5456".

In order to simplify handling the carry digits and make the program as straightforward as possible, the strings involved in the addition routine are made the same length by padding from the left with zeros (line 380). For instance, if Z\$="123" and A\$="45600" then we will pad Z\$ so that Z\$="00123". We also pad strings with zeros from the right in the multiplication routine so that the proper power of ten is obtained (line 330).

INFINI-MULT handles 123×456 as follows:

lines 250-330,	370-440
123	000
x 6	+ 738
738	738
123	0738
x 5	+6150
6150	6888
123	06888
x 4	+49200
49200	56088

If the two numbers to be multiplied differ in the number of digits, the multiplication routine will be faster with the smaller number as the multiplier (456 in example) and the larger number as the multiplicand (123 in example) — just as you learned in grade school. The digits "0" and "1" are treated preferentially in lines 270 and 280 so time will be saved if the number with many ones and zeros is used as the multiplier. It will be faster to multiply 456 by 123 in INFINI-MULT than 123 by 456.

I have made no provision for handling decimal points: this would be an interesting modification for you to make. To sidestep this limitation use the same trick that you learned in school: count the number

chips...chips...chips...chips...chips...chips...

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of places to the right which the decimal point must be moved to reach the last digit in the multiplicand and multiplier, add, and move that many places to the left in the product. For example, consider $1.23 \times .456$:

$$\begin{array}{r} 1.23 \quad 2 \text{ right } \rightarrow \quad 123 \\ \times .456 \quad +3 \text{ right } \rightarrow \quad \times 456 \\ \hline .56088 \quad \leftarrow 5 \text{ left} \quad 56088 \end{array}$$

INFINI-MULT follows the simple rules of arithmetic which you learned early in school. There may be faster or more sophisticated ways of getting the extra precision you desire. The PET/CBM PERSONAL COMPUTER GUIDE contains some interesting double-precision routines for addition, subtraction, and multiplication. Play around with INFINI-MULT and some evening when you feel like writing a quick program take a shot at INFINI-DIVI.

Program 1: Microsoft Version

```

100 REM INFINITE PRECISION MULTIPLY
110 REM G.H.WATSON 6/25/81
120
130 REM INITIALIZATION
140
150 DIM P,C,D$,J,Z,A,X,Y,X$,Z$,A$
160 DIM I,AL,ZL,XL,YL,Y$
170 INPUT "X = ";X$:INPUT "Y = ";Y$
180 XL=LEN(X$):YL=LEN(Y$)
190 I=XL+YL:DIM N$(9),Q$(I),C$(8)
200 FOR J=1TOI:Q$(J)="0"+Q$(J-1):NEXT J
210 FOR J=0TO9:N$(J)=CHR$(J+48):NEXT J
215 FOR J=1TO8:C$(J)=N$(J):NEXT J
220
230 REM MULTIPLICATION ROUTINE
240
250 FOR I=YLTO1 STEP-1:C=0:D$=""
260 Y=VAL(MID$(Y$,I,1))
270 IF Y=0 THEN 450
280 IF Y=1 THEN D$=X$:GOTO 330
290 FOR J=XLTO1 STEP-1
300 X=VAL(MID$(X$,J,1))
310 P=X*Y+C:GOSUB 500
320 NEXT J
330 A$=C$(C)+D$+Q$(YL-I)
340
350 REM ADDITION ROUTINE
360
370 ZL=LEN(Z$):AL=LEN(A$)
380 Z$=Q$(AL-ZL)+Z$:C=0:D$=""
390 FOR J=ALTO1 STEP-1
400 Z=VAL(MID$(Z$,J,1))
410 A=VAL(MID$(A$,J,1))
420 P=Z+A+C:GOSUB 500
430 NEXT J
440 Z$="":IF C THEN Z$=C$(C+1,C+1)
445 Z$(LEN(Z$)+1)=D$
450 NEXT I
460 REM
470 PRINT "Z=";Z$
480 END
490 REM
500 C=INT(P/10):T$=D$:D$=N$(P-C*10+1,P-C*10+1):D$(LEN(D$)+1)=T$:RETURN

```

```

440 Z$=C$(C)+D$
450 NEXT
460
470 PRINT "Z = ";Z$
480 END
490
500 C=INT(P/10):D$=N$(P-C*10)+D$:RETURN
READY.

```

Program 2: Atari Version

```

130 REM : INITIALIZATION
140 REM
150 DIM D$(99),X$(99),Z$(99),A$(99)
160 DIM Y$(99),T$(99)
170 PRINT "X=";:INPUT X$
175 PRINT "Y=";:INPUT Y$
180 XL=LEN(X$):YL=LEN(Y$)
190 I=XL+YL:DIM N$(10),Q$(I),C$(10)
200 FOR J=1 TO I:Q$(J,J)="0":NEXT J
210 N$="0123456789":C$=" 12345678 "
220 REM
230 REM : MULTIPLICATION ROUTINE
240 REM
250 FOR I=YL TO 1 STEP -1:C=0:D$=""
260 Y=VAL(Y$(I,I))
270 IF Y=0 THEN 450
280 IF Y=1 THEN D$=X$:GOTO 330
290 FOR J=XL TO 1 STEP -1
300 X=VAL(X$(J,J))
310 P=X*Y+C:GOSUB 500
320 NEXT J
330 A$="":IF C THEN A$=C$(C+1,C+1)
335 A$(LEN(A$)+1)=D$:IF YL-I THEN A$(LEN(A$)+1)=Q$(1,YL-I)
340 REM
350 REM : ADDITION ROUTINE
360 REM
370 ZL=LEN(Z$):AL=LEN(A$)
380 T$=Z$:Z$="":IF AL-ZL THEN Z$=Q$(1,AL-ZL)
385 Z$(LEN(Z$)+1)=T$:C=0:D$=""
390 FOR J=AL TO 1 STEP -1
400 Z=VAL(Z$(J,J))
410 A=VAL(A$(J,J))
420 P=Z+A+C:GOSUB 500
430 NEXT J
440 Z$="":IF C THEN Z$=C$(C+1,C+1)
445 Z$(LEN(Z$)+1)=D$
450 NEXT I
460 REM
470 PRINT "Z=";Z$
480 END
490 REM
500 C=INT(P/10):T$=D$:D$=N$(P-C*10+1,P-C*10+1):D$(LEN(D$)+1)=T$:RETURN

```

VARIABLE TABLE FOR INFINI-MULT

X\$	multiplicand
Y\$	multiplier
Z\$	product
A\$	intermediate addend
D\$	working string for creating A\$ and Z\$ from digits
X, Y	value of selected digit of X\$, Y\$
Z, A Z\$, A\$
XL, YL	length of X\$, Y\$
ZL, AL Z\$, A\$
C	carry digit
P	result formed by numerical operations on digits
J, I	indices for selecting digits from strings
Q\$()	zeroes for padding strings
N\$()	decimal numerals
C\$()	carry numerals, same as N\$() except that C\$(0)=" " and N\$(0)="0" and C\$(9) is unneeded.



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More About Numbers

Edmund N. Ricchezza

Certain numbers when acted upon in a certain manner will converge to a definite number. There are many of these, though the best known are Ulam's Conjecture, The 6174 Problem, and The Golden Mean.

Ulam's Conjecture states that any positive integer will always converge to "1" if acted upon as follows:

- 1) If it is even, divide by 2.
- 2) If it is odd, multiply by 3 and add 1.

For example, consider 15:

Since it is odd we multiply by 3 and add 1 obtaining	46
46 is even so we divide by 2 and obtain	23
Multiply 23 by 3 and add 1	70
Divide 70 by 2	35
Multiply 35 by 3 and add 1	106
Divide 106 by 2	53
Multiply 53 by 3 and add 1	160
Divide 160 by 2	80
Divide 80 by 2	40
Divide 40 by 2	20
Divide 20 by 2	10
Divide 10 by 2	5
Multiply 5 by 3 and add 1	16
Divide 16 by 2	8
Divide 8 by 2	4
Divide 4 by 2	2
Divide 2 by 2 Q E D	1

Programming this is elementary but it will reveal many curious situations. Consider this: 50,000,000 requires 106 operations to converge to

1 while the much smaller 63 requires 107 operations to converge to 1.

The "6174 Problem" states that any positive 4-digit integer except those with all the same digits will converge to "6174" when acted upon as follows:

1. Arrange the number in descending order.
2. Arrange the number in ascending order.
3. Subtract. Take this subtracted number as the new 4-digit number and repeat the process.

After not more than five iterations the difference will always be 6174. For example consider 4389:

9843	6543	8730	8532
<u>-3489</u>	<u>-3456</u>	<u>- 378</u>	<u>-2358</u>
6354	3087	8352	6174

This makes for an interesting and not too difficult program exercise.

Quotients of successive terms of the Fibonacci Sequence will converge to .61803398. The ancient Greeks called this the "Golden Mean" because it expressed the ideal ratio of width to length that gave the most aesthetically appealing building or room.

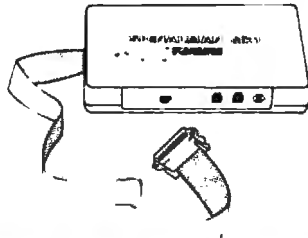
I found this relationship fascinating considering that Fibonacci was born c. 1170, centuries after the Greeks discovered this number.



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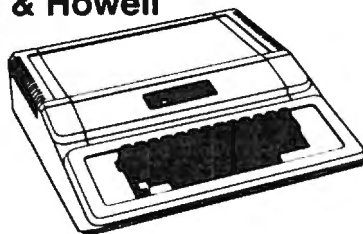
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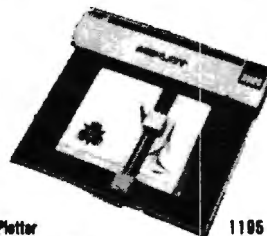
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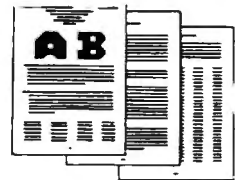
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Word Hunt

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This game is designed to test your ability to find specific words or letter sequences hidden in a 10 by 10 letter matrix. Scoring is based on the time it takes to enter your correct answer within a given time period determined by the skill level selected. The program uses very little memory and will easily run in 8K.

To play the game, first select the skill level you want to play at, between 1 and 5. One is the easiest, allowing the maximum time of approximately 1.5 minutes to find each word. Skill level 5, however, will only allow about 20 seconds to find each word.

Next enter a list of ten words, each being three to eight characters long. Only the letters A to Z may be entered, but they really do not have to be words. You can even use the game to make learning foreign languages more fun. If two people are playing, let one player enter the words for the other to find. Try to mix the word lengths, entering both long and short words for best results. If too many long words are entered it may take a while for the puzzle to be generated. If any word will not fit into the matrix, enter a new list of words when asked.

When the puzzle is ready, hit any key to start the game. Timing will start when the first word is shown.

Scoring for a correct answer is based on the amount of time it takes to respond, with 100 points maximum for each of ten words. If a correct answer is given in five seconds, you score 100 points. After that, your possible score decreases with time to a minimum of ten points for a correct answer. A wrong answer does not score any points and you only get *one* try for each word.

To enter your answer, you give a row and column number of the first character of the word followed by the direction code (see the diagram in the game!). Any invalid entries are discarded and you only type numbers, you do not type a comma or RETURN.

Before looking at how the program actually works, let's take a look at the major variables used in the program:

S – defines the size of the letter matrix to be created.

W – defines the number of words to be entered and used in the matrix.

M(S,S) – is the actual letter matrix, note that a floating point numeric matrix is used instead of a string matrix. More about this later.

W\$(W) – contains the word list.

L(W,3) – remembers the starting location and direction of each word after it has been placed in the letter matrix. Each entry directly corresponds to the entry in the same position in the word matrix.

P(S,S) and F(8) – are working matrices used to create the actual letter matrix used in the game.

Now let's take a look at how the program works. First the program gets the desired skill level (SL) as a number between 1 and 5. The program sets a default value of 3 on the input line that the user can change before hitting the RETURN key. Lines 130-290 then get the list of words and check each is a valid character string (A-Z). The words are put into the word list in alphabetical order as each word is entered by the user. This avoids the time consuming process of sorting the entire word list at the end. In this way, there is a short delay as each word is entered. This short delay is not even noticeable by the user!

Line 340 initializes the latter matrix to all *'s (decimal value 42). Now each word in the word list is inserted randomly in the letter matrix in the following fashion:

- 1) The point matrix is cleared (line 360) so we can remember what points in the matrix have been tried for a particular word in the word list.
- 2) Lines 400-440 check that there is still at least one point in the letter matrix that has not been tried (entry in P is still 0). If all points have been tried, the user is asked to enter a new list of words since this list will not fit properly in the letter matrix.
- 3) A random starting point (that has not been tried) is chosen in line 450.
- 4) The starting point is flagged as having been tried (P value now 1) and then a check is made to see if the matrix position is open (still *) or matches the first letter of the word (lines 460-470).
- 5) Now the direction matrix (F) is cleared to remember what directions have been tried from this starting point (line 490).
- 6) A check is made that at least one direction still hasn't been tried from this point (lines 500-510).
- 7) A random direction (that has not been tried) is chosen in line 520.

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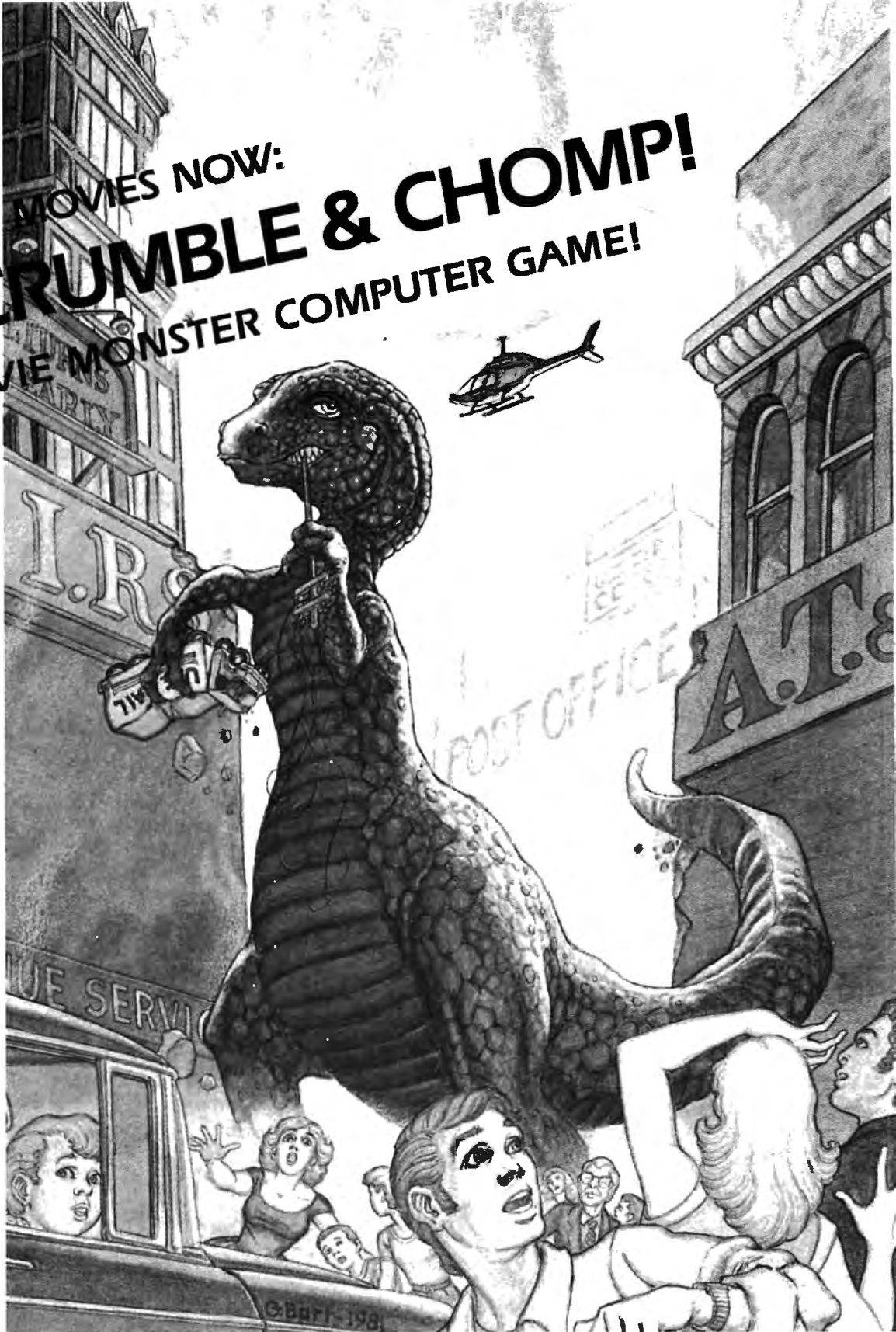
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8) Then the word is checked to see if it can physically fit in the matrix in the selected direction from the current starting point (lines 530-650). This insures the word will not exceed the boundaries of the letter matrix from this point.

9) If the word can fit, then each character position in the selected direction is checked against the corresponding character of the word (lines 760-690). Each character in the matrix must match the corresponding character in the word or must be unused (still *).

10) If the word can be entered at this starting point and in this direction, each letter is inserted in the latter matrix (lines 710-720).

Then the starting location and direction are saved for later use (line 740).

11) If the word will not fit, then the next direction is tried until all directions are exhausted from this point.

When all words have been put into the matrix, the remaining unused positions (still *) are filled in with random letters (lines 760-770).

Everything is now set to play the game, as soon as the player hits a key (lines 780-800). The letter matrix is displayed along with a direction code diagram and a score box (lines 820-960). A word is given to the player for him to find in the matrix and the timer is restarted (lines 970-1000). Then the program prompts the player for the starting location and direction code (lines 1020-1170). The values entered are then checked to see if correct, first against the values saved when the word was put into the matrix (lines 1190-1210). If the value does not match, then the program checks to see if a "double" was created when the unused positions were filled with random letters. Thus the program checks the player's answer again to insure it is right or wrong (lines 1230-1280). If a bad answer is entered, it is indicated and the correct answer is displayed with no score added (lines 1360-1430). A good answer is indicated and the appropriate score displayed and added to the player's total. The score is based on the selected skill level and the time it takes to enter the answer.

That's all there is to it! I should explain that a numeric vector was used for the actual letter matrix since it was easier and faster to use. Most people who have tried this game have found it to be very interesting and fun to play. At times it can even be educational. I only hope it's as much fun for you!

For those who might not want to type in the program, I'll supply copies on cassette tape for \$2. Be sure to send requests to me and not through the magazine.

Program 1: Atari Version

```

10 REM *** WORD HUNT ***
20 REM
30 REM BY: ROBERT W. BAKER
40 REM ATCO, NJ
50 REM *****
60 REM
70 OPEN #1,4,0,"K:"
80 S=10:W=10:DIM M$(S,S),W$(W*10),LNKW),P
(S,S),L(W,3),F(8),R$(10),T$(10)
85 T$="":FOR I=0 TO 9:W$(I*10+
1,I*10+10)=T$:NEXT I
90 POKE 752,0:PRINT "(CLEAR) (DOWN)WHAT S
KILL LEVEL"
100 ? :? "1 (EASY) - TO - 5 - (HARD)?3(2
LEFT)";
110 INPUT X:IF X<1 OR X>5 THEN 100
120 SL=6-X
130 ? "(2 DOWN)ENTER ";W;" WORDS,"
140 ? "Each 3 to 7 characters long(2 DOWN)
"
150 REM *** GET WORDS & PUT IN ORDER
160 REM *** LONGEST TO SHORTEST
170 FOR X=1 TO W:L(X,1)=0:L(X,2)=0:L(X,3
)=0
180 PRINT "WORD ";X:;INPUT R$
190 Q=LEN(R$)
200 IF Q<3 THEN ? "% TOO SHORT *":GOTO 1
80
210 IF Q>7 THEN ? "% TOO LONG *":GOTO 1
80
220 X9=0:T$="*":T$(2)=R$:T$(LEN T$+1)="
*":FOR Y=1 TO Q:A=ASC(T$(Y+1,Y+1))
230 IF A<65 OR A>90 THEN X9=1:Y=Q
240 NEXT Y:IF X9=1 THEN PRINT "% BAD WOR
D *":GOTO 180
250 IF X=1 THEN T$=R$:T$(Q+1)="*":W$(X*1
0-9,X*10)=T$:LNK X)=Q+1:GOTO 290
260 X9=0:FOR Y=1 TO X-1:IF Q<LNK Y)-1 TH
EN 280
270 FOR B=X TO Y+1 STEP -1:T$=W$(B-1)*1
0-9,(B-1)*10):W$(B*10-9,B*10)=T$:LNK B)=L
NK B-1):NEXT B
275 T$=R$:T$(Q+1)="*":W$(Y*10-9,Y*10)=T$
:LNK Y)=LEN T$):Y=X-1
280 NEXT Y:IF X9=0 THEN T$=R$:T$(Q+1)="*
":W$(X*10-9,X*10)=T$:LNK X)=LEN T$)
290 NEXT X
300 POKE 752,1:?"(CLEAR) (7 DOWN)That's
enough words!"
310 PRINT "(6 DOWN)Please be patient....
"
320 ? "(3 DOWN) I'm now makin
g the puzzle!"
330 REM *** INITIALIZE LETTER MATRIX ***

```


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```

340 FOR X=1 TO S:FOR Y=1 TO S:M(Y,X)=42:
NEXT Y:NEXT X:Q=0
350 REM *** INIT POINT MATRIX & GET NEXT
WORD
360 FOR X=1 TO S:FOR Y=1 TO S:P(Y,X)=0:N
EXT Y
370 NEXT X:Q=Q+1:IF Q>W THEN 760
380 G=LNK(Q)-2
390 REM *** TRY ALL POINTS FOR EACH WORD
400 X9=0:FOR X=1 TO S:FOR Y=1 TO S:IF P(
Y,X)=0 THEN X9=1:X=S:Y=S
410 NEXT Y:NEXT X:IF X9=1 THEN 450
420 REM *** WORD WILL NOT FIT, TRY AGAIN
430 ? "(CLEAR)This list of words will no
t all fit."
440 ? :? "Please enter another list of w
ords!":GOTO 130
450 A=INT(S*RND(1)+1):B=INT(S*RND(1)+1):
IF P(B,A)>0 THEN 450
460 P(B,A)=1:IF M(B,A)=42 THEN 490
470 IF M(B,A)>ASC(W$(Q*10-9)) THEN 400
480 REM *** TRY ALL DIRECTIONS FROM THIS
POINT
490 FOR X=1 TO 8:F(X)=0:NEXT X
500 X9=0:FOR X=1 TO 8:IF F(X)=0 THEN X9=
1:X=8
510 NEXT X:IF X9=0 THEN 400
520 D=INT(8*RND(1)+1):IF F(D)=1 THEN 520
530 F(D)=1:ON D GOTO 550,590,580,620,610
,650,640,560
540 REM *** CHECK WORD WILL FIT
550 IF (A+G)>S THEN 500
560 IF (B-G)<1 THEN 500
570 GOTO 670
580 IF (B+G)>S THEN 500
590 IF (A-G)>S THEN 500
600 GOTO 670
610 IF (A-G)<1 THEN 500
620 IF (B+G)>S THEN 500
630 GOTO 670
640 IF (B-G)<1 THEN 500
650 IF (A-G)<1 THEN 500
660 REM *** CHECK WORD MATCHES INTO MATR
IX
670 X=A:Y=B:X9=0:FOR N=2 TO G+1:GOSUB 15
50:IF M(Y,X)=42 THEN 690
680 IF M(Y,X)>ASC(W$((Q-1)*10+N)) THEN
X9=1:N=G+1
690 NEXT N:X=A:Y=B:IF X9=1 THEN 500
700 REM *** ENTER WORD
710 FOR N=1 TO G+1:IF M(Y,X)=42 THEN M(Y
,X)=ASC(W$((Q-1)*10+N))
720 GOSUB 1550:NEXT N
730 REM *** SAVE START & DIRECTION INFO
740 L(Q,1)=A-1:L(Q,2)=B-1:L(Q,3)=D:IF D<
W THEN 360
750 REM *** FILL IN SPACES
760 FOR Y=1 TO S:FOR X=1 TO S:IF M(Y,X)=
42 THEN M(Y,X)=INT(25*RND(1)+65)
770 NEXT X:NEXT Y:WP=0:TS=0
780 ? "(CLEAR)<10 DOWND                                IR
EADY!"
790 ? "(6 DOWND)Depress any key when read
y to play!"
800 IF PEEK(764)=255 THEN 800
805 POKE 764,255
810 REM *** SET UP DISPLAY
820 ? "(CLEAR)<DOWND      1 COLUMN1";:POKE
85,26:?"IW O R D!"
830 REM *** PRINT 'ROW' DOWN LEFT COLUMN
840 REM *** START OUT DOWN 4
850 REM *** LATER DO 5 UP & 3 RIGHT
860 ? "(4 DOWND)IRI<DOWND<LEFT>|OI<DOWND<
LEFT>|MI<5 UP><3 RIGHT>";
870 FOR X=0 TO S-1:? X:;NEXT X:? :Y=1:GO
SUB 1650
880 FOR Y=1 TO S:? "(2 RIGHT)";Y-1;"(=)"
;
890 FOR X=1 TO S:? CHR$(M(Y,X));:NEXT X
900 ? "(=)":NEXT Y:Y=0:GOSUB 1650
910 ? :?"IDIRECTIONS:1":?"<DOWND 7 8
1"
920 ? " (G {=} {F})":?" 6(R) (T) (R)2":?
" (F) {=} {G}":?" 5 4 3"
930 G=16:GOSUB 1700:?" | SCORE 1"
:POKE 85,25:?"(U) (B)"
940 POKE 85,25:?"(U) 0 (B)"
950 POKE 85,25:?"(U) (B)"
955 POKE 85,25:?"(9 MD"
960 G=0:GOSUB 1700:?"
":REM <-- 19 SPACES
970 WP=WP+1:IF WP>W THEN 1450
980 Q=LNK(WP)-1
990 REM *** NEXT WORD
1000 GOSUB 1700:POKE 85,29-(Q/2):? W$((W
P-1)*10+1,(WP-1)*10+Q)
1005 POKE 20,0:POKE 19,0:REM KILL RTCLK
1010 REM *** GET START LOC
1020 G=3:GOSUB 1700:?"STARTING LOCATION
":POKE 85,20:?"(ROW,COLUMN):"
1030 FOR G=6 TO 14:GOSUB 1700
1040 ? " ":NEXT G:G=6:
GOSUB 1700:REM <-- 19 SPACES
1050 GET #1,B:IF B=155 THEN 1050
1070 PRINT CHR$(B);",":;IF B=48 THEN B=0
:GOTO 1090
1080 B=B-48:IF B<1 OR B>9 THEN PRINT "(2
BACK S)":;GOTO 1050
1090 GET #1,A
1100 IF A=155 THEN 1090
1110 PRINT CHR$(A):;IF A=48 THEN A=0:GOT

```

the SOFTWARE connection For Atari Only

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The following require joystick controllers

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```

0 1140
1120 A=A-48:IF A<1 OR A>9 THEN 1030
1140 G=8:GOSUB 1700:PRINT "DIRECTION:":?
:POKE 85,20:?" (LEFT)";
1150 GET #1,D
1160 IF D=155 THEN 1150
1170 PRINT CHR$(D);:D=D-48:IF D<1 OR D>8
THEN 1140
1180 REM *** CHK IF GOOD INFO INPUT
1190 WT=PEEK(20)+256*PEEK(19):IF B<>L(WP
,2) THEN 1230
1210 IF D=L(WP,3) THEN 1360
1220 REM *** CHK IF A DOUBLE MAY EXIST
1230 X=A+1:Y=B+1:G=L(WP)-1:IF M(Y,X)<>A
SC(W$(WP*10-9)) THEN 1300
1240 X9=0:FOR N=2 TO G:GOSUB 1550:IF X<1
OR X>10 THEN 1270
1250 IF Y<1 OR Y>10 THEN 1270
1260 IF M(Y,X)=ASC(W$(WP-1)*10+N)) THEN
1280
1270 X9=1:N=G
1280 NEXT N:IF X9=0 THEN 1360
1290 REM *** BAD START/DIR - NO SCORE
1300 G=6:GOSUB 1700:PRINT "
";:B=L(WP,2):A=L(WP,1):REM 14 SPACES
1310 ? B;" ";A
1320 G=10:GOSUB 1700:?" ";L
(WP,3):REM 13 SPACES
(WP,3):REM 13 SPACES
1330 G=12:GOSUB 1700:?"(ESC){UP}
(ESC){UP}":REM 13 SPACES
1340 G=13:GOSUB 1700:?"(Z) INOI, CORREC
T (C)":GOTO 1420
1350 REM *** GOOD ANSWER - GET SCORE
1360 IF WT<<(SL*60) THEN WS=100:GOTO 1390
:REM <- MAX SCORE
1370 IF WT<(SL*1200) THEN WS=10:GOTO 139
0:REM <- MIN SCORE
1380 WS=5+INT(((SL*1200)-WT)/60)
1390 G=12:GOSUB 1700:?"(ESC){UP}
1400 G=13:GOSUB 1700:?"(Z) IYESI, ";WS;
" POINTS":TS=TS+WS
1410 REM *** UPDATE TOTAL SCORE
1420 G=18:GOSUB 1700:?"(8 RIGHT)";TS
1430 FOR X=1 TO 500:NEXT X:GOTO 960
1440 REM *** END GAME ***
1450 POSITION 2,15
1460 FOR X=1 TO 8:?" " " :NEXT
X:REM <- 12 SPACES
1470 FOR G=-2 TO 14:GOSUB 1700
1480 PRINT " " " :NEXT G:RE
M 17 SPACES
1490 POSITION 2,15:?"PLAY AGAIN (Y OR N
) ?"
1500 GET #1,R
1510 IF R=ASC("Y") THEN 90

```

```

1520 IF R<>ASC("N") THEN 1500
1530 END
1540 REM *** SUBR TO INC COORDINATES IN
DIR
1550 ON D GOTO 1560,1570,1580,1590,1600,
1610,1620,1630
1560 Y=Y-1
1570 X=X+1:RETURN
1580 X=X+1
1590 Y=Y+1:RETURN
1600 Y=Y+1
1610 X=X 1:RETURN
1620 X=X-1
1630 Y=Y-1:RETURN
1640 REM *** SUBR FOR BOT TOP/BOTTOM
1650 PRINT "(3 RIGHT)";:IF Y=1 THEN ? "(
0)";:GOTO 1670
1660 PRINT "(Z)";
1670 FOR X=0 TO S-1:?"(R)";:NEXT X:IF Y
=1 THEN PRINT "(E)":RETURN
1680 ? "(C)":RETURN
1690 REM *** SUBR TO POSITION
1700 POSITION 20,G+2:RETURN

```

Program 2: Microsoft Version

```

10 REM ***** W O R D H U N T ***
**
20 REM
30 REM BY: ROBERT W. BAKER, ATCO, ~
NJ
40 REM
50 REM *****
**
60 :
70 FOR X=1 TO VAL(RIGHT$(TI$,2)) :
R=RND(1) :NEXT :POKE 59468
,12
80 S=10 :W=10 :DIM M(S,S),W$(W),P(
S,S),L(W,3),F(8)
90 PRINT"{CLEAR}{DOWN}WHAT SKILL L
EVEL"
100 PRINT :PRINT"1 (EASY) - TO - 5 ~
(HARD) 3{03 LEFT}";
110 INPUT R$:X=VAL(R$) :IF X<1 OR ~
X>5 THEN 90
120 SL=6-X
130 PRINT"{02 DOWN}ENTER"W"WORDS,"
140 PRINT :PRINT"EACH 3 TO 8 CHARAC
TERS LONG{02 DOWN}
150 REM **** GET WORDS & PUT IN ORD
ER
160 REM **** LONGEST TO SHORTEST
170 FOR X=1 TO W :L(X,1)=0 :L(X,2)=
0 :L(X,3)=0
180 PRINT"WORD";X;TAB(8);"{02 RIGHT

```

```

RIGHT}?{03 LEFT}";
190 INPUT R$: Q=LEN(R$)
200 IF Q<3 THEN PRINT TAB(26); "{UP}
* TOO SHORT *": GOTO 180
210 IF Q>8 THEN PRINT TAB(26); "{UP}
* TOO LONG *": GOTO 180
220 X9=0 :FOR Y=1 TO Q :A=ASC(MID$(
***+R$+***, Y+1, 1))
230 IF A<65 OR A>90 THEN X9=1 :Y=Q
240 NEXT Y :IF X9=1 THEN PRINT TAB(
26); "{UP}* BAD WORD *": G
OTO 180
250 IF X=1 THEN W$(X)=R$+*** :GOTO ~
290
260 X9=0 :FOR Y=1 TO X-1 :IF Q<=LEN
(W$(Y))-1 THEN 280
270 FOR B=X TO Y+1 STEP -1 :W$(B)=W
$(B-1) :NEXT B :W$(Y)=R$+
*": X9=1 :Y=X-1
280 NEXT Y :IF X9=0 THEN W$(X)=R$+
*":
290 NEXT X
300 PRINT"{CLEAR}{07 DOWN}"; SPC(8);
"THAT'S ENOUGH WORDS!": RE
M <-- 7 DOWN
310 PRINT"{06 DOWN}PLEASE BE PATIEN
T ....." :REM <-- 6 DOWN
320 PRINT"{03 DOWN}"; SPC(12); "I'M N
OW MAKING THE PUZZLE!
330 REM **** INITIALIZE LETTER MATR
IX
340 FOR X=1 TO S :FOR Y=1 TO S :M(Y
,X)=42 :NEXT Y :NEXT X :Q=
0
350 REM **** INIT POINT MATRIX & GE
T NEXT WORD
360 FOR X=1 TO S :FOR Y=1 TO S :P(Y
,X)=0 :NEXT Y
370 NEXT X :Q=Q+1 :IF Q>W THEN 760
380 G=LEN(W$(Q))-2
390 REM **** TRY ALL POINTS FOR EAC
H WORD
400 X9=0 :FOR X=1 TO S :FOR Y=1 TO ~
S: IF P(Y,X)=0 THEN X9=1 :
X=S :Y=S
410 NEXT Y :NEXT X: IF X9=1 THEN 45
0
420 REM **** WORD WILL NOT FIT, TRY
AGAIN!
430 PRINT"{CLEAR}THIS LIST OF WORDS
WILL NOT ALL FIT
440 PRINT :PRINT"PLEASE ENTER ANOTH
ER LIST OF WORDS !": GOTO ~
130
450 A=INT(S*RND(1)+1) :B=INT(S*RND(
1)+1) :IF P(B,A)<>0 THEN 4
50
460 P(B,A)=1 :IF M(B,A)=42 THEN 490
470 IF M(B,A) <> ASC(LEFT$(W$(Q), 1)
) GOTO 400
480 REM **** TRY ALL DIRECTIONS FRO
M THIS POINT
490 FOR X=1 TO 8 :F(X)=0 :NEXT X
500 X9=0 :FOR X=1 TO 8 :IF F(X)=0 T
HEN X9=1 :X=8
510 NEXT X :IF X9=0 THEN 400
520 D=INT(8*RND(1)+1) :IF F(D)=1 GO
TO 520
530 F(D)=1 :ON D GOTO 550,590,580,6
20,610,650,640,560
540 REM **** CHECK WORD WILL FIT
550 IF (A+G)>S THEN 500
560 IF (B-G)<1 THEN 500
570 GOTO 670
580 IF (B+G)>S THEN 500
590 IF (A+G)>S THEN 500
600 GOTO 670
610 IF (A-G)<1 THEN 500
620 IF (B+G)>S THEN 500
630 GOTO 670
640 IF (B-G)<1 THEN 500
650 IF (A-G)<1 THEN 500
660 REM **** CHECK WORD MATCHES INT
O MATRIX
670 X=A :Y=B :X9=0 :FOR N=2 TO G+1 ~
:GOSUB 1550 :IF M(Y,X)=42 ~
GOTO 690
680 IF M(Y,X)<>ASC(MID$(W$(Q), N, 1))
THEN X9=1 :N=G+1
690 NEXT N :X=A :Y=B :IF X9=1 THEN ~
500
700 REM **** ENTER WORD
710 FOR N=1 TO G+1 :IF M(Y,X)=42 TH
EN M(Y,X)=ASC(MID$(W$(Q), N
, 1))
720 GOSUB 1550 :NEXT N
730 REM **** SAVE START & DIRECTION
INFO
740 L(Q,1)=A-1 :L(Q,2)=B-1 :L(Q,3)=
D :IF Q<W THEN 360
750 REM **** FILL IN SPACES
760 FOR Y=1 TO S :FOR X=1 TO S :IF ~
M(Y,X)=42 THEN M(Y,X)=INT(
25*RND(1)+65)
770 NEXT X :NEXT Y :WP=0 :TS=0
780 PRINT"{CLEAR}{10 DOWN}"; TAB(15)
; "{REV}READY" :REM <-- 10 ~
DOWN
790 PRINT"{06 DOWN} DEPRESS ANY KE
Y WHEN READY TO PLAY !": R
EM <-- 6 DOWN

```

```

800 R$="" :GET R$ :IF R$="" THEN 80
0
810 REM **** SET UP DISPLAY
820 PRINT"{CLEAR}{DOWN} {REV}COL
UMN";TAB(25);"{REV}W O R D
"
830 REM *** PRINT 'ROW' DOWN LEFT C
OLUMN
840 REM *** START OUT DOWN 4
850 REM *** LATER DO 5 UP & 3 OVER
860 PRINT"{04 DOWN}{REV}R{DOWN}{LEF
LEFT}O{DOWN}{LEFT}W{05 UP}
{03 RIGHT}{OFF}";
870 FOR X=0 TO S-1 :PRINT RIGHT$(ST
R$(X),1); :NEXT X :PRINT :
Y=1 :GOSUB 1650
880 FOR Y=1 TO S :PRINT"{02 RIGHT}"
;RIGHT$(STR$(Y-1),1);"]";
890 FOR X=1 TO S :PRINT CHR$(M(Y,X)
); :NEXT X
900 PRINT"]" :NEXT Y :Y=0 :GOSUB 16
50
910 PRINT :PRINT"{REV}DIRECTIONS:" ~
:PRINT"{DOWN} 7 8 1"
920 PRINT" M]N" :PRINT" 6@Q@2" :
PRINT"N]M" :PRINT" 5 4 3"
930 G=16 :GOSUB 1700 :PRINT" {R
REV} SCORE " :PRINT TAB(
25);"5 6
940 PRINT TAB(25);"5 0 6"
950 PRINT TAB(25);"5 6" :PRIN
T TAB(25);"8888888888
960 G=0 :GOSUB 1700 :PRINT" ~
" :REM <-- 19 S
PACES
970 WP=WP+1 :IF WP>W THEN 1450
980 Q=LEN(W$(WP))-1
990 REM **** NEXT WORD
1000 GOSUB 1700 :PRINT TAB(29-(Q/2))
;LEFT$(W$(WP),Q) :TI$="000
000"
1010 REM **** GET START LOC
1020 G=3 :GOSUB 1700 :PRINT"STARTING
LOCATION" :PRINT TAB(20);
"(ROW,COLUMN):
1030 FOR G=6 TO 14 :GOSUB 1700
1040 PRINT" " :NE
XT G :G=6 :GOSUB 1700 :REM
<-- 20 SPACES
1050 B$="" :GET B$ :IF B$="" THEN 10
50
1060 IF ASC(B$)=13 THEN 1050
1070 PRINT B$;","; :IF B$="0" THEN B
=0 :GOTO 1090
1080 B=VAL(B$) :IF B<1 OR B>9 THEN]P
RINT"{02 LEFT} {02 LEFT}"
; :GOTO 1050
1090 A$="" :GET A$ :IF A$="" THEN 10
90
1100 IF ASC(A$)=13 THEN 1090
1110 PRINT A$ :IF A$="0" THEN A=0 :G
OTO 1140
1120 A=VAL(A$) :IF A<1 OR A>9 THEN 1
030
1130 REM **** GET DIRECTION
1140 G=8 :GOSUB 1700 :PRINT"DIRECTIO
N:" :PRINT :PRINT TAB(20);
" {LEFT}";
1150 GET D$ :IF D$="" THEN 1150
1160 IF ASC(D$)=13 THEN 1150
1170 PRINT D$ :D=VAL(D$) :IF D<1 OR ~
D>8 THEN 1140
1180 REM **** CHK IF GOOD INFO INPUT
1190 WT=TI :IF B<>L(WP,2) THEN 1230
1200 IF A<>L(WP,1) THEN 1230
1210 IF D=L(WP,3) THEN 1360
1220 REM **** CHK IF A DOUBLE MAY EX
IST
1230 X=A+1 :Y=B+1 :G=LEN(W$(WP))-1 :
IF M(Y,X)<>ASC(LEFT$(W$(WP)
),1) THEN 1300
1240 X9=0 :FOR N=2 TO G :GOSUB 1550 ~
:IF X<1 OR X>10 THEN 1270
1250 IF Y<1 OR Y>10 THEN 1270
1260 IF M(Y,X)=ASC(MID$(W$(WP),N,1))
THEN 1280
1270 X9=1 :N=G
1280 NEXT N :IF X9=0 THEN 1360
1290 REM **** BAD START/DIR - NO SCO
RE
1300 G=6 :GOSUB 1700 :PRINT SPC(14);
:B$=STR$(L(WP,2)) :A$=STR
$(L(WP,1))
1310 PRINT RIGHT$(B$,LEN(B$)-1);",";
RIGHT$(A$,LEN(A$)-1)
1320 G=10 :GOSUB 1700 :PRINT SPC(13)
;L(WP,3)
1330 G=12 :GOSUB 1700 :PRINT"^";SPC(
13);"^"
1340 G=13 :GOSUB 1700 :PRINT"J {REV}
NO{OFF}, CORRECT K" :GOTO ~
1420
1350 REM **** GOOD ANSWER - GET SCOR
E
1360 IF WT<(SL*60) THEN WS=100 :GOTO
1390 :REM <-- MAX SCORE
1370 IF WT>(SL*1200) THEN WS=10 :GOT
O 1390 :REM <-- MIN SCORE
1380 WS=5+INT(((SL*1200)-WT)/60)
1390 G=12 :GOSUB 1700 :PRINT"^"
1400 G=13 :GOSUB 1700 :PRINT"J {REV}

```

```

YES{OFF},";WS;"POINTS" :TS
=TS+WS
1410 REM **** UPDATE TOTAL SCORE
1420 G=18 :GOSUB 1700 :PRINT"{07 RI
G RIGHT}";TS
1430 FOR X=1 TO 1000 :NEXT X :GOTO
960
1440 REM **** END GAME ****
1450 PRINT"{HOME}{15 DOWN}" :REM <-
- DOWN 15
1460 FOR X=1 TO 6 :PRINT"
~ " :NEXT X :REM <-- 12 SPA
CES
1470 FOR G=-2 TO 13 :GOSUB 1700
1480 PRINT" " :NEXT
~ G :REM 17 SPACES
1490 PRINT"{HOME}{20 DOWN}PLAY AGAI
N (Y OR N) ?" :REM <-- DOWN
20
1500 R$="" :GET R$ :IF R$="" THEN 1
500
1510 IF R$="Y" THEN 90
1520 IF R$<>"N" THEN 1500
1530 END
1540 REM **** SUBR TO INCR COORDINA
TES IN DIR
1550 ON D GOTO 1560,1570,1580,1590,
1600,1610,1620,1630
1560 Y=Y-1
1570 X=X+1 :RETURN
1580 X=X+1
1590 Y=Y+1 :RETURN
1600 Y=Y+1
1610 X=X-1 :RETURN
1620 X=X-1
1630 Y=Y-1 :RETURN
1640 REM **** SUBR FOR BOX TOP/BOTT
OM
1650 PRINT"{03 RIGHT}"; :IF Y=1 THE
N PRINT"0"; :GOTO 1670
1660 PRINT"=";
1670 FOR X=0 TO S-1 :PRINT"@"; :NEX
T X :IF Y=1 THEN PRINT"." :
RETURN
1680 PRINT"=" :RETURN
1690 REM **** SUBR TO POSITION
1700 PRINT"{HOME}"TAB(20); :FOR X9=
1 TO G+3 :PRINT"{DOWN}"; :N
EXT X9 :RETURN

```

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WARLOCK'S REVENGE

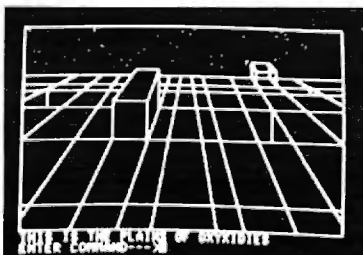


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Count The Hearts

Christopher J. Flynn
Herndon, VA

"Count the Hearts" is a VIC program which will help you to develop your child's counting skills. VIC will display a certain number of hearts on your television screen. Ask your child to count them. If your child can correctly count the hearts, he or she will be rewarded by a duet of chirping birdies. Otherwise, ... To challenge older children, you can place a limit on the time VIC allows for a response.

Once it is set up, no reading is required to play "Count the Hearts." However, preschoolers will probably need you to help them with the keyboard.

Setting Up

When you first start "Count the Hearts," it will ask you for a range of numbers and a time limit.

You can tailor the game to your child's counting skills by trying different number ranges. For example, you may want to start with numbers between one and five. Gradually, a child will work up to counting up to ten. If you notice difficulties with some numbers, you might want to work within that range (say from six to nine).

Here is how VIC will ask you to set the number range:

1. VIC will display:
ENTER NUMBER RANGE
LOW NUMBER (1) ?
2. You should type in the low number in the range (don't forget to hit RETURN). If you just hit RETURN, VIC will use one as the low number.
3. Next VIC will ask:
HIGH NUMBER (9) ?
4. Now type in the high number. Again, if you just hit RETURN, VIC will use nine as the high number.

VIC will make sure that your low number is really lower than your high number. It will also make sure that neither number is greater than 484. Why 484? Well, that's how many spaces are left on the screen for displaying the hearts.

The time limit gives you a way to speed up "Count the Hearts." If you don't take a guess at how many hearts there are within the time limit, then VIC will let you know that time's up. VIC will then just start another game.

VIC will ask you for the time limit:

5. VIC will display:
TIME LIMIT PER SET
SECONDS (120) ?

6. Type in the number of seconds you want to use for the time limit. If you just type RETURN, VIC will set the time limit to 120 seconds or two minutes.

By the way, if, in any of the above steps, VIC didn't understand your response, it will either ask the question again or ask you to repeat your response.

Counting Hearts

O.K. The television screen goes blank for just an instant. In that brief instant VIC is deciding how many hearts it will ask you to count. Then, one by one, VIC displays the hearts at random locations on the television screen. As it shows each new heart, VIC says in a deep voice, "BEEP!". Notice how VIC paints the hearts in different colors.

Now VIC will ask:

HOW MANY HEARTS ?

Ask your child to count them. Type in the number (don't forget RETURN!) and see what happens. What happens if your child gives the right answer? How about a wrong answer? What is your child's reaction?

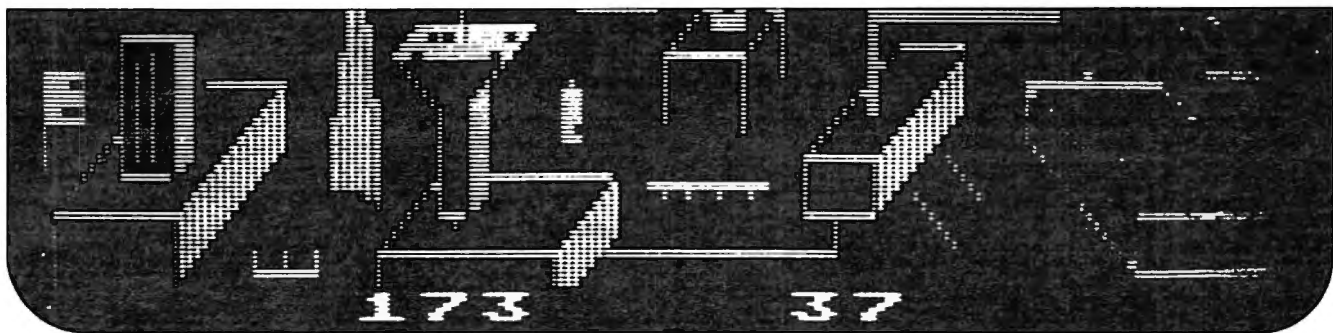
VIC will start a new game when the right answer is typed in or when time runs out and nothing has been heard from the keyboard. VIC is very patient with small folks learning to count. When a wrong answer is given, VIC just resets its timer and gives you another try.

Scoring

When you are finished playing "Count the Hearts", just hit the F1 key in reply to the "HOW MANY HEARTS ?" question. VIC will promptly clear the screen and tell you:

- how many games were played
- how many correct answers there were
- how many wrong answers there were
- how many times the player ran out of time

By keeping track of the number range (VIC shows you the range you used) and the scores, you can note your child's progress. For example, do you notice a little slowness in your child's learning to count past ten? We did. That seems to be the upper limit for our our three year old for a while.



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Create your own fast action graphics game for the Atari 400 or 800 using its player missile graphics features. By using player data stored as strings, players can be moved or changed (for animation) at machine language speed. All this is done with string variables (PO\$(Y)=SHIP4). This program is designed to permit creation of up to 4 players on the screen, store them as string data and then immediately try them out in the demo game included in the program. Instructions for use in your own game are included. **PM EDITOR** was used to create the animated characters in **ARTWORX RINGS OF THE EMPIRE** and **ENCOUNTER AT QUESTAR IV**.
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ROCKET RAIDERS by Richard Petersen (Atari 24K)
Defend your asteroid base against pulsar bombs, rockets, lasers, and the dreaded "stealth saucer" as aliens attempt to penetrate your protective force field. Precise target sighting allows you to fire at the enemy using magnetic impulse missiles to help protect your colony and its vital structures.
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INTRUDER ALERT! by Dennis Zander (Atari, 16K)
This is a fast paced action game in which you must escape from the "Dreadstar" with the secret plans. The droids are after you and you must find and enter your ship in order to escape. If you fail, the rebellion is doomed.
PRICE \$16.95 cassette \$20.95 diskette

THE RINGS OF THE EMPIRE: by Dennis Zander (Atari 16K)
The Empire has developed a series of battle stations protected by one or more rings of energy. You must destroy these weapons by attacking them in your Y-wing fighter armed with Zydon torpedoes. Each time you blast through the rings and destroy the station, the Empire develops a new station with more protective rings.
PRICE \$16.95 cassette \$20.95 diskette

FOREST FIRE: by Richard Petersen (Atari, 24K)
Using excellent color graphics, your Atari is turned into a fire scanner to help you direct operations to contain a forest fire. You must compensate for changes in wind, weather and terrain. Not protecting valuable property can result in startling penalties. Life-like variables make **FOREST FIRE** a very suspenseful and challenging simulation.
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PILOT: by Michael Pro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. **PILOT** produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE \$16.95 cassette \$20.95 diskette

ALPHA FIGHTER: by Douglas McFarland (Atari, 16K)
Consisting of two different programs, **ALPHA FIGHTER** requires you to destroy the alien starships. As you become more successful, the games get harder and harder.
PRICE \$14.95 cassette \$18.95 diskette

GIANT SLALOM: by Dennis Zander (Atari, 16K)
Bring the Winter Olympics to your computer anytime of the year! Use the joystick to guide your skier's path down a giant slalom course consisting of open and closed gates. Choose from three levels of difficulty. Take practice runs or compete against from two to eight additional skiers.
PRICE \$15.95 cassette \$19.95 diskette

HODGE PODGE: by Marsha Meredith (Apple 48K, Applesoft or Integer BASIC)
This captivating program is a marvelous learning device for children from 18 months to 6 years. **HODGE PODGE** consists of many cartoons, animations and songs which appear when any key on the computer is depressed. A must for any family containing young children and an Apple.
PRICE \$19.95 diskette

STUD POKER: by Jerry White (Atari, 16K)
This is the classic gambler's card game. You will find the computer to be a worthy opponent who occasionally bluffs but never cheats! **STUD POKER** employs all of the Atari's sound, color and graphics capabilities.
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BLOCKADE: by Edward Schneider (Atari, 16K)
Every games library needs **Blockade** program, and this is one of the best. Choose from three levels of difficulty and play against another person or by yourself against the clock.
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TEACHER'S PET: by Arthur Walsh (Atari, Apple, TRS-80, PET, North Star and CP/M (MBASIC) systems)
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This program is very "user friendly" yet employs all essential features needed for serious text editing with minimal memory requirements. Features include common sense operation, two different justification techniques, automatic line centering and straightforward text merging and manipulation. **TEXT EDITOR** files are compatible with **ARTWORX FORM LETTER SYSTEM**.
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The very popular **MAIL LIST 2.2** has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. **MAIL LIST** is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and **MAIL LIST** will even find and delete duplicate entries! The address files created with **MAIL LIST** are completely compatible with **ARTWORX FORM LETTER SYSTEM**.
PRICE \$49.95 diskette

THE VAULTS OF ZURICH: by Felix and Ted Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: **THE OPEC OIL DEEDS!**
PRICE \$21.95 cassette \$25.95 diskette

BRIDGE 2.0 by Arthur Walsh (Atari (24K), Apple TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, **BRIDGE 2.0** is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE \$17.95 cassette \$21.95 diskette

ENCOUNTER AT QUESTAR IV: by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend **Questar Sector IV** from the dreaded **Zentarians**. Using your plasma beam, hyperspace engines and wits to avoid **Zentarian** mines and death phasers, you struggle to stay alive. This **BASIC/Assembly** level program has super sound, full player missile graphics and real time action.
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Hints

You probably don't need to be reminded that the attention span of preschoolers is not long. Try to move on to another activity before your child gets bored and begins to act silly. You want your child to remember counting as something that is fun to do.

One way for you to help beginners is for you to point to the hearts very slowly one by one. Let your child count them as you point to them. Gradually your child will take over the pointing. And, before you know it, your child will be typing in the numbers on the keyboard! Experiment. Try out different arrangements. What works best for you?

The program will run on a standard VIC without memory expansion. If you need to, you should be able to modify Count the Hearts without too much trouble.

Now you're ready to play "Count the Hearts"! But remember, to stop the game and see your score, all you need to do is press the F1 key. Have fun.

Program 1: Microsoft Version

```

100 REM VIC-20
110 REM COUNT THE HEARTS
120 REM V1.0 7/81
130 REM
200 REM
210 REM HEARTS.BEGIN
220 GOSUB 30000
230 REM PLAY GAMES
240 GOSUB 1000
250 IF Q=0 THEN 240
260 REM HEARTS.END
270 GOSUB 31000
280 END
1000 REM PLAY GAMES
1010 PRINT CHR$(147)
1020 REM DISPLAY HEARTS
1030 N=LO+INT((HI-LO+1)*RND(1))
1040 FOR I=1 TO N
1050 P=INT(484*RND(1))
1060 CL=INT(8*RND(1)):IF CL=1 THEN 1
    060
1070 IF PEEK(VA+P)=83 THEN 1050
1080 POKE VA+P,83
1090 POKE CA+P,CL
1100 POKE VL,15
1110 POKE S2,200
1120 FOR Z=1 TO 400:NEXT
1130 POKE S2,0:POKE VL,0
1140 NEXT I
1150 G=G+1:REM GAMES
1160 PRINT CHR$(19);
1170 FOR I=1TO21:PRINT" ";:NEXT
1180 PRINTCHR$(19);"HOW MANY HEARTS ~
    ? ";
1190 REM GET RESPONSE
1200 GOSUB 3000
1210 IF R$="QUIT" THEN Q=1:RETURN
1220 IF R$="TIME" THEN GOSUB 9000:RE
    TURN
1230 REM O.K.?
1240 R=VAL(R$)
1250 IF R<>N THEN GOSUB 5000:GOTO 11
    60
1260 IF R=N THEN GOSUB 7000
1270 RETURN
3000 REM TIMED RESPONSE
3010 T1=TI+SC*60
3020 R$=""
3030 REM TRY A KEY
3040 GET A$
3050 IF TI>T1 THEN R$="TIME":RETURN
3060 IF A$="" THEN 3040
3070 IF ASC(A$)=133 THEN R$="QUIT":R
    ETURN
3080 IF ASC(A$)=13 THEN RETURN
3090 IF ASC(A$)=20 AND LEN(R$)>0 THE
    N GOSUB 3300:R$=LEFT$(R$,(
    LEN(R$)-1)):GOTO3040
3095 IF ASC(A$)=20 THEN 3040
3100 PRINT A$;
3110 IF A$<"0" OR A$>"9" THEN GOSUB ~
    3300:GOTO 3040
3120 R$=R$+A$
3130 GOTO 3040
3300 REM BACKSPACE
3310 PRINT CHR$(157);
3320 PRINT " ";
3330 PRINT CHR$(157);
3340 RETURN
5000 REM WRONG
5010 WR=WR+1
5030 REM UFO-VARIATION
5040 POKE VL,15
5050 FOR L=1 TO 15
5060 POKE SB,42
5070 FOR M=200 TO 220+L*2
5080 POKE S3,M
5090 NEXT M
5100 POKE SB,25
5110 FOR Z=1TO 25:NEXT Z
5120 NEXT L
5130 POKE VL,0:POKE S3,0
5140 POKE SB,27
5150 RETURN
7000 REM RIGHT
7010 RI=RI+1
7020 REM BIRDS VARIATION
7025 PRINT CHR$(19);:FOR Z=1 TO 21:P
    RINT " ";:NEXT Z
7030 POKE VL,15
7040 FOR L=1 TO 20
7050 PRINT CHR$(19);SPC(5);CHR$(106)
    ;CHR$(113);CHR$(107);

```

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MASTER MEMORY MAP(tm) — This is really the key to using the ATARI'S capabilities. We start out by explaining how to PEEK and POKE values into memory so that even new programmers can use this. Then we give you over 15 pages of the memory locations that are the most useful. The information is condensed from both the ATARI'S Operating System Manual and various articles and programs. It is, of course, useful even for experienced programmers as a reference. Also, we highly suggest that dealers offer this Memory Map to customers who request to be told how to use the power of the machine. We guarantee it will answer many of the questions you have about the machine.

\$6.95

TRICKY TUTORIALS(tm)

#1: DISPLAY LISTS — This program teaches you how to alter the program in the ATARI that controls the format of the screen. For example: when you say graphics 8 the machine responds with a large graphics 8 area at the top of the screen and a small text area at the bottom. Now, you will be able to mix the various modes on the screen at the same time. Just think how nice your programs could look with a mix of large and small text, and both high and low resolution graphics. This program has many examples plus does all of the difficult calculations!

#2: HORIZONTAL/VERTICAL SCROLLING — The information you put on the screen, either graphics or text, can be moved up, down or sideways. This can make some nice effects. You could move only the text on the bottom half of the screen or perhaps create a map and then move smoothly over it by using the joystick.

#3: PAGE FLIPPING — Normally you have to redraw the screen every time you change the picture or text. Now you can learn how to have the computer draw the next page you want to see while you are still looking at the previous page, then flip to it instantly. You won't see it being drawn, so a complicated picture can seem to just appear. Depending on your memory size and how complicated the picture, you could flip between many pages, thus allowing animation or other special effects with your text.

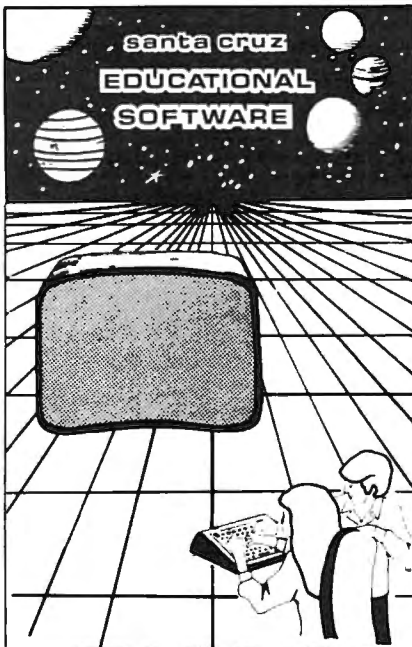
#4: BASICS OF ANIMATION — Shows you how to animate simple shapes using the PRINT and PLOT commands, and also has nice little PLAYER/MISSILE Graphics demo to learn. This would be an excellent way to start making your programs come alive on the screen. Recommended for new owners.

#5: PLAYER MISSILE GRAPHICS — This complex subject is demonstrated by starting with simple examples, and building up to a complete game and also an animated business chart on multiple pages! As always, the computer does most of the calculations. Requires 32K disk or tape and costs \$29.95.

#6: SOUND — From explaining how to create single notes, to demonstrating complex four channel sound effects, this newest tutorial is great. Even those experienced with ATARI's sound capabilities will find the menu of sound effects a needed reference that can be used whenever you are in the need of a special sound for your programs. Everyone will learn something new! Written by Jerry White.

Tricky Tutorials (except #5) require 16K memory for cassette orders and 24K for disk. The price is \$19.95 each. You may order 1, 2, 3, & 4 for \$64.95. All six in a colorful binder cost \$99.95.

THE GRAPHICS MACHINE!! — Turn your computer into an incredible graphics tool with advanced commands like circle, box, fill, polygon, line, help, etc. 3 colors in graphics 8 with instant text!!! Create colorful business charts or beautiful drawings and then save or retrieve them from disk in 5 SECONDS. YES, it's that fast. Needs all 48K disk and costs \$19.95.



MINI-WORD PROCESSOR — This is for those of you who have a printer, but don't want to spend \$100 or more for a fancy word processor. It is suitable for simple editing of text, accepts most control characters for your printer, and text is stored on disk for easy retrieval. Holds 2 1/2 typed pages at a time. Requires 32K, disk or tape. **\$19.95**

BOB'S BUSINESS — 14 small business type programs for home or office, all chosen from a nice menu. Supports printed output. 169 sectors of output require 16K tape, or 32K disk. **\$14.95**

KID'S #1 — Includes the following: 1) TREASURE — search for the lost treasure while trying to keep from falling into the sea. Nice graphics if you find it! 2) DIALOGUE — talk back to the computer about four subjects; 3) MATH QUIZ — Nice musical and graphical rewards for good scores. Parents input the level of difficulty.

KID'S #2 — A spelling quiz, a "scrabble" type game, and a version of Touch with the computer giving all the directions! Both Kid's programs require 16K tape or 24K disk and cost \$14.95 each.

MINI-DATABASE/DIALER — This unique new program stores and edits up to 8 lines of information such as name, address, and phone numbers, or messages, inventories or anything you want. It has the usual sort, search, and print options, but it also has an unusual feature. If your files include phone numbers and you have a touch-tone phone, the program will DIAL THE PHONE NUMBERS FOR YOU! This is perfect for those who make a lot of calls like salesmen, teens, or those trying to get through to busy numbers (acts as an auto-redialer). It is also a lot of fun to use. Requires 16K cassette or 24K disk and costs \$24.95.

FONETONE — For those who only want to store name and phone numbers and have the dialer feature as above, we offer this reduced version. Same memory requirements, but only costs \$14.95. Don't forget you must have a touch-tone phone.

PLAYER PIANO — Turns your keyboard into a mini-piano and more. Multiple menu options provide the ability to create your own songs, save or load data files using cassette or diskette, fix or change any of up to 400 notes in memory, and play all or part of a song. The screen displays the keyboard and indicates each key as it is played from a data file or the notes you type. You don't have to be a musician to enjoy this educational and entertaining program. Requires 24K cassette or 32K disk. **\$14.95**

BOWLERS DATABASE — Provides the league bowler with the ability to record and retrieve bowling scores providing permanent records. The data may then be analyzed by the program and displayed or printed in summary or detail form. Data may be stored on cassette or diskette and updated quickly and efficiently. The program provides such information as highest and lowest scores by individual game, (first, second, and third games throughout the season), high and low series, current average, and more. The program listing and documentation provided are a tutorial on ATARI basic and record keeping. Requires 16K for cassette or 24K for disk. **\$14.95**

By the time you read this all computers (400/800) being produced should have the famed GTIA chips included. ATARI service may upgrade older computers... call and ask (it's easy to do yourself!). We have one and the improvements that graphics modes 9, 10, and 11 offer are great!! To help you figure out what to do with the new modes a new Tricky Tutorial will be offered in March on Modes 9 to 11. Either give us a call or write around that time.

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```

7055 PRINT SPC(5);CHR$(117);CHR$(113
);CHR$(105);
7060 FOR M=254 TO 240+RND(1)*10 STEP
-1
7070 POKE S3,M
7080 NEXT M
7090 POKE S3,0
7100 FOR M=1 TO 100:NEXT M
7110 PRINT CHR$(19);SPC(5);CHR$(117)
;CHR$(113);CHR$(105);
7115 PRINT SPC(5);CHR$(106);CHR$(113
);CHR$(107);
7120 FOR M=1 TO 120*RND(1):NEXT M
7130 NEXT L
7140 POKE S3,0:POKE VL,0
7150 RETURN
9000 REM TIME
9010 TM=TM+1
9020 VM=VA+253:CM=CA+253
9030 REM TONE
9040 POKE S3,240:POKE VL,15
9050 J=0
9060 FOR L=15 TO 0 STEP -2
9070 POKE VM+J,81:POKE CM+J,2
9080 POKE VM-J,81:POKE CM-J,2
9090 POKE VM+22*J,81:POKE CM+22*J,2
9100 POKE VM-22*J,81:POKE CM-22*J,2
9110 FOR Z=1 TO 50:NEXT Z
9120 POKE VM+J,32
9130 POKE VM-J,32
9140 POKE VM+22*J,32
9150 POKE VM-22*J,32
9160 FOR Z=1 TO 50:NEXT Z
9170 POKE VL,L
9180 J=J+1
9190 NEXT L
9200 POKE VM-2,20:POKE CM-2,4
9210 POKE VM-1,9:POKE CM-1,4
9220 POKE VM,13:POKE CM,4
9230 POKE VM+1,5:POKE CM+1,4
9240 POKE S3,0:POKE VL,0
9250 FOR Z=1 TO 2000:NEXT Z
9260 RETURN
30000 REM HEARTS.BEGIN
30010 REM CONSTANTS/VARS
30020 VA=7702
30030 CA=38422
30040 SB=36879
30050 VL=36878
30060 S2=36875
30070 S3=36876
30080 S4=36877
30090 LO=1
30100 HI=9
30110 SC=120
30120 G=0
30130 TM=0
30140 RI=0
30150 WR=0
30160 Z=RND(-TI)
30170 PRINT CHR$(147);
30180 PRINT SPC(8);"VIC-20"
30190 PRINT
30200 PRINT"    COUNT THE HEARTS"
30210 PRINT:PRINT
30215 PRINT CHR$(158);
30220 PRINT"    COPYRIGHT 1981"
30230 PRINT"    HOMESPUN SOFTWARE"
30235 PRINT CHR$(31);
30240 PRINT:PRINT
30250 PRINT"ENTER NUMBER RANGE"
30260 INPUT"LOW NUMBER (1)";LO
30270 LO=ABS(INT(LO))
30275 IF LO<1 OR LO>484 THEN PRINT "S
ORRY":LO=1:GOTO 30260
30280 INPUT"HIGH NUMBER (9)";HI
30290 HI=ABS(INT(HI))
30300 IF HI<=LO OR HI>484 THEN PRINT"
SORRY":HI=9:GOTO 30260
30310 PRINT
30320 PRINT"TIME LIMIT PER SET:"
30330 INPUT"SECONDS (120)";SC
30340 SC=ABS(INT(SC))
30345 IF SC<1 THEN PRINT "SORRY":SC=1
20:GOTO 30330
30350 PRINT:PRINT
30360 PRINT"KEY F1 TO STOP"
30370 PRINT:PRINT
30380 PRINT"THANK YOU. HAVE FUN!"
30390 FOR Z=1 TO 2000:NEXT
30400 RETURN
31000 REM HEARTS.END
31010 PRINT CHR$(147)
31020 PRINT"COUNT THE HEARTS"
31030 PRINT:PRINT
31032 PRINT"LOW #",LO
31034 PRINT"HIGH #",HI
31036 PRINT:PRINT
31040 PRINT "# GAMES",G
31050 PRINT "# RIGHT",RI
31060 PRINT "# WRONG",WR
31070 PRINT "# TIME OUTS";TM
31080 RETURN

```

Program 2: Atari Version

```

100 REM ATARI 400/800
110 REM COUNT THE HEARTS
120 REM V1.1 7/81
130 REM
200 REM
210 REM HEARTS.BEGIN
220 GOSUB 30000
230 REM PLAY GAMES
240 GOSUB 1000
250 IF G=0 THEN 240

```

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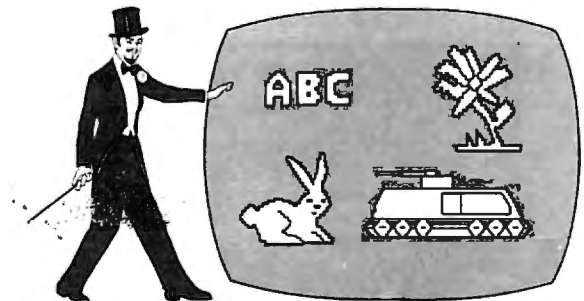
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```

260 REM HEARTS.END
270 GOSUB 31000
280 END
1000 REM PLAY GAMES
1010 GRAPHICS 1+16:SETCOLOR 0,0,0:POKE 7
56,226:DL=PEEK(560)+256*PEEK(561)+4:POKE
DL-1,66
1015 UA=PEEK(88)+256*PEEK(89)+40
1020 REM DISPLAY HEARTS
1030 N=LO+INT((HI-LO+1)*RND(0))
1040 FOR I=1 TO N
1050 P=INT(440*RND(1))
1060 CL=INT(3*RND(1)+1)
1070 T=PEEK(UA+P):IF T=64 OR T=128 OR T=
192 THEN 1050
1080 POKE UA+P,64*CL
1090 REM
1100 SOUND 0,100,10,8
1110 REM
1120 FOR Z=1 TO 100:NEXT Z
1130 SOUND 0,0,0,0
1140 NEXT I
1150 G=G+1:REM GAMES
1160 POKE 87,0:POSITION 1,0:?"
";:REM 19 SPACES
1180 POSITION 1,0:?"How many hearts?";
1190 REM GET RESPONSE
1200 GOSUB 3000
1210 IF R$="QUIT" THEN Q=1:RETURN
1220 IF R$="TIME" THEN GOSUB 9000:RETURN

1230 REM O.K.?
1240 P=10^(LEN(R$)-2):R=0:FOR I=2 TO LEN
(R$):R=R+(ASC(R$(I,I))-48)*P:R=INT(R+0.0
5):P=P/10:NEXT I
1250 IF R<N THEN GOSUB 5000:GOTO 1160
1260 IF R=N THEN POKE DL-1,70:GOSUB 7000

1270 RETURN
2000 STOP
3000 REM TIMED RESPONSE
3010 T1=PEEK(20)+256*PEEK(19)+SC*60
3020 R$=""
3030 REM TRY A KEY
3040 IF PEEK(20)+256*PEEK(19)>T1 THEN R$
="TIME":RETURN
3050 IF PEEK(53279)<7 THEN R$="QUIT":RET
URN
3060 IF PEEK(764)=255 THEN 3040
3070 GET #1,A
3080 IF A=155 THEN RETURN
3090 IF A=126 AND LEN(R$)>1 THEN GOSUB 3
300:R$=R$(1,LEN(R$)-1):GOTO 3040
3095 IF A=126 AND LEN(R$)=1 THEN 3020
3097 IF A=126 THEN 3040
3100 IF A<48 OR A>57 THEN 3040

3110 PRINT CHR$(A);
3120 R$(LEN(R$)+1)=CHR$(A)
3130 GOTO 3040
3300 REM BACKSPACE
3310 PRINT CHR$(30);" ";CHR$(30);:RETURN

5000 REM WRONG
5010 WR=WR+1
5030 REM UFO-VARIATION
5040 FOR L=1 TO 15
5050 FOR M=100 TO 140+L*2 STEP 2
5060 SOUND 0,M,10,8:POKE 712,PEEK(53770)

5070 NEXT M
5080 FOR Z=1 TO 10:NEXT Z
5090 NEXT L
5100 SOUND 0,0,0,0:POKE 712,0
5110 RETURN
7000 REM RIGHT
7010 RI=RI+1:POKE 87,1
7020 REM BIRDS VARIATION
7025 COLOR 32:PLOT 0,0:DRAWTO 19,0
7040 FOR L=1 TO 5
7050 POSITION 5,0:?"#6:CHR$(17);CHR$(20)
";CHR$(5);
7055 POSITION 10,0:?"#6:CHR$(26);CHR$(20)
";CHR$(3);
7060 FOR M=50 TO 10+10*RND(1) STEP -1
7070 SOUND 0,M,10,8
7080 NEXT M
7090 SOUND 0,0,0,0
7100 FOR M=1 TO 50:NEXT M
7110 POSITION 5,0:?"#6:CHR$(26);CHR$(20)
";CHR$(3);
7120 POSITION 10,0:?"#6:CHR$(17);CHR$(20)
";CHR$(5);
7130 FOR M=1 TO 60*RND(1):NEXT M
7140 NEXT L:POKE 87,0
7150 RETURN
9000 REM TIME
9005 POSITION 1,0:?"
TIME
OUT
";
9010 TM=TM+1
9020 UM=UA+229
9030 REM TONE
9040 SOUND 0,100,12,8
9050 J=0
9060 FOR L=15 TO 0 STEP -1
9070 POKE UM+J,148
9080 POKE UM-J,148
9090 POKE UM+20*J,148
9100 POKE UM-20*J,148
9110 FOR Z=1 TO 50:NEXT Z
9120 POKE UM+J,0
9130 POKE UM-J,0
9140 POKE UM+20*J,0

```

```

9150 POKE VM-20%J,0
9160 FOR Z=1 TO 50:NEXT Z
9170 SOUND 0,L*5,12,L
9180 J=J+(L/2<)>INT(L/2))
9190 NEXT L
9200 RETURN
30000 REM HEARTS.BEGIN
30010 REM CONSTANTS/VARS
30090 LO=1:HI=9:SC=120:G=0:TM=0:RI=0:WR=
0
30100 DIM R$(20):OPEN #1,4,0,"K:"
30170 GRAPHICS 0
30180 ? CHR$(125):POSITION 12,0:? " ATA
RI 400/800"
30190 POSITION 11,2:? "Count the Hearts"

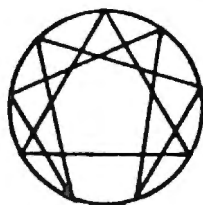
30210 ? :?
30220 ? "          Copyright 1981"
30230 ? "          HOMESPUN SOFTWARE"
30240 ? :?
30250 ? "Enter number range:"
30260 TRAP 30250:? "Low number (1)":INF
UT LO:TRAP 40000
30270 LO=ABS(INT(LO))
30275 IF LO<1 OR LO>440 THEN ? "SORRY":L
O=1:GOSUB 30260
30280 ? "High number (9)":TRAP 30280:IN

```

```

PUT HI:TRAP 40000
30290 HI=ABS(INT(HI))
30300 IF HI<=LO OR HI>440 THEN ? "SORRY"
:HI=9:GOTO 30260
30310 ?
30320 ? "TIME LIMIT PER SET:"
30330 ? "Seconds (120)":TRAP 30330:INPU
T SC:TRAP 40000
30340 SC=ABS(INT(SC))
30350 ? :?
30360 ? "PRESS [OPTION] TO STOP"
30370 ? :?
30380 ? "THANK YOU. Have fun!"
30390 FOR Z=1 TO 100:NEXT Z
30400 RETURN
31000 REM HEARTS.END
31010 GRAPHICS 0
31020 ? "COUNT THE HEARTS"
31030 ? :?
31032 ? "LOW #",LO
31034 ? "HIGH #",HI
31036 ? :?
31040 ? "GAMES",G
31050 ? "RIGHT",RI
31060 ? "WRONG",WR
31070 ? "TIME OUTS ";TM
31080 RETURN

```



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Family: A Simulation In Genetics

Andy Gamble
Columbia College
Vancouver, Canada

Biology teachers know only too well the practical problems of illustrating the effects of gene selection. Mendel struck it lucky with his pea plants, but even they are a little too complicated for an introductory class. Besides, any meaningful experiment would take months, even years, to conduct. Barring a few thousand fruit-flies, what can one do?

Once again the mild-mannered computer steps into the nearest telephone booth and saves the day. This program lightheartedly illustrates the genealogy of a Martian couple.

Mars Genetics

A subject was clearly needed which could be easily displayed on the PET screen, with control over a few features. In this case, the Martians have either white or gray hair (green or light green on some PETs) and round or slanted eyes. The gene for white hair is dominant, as is the gene for round eyes. Male and female Martians are represented by square and round jawlines respectively.

The usual method of denoting dominant and recessive genes by upper and lower case letters is not used here, as the PET cannot display both with the graphics characters at the same time.

The program can be used in two ways. First, merely as a demonstration of the effects of gene selection. Genes are chosen at random from the parents, and control the facial features of their 24 children. The sexes are also randomly assigned. The genes for the parents can be picked at random by the program, or chosen by the user.

Alternatively the user may choose to have the faces of the parents and children displayed, but not their genes. The parents' genes can therefore be determined from the features, giving practice of a more experimental kind.

The instructions and the RUN of the program should be self-explanatory. There are several techniques used in the program which I think are quite interesting. I believe very strongly in making programs as user-friendly as possible, and this is particularly important when dealing with INPUT

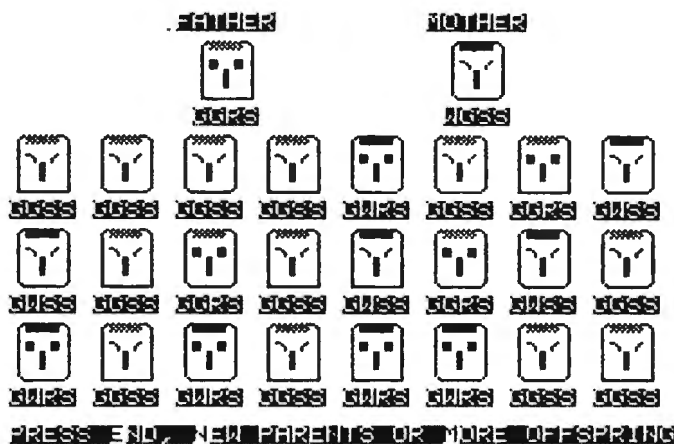
statements. When a yes/no answer is needed, the easiest method is to use a trick INPUT statement (see lines 280-410).

Parts of this program need input which is less obvious to the user: namely, the genes R,S,W and G. It's perfectly possible to remind the user of this when necessary, but here a different method is used. When that input is called for, the genes are displayed on the screen, as for example:

```
WG
↑
```

The arrow is moved left or right by the < and > keys; the genes are picked by pressing return. This is foolproof as far as I can tell, and there is the added advantage of it being obvious which genes are to be chosen (see lines 510-1080).

The program uses over 8K as given so, to run it on 8K machines some editing is necessary. The instructions can be removed (lines 280-310, 1520-1870) and printed separately for student use. Removing all the REM statements also (none are referenced) brings the memory needed down to just over 6K. Family will run on all 40-column PETs.



```
100 REM FAMILY
110 REM ANDY GAMBLE JUNE 81
120 REM COLUMBIA COLLEGE, 1619 W10 ~
    AVE
130 REM VANCOUVER BC V6J 2A2
140 GOTO1430
150 REM HP<=35,VP<=19
160 VT$="{HOME}{25 DOWN}"
170 X=RND(-RND(0))
180 DEFFNR(X)=INT(2*RND(1)+1)
190 NOS="] ' &]"
200 CH$(1)="J@@" : REM FEM
210 CH$(2)="-@@" : REM MALE
220 EY$(1)="] ; ,]"
230 EY$(2)="] IU]"
240 HA$(1)="U" " I"
250 HA$(2)="U( ( I"
```

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```

260 REM W OVER G, R OVER S
270 GE$="N"
280 INPUT "{CLEAR}{04 DOWN}DO YOU NE
ED INSTRUCTIONS  _{03 LEFT
LEFT}";ZZ$
290 IFZZ$=" " THEN 280
300 IFLEFT$(ZZ$,1)="Y" THEN 1520
310 IFLEFT$(ZZ$,1)<>"N" THEN 280
320 GE$="N":PRINT "{CLEAR}{03 DOWN}D
O YOU WANT TO GUESS THE GE
NOTYPES";
330 INPUT "(Y/N)  _{03 LEFT}";GE$
340 IFGE$=" " THEN 320
350 GE$=LEFT$(GE$,1):IFGE$="N" THEN 3
70
360 GOTO 430
370 PRINT "{CLEAR}{03 DOWN}ARE THE G
ENES FOR THE PARENTS TO BE
CHOSEN RANDOMLY ";
380 INPUT "(Y/N)  _{03 LEFT}";ZZ$
390 IFZZ$=" " THEN 370
400 IFLEFT$(ZZ$,1)="N" THEN 500
410 IFLEFT$(ZZ$,1)<>"Y" THEN 320
420 REM RANDOM
430 FORI=1TO2:FE$(I)="R":IFRND(1)>.
5 THEN FE$(I)="S"
440 FH$(I)="W":IFRND(1)>.5 THEN FH$(I
)="G"
450 NEXT
460 FORI=1TO2:ME$(I)="R":IFRND(1)>.
5 THEN ME$(I)="S"
470 MH$(I)="W":IFRND(1)>.5 THEN MH$(I
)="G"
480 NEXT
490 GOTO 1090
500 PA=33067
510 PRINT "{CLEAR}{02 DOWN}CHOOSE GE
NES FOR FATHER'S HAIR:"
520 PRINT "{03 DOWN}"TAB(19)"{REV}WG
"
530 E$(1)="":E$(2)=" "
540 GOSUB 2020
550 POKEPA,30
560 FORI=1TO2
570 GOSUB 1960
580 FH$(I)="G":IFPA=33067 THEN FH$(I)
="W"
590 H$(I)=FH$(I)
600 NEXT
610 VP=10:HP=18:SEX=2
620 GOSUB 1920
630 GOSUB 1360
640 GOSUB 2040
650 PRINT "{02 DOWN}":GOSUB 1890
660 PRINT "{CLEAR}{02 DOWN}CHOOSE GE
NES FOR FATHER'S EYES:"
670 PRINT "{03 DOWN}"TAB(19)"{REV}RS
"
680 GOSUB 2020
690 POKEPA,30
700 FORI=1TO2
710 GOSUB 1960
720 FE$(I)="S":IFPA=33067 THEN FE$(I)
="R"
730 E$(I)=FE$(I)
740 NEXT
750 VP=10:HP=18:SEX=2
760 GOSUB 1920
770 GOSUB 1360
780 GOSUB 2040
790 PRINT "{02 DOWN}":GOSUB 1890
800 PRINT "{CLEAR}{02 DOWN}CHOOSE GE
NES FOR MOTHER'S HAIR:"
810 PRINT "{03 DOWN}"TAB(19)"{REV}WG
"
820 GOSUB 2020
830 E$(1)="":E$(2)=" "
840 POKEPA,30
850 FORI=1TO2
860 GOSUB 1960
870 MH$(I)="G":IFPA=33067 THEN MH$(I)
="W"
880 H$(I)=MH$(I)
890 NEXT
900 VP=10:HP=18:SEX=1
910 GOSUB 1920
920 GOSUB 1360
930 GOSUB 2040
940 PRINT "{02 DOWN}":GOSUB 1890
950 PRINT "{CLEAR}{02 DOWN}CHOOSE GE
NES FOR MOTHER'S EYES:"
960 PRINT "{03 DOWN}"TAB(19)"{REV}RS
"
970 GOSUB 2020
980 POKEPA,30
990 FORI=1TO2
1000 GOSUB 1960
1010 ME$(I)="S":IFPA=33067 THEN ME$(I)
="R"
1020 E$(I)=ME$(I)
1030 NEXT
1040 VP=10:HP=18:SEX=1
1050 GOSUB 1920
1060 GOSUB 1360
1070 GOSUB 2040
1080 PRINT "{02 DOWN}":GOSUB 1890
1090 PRINT CHR$(147)TAB(10)"{REV}FATH
ER{09 RIGHT}MOTHER"
1100 VP=1:HP=11:SEX=2
1110 FORI=1TO2:H$(I)=FH$(I):E$(I)=FE
$(I):NEXT
1120 GOSUB 1920
1130 GOSUB 1360
1140 VP=1:HP=26:SEX=1
1150 FORI=1TO2:H$(I)=MH$(I):E$(I)=ME
$(I):NEXT
1160 GOSUB 1920
1170 GOSUB 1360

```



```

1180 REM OFFSPRING
1190 FORI=1TO3:FORJ=0TO7
1200 VP=1+5*I:HP=5*J
1210 H$(1)=FH$(FNR(1)):H$(2)=MH$(FNR
(1))
1220 E$(1)=FE$(FNR(1)):E$(2)=ME$(FNR
(1))
1230 HC=1:IF(H$(1)="G")AND(H$(2)="G"
)THENHC=2
1240 EC=1:IF(E$(1)="S")AND(E$(2)="S"
)THENEC=2
1250 SEX=FNR(1)
1260 GOSUB1360
1270 NEXTJ,I
1280 IFGE$="Y"THENGOSUB2070
1290 PRINT"{DOWN}{REV}PRESS {OFF}E{R
REV}ND, {OFF}N{REV}EW PARE
NTS OR {OFF}M{REV}ORE OFFS
PRING"
1300 GOSUB1900
1310 IFZZ$="N"THEN320
1320 IFZZ$="M"THEN1190
1330 IFZZ$<>"E"THEN1300
1340 PRINT"{HOME}";:END
1350 REM DRAW FACE
1360 PRINTLEFT$(VT$,VP+1)TAB(HP);
1370 PRINTHA$(HC)"{04 LEFT}{DOWN}";
1380 PRINTEY$(EC)"{04 LEFT}{DOWN}";
1390 PRINTNO$"{04 LEFT}{DOWN}"CH$(SE
X)"{04 LEFT}{DOWN}";
1400 IFGE$="N"THENPRINT"{REV}"H$(1)H
$(2)E$(1)E$(2)"{OFF}":RETU
RN
1410 IFGE$="Y"THENPRINT"
"
1420 RETURN
1430 PRINT"{CLEAR}":FORI=32768TO3280
7:POKEI,224:POKEI+960,224:
NEXT
1440 FORI=32808TO33688STEP40:POKEI,2
24:POKEI+39,224:NEXT
1450 PRINT"{HOME}{04 DOWN}"
1460 PRINTTAB(9)" O# $' L
1470 PRINTTAB(9)" L$::::MNLLLLNM
1480 PRINT"{HOME}{10 DOWN}"TAB(16)"{
REV}FAMILY"
1490 PRINT"{HOME}{12 DOWN}"TAB(25)"A
NDY GAMBLE"
1500 PRINT"{07 DOWN}";:GOSUB1890
1510 GOTO160
1520 PRINT"{CLEAR}{02 DOWN}"TAB(15)"
{REV}FAMILY{OFF}{02 DOWN}"
1530 PRINT"THIS PROGRAM SHOWS YOU A ~
TYPICAL FAMILY OF MARTIANS
: TWO PARENTS";
1540 PRINT" AND ";
1550 PRINT"THEIR 24 CHILDREN. YOU ~
CAN TELL THE DIFFERENCE"
1560 PRINT"BETWEEN MALE AND ";
1570 PRINT"FEMALE MARTIANS VERY EA
SILY. MALES HAVE SQUARE JA
WS AND"
1580 PRINT"FEMALES HAVE ";
1590 PRINT"ROUND ONES. OTHER THAN TH
ATTHEY HAVE WHITE OR GRAY ~
HAIR, AND ROUND
1600 PRINT"OR SLANTED EYES. THESE ~
TRAITS ARE";
1610 PRINT" CONTROLLED BY GENES ~
W AND G FOR ";
1620 PRINT"THE HAIRAND R AND S FOR T
HE EYES. W IS DOMINANT OVE
R G AND R IS ";
1630 PRINT"DOMINANT OVER S. HERE A
RE TWO TYPICAL MARTIANS:"
1640 VP=17:HP=15:SEX=1:H$(1)="G":H$(
2)="W":E$(1)="R":E$(2)="S"
:EC=1:HC=1
1650 GOSUB1360
1660 VP=17:HP=22:SEX=2:H$(1)="G":H$(
2)="G":E$(1)="S":E$(2)="S"
:EC=2:HC=2
1670 GOSUB1360:PRINT"{DOWN}";
1680 GOSUB1890
1690 PRINT"{CLEAR}{02 DOWN}YOU MAY C
HOOSE THE GENES FOR THE HA
IR"
1700 PRINT"AND EYES OF BOTH THE MOTH
ER AND THE"
1710 PRINT"FATHER WHEN THE PROGRAM R
EQUESTS IT,"
1720 PRINT"BY CHOOSING TWO GENES SU
CH AS 'GG'"
1730 PRINT"OR 'RR' - WHATEVER YOU LI
KE. YOU CAN"
1740 PRINT"ALSO LET THE PROGRAM CHOO
SE THE"
1750 PRINT"PARENTS' GENES RANDOMLY."
1760 PRINT"{DOWN}AFTER YOU ARE SHOWN
THE OFFSPRING, YOU"
1770 PRINT"WILL HAVE A CHOICE AS TO ~
MORE OFFSPRING"
1780 PRINT"BY THE SAME PARENTS, DIFF
ERENT PARENTS,"
1790 PRINT"OR ENDING THE PROGRAM.{02
DOWN}"
1800 GOSUB1890:PRINT"{CLEAR}{02 DOWN
DOWN}ALTERNATIVELY YOU CAN
CHOOSE TO BE SHOWN"
1810 PRINT"{UP}THE FACES, AND TRY TO
GUESS THE"
1820 PRINT"PARENTS' GENES (THEIR GEN
OTYPES)."
1830 PRINT"{DOWN}NOTE THAT THE COMPU
TER HAS IN MIND ONE"
1840 PRINT"PARTICULAR SET OF GENES: ~
OTHERS MAY BE"

```

```

1850 PRINT"POSSIBLE BUT WILL GIVE A ~      "FH$(1)FH$(2)
      WRONG ANSWER."                    2230 FG=1
1860 PRINT"{03 DOWN}";:GOSUB1890        2240 GOTO2340
1870 GOTO320                             2250 IF MH$(1)=HG$(1) ANDMH$(2)=HG$(
1880 REM GET-CONT                        2)THEN2290
1890 PRINTTAB(8)"{REV}PRESS ANY KEY ~  2260 IF MH$(1)=HG$(2) ANDMH$(2)=HG$(
      TO CONTINUE"                      1)THEN2290
1900 GETZZ$:IFZZ$=""THEN1900            2270 GOTO2320
1910 RETURN                               2280 REM MOTHER GUESS CORRECT
1920 HC=1:IF(H$(1)="G")AND(H$(2)="G"    2290 PRINTLEFT$(VT$,6);TAB(26)"{REV}
      )THENHC=2                          "MH$(1)MH$(2)
1930 EC=1:IF(E$(1)="S")AND(E$(2)="S"    2300 GOTO2340
      )THENEC=2                          2310 REM BOTH WRONG
1940 RETURN                               2320 PRINTLEFT$(VT$,22);"{REV}      AN
1950 REM CHOOSE GENES                   SWER IS WRONG: TRY AGAIN O
1960 GOSUB1900                           R {OFF}E{REV}ND      "
1970 IFZZ$="("<"ANDPA=33068THENPOKEPA,  2330 GOTO2090
      32:PA=33067:POKEPA,30              2340 PRINTLEFT$(VT$,22);"{REV}  INPU
1980 IFZZ$="(">"ANDPA=33067THENPOKEPA,  T GENES FOR HAIR OF OTHER ~
      32:PA=33068:POKEPA,30              (W/G)      "
1990 IFZZ$("<"CHR$(13)THEN1960          2350 GOSUB1900
2000 RETURN                               2360 IFZZ$="W"ORZZ$="G"THEN2390
2010 REM MESSAGE                         2370 IFZZ$="E"THEN1340
2020 PRINTLEFT$(VT$,19);"{REV}PRESS ~  2380 GOSUB1900
      < TO MOVE LEFT, > TO MOVE ~      2390 HG$(1)=ZZ$
      RIGHT "                             2400 GOSUB1900:IFZZ$="W"ORZZ$="G"THE
2030 PRINTLEFT$(VT$,20);"{REV}  PRE    N2420
      SS RETURN WHEN GENE IS CHO        2410 GOSUB1900
      SEN      ":RETURN                  2420 HG$(2)=ZZ$
2040 PRINTLEFT$(VT$,19);"              ~  2430 PRINTLEFT$(VT$,22);"      ~
      "                                  "
2050 PRINTLEFT$(VT$,20);"              ~  2440 IFFG=1THEN2520
      "                                  2450 IF FH$(1)=HG$(1) ANDFH$(2)=HG$(
      ":RETURN                            2)THEN2500
2060 REM HAIR GENE GUESS                 2460 IF FH$(1)=HG$(2) ANDFH$(2)=HG$(
2070 PRINTLEFT$(VT$,22);"{REV}INPUT ~  1)THEN2500
      GENES FOR HAIR OF ONE PARE        2470 IFFG=0THEN2590
      NT (W/G)"                          2480 GOTO2520
2080 FG=0                                2490 REM FATHER GUESS CORRECT
2090 GOSUB1900                           2500 PRINTLEFT$(VT$,6);TAB(11)"{REV}
2100 IFZZ$="W"ORZZ$="G"THEN2130          "FH$(1)FH$(2)
2110 IFZZ$="E"THEN1340                   2510 GOTO2620
2120 GOSUB1900                           2520 IF MH$(1)=HG$(1) ANDMH$(2)=HG$(
2130 HG$(1)=ZZ$                          2)THEN2560
2140 GOSUB1900:IFZZ$="W"ORZZ$="G"THE    2530 IF MH$(1)=HG$(2) ANDMH$(2)=HG$(
      N2160                              1)THEN2560
2150 GOSUB1900                           2540 GOTO2590
2160 HG$(2)=ZZ$                          2550 REM MOTHER GUESS CORRECT
2170 PRINTLEFT$(VT$,22);"              ~  2560 PRINTLEFT$(VT$,6);TAB(26)"{REV}
      "                                  "MH$(1)MH$(2)
2180 IF FH$(1)=HG$(1) ANDFH$(2)=HG$(    2570 GOTO2620
      2)THEN2220                          2580 REM BOTH WRONG
2190 IF FH$(1)=HG$(2) ANDFH$(2)=HG$(    2590 PRINTLEFT$(VT$,22);"{REV}      AN
      1)THEN2220                          SWER IS WRONG: TRY AGAIN O
2200 GOTO2250                            R {OFF}E{REV}ND      "
2210 REM FATHER GUESS CORRECT            2600 GOTO2350
2220 PRINTLEFT$(VT$,6);TAB(11)"{REV}    2610 REM EYE GENE GUESS
                                           2620 PRINTLEFT$(VT$,22);"{REV}INPUT ~

```

```

GENES FOR EYES OF ONE PARE
NT (R/S) "
2630 FG=0
2640 GOSUB1900
2650 IFZZ$="R"ORZZ$="S"THEN2680
2660 IFZZ$="E"THEN1340
2670 GOSUB1900
2680 EG$(1)=ZZ$
2690 GOSUB1900:IFZZ$="R"ORZZ$="S"THE
N2710
2700 GOSUB1900
2710 EG$(2)=ZZ$
2720 PRINTLEFT$(VT$,22);"
"
2730 IF FE$(1)=EG$(1) ANDFE$(2)=EG$(
2)THEN2770
2740 IF FE$(1)=EG$(2) ANDFE$(2)=EG$(
1)THEN2770
2750 GOTO2800
2760 REM FATHER GUESS CORRECT
2770 PRINTLEFT$(VT$,6);TAB(13)"{REV}
"FE$(1)FE$(2)
2780 FG=1
2790 GOTO2890
2800 IFME$(1)=EG$(1)ANDME$(2)=EG$(2)
THEN2840
2810 IFME$(1)=EG$(2)ANDME$(2)=EG$(1)
THEN2840
2820 GOTO2870
2830 REM MOTHER GUESS CORRECT
2840 PRINTLEFT$(VT$,6);TAB(28)"{REV}
"ME$(1)ME$(2)
2850 GOTO2890
2860 REM BOTH WRONG
2870 PRINTLEFT$(VT$,22);"{REV} AN
SWER IS WRONG: TRY AGAIN O
R {OFF}E{REV}ND "
2880 GOTO2640
2890 PRINTLEFT$(VT$,22);"{REV} INP
UT GENES FOR EYES OF OTHER
(R/S) "
2900 GOSUB1900
2910 IFZZ$="R"ORZZ$="S"THEN2940
2920 IFZZ$="E"THEN1340
2930 GOSUB1900
2940 EG$(1)=ZZ$
2950 GOSUB1900:IFZZ$="R"ORZZ$="S"THE
N2970
2960 GOSUB1900
2970 EG$(2)=ZZ$
2980 PRINTLEFT$(VT$,22);"
"
2990 IFFG=1THEN3070
3000 IF FE$(1)=EG$(1)ANDFE$(2)=EG$(2
)THEN3050
3010 IFFE$(1)=EG$(2)ANDFE$(2)=EG$(1)
THEN3050
3020 IFFG=1THEN3140
3030 GOTO3070
3040 REM FATHER GUESS CORRECT
3050 PRINTLEFT$(VT$,6);TAB(13)"{REV}
"FE$(1)FE$(2)
3060 GOTO3170
3070 IFME$(1)=EG$(1)ANDME$(2)=EG$(2)
THEN3110
3080 IFME$(1)=EG$(2)ANDME$(2)=EG$(1)
THEN3110
3090 GOTO3140
3100 REM MOTHER GUESS CORRECT
3110 PRINTLEFT$(VT$,6);TAB(28)"{REV}
"ME$(1)ME$(2)
3120 GOTO3170
3130 REM BOTH WRONG
3140 PRINTLEFT$(VT$,22);"{REV} AN
SWER IS WRONG: TRY AGAIN O
R {OFF}E{REV}ND "
3150 GOTO2900
3160 REM ALL CORRECT
3170 PRINTLEFT$(VT$,22);"{REV}
CORRECT! TRY AGAIN? (Y/N
)
"
3180 GOSUB1900
3190 IFZZ$="Y"THEN320
3200 IFZZ$<>"N"THEN3180
3210 GOTO1340

```

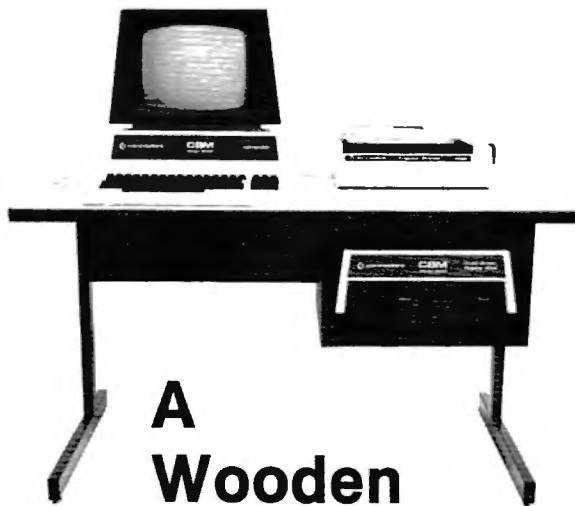
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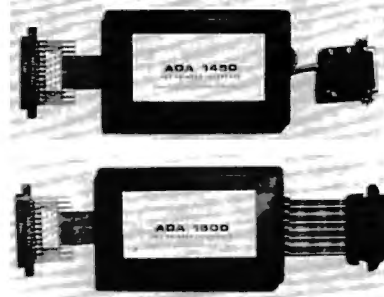
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Learning With Computers

Word Processing In The Classroom

Glenn Kleiman and Mary Humphrey
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"All right, class. Load the word processing program and put your name at the top of a new file. We're all going to write thank you letters to the PTA for buying the computers for our class."

In recent months we have heard from a number of teachers, students and researchers who have been using computerized word processing in classrooms. All have found it to be a successful and valuable experience, even with children as young as second grade. In this month's column we focus on word processing – what it is, some ways it is being used in classrooms, its effects on children's writing, and how to get started with it.

What Is Word Processing?

Word processing is the use of computer-controlled writing systems. The computer system replaces not only the typewriter, pen or pencil, but also the scratch paper, eraser, scissors and tape, and, in some advanced systems, the dictionary.

Programs are available to turn almost every personal computer into a word processing system. For most computers there is a choice ranging from very simple word processing programs to programs so sophisticated they match the capabilities of the

word processors found in many offices. While there are important differences, even the simpler programs provide valuable writing aids.

Word processing programs make it easy to create and modify essays, notes, letters, outlines – any form of written material. The text is typed on the computer keyboard and appears on the screen. All word processors provide ways to correct typing errors, insert or delete words, save your writing for later work, and print it when you are finished. More advanced word processors can search for a given sequence of letters in the text and replace it with another sequence (great for correcting habitual spelling errors, or replacing all instances of "utilize" with "use"). They make it possible to move sections of text, such as when you decide a paragraph you put in the introduction would be better in the conclusion. They also let you format the print-out: setting margins and spacing between lines, centering headings, numbering pages and so on. Very advanced word processors add a dictionary so spelling can be checked automatically. An on-line thesaurus and systems that do some checking of sentence syntax are being developed. Perhaps some day we will have a computerized Strunk and White's *Elements of Style* program to point out the needless words we should omit.

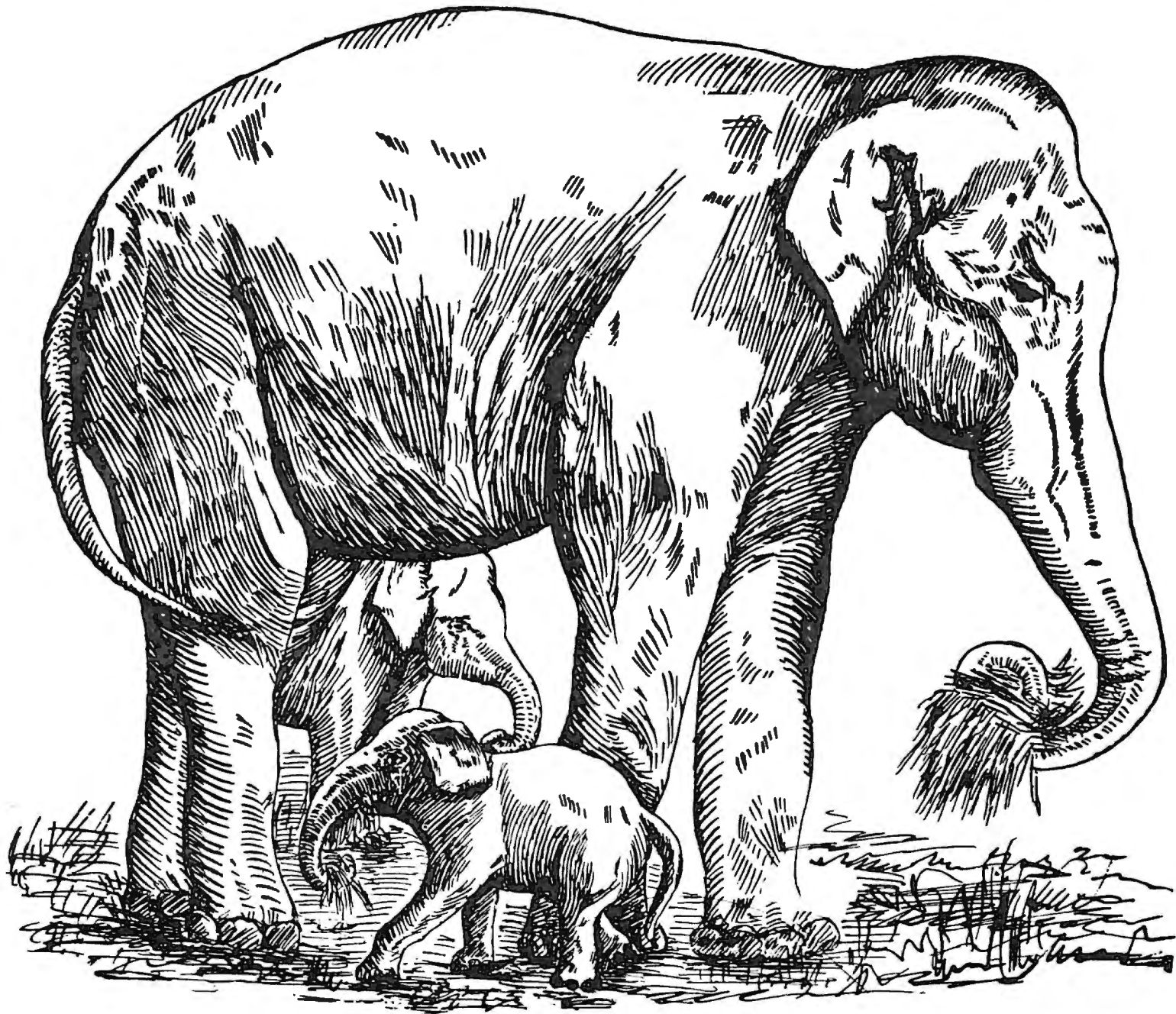
How Can Word Processing Be Used In Education?

Teachers often report that children are unwilling to write and even more unwilling to edit and revise what they have written. Writing requires both the mental processes of composing text and the physical processes of producing it. Computerized word processing makes the physical aspects of producing and editing text much easier, so more attention can be devoted to the mental aspects. Word processors can also be used to create situations which stimulate children's creativity with language and motivate them to write.

A fourth grade class in Oceanside, California, has produced a school newsletter with their word processing system. The well written, eleven page newsletter contains news stories, book reviews, jokes, original stories, and letters to the editor. The newsletter reflects careful use of the formatting capabilities of the word processing system. It has centered headlines and is neatly divided into pages with two columns of print on each page.

The children in this class did most of their writing in pairs, helping each other both in using the computer and in creating and editing text. The children could access each other's working drafts and offer comments on them. They used a word processing program developed by researchers at the University of California at San Diego. It contains some special features, such as a command that automatically arranges the text into a paragraph

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format or a sentence format. The ease of making changes made editing and revising fun rather than a chore. In a letter to the editor of the newsletter, two of the children reported that writing with the computer was "...funner and easier than writing with pencil and paper. Also it does not hurt your hand."

The potential of word processors to facilitate children's writing has been further demonstrated at the Trillium School, a special school for learning disabled children in Ontario, Canada. The students range from 7 to 16 years old, but their reading levels range from first grade to fifth grade. Many of these children had previously refused to do any form of writing. The school recently began using computers in the classrooms and found the children were eager to use them. When word processing was introduced, the teachers were delighted to find the students' enthusiasm for computers carried through to using them for writing. These students now write school reports, take essay exams and do creative writing assignments with the word processor.

In the East York schools in Ontario, Canada, children from second to eighth grade are being given the opportunity to use word processing programs. Teachers of all grades indicate that children are eager to write with the computer. After some initial typing practice, the children find it much easier than using a pencil, pen or typewriter. They write more, edit more, and produce better compositions.

The teachers and researchers who have observed children using word processors report very consistent patterns of change in the children's writing. The most immediate result is that students want to write more often and produce longer compositions. Teachers of young children have reported that the length of the average essay doubles. The next change occurs when the children become familiar with the editing capabilities of the word processor. First they start being more careful to correct typing, spelling and punctuation errors. Then they begin to change words and sentences. Finally, they learn to reorganize the material, moving, adding and deleting large sections of text. They no longer just edit for details but also pay more attention to the meaning of ideas and the order of presentation.

Overall, using word processors has been very beneficial in the classes we have seen. The children enjoy writing more, they are more willing to revise their work, and they produce better essays. They take pride in the quality of their writing, the final neat print-outs, and the fact that they know how to use a computer.

The potential of word processors as a creative

teaching resource is just beginning to be realized. We have heard of a number of interesting ideas that are now being developed or tested. The Department of Education has contracted with Bolt Beranek and Newman, Inc., a company in Cambridge, Massachusetts, to develop a writing curriculum using computer technology. The aims of the project are to develop tools to facilitate writing, and environments to encourage and motivate writing. One plan is to set up a within-school computer based message system. Students can use this to exchange information, take surveys of students' and teachers' opinions, ask for information, and other such uses. Using the message system will require learning to use a computer and text editor.

Researchers from the University of California at San Diego are developing a new use of computers in schools. They will have children in California exchange written messages with children in Alaska. All of the writing will be done on computers and the messages will be sent via an electronic communication system. This will allow immediate responses and on-line interactions.

Another possibility for using word processing is interactive stories in which the child helps create a story as he or she reads it. This can be done in various ways. In one use of interactive stories, the children are given incomplete stories. They then use the word processor to fill in the missing parts and perhaps change parts of the original story. Another possibility is to give children paragraphs describing various events. The children choose which events to put in their stories, and how these events should be sequenced and interrelated.

Getting Started With Word Processing

Once you have a computer, you need to add a word processing program and a printer to use it for producing and editing text. There are many word processing programs available for each of the widely sold computers. In a future column we may review some of them with an eye towards classroom rather than office use.

Two general points merit mentioning here. One is that children seem best able to use programs with what are known as *screen editors*. With a screen editor, what you see on the screen is what you get on the printer, and making a change on the screen automatically makes the same change in the computer's memory. The other point is to remember that for most classroom purposes you do not need as sophisticated and expensive a word processing program as you would want in an office.

There are three classes of printers. Thermal or electrostatic printers are the least expensive to buy. They print quickly and are relatively quiet. Their disadvantage is that they require special paper and, if they are to be used a great deal, this

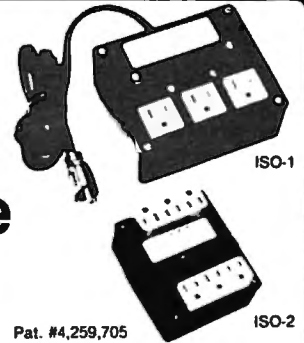
can become very costly. The next type is the dot matrix printer. These are more expensive to buy than thermal printers, but since they use regular paper they may be more economical in the long run. Dot matrix printers are widely used and are the best choice for most classroom word processing applications. Their main disadvantage is they tend to be noisy. The third type is typewriter-quality printers. These produce the nicest print, but are much more expensive. When checking into printers, be sure to check the cost of the interface you will need to attach the printer to your computer.

One worry is that children have to learn to type in order to use word processing programs. We have found that with just a little practice most children prefer typing to writing with a pen or pencil. Also, several programs, such as *Typing Tutor* by Microsoft, are available to help master typing.

We do not have the space here to mention all the relevant projects, ideas and products. (Fortunately, we do all our writing on a word processor, so that when we realized we had written too much, it was easy to edit and reorganize this article to fit our space.) We have covered just a few of the many possible uses of word processing programs in education. We hope to hear from you about other innovative projects and ideas. ©

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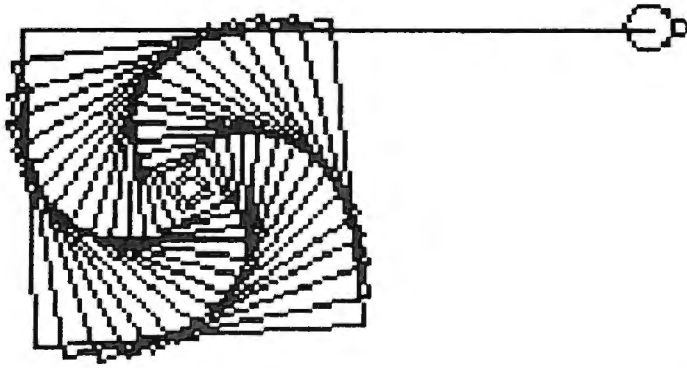
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Procedures And Pathways

All turtle languages incorporate at least two basic commands – one to move the turtle forward and another to make it turn. In Atari PILOT, for example, one can have the turtle draw a 40 unit square by entering the commands:

```
GR: DRAW 50
GR: TURN 90
GR: DRAW 40
GR: TURN 90
GR: DRAW 50
GR: TURN 90
GR: DRAW 40
GR: TURN 90
```

Figure 1.



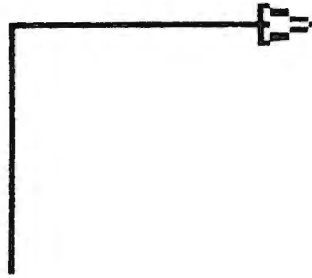
GR: DRAW 40

Figure 2.



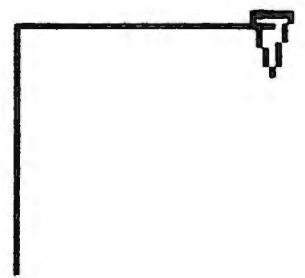
GR: TURN 90

Figure 3.



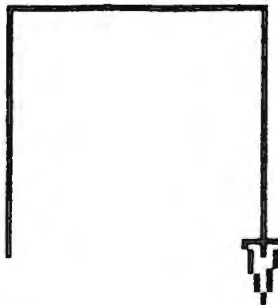
GR: DRAW 40

Figure 4.



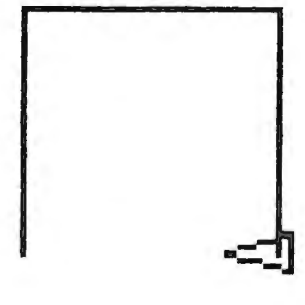
GR: TURN 90

Figure 5.



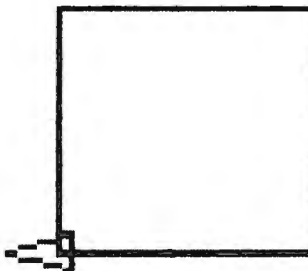
GR: DRAW 40

Figure 6.



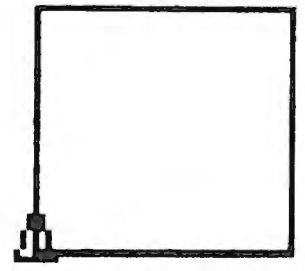
GR: TURN 90

Figure 7.



GR: DRAW 40

Figure 8.



GR: TURN 90

If you want lots of these squares, most turtle environments will let you create a *procedure* which can be used anytime you want to draw this figure. In our case (using Atari PILOT), the procedure starts with a name (for example, *SQUARE). Next, the commands shown above are entered, and finally the *end* command is entered. In PILOT this last command is simply E:.

Once a procedure is defined, it can be used to create copies of squares at any screen location,

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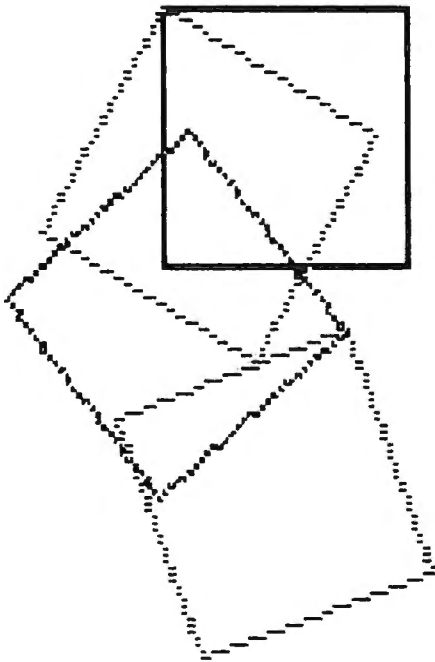
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orientation, or color you may desire. In our case, one simply uses the procedure with the *use* command; e.g., U: *SQUARE. In this manner, procedures let you extend the number of things the turtle can "understand". To see how handy this is, look at the following program which draws several squares:

```
GR: PEN YELLOW
GR: GOTO -30,0
U: *SQUARE
GR: PEN BLUE
GR: TURN 30
U: *SQUARE
GR: GOTO 20,30
GR: TURN 40
U: *SQUARE
GR: PEN RED
GR: TURN 70
U: *SQUARE
```

Figure 9.



While this isn't a particularly pretty picture, it does illustrate how to use procedures to save a lot of typing! Procedures also make programs easier to read.

An even greater value of procedures is the freedom they give you while you are writing a program. As you think about what you want your program to do, you can write the program in outline form, with procedure names being used for those activities you haven't fully defined. Next, you can create each procedure and test it out independently of the others to make sure it works. In this way you

can make steady progress from the outline to the final program without having to deal with massive numbers of statements at a time. I tend to keep procedures short and sweet – and to use lots of them.

The next topic for this month is the idea of a closed *pathway*. Closed turtle paths have some interesting properties. If you look at the figures shown above for the square, you might think that we were done when we drew the fourth side (Figure 7). If you think about it some more, you will see that the turtle is back at the place where it started, but that it hasn't returned to its original orientation. Closed turtle pathways have the property that the turtle returns to its original location and orientation at the end of the trip. This is a very important point to remember.

Now that we have defined a pathway, let's look at a simple way to create some special closed paths in Atari PILOT. One type of closed path creates geometric shapes called regular polygons. A regular polygon is a closed figure which is made from equal length sides and equal turning angles. While we could repeat our DRAW and TURN commands for each side and angle, this would make our procedures very long and tedious to type out. Fortunately, Atari PILOT allows some shorthand to make this task easier. For example, the command:

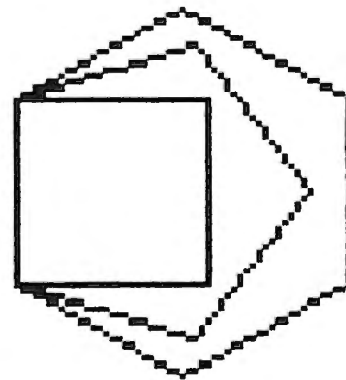
```
GR: 4(DRAW 30; TURN 90)
```

will draw a square on the display screen. The command says, in effect, "Repeat, four times, the commands DRAW 30 and TURN 90".

Using this shorthand, we can create several polygons to study.

```
GR: 4(DRAW 30; TURN 90)
GR: 5(DRAW 30; TURN 72)
GR: 6(DRAW 30; TURN 60)
```

Figure 10.



```
GR: 4 (DRAW 30; TURN 90)
GR: 5 (DRAW 30; TURN 72)
GR: 6 (DRAW 30; TURN 60)
```

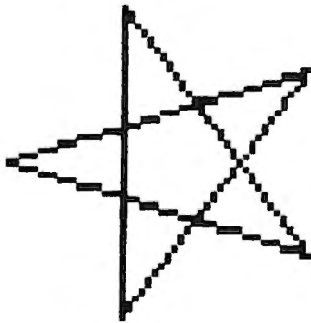

We have created three closed paths – a square, a pentagon, and a hexagon. If you look at the commands which created these figures, you will notice that the only thing that changed was the number of sides and angles, and the amount that was turned each time. If you are really on your toes, you might have noticed that the total amount turned for each figure was the same: $4 \times 90 = 360$, $5 \times 72 = 360$, and $6 \times 60 = 360$. The total amount of turning for simple closed paths is 360 degrees, regardless of the number of sides on the polygon. This is called the Turtle Total Trip Theorem, and it is a beautiful unifying concept that makes turtle geometry quite valuable.

If you would like some challenges until next time, think about these two problems.

1. Can you use the Turtle Total Trip Theorem to help you make a figure which looks like a circle?
2. Look at the picture which results from this command:

GR 5(DRAW 50; TURN 144)

Figure 11.



How much total turning did this figure require? Why?

Until next time, keep those turtles moving, and send me ideas, pictures, programs, and anything else you want to share with your fellow members. Friends of the Turtle chapters should be started in your home town. Let me know what you are doing.

Resource List

Turtle graphics is increasing in popularity both as an educational and as an artistic tool. From time to time, we will publish updates of books, languages, and organizations which incorporate and/or describe turtle geometry. As you look at this list, you

might find that I have left some important references out – please let me know what is missing! In the meantime, here is a beginning list to get us started.

Books:

Mindstorms: Children, Computers, and Powerful Ideas by Seymour Papert (Basic Books, 1980).

Turtle Geometry: The Computer as a Medium for Exploring Mathematics, by Harold Abelson and Andrea diSessa (MIT Press, 1981).

Computer Languages and Products:

Big Trak (programmable robot vehicle from Milton Bradley)
Atari PILOT (language cartridge for Atari 400 and 800 from Atari)

TI LOGO (language cartridge for the TI 99/4 and 99/4A from Texas Instruments)

WSFN (language disk or tape for the Atari 400 and 800 from Atari Program Exchange)


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Organizations:

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Large Alphabet For The VIC

Doug Ferguson
Elida, OH

There are many exciting applications for the 64 programmable characters on the VIC-20. David Malmberg's article in the first issue of *Home and Educational COMPUTING!* explains fully how the VIC can generate programmable characters merely by changing the contents of memory location 36869, and by redefining the 64 eight-pixel tall characters beginning at 7168.

Another interesting memory location in the VIC is nearby: 36867. Changing its contents creates double-sized characters. By POKEing a 47 into 36867, the bottom border of the screen drops out of sight and vertically-paired characters occupy "stretched" screen locations. After clearing the screen, type an A and get $\overset{\text{B}}{\text{A}}$. Actually, the VIC's first character is the "@" (screen POKE 0) which yields $\overset{\text{A}}{\text{A}}$. Continue to type the alphabet and see how the stacked letters follow a pattern. To return to normal, POKE 36867,46 or hit the RESTORE and RUN/STOP keys simultaneously.

I set about to combine these two ideas so that I could get a large alphabet. I painstakingly re-programmed the B to look like the top of a stretched "A" and the C to look like its matching bottom half. Continuing on for nearly two hours, I made it to the "O" and gave up for the night.

Somehow, the clear light of day the next morning directed me toward a much simpler approach: if the characters already reside in ROM, just read each eighth of a character *twice* into the RAM space for programmable characters to program two letters at a time!

Clearly, only 32 such stretched characters can be made since only 64 unstretched characters can be readily programmed. The space key and all the numerals fall in the wrong half of the 64, but all 26 letters of the alphabet can be stretched with the following, surprisingly short, program:

```

10 POKE 56,28: REM RELOCATE END-OF-MEMORY
    POINTER
20 CH=32776: REM LOCATION OF ALPHABET
    IN ROM
30 FOR X=7184 TO 7600 STEP 2: REM ALPHABET
    IN RAM
40 POKE X, PEEK(CH): POKE X+1, PEEK(CH):
    REM STRETCH
50 CH=CH+1: NEXT X: REM LOOP
60 POKE 36879,25: REM NO MORE BORDER
  
```

```

70 POKE 36869,255: REM PROGRAMMABLE
    CHARACTERS
80 POKE 36867,47: REM STRETCHED CHARACTERS
90 PRINT "(clear)ABCDEFGHIJKLMNOPQRSTUVWXYZ
    WXYZ": END
  
```

Lines 20 through 50 read the normal alphabet (8x8 pixels) out of ROM and into RAM. Since RAM is also where a longer program will do its work, line 10 tells the computer not to go beyond 7134 (28 times 256). Line 60 is for the purist who notices the lack of a bottom border with the "normal" screen.

Simple? Certainly. The biggest drawback is the lack of numerals and spaces. In string variables with spaces, e.g., A\$="HELLO THERE", the space can be replaced by the symbol for cursor-right.

The applications of this large alphabet program are left to the reader. Although it is obvious that any characters can be programmed for stretching, only the alphabet (and a few insignificant symbols) can be programmed in a way that an exact keyboard-to-character correspondence can be realized.

I would appreciate hearing from anyone who can expand on this or who has a clever application. ©

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Concentration

Charles Brannon
Editorial Assistant

One application of a user-definable character set is high-resolution, five-color games in GRAPHICS modes one and two. For example, the invaders in Atari's Space Invaders game are GRAPHICS 1 characters. The illusion of smooth motion is performed with the aid of a special feature of the Atari, horizontal fine scrolling. Although my game is less ambitious, it shows what you can do with minimum effort – I spent no more than three hours programming – from the design to the finished game.

The game is based on the card game "Concentration." Two decks of cards are thoroughly shuffled together, then laid out in a matrix of 8 by 13 cards. Each player takes his turn by turning over two cards. If they match, they are removed from the set and this "point" is credited to the player. If not, they are flipped back over. The game continues until all the cards have been matched and removed.

The Atari Version Is Slightly Different

The Atari version of the game is rather different, but the idea is similar. Nineteen different graphics symbols (people, sailboats, "happy faces," cars, etc.) are randomly hidden in a 16 by 20 array. When the game is run, the computer draws the "board," a solid green rectangle. It then flashes the prompt "START/SELECT" at the bottom of the screen. Press [SELECT] to change the number of players, and [START] to begin play. A solid red cursor is placed at the top left corner of the board. Move the cursor with joystick #1 (everyone uses the same joystick). When you wish to "flip" a card, press the red button. Then try to match the revealed symbol by selecting another. If successful, your score is increased by one. The play then passes to the next player. Since the array is 16 by 20 elements, (a total of 320) there could be as many as 160 matches. Unlike the card game version, there are multiple pairs of each symbol. This could make for a very long game, so, instead, the first player to get ten matches wins. SuperFont (COMPUTE! #20) could be used to design other gaming characters.

```

150 GOSUB 740
160 GRAPHICS 1+16:POKE 756,BASE
170 POKE (PEEK(560)+256*PEEK(561)+3),7+6
4
180 SETCOLOR 2,0,10:SETCOLOR 4,6,0:SETCO
LOR 1,12,6
190 IF T=0 THEN DIM A(16,20),CH$(20),SC(
4),PROMPT$(24)
200 FOR I=1 TO 4:SC(I)=0:NEXT I
210 CH$=")*+,-./:;<=>@[^\]^_'"
220 COLOR 1
230 PROMPT$="|START |SELECTSTART |SELECT
|"
240 FOR Y=1 TO 20:FOR X=1 TO 16:A(X,Y)=I
NT(19*RNDC(0)+1):PLOT X+1,Y+2:NEXT X:NEXT
Y
250 POSITION 3,0:? #6;"|concentration|"
260 NP=1:POSITION 2,2:? #6;"ABCDEFGHIJKL
MNOP":FOR I=1 TO 20:COLOR 224+I:PLOT 1,I
+2:NEXT I
270 POSITION 5,1:? #6;"|PLAYERS| ";NP:PO
KE 53279,8:POKE 20,26:K=0
280 IF PEEK(20)>25 THEN POSITION 4,23:?
#6;PROMPT$(1+K*12,12+K*12):POKE 20,0:K=1
-K
290 IF T THEN 310
300 T=PEEK(53279):IF T=7 THEN T=0:GOTO 2
80
310 IF PEEK(53279)=T THEN 310
320 IF T=5 THEN NP=NP*(NP<4)+1:T=0:P=T:G
OTO 270
330 IF T<>6 THEN 300
340 POSITION 4,23:? #6;" "
350 REM MAIN LOOP
360 P=P*(P<NP)+1:POSITION 2,1:? #6;"|PLA
YER| ";P;" score ";SC(P)
370 GOSUB 610:X1=X:Y1=Y:U1=U
380 GOSUB 610:IF U=U1 THEN 450
390 SOUND 0,20,2,8:SOUND 1,100,12,8:FOR
W=1 TO 50:NEXT W:SOUND 0,0,0,0:SOUND 1,0
,0,0:POSITION 5,23:? #6;"|PRESS FIRE|"
400 IF STRIG(0)=1 THEN 400
410 IF STRIG(0)=0 THEN 410
420 POSITION 5,23:? #6;" "
430 COLOR 1:PLOT X+1,Y+2:PLOT X1+1,Y1+2:
SOUND 0,12,12,8:FOR W=1 TO 20:NEXT W
440 SOUND 0,0,0,0:GOTO 360
450 FOR I=1 TO 15 STEP 0.4:SOUND 0,I*17,
12,I:SOUND 1,I*17,12,I:NEXT I:SOUND 0,0,
0,0:SOUND 1,0,0,0
460 SC(P)=SC(P)+1:POSITION 17,1:? #6;SC(
P):FOR I=1 TO 10:POKE 709,PEEK(53770):PO
KE 53279,0
470 FOR W=1 TO 10:NEXT W:NEXT I:POKE 709
,198:IF SC(P)=10 THEN 520
,198:IF SC(P)=10 THEN 520

```

```

100 REM | Concentration |
110 REM
120 REM (C) 1981 Small Systems
    Services, Inc.
130 REM Charles Brannon 12/03/81
140 REM

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```

480 POSITION 5,23: ? #6: "IPRESS FIRE!"
490 IF STRIG(0)=1 THEN 490
500 IF STRIG(0)=0 THEN 500
510 POSITION 5,23: ? #6: "          " :GOTO
    360
520 POSITION 0,2: ? #6: "Player number ";P
    ;" Iwins!":POKE 53279,8
530 FOR I=0 TO 15 STEP 0 4:SETCOLOR 4,I,
    6+INT(4*RND(0)):SOUND 0 10+5*RND(0).10,4
    :SOUND 1,50+10*I,12,8:NEXT I
540 SOUND 0,0,0,0:SOUND 1,0,0,0:SETCOLOR
    4,6,0
550 T=PEEK(53279):IF T=7 THEN 550
560 IF T<>3 THEN 160
570 FOR X=1 TO 16:FOR Y=1 TO 20
580 LOCATE X+1,Y+2,Z:IF Z<>1 THEN COLOR
    Z-128:PLOT X+1,Y+2:GOTO 600
590 COLOR ASC(CH$(A(X,Y)))+128:PLOT X+1,
    Y+2
600 NEXT Y:NEXT X:GOTO 550
610 X=1:Y=1
620 LOCATE X+1,Y+2,Z:COLOR Z+32-160*(Z>1
    ):PLOT X+1,Y+2:TX=X:TY=Y
630 ST=STICK(0):TR=STRIG(0):IF TR=0 AND
    Z=1 THEN 720
640 IF PEEK(53279)<7 THEN COLOR Z:PLOT X
    +1,Y+2:GOTO 550
650 IF ST=15 THEN 630
660 T=INT(100*RND(0)+50):SOUND 0,T,10,8:
    SOUND 1,T+20,10,8
670 IF ST=14 OR ST=10 OR ST=6 THEN Y=Y-1
    :IF Y<1 THEN Y=20
680 IF ST=9 OR ST=5 OR ST=13 THEN Y=Y+1:
    IF Y>20 THEN Y=1
690 IF ST>8 AND ST<12 THEN X=X-1:IF X<1
    THEN X=16
700 IF ST>4 AND ST<8 THEN X=X+1:IF X>16
    THEN X=1
710 COLOR Z:PLOT TX+1,TY+2:SOUND 0,0,0,0
    :SOUND 1,0,0,0:GOTO 620
720 FOR I=1 TO 7:COLOR 1+I:PLOT X+1,Y+2:
    SOUND 0,100+I*10,12,8:FOR W=1 TO 20:NEXT
    W:NEXT I:SOUND 0,0,0,0
730 U=A(X,Y):COLOR ASC(CH$(U,U))+128:PLO
    T X+1,Y+2:RETURN
740 REM INITIALIZE CHARACTER SET
750 BASE=PEEK(106)-8:CHSET=BASE*256
760 GRAPHICS 2+16:POSITION 3,4: ? #6: "ICI
    OnlcEINTirAlTilon!"
770 POSITION 2,6: ? #6: "patience please"
780 FOR I=CHSET TO CHSET+127:READ A:POKE
    I,A:POKE 712,A:SOUND 0,A,10,8:NEXT I
790 FOR I=CHSET+26*8 TO CHSET+32*8+7:REA
    D A:POKE I,A:POKE 712,A:SOUND 0,A,10,8:N
    EXT I
800 FOR I=CHSET+59*8 TO CHSET+63*8+7:REA

```

```

D A:POKE I,A:POKE 712,A:SOUND 0,A,10,8:N
EXT I
810 FOR I=128 TO 207:A=PEEK(57344+I):POK
E CHSET+I,A:POKE 712,A:SOUND 0,A,10,8:NE
XT I
820 FOR I=264 TO 471:A=PEEK(57344+I):POK
E CHSET+I,A:POKE 712,A:SOUND 0,A,10,8:NE
XT I
830 SOUND 0,0,0,0:RETURN
840 DATA 0,0,0,0,0,0,0
850 DATA 255,255,255,255,255,255,255,255
860 DATA 0,255,255,255,255,255,255,255
870 DATA 0,0,255,255,255,255,255,255
880 DATA 0,0,0,255,255,255,255,255
890 DATA 0,0,0,0,255,255,255,255
900 DATA 0,0,0,0,0,255,255,255
910 DATA 0,0,0,0,0,0,255,255
920 DATA 0,0,0,0,0,0,0,255
930 DATA 24,24,19,124,88,24,20,54
940 DATA 0,0,0,29,20,127,34,0
950 DATA 129,66,69,36,36,69,66,129
960 DATA 0,0,0,96,95,101,5,0
970 DATA 0,16,40,68,254,124,0,0
980 DATA 0,102,102,0,129,66,60,0
990 DATA 0,56,124,84,124,56,40,68
1000 DATA 0,0,68,34,63,34,68,0
1010 DATA 0,195,102,60,126,36,0,0
1020 DATA 66,255,102,90,90,102,255,66
1030 DATA 16,16,16,56,56,56,124,254
1040 DATA 0,0,56,68,94,68,56,0
1050 DATA 0,16,40,68,254,68,40,16
1060 DATA 0,170,108,198,16,198,108,170
1070 DATA 170,85,170,85,170,85,170,85
1080 DATA 16,56,124,254,84,16,16,124
1090 DATA 14,8,12,8,0,56,120,40
1100 DATA 0,255,0,255,0,255,0,255
1110 DATA 24,56,120,8,8,136,127,62

```

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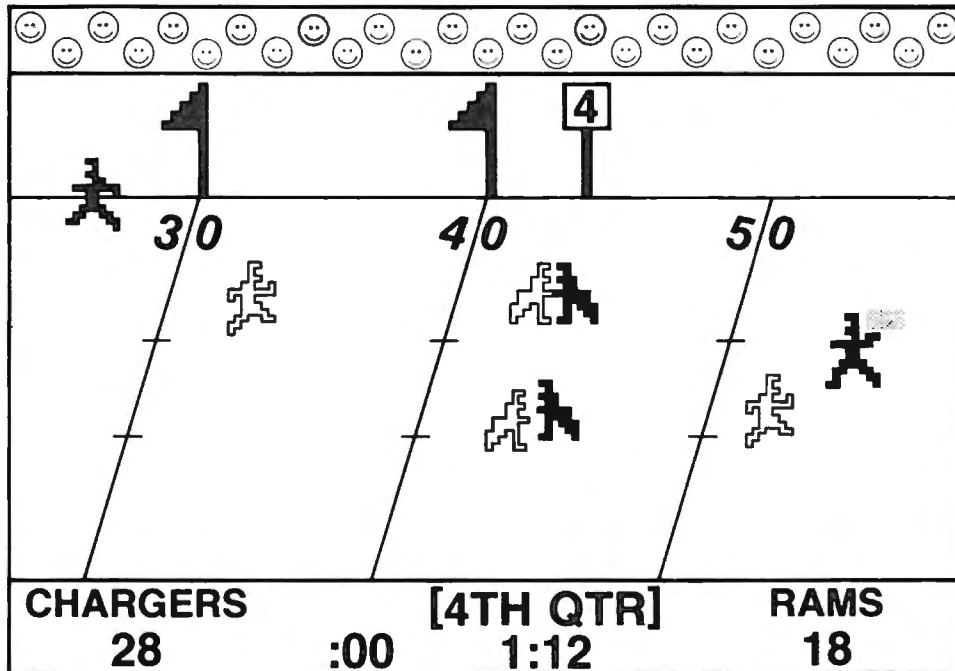
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Wichita State University
Wichita, KS

Since the first day that I had my Apple II, I have been frustrated by the inability to fully identify stored programs and files except by using long names. Wouldn't it be nice, for example, to have the date of the latest revision of a program stored along with its name? Of course, a person can always make the date part of the name, but I thought that there ought to be a better way. There is a better way. I have written a program to make writing comments in the catalog easy.

Control Characters

You may have already discovered that some control characters can be part of program and file names in the catalog. For example, a CTRL-J at the end of a program name is helpful in formatting the catalog. The CTRL-J is a linefeed which, when entered as the last character in a program name, has the effect of leaving an empty line between that program name and the next one when the catalog is listed. Another control character which can be inserted into a program name is CTRL-G which will make the Apple beep when the name of the program is listed in the catalog.

Most of the other control characters can be entered into program names, but generally they are not particularly useful. One application they do have is based on the fact that control characters in a name do not actually appear on the screen in the catalog, but they must be used in order to access the program on the disk. Their invisibility can provide a measure of security by preventing someone else from readily loading programs off of your disk. (See your Apple DOS manual for a program to detect most of these control characters.)

The control character that I have found useful in creating comments for the catalog is CTRL-H, the backspace character. This character cannot easily be entered directly into a program name.

Typing CTRL-H is the same as pressing the left arrow; you can backspace over characters, but the character that you backspace over is deleted from the name as you backspace. The solution to this difficulty is to put CHR\$(8) into a string variable that you use as the program name. In *immediate mode*, [not in a program – just type it on the screen directly] try going through the routine below using an initialized disk with only the HELLO program on it:

```
]CATALOG
DISK VOLUME 254
  A 002 HELLO
]D$ = CHR$(4)
]NAME$ = "ABC" + CHR$(8) + CHR$(8) + "DEF"
]?D$"SAVE";NAME$
]CATALOG
DISK VOLUME 254
  A 002 HELLO
  A 004 ADEF
]LOAD ADEF
FILE NOT FOUND
]
```

The lines that start with a "]" prompt are the ones that I typed into the Apple. The others are those that the computer wrote. When I try to load ADEF the computer tells me FILE NOT FOUND because the name is not ADEF, but "ABC" + CHR\$(8) + CHR\$(8) + "DEF". Although the program name in the catalog appears to be four characters long, if you were to ask ?LEN(NAME\$) you would find that it is actually eight characters long.

This information about CHR\$(8) is really all that you need in order to be able to write comments into your catalog. You simply create a string variable that contains enough backspace characters to backspace over the letter that identifies the file type and the number that gives how many sectors are occupied on the disk by the file. Once all of that information is backspaced over, the desired comment is entered into the string. The string variable is then used as shown above to SAVE a program – any program. The "comment" is actually the name of a program – whatever program you had in memory when you do the SAVEing – but it doesn't look like a program name because the file type and sector-count information is missing.

Some Limitations

This commenting technique does have its limitations. Names of programs are limited to 30 characters by DOS. Since the first character of a name cannot be a control character, seven backspaces are needed to erase the information that is normally printed. The first character, plus these backspaces, consume eight of the available 30 characters, so only 22 characters can go into a comment. In addi-

tion, you have only limited control over where in the catalog the comment appears. This kind of comment is best used for disks on which people are not going to be making many changes. As long as you start with a fresh disk and put the files, programs, and comments onto the disk in the order you wish them to appear, the catalog will come out fine. If you modify programs in such a way as to change their length, then the order of items in the catalog may be changed and the comments will no longer be adjacent to the program name. One more limitation is that hard copies of the catalog are harder to make appear as nice as the screen listing of the commented catalog. If you try to print the catalog directly, the printer will backspace and overstrike the original characters.

This difficulty can be overcome by listing the catalog on the screen and then, using a program such as that by Jeff Schmoyer (**COMPUTE!** #6) to route the screen image to the printer. In spite of these limitations, I have prepared commented catalogs such as the one in Figure 1. Each line of letters is actually a program name, but the only programs of interest are the ones that have the file type and sector count next to them. The other program names serve only as comments, and the actual programs could be anything (or nothing).

Clearly typing all of these names with the CHR\$(8) feature inserted could be quite a chore at the keyboard, so I wrote a program to enter the comments into the catalog. The program is called simply "Catalog Commenter" and is a short BASIC (Applesoft) program. The program shows just how long the name can be and lets you either erase or write names. It then gets a catalog so that you can see what you have done. Hitting any key clears the screen and takes you back to the beginning of the program. This program is the one that was used to prepare the catalog Figure 1. After the backspace characters, two spaces are inserted into the initial part of the string variable used for the name. This spacing makes the comments appear lined up with the sector count of the "real" program names in the catalog, but further limits the length of the comments to 20 characters.

Figure 1.

DISK VOLUME 254

A 025 PH PLOT-BUFFER CAPACITY
(MAIN PROGRAM WHICH
LOADS OTHER FILES)

*B 002 OR LOADER & LINE ERASE
(OVERLAYS HIRES PAGE
2 ONTO PAGE 1 AND
ERASES HIRES TEXT
LINES. A\$300; A\$325)

*B 027 MZCHAR3
(SPECIAL WHITE CHARACTER SET. A\$6000)

*B 006 INSTRUCTIONS
(BINARY TEXT FILE OF
INSTRUCTIONS. A\$8000)

*B 034 COVER PAGE
(BINARY HIRES FILE.)

```

100 REM ** CATALOG COMMENTER**
110 REM BY RICHARD CORNELIUS
120 REM CHEMISTRY DEPARTMENT
130 REM WICHITA STATE UNIV.
140 REM WICHITA, KS 67208
150 REM (316) 689-3120
160 REM **INITIALIZATION**
170 D$= CHR$(13) + CHR$(4)
180 REM D$ SIGNALS DOS COMMAND
190 N$= CHR$(8) + CHR$(8) + CHR$(8)

200 REM CHR$(8) IS BACKSPACE
210 N$="A"+N$+N$+CHR$(8)+" "
220 HOME: VTAB 5
230 REM **GET COMMENT**
240 PRINT "TYPE IN COMMENT"
250 PRINT"---UP TO THIS LONG--"
260 INPUT";C$
270 PRINT
280 PRINT"WRITE(W), ERASE(E), OR QUIT(Q)?"
290 GET G$
300 IF G$= "Q" THEN 410
310 IF G$ <> "E" AND G$ <> "W" THEN ~
    GOTO 220
320 REM **CREATE PROGRAM NAME**
330 N$= N$ + C$
340 REM **WRITE TO DISK**
350 IF G$= "E" THEN 370
360 PRINT D$"SAVE";N$:GOTO 380
370 PRINT D$"DELETE";N$
380 PRINT D$"CATALOG"
390 GET G$
400 IF G$ <> "Q" THEN 220
410 PRINT:PRINT"THE END"

```

STARFIGHT3

David R Mizner
Houston, TX

STARFIGHT3 is a program that will let you fight off Klingons to save the Federation. Before you start typing away, a little word of warning is needed. This program *loves* memory. In fact, STARFIGHT3 will use it all up; so be careful entering the program. An extra space added now may cause a "no memory" message later.

Have fun!!!

Program Description

A new Galaxy is generated each time the program is RUN. A random number of stars (maximum of 25) and Klingons (maximum of 3) are generated and, along with the Enterprise, are randomly placed in a 10x10 Galaxy.

The Enterprise is equipped with three photon torpedos for every Klingon, and three shield units. Three hits on the Enterprise from Klingon attacks will deplete its shield, a fourth hit will destroy the enterprise. There will be self-destruction if the Enterprise runs into a star or Klingon while traveling around the Galaxy.

Klingons (all that have not been destroyed) will fire at the Enterprise if your response time for a command is too slow or if your torp misses. Only one hit on the Enterprise is allowed per attack. Take note that the Klingons fire their torps in eight directions while the good guys can only fire in one direction at a time. However, neither side can fire through a star.

The stars and Klingons remain stationary throughout the game.

Program Directions

1. Observe operating procedures for VIC20.

2. Commands

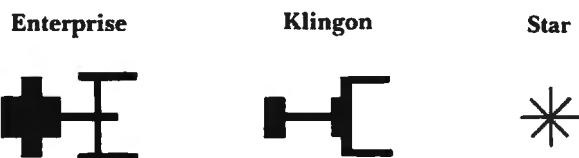
- Move: VIC will request direction and distance. Direction is a number from 1 through 8, while distance is the number of spaces you want to move.
- Torp: VIC will request a direction. Torp does not have a distance since a photon torpedo will travel until it hits a star, Klingon, or Galaxy boundary.
- End: This command ends the game. "You surrendered" is the real meaning of "end."

3. Scan

- A scan is generated before each command request.
- The Galaxy is displayed so you can see the

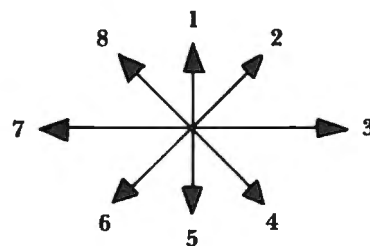
actual location of stars, Klingons, and the Enterprise. At the same time, the direction code is printed out.

c. Scan code.



4. Direction

The direction for moving the Enterprise or firing a photon torpedo is given by entering a number from 1 through 8. These numbers will let you move or fire a torp every forty-five degrees.



5. Changing the game's difficulty

- You can change the number of torps allowed by modifying line 120.
- Another way is to change the time you are allowed before the Klingons fire. The value of TIS is changed by modifying lines 450,545, and/or 1530.

```

10 PRINT"{CLEAR}  ** STARFIGHT3 **"
20 PRINT:PRINT"DAVID R MIZNER,SEP81"
30 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE51
  ,PEEK(55):CLR
40 CS=256*PEEK(52)+PEEK(51)
50 FORI=CSTOCS+511:POKEI,PEEK(I+32768-CS
  ):NEXT
60 FORI=7168TO7175:READJ:POKEI,J:NEXT
70 DATA15,68,228,254,228,68,15,0
80 FORI=7448TO7455:READJ:POKEI,J:NEXT
90 DATA7,12,204,252,204,12,7,0
100 POKE36869,255
110 DIMA%(10,10),KL(6)
120 FORI=1TO10
130 FORJ=1TO10
140 A%(I,J)=0
150 NEXTJ
160 NEXTI
170 K=INT(RND(1)*3+1):S=INT(RND(1)*25+1)
180 KC=K:T=3*K:H=3
190 FORI=1TOS
200 GOSUB840
210 IFA%(C1,C2)<>0THEN200

```

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```

220 A%(C1,C2)=1
230 NEXTI
240 FORI=1TOK
250 GOSUB840
260 IFA%(C1,C2)<>0THEN250
270 A%(C1,C2)=2:KL(I)=C1:KL(I+3)=C2
280 NEXTI
290 GOSUB840
300 IFA%(C1,C2)<>0THEN290
310 A%(C1,C2)=3:E1=C1:E2=C2
320 PRINT:PRINT:PRINT"KLINGONS",K
330 PRINT:PRINT"TORPS",T
340 PRINT:PRINT"STARS",S
350 FORI=1TO3000:NEXT
360 GOSUB860
370 PRINT:PRINT"ENTER YOUR COMMAND"
380 PRINT"1=MOVE 2=TORP 3=END"
390 TI$="000000"
400 INPUTC
410 IFTI$<"000015"THEN440
420 GOSUB1130
430 GOTO360
440 ONCGOTO470,580
450 PRINT">YOU SURRENDERED"
460 GOTO1420
470 PRINT:PRINT"ENTER DIRECTION,DISTANCE"

480 C1=E1:C2=E2:TI$="000000"
490 INPUTC,D
500 IFTI$<"000015"THEN530
510 GOSUB1130
520 GOTO350
530 IFC>8ORD>14THEN490

```

```

540 A%(E1,E2)=0:GOSUB670
550 E1=T1:E2=T2
560 IFA%(E1,E2)=1ORA%(E1,E2)=2THENPRINT">
HIT A STAR OR KLINGON":GOTO1420
570 A%(E1,E2)=3:GOTO360
580 IFT>0THENGOSUB1270
590 IFT>0ANDKC>K0THEN360
600 PRINT">NO MORE TORPS"
610 IFKC>1THEN640
620 PRINT">RAM LAST KLINGON"
630 GOTO470
640 PRINT">YOU'RE OUTNUMBERED"
650 PRINT">FEDERATION IS LOST"
660 GOTO1420
670 ONCGOTO690,700,710,720,730,740,750
680 U=-1:V=-1:GOTO760
690 U=-1:V=0:GOTO760
700 U=-1:V=1:GOTO760
710 U=0:V=1:GOTO760
720 U=1:V=1:GOTO760
730 U=1:V=0:GOTO760
740 U=1:V=-1:GOTO760
750 U=0:V=-1
760 FORI=1TOD
770 T1=C1+I*U:T2=C2+I*V
780 IFT1<1ORT1>10ORT2<1ORT2>10THEN820
790 IFA%(T1,T2)>0THEN830
800 NEXTI
810 GOTO830
820 T1=C1+(I-1)*U:T2=C2+(I-1)*V
830 RETURN
840 C1=INT(RND(1)*10+1):C2=INT(RND(1)*10+
1)

```

```

850 RETURN
860 PRINT:PRINT" *** SCAN ***"
870 PRINT:PRINT" ++++++"
880 FORI=1TO10
890 PRINT" +";
900 FORJ=1TO10
910 ONA%(I,J)+1GOTO940,960,980
920 PRINT"@";
930 GOTO990
940 PRINT" ";
950 GOTO990
960 PRINT"*";
970 GOTO990
980 PRINT"#";
990 NEXTJ
1000 ONIGOTO1020,1030,1040,1050,1060,1070,
1080
1010 GOTO1090
1020 PRINT"+ COURSE":GOTO1100
1030 PRINT"+":GOTO1100
1040 PRINT"+ 1":GOTO1100
1050 PRINT"+ 8 2":GOTO1100
1060 PRINT"+ 7 3":GOTO1100
1070 PRINT"+ 6 4":GOTO1100
1080 PRINT"+ 5":GOTO1100
1090 PRINT"+
1100 NEXTI
1110 PRINT" ++++++"
1120 RETURN
1130 FORM=1TOK
1140 C1=KL(M):C2=KL(M+3):D=14
1150 IFA%(C1,C2)=0THEN1210
1160 PRINT">KLINGON SHOOTING"
1170 FORC=1TO8
1180 GOSUB670
1190 IFA%(T1,T2)=3THEN1230
1200 NEXTC
1210 NEXTM
1220 GOTO1260
1230 H=H-1:IFH<0THEN650
1240 PRINT:PRINT">ENTERPRISE IS HIT"
1250 PRINTH"SHIELD UNITS LEFT"
1260 RETURN
1270 PRINT:PRINT"PHOTON TORP DIRECTION"
1280 TIS="000000"
1290 INPUTC
1300 IFTIS<"000015"THEN1330
1310 GOSUB1130
1320 GOTO1410
1330 C1=E1:C2=E2:T=T-1:D=14
1340 IFC>8THEN1270
1350 GOSUB670
1360 IFA%(T1,T2)<>2THEN1400
1370 A%(T1,T2)=0:KC=KC-1
1380 IFKC=0THENPRINT"> FEDERATION SAVED <"
:GOTO1420
1390 GOTO1410
1400 GOSUB1130
1410 RETURN
1420 PRINT:PRINT
1430 INPUT"ANOTHER GAME 1=YES";2
1440 IFZ=1THEN120
1450 END

```

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Swirl And Scribble

Matt Giwer
Annandale, VA

Swirl produces extremely complex designs in Graphics 8 which have to be seen to be appreciated. These are not simple sinusoidal or trigonometric plots, but rather are of some artistic merit and may be suitable for logos, letterheads and the like.

The basis for these plots is the set of equations in lines 230 and 235. They arise from the study of modern control theory and are of interest in that a very small change in the two input constants, A and C, can produce a very large change in the shape and character of the plots. The program is easily adaptable to computers other than the Atari by simply plotting the values of X and Y as in line 250. The values of R and T merely center the plot on the screen.

On your first few plots you will notice that, for the first minute or so, the points will all be in a small area in the center. REM lines 2249 and 2250 show how to change line 250 to show this region. To get you started the 501 through 660 REM lines show pairs of values for A and C respectively.

A note of caution: since this uses Graphics 8+16, if the program should end, the display will go back to Graphics 0 and tell you that it is ready. This is why the I loop in line 215 is set to 3000. Although a few hundred would be more than enough to fill enough to fill the screen the extra hundreds hurt nothing and permit unexpected phone calls and the like.

Scribble

A computer program should be scaled to its users. Scribble is a simple program thrown together at the insistence of my six year old who remembered that our last computer had a built in game called scribbling. The Atari would never be up to his standards until there was a way to scribble on the screen. So in order to keep down the heated discussions as to which computer to hook up to the TV I threw this short program together. To my surprise this little program is held higher in his estimation than Star Raiders and is second only to his favorite sea serpent. I offer it here for your child's enjoyment.

To use, a joystick is inserted into position number one and this draws a line on the screen. Pushing the trigger erases the screen. No other

provision for operator interaction is made. Keeping it simple kept it popular.

Scribble

```
1 REM NAME SCRIBBLE
1100 GRAPHICS 5+16
1102 COLOR 1
1210 A=STICK(0)
1220 IF A=7 THEN X=X+1
1230 IF A=11 THEN X=X-1
1240 IF A=14 THEN Y=Y-1
1250 IF A=13 THEN Y=Y+1
1260 IF A=6 THEN X=X+1:Y=Y-1
1270 IF A=5 THEN X=X+1:Y=Y+1
1280 IF A=9 THEN X=X-1:Y=Y+1
1290 IF A=10 THEN X=X-1:Y=Y-1
1400 IF X<0 THEN X=0
1410 IF X>79 THEN X=79
1420 IF Y<0 THEN Y=0
1430 IF Y>47 THEN Y=47
1500 PLOT X,Y
1510 IF STRIG(0)=0 THEN GRAPHICS 5+16
1550 GOTO 1210
```

Swirl

```
50 GRAPHICS 0
80 ? :? :? :?
90 ? "INPUT A AND C :";
100 INPUT A,C
110 ? "A=";A;" C=";C
151 GRAPHICS 8+16:COLOR 1
152 R=150
153 T=85
154 SETCOLOR 2,1,0
155 SETCOLOR 1,4,13
170 X=1
180 Y=1
215 FOR I=1 TO 3000
220 S=X
230 X=A*Y+C*X+S*XXXX*(1-C)/(1+XXX)
235 Y=-S+C*X+2*XXXX*(1-C)/(1+XXX)
250 TRAP 315:PLOT X+R,Y+T:TRAP 40000
315 NEXT I
```

```

320 GOTO 220
330 END
501 REM 1.01,-1
502 REM 1.01,-.95
503 REM 1.01,-.92
504 REM VERY GOOD, BLACK HOLE 1.01,+0.8
505 REM 1.01,-.1
600 REM 1.0001,-2
601 REM A RANGE .999 AND .992; C RANGE -
2.0055 AND -1.9
650 REM 1.01,0
651 REM 1.008,+0.001<>-0.001
660 REM 1.008,+0.05<>-0.05
2249 REM TO SEE THE CENTER OF THESE PLOT
SCHANCE LINE 250 TO
2250 REM LINE 250 TRAP 315:PLOT X*10+R,Y
*10+T:TRAP 40000
4900 END
5000 GRAPHICS 0:LIST 1,330

```

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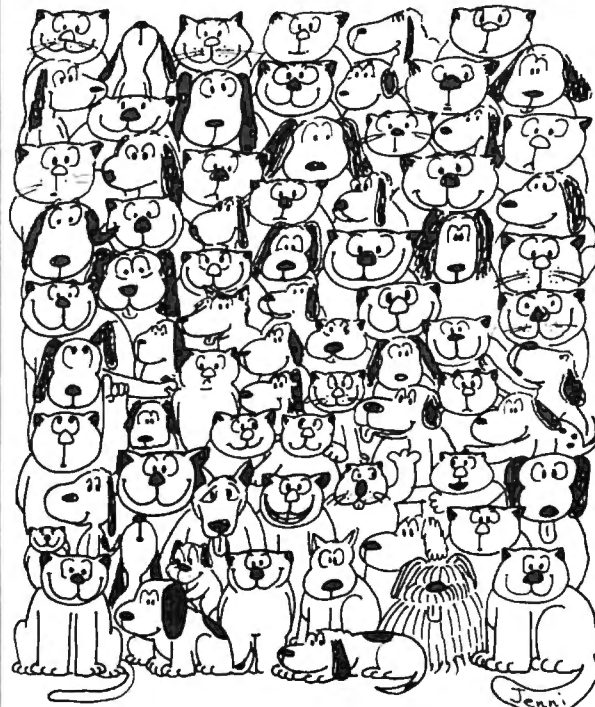
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Loran Gruman
Burnsville, MN

Here is a one-player game for a 40-column PET [or an 80 column machine with the program in **COMPUTE!** #12, pg. 130 loaded — Ed.]. If your machine has sound, turn it on.

```

100 REM WEB WRITTEN 1980 BY LORAN G
    RUMAN 2300 SO SKYLINE DR. ~
    BURNSVILLE
110 REM MINNESOTA, 55337
120 POKE59467,0
130 PRINT"{CLEAR}{02 DOWN}{08 RIGHT
    RIGHT}{REV}WEB INSTRUCTION
    S:{OFF}"
140 PRINT"{02 DOWN}YOU ARE THE NUMB
    ER."
150 PRINT"KEEP THE MOVING NUMBER FR
    OM TOUCHING ANYWEB ON THE ~
    SCREEN."
160 PRINT"{DOWN}THE NUMBER IS CONTR
    OLLED BY PUSHING:
170 PRINT"{DOWN}{03 RIGHT}8=UP ~
    8"
180 PRINT"{03 RIGHT}4=LEFT ~
    B"
190 PRINT"{03 RIGHT}6=RIGHT ~
    4C5C6"
200 PRINT"{03 RIGHT}2=DOWN ~
    B"
210 PRINT"{03 RIGHT}5=STOP ~
    2"
220 PRINT"{DOWN}          TEN HITS A
    ND YOUR OUT.{DOWN}"
230 PRINT"{02 DOWN}{04 RIGHT}PUSH A
    NY KEY WHEN READY TO START
    "
240 GETK$:IFK$=""THEN240
250 PRINT"{CLEAR}":A=32768:F=49
260 R=INT(RND(1)*500)+1:Q=A+R
270 GETB$
280 IFB$="4"THENC=-1:S=1
290 IFB$="6"THENC=1:S=1
300 IFB$="8"THENC=-40:S=1
310 IFB$="2"THENC=40:S=1
320 IFB$="5"THENC=0:S=0
330 IFC=40ORC=-40THEN360
340 IFP+C>39ORP+C<0THENC=0:S=0:GOTO
    360
350 P=P+C
360 IFAA=ETHENE=INT(RND(1)*25)+1:I=
    TT:TT=INT(RND(1)*4)+1:AA=0
370 IFTT=1THENQ=Q+1
380 IFTT=2THENQ=Q-1
390 IFTT=3THENQ=Q-40
400 IFTT=4THENQ=Q+40
410 IFTT=4ANDI=3THENQ=Q+1
420 IFTT=3ANDI=4THENQ=Q-1
430 IFQ>33768THENTT=3:GOTO360
440 IFQ<32768THENTT=4:GOTO360
450 LETAA=AA+1
460 POKEQ,81
470 IFA+C>33767ORA+C<32768THENS=0:G
    OTO270
480 T=T+S:IFS<>0THEN GOSUB680
490 A=A+C
500 V=PEEK(A)
510 IFV<>32ANDDV<>FTHENN=1
520 IFV=FTHENN=1
530 IFC=0THENN=0
540 IFN=1THENGOSUB650
550 F=F+N:IFF=58THEN570
560 N=0:POKEA,F:GOTO270
570 PRINT"YOU SCORED A TOTAL OF";T"
    {LEFT} ":PRINT:GOSUB690
580 PRINTTAB(30);"          ";
590 PRINT"          {02 LEFT}{0
    2 UP}"
600 PRINT"DO YOU WISH TO PLAY AGAIN
    (Y/N)";
610 GETPG$:IFPG$=""THEN610
620 IFPG$="Y"THENCLR:GOTO250
630 IFPG$="N"THENPRINT"{CLEAR}THANK
    S FOR PLAYING ":END
640 IFPG$<>"Y"ORPG$<>"N"THEN610
650 POKE59466,0:POKE59467,16:POKE59
    466,15
660 FORNN=30TO90STEP6:POKE59464,NN:
    NEXT
670 POKE59467,0:RETURN
680 POKE59464,150:POKE59467,16:POKE
    59466,15:FORZ=1TO10:NEXT:P
    OKE59467,0:RETURN
690 POKE59466,0:POKE59467,16:POKE59
    466,51
700 FORNN=225TO120STEP-2:POKE59464,
    NN:NEXT:FORNN=120TO255STEP
    2
710 POKE59464,NN:NEXT:POKE59467,0:R
    ETURN

```

Review:

Votrax Type 'n Talk: TNT

Charles Brannon
Editorial Assistant

The concept of the Votrax Type 'n Talk speech synthesizer is simple: you send the device a word, and it pronounces it. For example, the command PRINT#1, "HELLO" would cause the Votrax to say "hello." This makes programming it simple and fun. Other synthesizers can require you to construct words from one or two letter *phonemes*, the simplest units of speech. For example, the word "hello" might be coded as: "H EH3 L O" or "[@X&." Yet another kind of synthesizer lets you send English words, but has a memorized vocabulary which is limited by memory size. What makes Votrax unique is the combination of ease-of-use and flexibility.

The voice is distinct and understandable, but it is obviously artificial. It sounds robotic, similar to the voice synthesizers found in many arcade and electronic pinball games. Both volume and frequency (pitch) can be adjusted with knobs. The voice sounds most natural at its lower frequency.

Built into the unit is a "text-to-speech" algorithm that converts English words into phonemes that can be pronounced by the device — no easy task. Considering the complexity of the English language, it is a remarkably good algorithm, permitting you to generate speech with straightforward PRINT statements. Its arbitrary methods can cause some problems. "COMPUTE!" sounds like "comput." "HELLO" sounds a bit slurred, "HUH LO" sounds better. It is sometimes necessary to intentionally misspell. "COMPUTE!" sounds excellent when spelled "COM PEWT." The space breaks longer words into distinct syllables. Some few words are tougher to generate; for example, MOUSE becomes "mus" (the *ous* is treated like the *ous* in *dangerous*). Spelling it MOWSE doesn't help; it comes out "mose" as in *most*. To solve any such problems you can also program speech directly with phonemes.

Is Votrax for you? It depends on the application. Votrax can be the basis for some fascinating dialogue games, such as ELIZA and Adventure. It

can liven up arcade games with threats, taunts, and warnings (We Are The MURLOD Invaders).

Voice synthesis is an alternate (superior?) man-machine interface; it can streamline business (can you imagine your computer saying "Please insert the Word Processing Disk?"). It would be of tremendous aid to the blind, where every character typed could be spoken and, when SPACE was pressed, the preceding word spoken.

Votrax can be attached to almost any computer, via an RS-232 interface. It can even be attached between the computer and another device, permitting data to be spoken automatically (CompuServe becomes TalkuServe?). Although a one-watt amplifier is built in, you must provide a speaker (eight-ohm).

The significance of the Votrax Type 'n Talk is its text-to-speech routine. It permits beginners to use it immediately, and relieves professionals of the tedium of phoneme construction. The Votrax deserves its acronym — any device that can pack so much power into such a small box is truly TNT!

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Review:

Olympia's ES 100 KRO Typewriter/ Printer

Richard Mansfield
Assistant Editor

The ES100, one of a line of Olympia printer-typewriter combinations, can serve as an advanced, stand-alone typewriter with correction facilities or as a computer printer. It contains a built-in RS 232-C serial interface and will work with most personal computers. As one of the new "intelligent" typewriters, it operates somewhat differently from the venerable machines so common only a few years ago.

The first thing you notice is that very little is *mechanical* – you don't move margin stops, you simply set them with left and right margin keys. All keys are repeating, when used with the "repeat" key. Reverse vertical half-line spacing (for superscripts), choice of two pitches, reverse tabulation, CR without LF, and several line spacings are all key-selected. Unlike the older generation of electrics, most of the formatting and spacing is done from the keyboard. As when using a word processor, you can move around the page without taking your fingers from the keys.

Another feature of this latest generation of typewriters is their feel. They resemble a computer keyboard in layout, versatility, and touch. Instead of a direct mechanical relationship between a pressed key and struck paper, the keys simply click to let you know that they've been acknowledged by the system. The 96-character typewheel responds at 16 characters per second (if you could type that fast). This separation of the mechanical from the keyboard activities makes sense when the printing mechanism does not care whether it gets information from the keys or from a computer.

A green LED shows, on a numbered scale, the precise typing position. The value of some of these features might not be immediately obvious, but, in use, their utility becomes clear. The carriage return without line feed, for example, makes underlining easier. Reverse tabulation means that you don't

need to return to the left hand margin to access the tab stops – you can move left through the stops as well as tabbing right, the traditional direction.

Specifications

The typewriter stores functions in an accumulator with the margin release and tab settings "remembered" for 70 to 90 hours. A "correction memory" allows the revision of up to eight characters if the mistake is noticed at once. Depending on the platen size (13/15 inches) the printer supports a maximum paper width of 12.9/15.3 inches and a line length of 11.6/15.5 inches. The unit weighs 30.3/36.3 pounds.

There are 92 characters on the keyboard and line spacing can be either 1, 1½, or double. Horizontal spacing (keyboard selected) is between ten and twelve characters per inch. A variety of typestyles are available on the printwheels and there are five types of ribbon cartridges (black, black/red, carbon, correctable film, or multi-strike).

Using a standard Type D 25 connector, the interface permits odd, even, or no parity bits and the data rate is jumper selectable between 110, 134.5, 150, or 300 baud.

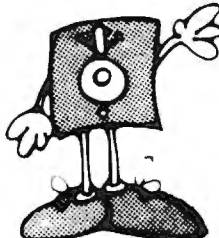
There are a variety of "daisywheel" printers on the market. These printers feature excellent, crisp lettering and typefaces which are easily and quickly changed. The Olympia ES 100 KRO deserves to be considered even if the intent is simply to upgrade an older electric typewriter to the new generation of intelligent electrics. If you ever want computerized, full word processing – the purchase of one of the state-of-the-art electrics would make the transition painless.

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RPL: A FORTH Sequel?

Jim Butterfield
Toronto, Canada

RPL is a FORTH-related language produced by Samurai Software. There are versions for all PET/CBM machines, and it will fit in systems as small as 8K. It is similar to FORTH in many ways ... but there are fundamental differences.

RPL stands for Reverse Polish Language. This is the backwards-type of coding which calls for you to write $X + Y$ as $X Y +$ and $PRINT M$ as $M PRINT$. Owners of Hewlett-Packard calculators will be used to this kind of thing by now and, in fact, it makes good coding sense to do it this way.

Proprietary

Since RPL is a proprietary system, the language must be considered in a different category from FORTH, FORTRAN, or BASIC. It seems unlikely that competing RPL's would be generated by various sources, and RPL literature will be confined to a relatively small community of purchasers.

Timothy Stryker, the author of the language and compiler, has taken many of the characteristics of FORTH, rebuilding and reconceptualizing as he saw desirable. The result will not please FORTH traditionalists – it has a different style from FORTH – but it does form an interesting new language.

Faster? Simpler?

One-to-one comparisons of FORTH versus RPL programs shows that RPL fits in slightly less space and runs slightly faster. This is surprising, since FORTH is known for its compactness and high speed.

Savings in time and memory are achieved, at least in part, by reducing the generality of the language. FORTH works interactively with a user; each program module can be checked out the moment it is typed in, and the user can try things out as he builds his program. RPL is less interactive: the user writes code and then gives the command **COMPILE** to generate a runnable program. This allows RPL to be more efficient, but reduces user interaction; however, RPL has features to offset this problem during debugging.

Another reason for RPL's speed and compact-

ness is in the internal representation of the program. FORTH uses threaded code, where each "action" of a command is represented by a subroutine address; RPL uses p-code, with each action represented by a token value.

RPL has a streamlined vocabulary of operators; slightly over forty commands are implemented, and all are useful. This compares well with FORTH, which seems to the beginner to be cluttered up with hundreds of commands, many of which are seldom needed by the programmer. The commands are nicely chosen for newcomers; many closely parallel BASIC keywords.

PET/CBM owners will be pleased to see that their machine's characteristics are well supported by RPL. BASIC can co-exist with RPL, and file input/output capabilities are preserved. There's a danger, of course: Programs using "custom" features won't transport well to other computers.

SIM, a symbolic debugger, is sold as a separate package. It allows users to try out sequences of commands before writing them into a program. It has a nice way of presenting the stack visually which may help give users an intuitive feel for how RPL works.

Considerable documentation comes with RPL (60 pages) and SIM (12 pages). The material is nicely written and is quite well done; the approach is tutorial in nature and uses examples liberally.

We've been comparing RPL to FORTH because of the similarities in the languages. RPL deserves to be rated on its own merits.

It's not as easy as BASIC or as pretty as APL. But RPL is fast, compact, and relatively straightforward to program. Users will have to learn to cope with stacks and the backwards-like Reverse Polish Notation. It may take a particular mentality to get hot in an RPL-like language; but the payoff in efficiency can be very good.

*Samurai Software, P.O. Box 2902, Pompano Beach, FL 33062.
RPL Compiler, \$49.95 on disk, \$44.95 on cassette; Debugger
Compiler and Debugger are ordered together. Specify computer ROM
system and disk type.*



Review:

Ricochet

Richard Mansfield
Assistant Editor

An intriguing new game from Automated Simulations, Ricochet (for the Apple, Atari, or TRS-80) demonstrates why there is so much new interest in games. With the advent of the computer, suddenly there are entirely new categories of games: simulations, interactive adventure stories, exciting hybrids which combine the preplanning involved in traditional strategy games like chess with the visual, physical action of games like pinball.

Ricochet falls into the hybrid category; it has to be seen to be understood, but it's something of a combination of pool and checkers. Each player (you vs. the computer or you vs. a friend) has nine "bars" which initially appear in front of a set of "bumpers." The bars start out in a 4-3-2 pattern, guarding your bumpers, since your opponent can score points by landing in your bumpers.

There are two possible ways to react during your turn. You can change the arrangement of your bars or you can *launch* which sends a ball out from one of your corners ricocheting off walls, bars, and bumpers, and gaining points for each one hit. The ball continues to ricochet until it goes past a bumper into space or hits a corner launcher. Hitting a corner, aside from ringing up points, can render that particular launcher useless for the remainder of a game. You make your moves and launches either from the keyboard or with joysticks.

Broadly defined, the idea is to arrange your bars (which toggle between vertical and horizontal orientation, when hit) so that you best protect your bumpers and launchers. Likewise, you attempt to launch in such a way as to maximize the damage to your opponent.

A Smart Clock

Ricochet takes full advantage of the computer's ability to handle many variations of play. If you play against the computer, it can take on four distinct "personalities" each of which use different strategies. Beyond this, there are five variations of the game itself. In variant two, you can win extra

launches, and variant three adds two extra bumpers to each side. Variant five removes all the position markers from the playfield and it becomes more difficult to predict the ricochet effects of a launch.

If a player takes too much time planning or arranging his bars, a *smart clock* starts giving points to the opponent. It is smart because it determines how much is "too much time" by averaging the opponent's decision-making time. In effect, if you make your moves quickly, you force your opponent to move quickly too.

The game is "intelligent" in several senses. If you lose a game, the next game adds point value to your opponent's bumpers while your bumpers retain their original value. This evens things up since you will score more points when you hit the opponent's bumpers.

In the past few years, with computers becoming widely available in homes and game arcades, a variety of new types of games have appeared. Ricochet is an excellent example of this emerging art form.

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Review:

Atari Microsoft BASIC (Part I)

Jerry White
Levittown, NY

*Editor's Note: This review is in three parts. The second and third parts will appear in **COMPUTE!** April and May. — RTM*

Not long ago, the Atari Personal Computer owner had two programming alternatives: 8K Atari BASIC and Assembler Language. Now there are three versions of BASIC from which to choose, plus PILOT and PASCAL.

The most recent Basic on the market is called Atari Microsoft BASIC (AMSB). Those of you familiar with other versions of Microsoft will feel right at home with the Atari version. It is said to be the most powerful Microsoft of them all and will certainly make program conversion much easier. The manual provides all the information needed for converting from many other versions of BASIC including PET BASIC, Apple and Applesoft BASIC, Radio Shack Level II BASIC, and Atari 8K BASIC.

This series of articles is being written to help you decide if AMSB is for you. If the Atari is the only computer you've ever had, and 8K Atari BASIC is the only version you've ever used, you will need some specific comparisons to understand the advantages and disadvantages of using AMSB.

Disadvantages??? Yes, although AMSB provides dozens of advantages over 8K Atari BASIC, there are always two sides to every story. So let's get the bad news out of the way first.

The most obvious of the bad news is cost, about \$80.00. You'll also need at least 32K RAM and a disk drive since, as of this writing, AMSB is available only on diskette and requires 11,252 bytes more than 8K Atari BASIC. Since the language must load from disk, there's 40 seconds of boot and load time.

Some Tradeoffs

If you can live with the previously mentioned disadvantages, you'll surely find the power and flexibility of AMSB worth looking into. There are, however, a few other sacrifices that must be made by the 8K BASIC user. AMSB has no immediate

syntax error checking and permits only two abbreviations, ? = PRINT and ! = REM. Oh how I miss typing GR.0. You also must give up that unlimited length string in trade for string arrays. The 8K STICK, STRIG, PADDLE, and PTRIG commands are not included, but they are easily replaced with PEEK and POKE.

Now for the good news! Here are a few of the most significant advantages AMSB has to offer:

COMMAND	PROVIDES...
AUTO	Automatic line numbering.
COMMON	Variable values are passed from one program run to another.
DEF	Define integer, single, and double precision.
DEL	Delete range of lines from program.
DIM	Three Dimensional Alpha/Numeric Arrays
ELSE	IF THEN ELSE decisions.
INSTR	Search for a small string within a larger string.
MOVE	MOVE a number of bytes from one area of memory to another.
OPTION	Reserve RAM for Assembler Routines, Player Missile Graphics, Redefined Character Sets.
PRINT	AT specified coordinates.
PRINT	(TAB) and (SPC) positioning.
PRINT	USING for formatting output such as right justified currency amounts.
RENUM	Renumber lines and references.
TIME	In 60ths of a second.
TIME\$	Current time in HH:MM:SS format.
TRON	Current line number trace display on.
	Turn off trace function.
VERIFY	Verify Program in memory with program on tape or disk.
WAIT	Loop until specified conditions exist.

Many commands are identical in both Atari BASICs. Some commands perform identical functions but are formatted differently. For example, 8K BASIC uses the XIO command for many useful functions. AMSB makes things easier to remember with commands like FILL, KILL, LOCK, MERGE, NAME, and UNLOCK. AMSB uses PLOT TO instead of DRAWTO, CLS instead of ?CHR\$(125), and SCRNS\$ instead of LOCATE.

Some of the other commands available in AMSB include AFTER, CLEAR STACK, EOF, ERL, ERR, ERROR, INKEY\$, LEFT\$, LINE INPUT, MID\$, ON ERROR, RANDOMIZE, SAVE with LOCK, STACK, and STRING(n,X\$).

One beautiful feature was added to the SOUND command. An optional fifth variable for duration has been added. The duration is a value of up to 255 JIFFIES (60ths of a second). Up to 25 SOUND commands may be stored on the STACK, eliminating the need for many time delay loops. AMSB can go on to calculations or display work while SOUND commands execute at previously specified intervals.

The ability to define integers allows floating point routines to be bypassed. This can account for significantly faster execution. How much faster, you ask? I'll get into speed comparisons and routine examples in part two of this series.

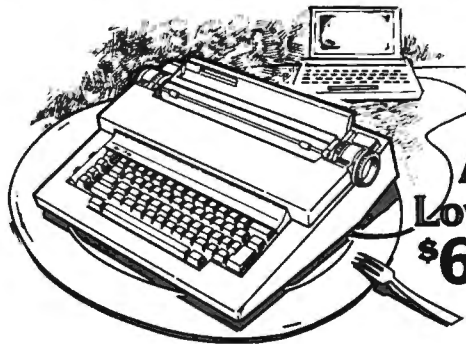
I Use All Three

Before closing this segment, I'd like to voice some of my own personal opinions. AMSB will certainly find its place in the rapidly growing Atari software market. Both the beginner and experienced programmer can benefit from the wide range of commands offered. The buyer should also be aware of another alternative called BASIC A+.

Anything you can do using AMSB can be done in 8K BASIC with occasional help from an Assembler subroutine. AMSB offers a great deal to the BASIC only programmer, but cannot be used by those with less than 32K RAM or without a disk drive. Personally, I've grown to really appreciate the amazing number of features Atari BASIC has squeezed into an 8K ROM cartridge. I've also learned to appreciate fast binary I/O and the DIR (Disk Directory) feature available in BASIC A+, as well as the speed made possible by the AMSB integer feature. They all have their advantages and disadvantages. Which one do I recommend you ask? I use all three.

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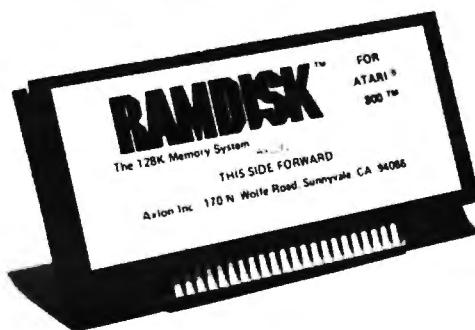
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TELECOMMUNICATIONS

Modem Applications

Michael E. Day
Chief Engineer
Edge Technology

*In **COMPUTE!**, September, 1981, #16, Mr. Day discussed technical specifications for MODEM's. Here he explores several uses for MODEM's in everyday computing. — The Editors*

One of the questions I am often asked is: "Why do I need a modem?" It is interesting that this question would be asked rather than just "Do I need a modem?" since this indicates several things. The need for the modem is already felt.

The feeling of the need for the modem comes about because of the large amount of information presented to the person about telecommunications both in magazines such as this one and in talking to other computer users. This tends to lead to the belief that if you do not have a modem you are not using your computer to its fullest potential. Unfortunately, the reasoning for this belief is not readily apparent. Analysis of the information generally presented on telecommunications shows why this is so. The most common type of information that is presented is of a technical nature. This assumes that you already know why you do or do not need a modem, and are simply after "how does it work" information. The other type of information that is presented is applications information. Again this assumes that you already know why the modem is needed, and that you are simply after the information on how to use it for a particular type of application.

The question *why* is one of the hardest of this type to answer. It cannot be answered directly. When you ask *why*, what you are really saying is give me more information so that I can decide if I really need it. The information that is normally provided is reference information with which you are familiar. In answer to "Why do I need a car?",

one might answer "In order to get to and from work." This provides a base point that you can expand upon to gain the information needed to determine how the car would fit into your lifestyle. A response could be "But I can take the bus." with a return of "But what if you work odd hours when the bus doesn't run?" This generates the pros and cons necessary to make a final decision.

The problem that we have with the modem is the same problem that the computer has experienced — a lack of readily discernible common reference points. In answer to why do I need a computer, the easily determined reference points tended to be rather weak, such as to balance your checkbook, or keep records of your gas mileage. Since these could be done far more cheaply with existing alternative methods, they hardly generate a decision in favor of the computer. The computer is slowly overcoming this problem by creating its own reference points. The computer is doing things that were not possible before (controlling heating and lighting to minimize utility bills, or writing letters (or magazine articles) with greater ease than ever before, even playing exciting new games and, as a side benefit, you can balance your checkbook too.

The modem is going through the same stage of development of use. It is a device that has entirely new uses and concepts that are not currently realized, and it must "create" these in our awareness so that they can be realized of their own accord.

Computerized Bulletin Boards

Originally the question was easy to answer, the modem was for the purpose of operating a computer from a remote location. If you had to do this, you had to have the modem. If you did not have to, then you did not need a modem.

Now, however, that use of the modem has been radically altered. With the advent of the personal computer we can put the computer at the remote location along with the user.

If you are only going to use the computer to play games or balance your checkbook, you probably don't need a modem. If you want to communicate with other computer users, however, there is a very good probability that, at some point, you will need a modem.

One of the new uses is the Computerized Bulletin Board Systems that appeared. These are public access message systems which can be used by anyone to post messages or read those left by others. These tend to be messages that don't fit into normal modes of communication and include calls for help, general notices of information, advertisements, classifieds, and personal messages. There is no charge for the use of these systems, they are

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As an outgrowth of the BBS's are the remote computer systems and database systems. Although many of them are open to the general public, they are not readily usable due to the technical knowledge needed. Additionally, these systems tend to be very specific in the application to which they are oriented and are generally of little or no use to the general public.

Because the bulletin boards are privately supported, they are limited in the scope of services they can provide. For those who are willing to pay, there are more elaborate systems available. The most widely-known are CompuServe, The Source, and Micronet. These systems provide a wider range of services including message transfer, information retrieval (stock reports, news, etc.), conferencing, program storage and retrieval, and running programs.

Often there is a need to find information of a more extensive or technical nature than can be provided by the general services systems. This need is provided for by the technical information database systems. These systems are usually oriented around a particular subject area or group of areas. The technical data systems, by being very specific can carry a much wider range of information on a subject than is possible on a general information system. Because this information is also the most expensive to obtain, these systems are the most expensive to use. They can cost over \$100 an hour.

Multuser Systems

Finally we come to the original multuser computer systems, time-share computer systems. These systems are rented on a usage basis to anyone who needs a computer, but, for some reason, does not have a computer of his or her own available. These are generally used for overflow work, temporary, or occasional applications where it is not possible or practical to use one's own computer. The cost of using these systems can vary widely depending on how the usage is determined.

It is interesting that now that the personal computer has come into being, another application appears to be evolving. This can best be understood by describing the need that has been generated.

If you wish to say something to George who lives down the street, you could go to his house and speak to him directly, or you could call him up on the telephone and talk to him. In the first case there was no *equipment* involved in talking to George, you went to his house. This is *direct* communications. In the second instance you used the telephone to talk to him. Rather than expend the energy to go

to George, you used a device which allowed you to talk to George without actually going to his house and thus you were *communicating at a distance*.

If you and George both have a computer and you wish to share programs you have written, there are many ways this could be done. You could put a copy of the program on a cassette or floppy disk and give it to George to read into his computer. This works great if George has a similar computer and can read the tape or disk.

If the two systems are not compatible, another way will have to be found. One way that has been used a lot is for you to simply provide George with a written copy of the program and let him type it into his system. This isn't too bad if the program isn't very long and is in human-readable form. This is the way most magazines provide programs as it is the surest way to cover a wide range of computers. But, as mentioned, if the program is not in a human-readable form, or is excessively long, this method does not work very well.

Computers Talking To Computers

A method of communication that computer hobbyists have often used is to directly tie their computers *back to back*. This is a form of *direct communication*. This allows the computers to talk to each other, but has the disadvantage of requiring that both computers be next to each other. To date, it has also meant that the computer operator be fully knowledgeable of the way the computer internals work as well as the programming needed to allow the two computers to talk to each other. This can be a bit much for the general user and, in fact, has baffled quite a few experienced computer technicians.

The modem provides a common link that both computers can communicate through. By defining a standard of how the interconnection between the computers is to be accomplished, the problem of how to hook the two computers together is eliminated. What is occurring now is a definition of the method of communication between the computers. Although there are some communications programs in use already, they are currently machine-type dependent. An Apple can talk to another Apple, but it can't talk to an Altair. Most of the programs that are used to allow one computer to communicate to another are in the early stages of development: they allow the communication to occur, but there is little or no provision for options or alternatives. They tend to be very restrictive in their use.

As the need to communicate between different types of computers grows, the communications programs will become simultaneously more comprehensive and easier to use.

7 ATARI PRODUCTS



THE MONKEY WRENCH

The Monkey Wrench is a machine language ROM cartridge which extends the operating capability of the ATARI 800 computer. The Monkey Wrench provides 9 new BASIC commands. They are:

- Auto Line Numbering** - Provides new line numbers when entering BASIC program lines.
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- Cursor Exchange** - Allows usage of the cursor keys without holding down the CTRL key.
- Change Margins** - Provides the capability to easily change the screen margins.
- Memory Test** - Provides the capability to test RAM memory.
- Hex Conversion** - Converts a hexadecimal number to a decimal number.
- Decimal Conversion** - Converts a decimal number to a hexadecimal number.
- Monitor** - Enter the machine language monitor. In addition to the BASIC commands, the Monkey Wrench also contains a machine language monitor with 15 commands used to interact with the powerful features of the 6502 microprocessor.

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The Machine Language Monitor for ATARI provides 21 commands which allows the user the ability to interact with the 6502 microprocessor. It is compatible with ATARI BASIC and (once loaded) is ready for your use at anytime. The monitor comes on cassette or on diskette for the ATARI 810 disk.

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Machine Language: Loops And Quality

Jim Butterfield
Toronto, Canada

Program loops seem to be a byproduct of laziness. When a programmer tires of writing a series of instructions, he produces a loop to save coding time and processor memory. Yet something more profound happens at the same time: the program usually becomes more generalized.

Suppose I wanted to place the value hexadecimal 20 into locations \$8000 to \$8027. My first instinct is to code: LDA #\$20 : STA \$8000 : STA \$8001 : STA \$8002 ... and so on. Around the time I reach \$800B, it will probably occur to me that I'm writing a lot of essentially similar code. Creative sloth comes into play. I observe that the repeated instruction is STA \$something. Racking my brains, I decide that if I could vary the "something" part, I could then do most of the job with a variable instruction.

"Indexing!", I cry, and proceed to tear up the old sheets and code LDX #\$00: LDA #\$20: (loop) STA \$8000,X: INX: CPX #\$28: BNE (loop). This drops coding to six instructions instead of forty-one and memory usage to twelve bytes instead of one hundred and twenty-two; but the running time increases from 162 to 443 microseconds. There's no use crying over spilt microseconds: the time difference is less than a three-thousandth of a second, and I'll usually happily take it rather than a case of writer's cramp.

But something more important has happened than just mechanics. If I want to convert my first ("hard way") program so that it stored into 64 locations, or stored to address \$0400 and up, I have no choice but to rewrite. On the second program which uses loops, it's a snap. A mere stroke of the coding pen, a one or two byte change, and the job's done. We've somehow created a program that's more general and more applicable to a range of tasks.

As we consolidate our program, we have to generalize. And as we generalize, we not only

shorten the code: we create sturdier and more broadly applicable code.

A word to those picky bit-and-microsecond counters who will point out that we could save two bytes and a few dozen microseconds by starting our index X at 39 and counting it down to zero. Sure you can. But that kind of picking is not what makes sounder code. We want to look for methods that generalize; they are the ones that will produce sturdy and reliable code ... and perhaps save us a few coding lines and bytes.

A Larger Scale

The same ideas apply to coding that repeats several lines. When you find yourself writing the same code, look for a generalization. Take these two sets of coding:

ONE	LDX	#\$09	ZRO	LDX	#\$06
	PHA			PHA	
ONE1	BIT	CLKRDI	ZRO1	BIT	CLKRDI
	BPL	ONE1		BPL	ZRO1
	LDA	#126		LDA	#195
	STA	CLK1T		STA	CLK1T
	LDA	#\$A7		LDA	#\$A7
	STA	SBD		STA	SBD
	

The above subroutines are from the tape write program of the KIM. ONE writes a logic 1 to tape; ZRO writes a logic 0 to tape. They are very similar. The only differences are: nine versus six on the first line, and 126 versus 195 on the fifth line. How might we consolidate these two pieces of program?

At the moment, the Y register doesn't seem to be used. We could ask the calling routine to set Y to zero or one, depending on whether we wanted to call ZRO or ONE activities; and then write a common routine:

ZONE	LDX	TABLE,Y
	PHA	
ZONE1	BIT	CLRKDI
	BPL	ZONE1
	LDA	TIMING,Y
	STA	CLK1T
		...etc.

We have now consolidated the two routines. The values 6 and 9 which count the number of cycles in each signal are now stored in a table TABLE. The values 126 and 195 which set the timing of each cycle are in a second table TIMING.

Have we accomplished anything other than saving a few bytes of code? Yes, almost accidentally. Now that the number of cycles are stored neatly in a table, we can easily adjust them to change the type of signal we write. In fact, this particular coding was part of the sequence that led to the introduction of the high speed tape format known as Hypertape.

Deeper...

The programmer doesn't always have free registers,

of course; but the methodology of saving registers isn't hard to do.

Where addresses within a program change from routine to routine, the best way to handle this is via indirect addresses. If program 1 searches table 1, and program 2 searches table 2 and so forth, indirect address.

Consider: if you have written a game with planes and tanks moving around the screen, you may find that, with a little work, a single subroutine can move both craft around. Once you have generalized, all sorts of bonuses arrive: the bombs and shells can likely be folded into the same subroutine. Collisions and other effects can now be handled in their generalized form rather than as special coding (did a bomb hit a shell? did a plane hit a bomb? did a shell go off screen? etc...)

What seems to start out as laziness or convenience develops into something more important. In reaching for the general solution, we write much better code.


Many programmers often find themselves very pleased with a program they have written; it seems "good" to them, although they don't know exactly why. It's usually because they have solved more than the specific problem — they have solved a whole class of problems. ©

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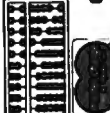
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INSIGHT: ATARI

Bill Wilkinson
Optimized Systems Software

Good news! I have finally found out how and where you will be able to obtain copies of *De Re Atari* ... and it won't even cost you your left thumb. The Atari Program Exchange now has it available for \$19.95 plus shipping. The part number for it is APX-90008, and you can order it through 800-538-1862 (800-672-1850 in California). There are several changes and improvements from earlier versions, including a section on the GTIA. One disappointment is that an appendix on random access files has been deleted. Oh well, leaves room for me to do a future article.

The How and Why articles on Atari BASIC that appeared in the last two issues were the result of requests for ways of "hooking into" BASIC, in order to add commands, etc. I am trying to gently break the news that you *can't* add commands to a RUNning program (though direct, keyboard commands can be done by intercepting keyboard input, as I presume the Eastern House "Monkey Wrench" does.). But I have been trying to lead up to *why* you can't add commands, so that people won't waste time on false leads in trying to prove me wrong.

However, I am suspending the How and Why series this month in order to take a look at the USR function. It is my belief that the USR function will give most of you access to all the added commands you could write, which lessens somewhat the impact of not being able to integrate your own commands. In addition to some suggestions on usage, this month we implement a really powerful USR function: one which will play a song (or most any kind of sound) in the background while your BASIC program continues to chug away (zapping Klingons, etc.). Naturally, there will also be the usual mix of tricks, etc.

In order to deliver on my promise to the BASIC users regarding the song-playing USR function, I must first lead the assembly language fanatics through a short intro to the Atari's interrupt system. As far as I know, the Atari is the only low-end personal computer that gives you such complete access to a fully-integrated, usable interrupt system. The Atari OS is structured to take advantage of several of these interrupts; and, more importantly, the user is invited to gain full or partial control of most interrupt routines. This despite the fact that Atari's interrupt service routines are in ROM.

The 6502 microprocessor supports two types of interrupts: NMI (Non-Maskable Interrupt) and

IRQ (Interrupt ReQuest). A bit in the CPU status byte controls whether IRQ's will generate interrupts, but if an NMI signal is presented to it the 6502 will always call in interrupt service routine. Atari, however, allows the user to prevent NMI's from reaching the CPU (except for the RESET button), thus giving even greater control. Once again, I must refer you to the Atari Technical Manual for full details, but herewith is a summary of the available interrupts.

Table 1. Available Interrupts

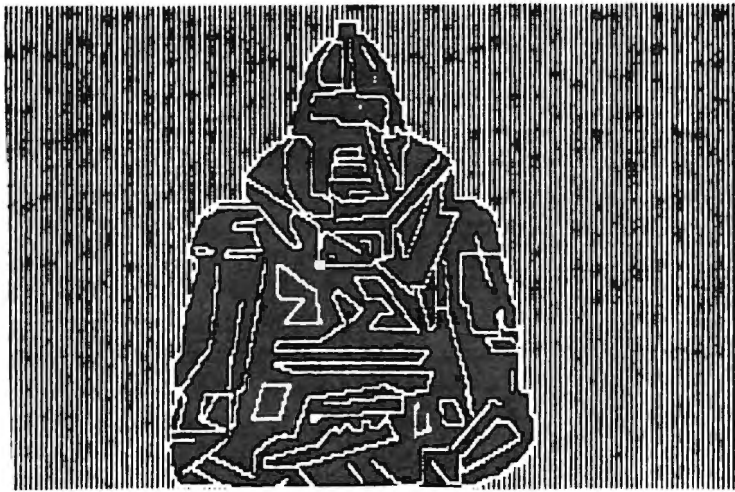
Type	Description
NMI	Reset Button (the only uncontrollable interrupt)
NMI	Display List Interrupt
NMI	Vertical Blank Interrupt (60 times per second)
IRQ	BREAK key
IRQ	any other key
IRQ	Serial Input (for SIO communication with disk, etc.)
IRQ	Serial Output (ditto)
IRQ	Serial Transmission Completed (ditto)
IRQ	Timer #4
IRQ	Timer #2
IRQ	Timer #1
IRQ	6520 parallel port "A"
IRQ	6520 parallel port "B"
IRQ	BRK instruction encountered (internal to 6502)

Each of the available interrupts, except the Reset Button and the BREAK key (and Timer #4 on all except newest machines), has a vector (two byte pointer) through RAM. To take control of an interrupt, simply put the address of your routine in the vector, and OS will call you instead of the default routine. The only exception is the Vertical Blank Interrupt, which is handled slightly differently and is the real subject of this article.

The Vertical Blank Interrupt (VBI) is really the key to many of Atari's unique features. It occurs 60 times per second, at the bottom of each scan of the TV screen, and is used by the OS ROMs to do all sorts of things. First, and perhaps most obvious, it drives the three-byte clock at locations \$12,\$13,\$14 (18,19,20 decimal) as well as several other usable event timers (e.g., serial bus timeout), most of which are accessible to the user. Second, and most useful, it allows changes to the graphics-related hardware at a time when nothing is being displayed on the screen: it moves all the "shadow" locations (see the technical manual) to their corresponding hardware ports.

Of necessity, then, the user would not normally want to interfere with the operations of the VBI routines. But, once again, the Atari software design team thought ahead: they provided not one, but two, VBI vectors. Thus, upon receipt of a VBI request, the ROM code first calls the routine pointed

FOR ATARI



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to by vector VVBLKI (at \$0222) and then calls via the vector VVBLKD (at \$0224). The 'I' and 'D' stand for "Immediate" and "Deferred," respectively.

Normally, the user routine would not replace the vector at VVBLKI. Thus the Atari ROM code can update its clocks and move its "shadow" registers in confidence that it will finish its job before the screen starts displaying the next TV frame.

The user may replace VVBLKD to cause his routine to execute directly after the Atari system code.

Some cautions are in order:

(1) Disaster will strike if your VBI routine is not done before the next VBI occurs. If you simply need to synchronize your routine to a vertical blank, just wait for the system clock to tick before starting (see the label WAITVB in this month's example program).
 (2) As with most Atari vectors, the safest way to use these is to move them somewhere in your own data area, replace them with your pointer, and have your code finish up by jumping back via the original Atari routine. This is particularly important to do with interrupt handlers, else the interrupt system may not be properly reset.

Finally, let me note that you may, if you really have to, steal the entire VBI processing for yourself. This is not necessarily bad (especially if you are writing a dedicated game, etc.), but be forewarned that you will have to worry about shadow registers, etc., yourself. There is a lot more to this subject, including what Atari refers to as time-critical I/O, but for most purposes you should be able to work within the rules I have outlined.

A Real, Live Example

The example program this month is designed to be used via `USR` from BASIC, but there is a simplified entry point from assembly language. You could lift this program as is and plunk it into any assembled game, etc. The idea behind the program is simple: a routine is passed a sequence of bytes which are interpreted to be commands to the sound genera-

tors of the Atari hardware. The routine examines the bytes and performs the requests. One of the available requests is to "play" sound(s) for a specified length of time; upon encountering this request, the routine waits the appropriate time before processing the next byte. Simple.

Except that this routine will operate (invisible to a running BASIC program) merrily playing

Main Assembly Listing

```

0000      1000      .PAGE "      equates, origins, etc."
          1010      ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          1020      ;
          1030      ; PLAYIT  -- a demonstration of performing
          1040      ;          clocked, interrupt-driven
          1050      ;          tasks under Atari OS.
          1060      ;
          1070      ; Written by Bill Wilkinson
          1080      ;       for March, 1982, COMPUTE!
          1090      ;
          1100      ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          1110      ;
0600      1120      ORIGIN =   $0600
0000      1130      * =   ORIGIN
          1140      ;
00FF      1150      LOW   =   $FF
0100      1160      HIGH  =   $100
          1170      ;
D200      1180      AUDF1 =   $D200      ; Frequency, audio channel 1 (sound
          0)
D201      1190      AUDC1 =   $D201      ; Channel 1 control & volume
          1200      ;
0224      1210      VVBLKD =   $0224      ; Delayed Vertical Blank routine
          1220      ;
0014      1230      CLOCKLSB = $14        ; the system clock, LSB of 3
          1240      ;
00CE      1250      PLAYADDR = $00CE     ; 2 byte pointer in safe place
          1260      ;
          1270      ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          1280      ;
          1290      ; Equates for our private sound commands
          1300      ;
00FF      1310      CMDR  =   255        ; Repeat
00FE      1320      CMDS  =   254        ; Stop sound (keep routine going)
00FD      1330      CMON  =   253        ; Number of voices
00FC      1340      CMTV  =   252        ; set Tone and Volume
0000      1350      CMDE  =   0          ; End (but sound not turned off)
          1360      ;

0600      1370      .PAGE "      install our PLAYIT routine "
          1380      ;
          1390      ; INSTALL is the entry point called from BASIC
          1400      ;
          1410      ; The BASIC program calls us via
          1420      ;       USR( INSTALL, ADR(playit-command-string) )
          1430      ;
          1440      ; The routine may be called from
          1450      ;       assembly language at INSTALL1
          1460      ;       by placing the address of the
          1470      ;       command string in A,Y (LSB,MSB)
          1480      ;
          1490      INSTALL
0600 68      1500      PLA          ; BASIC tells us how many parameters
0601 C901      1510      CMP   #1      ; better just have one!
0603 D0FE      1520      GOOF   BNE   GOOF   ; else only RESET will get him out!
0605 68      1530      PLA
0606 A8      1540      TAY          ; MSB to Y register
0607 68      1550      PLA          ; LSB to A register
          1560      ;
0608      1570      INSTALL1 = *        ; assembly language entry point
          1580      ;
          1590      ; first, we wait for a vertical blank
          1600      ; ...to ensure we don't get a VBLANK
          1610      ;       interrupt while we are working!
          1620      ;
0608 A614      1630      LOX   CLOCKLSB
          1640      WAITVB
060A E414      1650      CPX   CLOCKLSB ; has clock ticked?
060C F0FC      1660      BEQ   WAITVB  ; no...keep waiting
          1670      ;
          1680      ; OKAY TO PROCEED
          1690      ;
060E B5CE      1700      STA   PLAYADDR ; we preempted a zero page spot

```

along while BASIC continues what it is doing. To accomplish this, we have hooked into VVBLKD (as described above). The user specifies the note duration as a number of "jiffies" (60ths of a second), and we let the VBI count down the duration for us.

The commands are imbedded in a string of bytes passed to the routine. Playit recognizes six command types, as shown in Table 2. Playit is not particularly sophisticated. For example, all voices must play sounds for the same duration and, when chang-

Table 2. Playit Command Codes

Byte value	Name	Description
255 (\$FF)	CMDR	Repeat the entire sound command string
254 (\$FE)	CMDS	Stop all sounds (do not end command string)
253 (\$FD)	CMDN	Number of voices is specified in next byte (0-4)
252 (\$FC)	CMDTV	Specify Tone and Volume (as in SOUND 0, freq, TONE, VOLUME). Must be followed by 0-4 bytes (one per each voice as specified by CMDN), each of which specifies a Tone/Volume for one channel.
0 (\$00)	CMDE	End command, unhook from VVBLKD. Does not turn off sound, so is usually preceded by CMDS.
any other	---	Any other value is assumed to be a duration, given in 'jiffies' (60ths of a second). Must be followed by 0-4 bytes (one per voice as specified by CMDN), each of which specifies the frequency of the sound for one channel (as in SOUND 0, FREQ, tone, volume).

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ing volume or tone quality, all voices must be respecified. A more sophisticated sound interpreter would presumably mean smaller command strings but a bigger interpreter. If you go to the trouble to type in both Playit and Playit From BASIC, you will see that some more than acceptable sounds can be accomodated, so I am reasonably happy with the results.

Some interesting projects remain: Why not convert Atari's Music Composer disk files to Playit-compatible strings? Or how about a real Music Compiler written in BASIC? How about making Playit relocatable, a la last month's article? Please write and tell of your successes (or failures?).

Last but not least, another caution: since I/O to anything but the screen or keyboard uses the SIO serial bus driver, and since the serial bus uses the sound generators to get its baud rates, etc., you MUST turn off sound generation (commands CMDS, CMDE) before doing such I/O.

Atari BASIC: On Sounds, Hex Numbers, And The USR Function

The featured idea and program in this issue is the Playit From BASIC listing which follows. The program itself is not very sophisticated: it simply allows the one-character command codes (R,S,N,T,E) and hex data bytes to be translated into characters in a string. It then passes the address of the string to Playit (the assembly language program) and comes back to the user, ready to compile the next string of commands. If you intend to emulate this scheme, rather than use the program as is, you might be advised to put the sound command string into memory you have reserved (e.g., via the "Simplest Method" given in previous articles in this series). Putting the command in a string is inviting trouble: if your program stops, if you ENTER new

```

0610 8DC206 1710 STA REPEAT ; just in case of a repeat cmd
0613 84CF 1720 STY PLAYADDR+1
0615 8CC306 1730 STY REPEAT+1 ; similarly for MSB
          1740 ;
0618 AD2402 1750 LDA UVBLKD ; prepare to save the ptr
061B AC2502 1760 LDY UVBLKD+1
061E C93C 1770 CMP #PLAYIT&LOW ; already saved?
0620 D004 1780 BNE NOWINSTALL ; no
0622 C006 1790 CPY #PLAYIT/HIGH
0624 F010 1800 BEQ INSTALLED ; yes
          1810 ;
          1820 NOWINSTALL
0626 8DC406 1830 STA SAVEVBLK
0629 8CC506 1840 STY SAVEVBLK+1 ; save system vector
          1850 ;
062C A93C 1860 LDA #PLAYIT&LOW
062E 8D2402 1870 STA UVBLKD ; and install our own

0631 A906 1880 LDA #PLAYIT/HIGH
0633 8D2502 1890 STA UVBLKD+1
          1900 INSTALLED
0636 A901 1910 LDA #1 ; A single clock tick
0638 8DC706 1920 STA DURATION ; until we start playing
063B 60 1930 RTS ; done with install!
          1940 ;

063C 1950 .PAGE " The actual PLAYIT routine"
          1960 ;
          1970 ; PLAYIT is the entry point for our Delayed
          1980 ; Vertical Blank routine
          1990 ;
          2000 ; PLAYIT 'reads' the sound command string
          2010 ; and plays our 'song'
          2020 ;
          2030 ; SAM is simply the looping point for cmds
          2040 ;
          2050 PLAYIT
063C CEC706 2060 DEC DURATION ; keep on playing?
063F D029 2070 BNE EXIT ; yep...no changes
          2080 ;
          2090 SAM
0641 20B706 2100 JSR GETCMD ; get a byte from command string
0644 C900 2110 CMP #CMDE ; End it now?
0646 F053 2120 BEQ DDEND ; yes
0648 C9FF 2130 CMP #CMDR ; D.C. al Fine?
064A F05E 2140 BEQ DORPT ; yes
064C C9FE 2150 CMP #CMDS ; Stop all sound ?
064E F03F 2160 BEQ DDSTOP ; yep
0650 C9FC 2170 CMP #CMDTV ; Tone and Volume on TV?
0652 F02A 2180 BEQ DDTV ; yeah
0654 C9FD 2190 CMP #CMDN ; Number of voices change?
0656 F015 2200 BEQ DONUM ; uh-huh
          2210 ;
          2220 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          2230 ;
          2240 ; if none of the above, must be duration
          2250 ;
          2260 DODURATION
0658 8DC706 2270 STA DURATION ; we assume so
065B AEC606 2280 LDX NUMVCS
065E 300A 2290 BMI EXIT ; no voices, just duration
          2300 FREQLP
0660 20B706 2310 JSR GETCMD ; yes...get next byte
0663 9D00D2 2320 STA AUDF1,X ; and set the frequency
0666 CA 2330 DEX
0667 CA 2340 DEX ; see if more voices
0668 10F6 2350 BPL FREQLP ; yes...keep trying
          2360 ; no...fall through to EXIT
          2370 ;
          2380 EXIT
066A 6CC406 2390 JMP (SAVEVBLK) ; let OS clean things up
          2400 ;
          2410 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          2420 ;
          2430 ; set number of voices
          2440 ;
          2450 DONUM

066D 20B706 2460 JSR GETCMD ; next byte...
0670 AA 2470 TAX
0671 CA 2480 DEX
0672 8A 2490 TXA ; less one
0673 3003 2500 BMI NUMDK ; if < zero, leave it alone
0675 2903 2510 AND #03 ; Ensure 1-4 voices
0677 0A 2520 ASL A ; doubled, for ease of use
          2530 NUMDK
0678 8DC606 2540 STA NUMVCS ; as number of voices
    
```


lines, if you DIMension more variables, etc., the string may move and Playit would start playing random sounds.

The commands have simply been entered into the program via DATA statements starting at line 9000. Those of you who go to the trouble to enter all this will, I hope, be pleasantly surprised by the sounds generated by lines 9400-9418. You will probably be dismayed, however, at the idea of putting in such a complex sound yourself. That is why I encourage someone to come up with a better "Music Compiler" along these same lines.

In any case, I invite you to compose your own music or sounds to be put into this system. Generally, I wrote a sound in BASIC to test it before committing it to DATA statements. For example, the "CHOO-CHOO" sound evolved from this BASIC line:

```
FOR V=15 TO 0 STEP -1 : SOUND
O,V,O,V : NEXT V
```

The above sounds like an explosion, but if you slow it down a little and repeat it regularly you can train it as you wish. On to the short subjects.

HexDec

If you have already peeked at the listing of Playit From BASIC, you may have noted an unusual looking hexadecimal to decimal conversion routine. In fact, I herewith present you with a "one-liner" HexDec program:

```
1 DIMH$(23),N$(9):H$=".,ABCDEF
GHI!!!!!! JKLMNO":IN.N$:F.I=
ITOLEN(N$):N=N*16+ASC(H$(ASC
(N$(I))-47))
:N.I?:N:RUN
```

The underlined characters are control characters (control-comma is the heart, etc.). The abbreviations are necessary to get it to fit on one line. To see how it works, figure out what happens when you input "9A". Recall that ASC("9") is 57 and ASC("A") is



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65. 57-47 is 10 and 65-47 is 18. Look at the 10th and 18th characters in H\$. What is ASC("control-I")? ASC("control-J")?

You can avoid the control characters by adding the -64 shown in Playit From BASIC. Simple.

DecHex

This isn't really pertinent, but while we are on the subject of one-liners:

```
1DIMH$(16):H$="0123456789ABCDEF":IN:N:M=4096:F:I=1TO4:J=INT(N/M):?H$(J+1):N=N-M*J:M=M/16:N.N:?:RUN
```

The USR And ADR Functions

Even though the methods of using the USR function are fairly thoroughly covered in the *Atari BASIC Reference Manual*, I find that many users are not fully aware of the real power of this function. Recall that the general syntax of this function is:

```
USR( addr [,expr [,expr ... ]])
```

In other words, in addition to giving BASIC an address to call, you may pass *any number* of expressions to the assembly language routine. BASIC converts each expression to a 16-bit integer, pushes the result on the CPU stack, and cleans up by pushing on a single byte which tells the number of such expressions it pushed. (The address, which may itself be an expression, is *not* pushed and is not counted by that single byte.)

So what can we pass to assembly language? Obviously, numbers in the range of 0 to 65535. But what about characters? Conceive of

```
USR( addr, ASC("T"), expr ) ,
```

where the "T" might be used as a mnemonic command to tell the routine which of several functions is desired. How about strings of characters? Recall that the three essential ingredients defining a

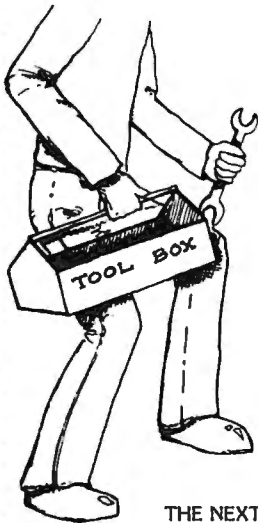
```
067B 4C4106 2550      JMP  SAM
                2560 ;
                2570 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                2580 ;
                2590 ; set tone and volume
                2600 ;
                2610 DDTV
067E AEC606 2620      LDX  NUMVCS
0681 30BE 2630      BMI  SAM      ; no voices to set
                2640 TVLP
0683 20B706 2650      JSR  GETCMD  ; get next byte
0686 9D01D2 2660      STA  AUDC1,X  ; treat as t&v command
0689 CA 2670      DEX
068A CA 2680      DEX      ; more voices?
068B 10F6 2690      BPL  TVLP  ; yes
068D 30B2 2700      BMI  SAM      ; no
                2710 ;
                2720 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                2730 ;
                2740 ; STOP the sound (by clearing all sound regs)
                2750 ;
                2760 DOSTOP
068F A207 2770      LDX  #7
0691 A900 2780      LDA  #0
                2790 STOPLP
0693 9D00D2 2800      STA  AUDF1,X  ;freq and vol to zero
0696 CA 2810      DEX
0697 10FA 2820      BPL  STOPLP
0699 30A6 2830      BMI  SAM      ; sound stops, pgm keeps going
                2840 ;
                2850 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                2860 ;
                2870 ; END the processing (but doesn't stop sound)
                2880 ;
                2890 DOEND
069B ADC406 2900      LDA  SAVEVBLK
069E 8D2402 2910      STA  VVBLKD  ; restore system ptr
06A1 ADC506 2920      LDA  SAVEVBLK+1
06A4 8D2502 2930      STA  VVBLKD+1  ; and, to OS, we aren't here
06A7 6CC406 2940      JMP  (SAVEVBLK) ; one last time
                2950 ;
                2960 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                2970 ;
                2980 ; repeat the same stuff again
                2990 ;
                3000 DORPT
06AA ADC206 3010      LDA  REPEAT
06AD 85CE 3020      STA  PLAYADDR
06AF ADC306 3030      LDA  REPEAT+1
06B2 85CF 3040      STA  PLAYADDR+1 ; just reset the address
06B4 4C4106 3050      JMP  SAM      ; and try it again

06B7 3060      .PAGE " the GETCMD subroutine"
                3070 ;
                3080 ; simply gets next byte from
                3090 ; command string
                3100 ;
                3110 GETCMD
06B7 A000 3120      LDY  #0
06B9 B1CE 3130      LDA  (PLAYADDR),Y ; get the byte
06BB E6CE 3140      INC  PLAYADDR ; bump LSB of pointer
06BD D002 3150      BNE  GCEXIT ; done
06BF E6CF 3160      INC  PLAYADDR+1 ; and the MSB
                3170 GCEXIT
06C1 60 3180      RTS
                3190 ;

06C2 3200      .PAGE " ram usage"
                3210 ;
06C2 0000 3220 REPEAT .WORD 0 ; in case we hear it again
06C4 0000 3230 SAVEVBLK .WORD 0 ; so we can jmp indirect
06C6 00 3240 NUMVCS .BYTE 0 ; controls TVLP and FREQLP
06C7 00 3250 DURATION .BYTE 0 ; how long we hold a sound
                3260 ;
                3270 ;
06C8 3280      .END

=0600 ORIGIN          =00FF LOW            =0100 HIGH           =D200 AUDF1
=0201 AUDC1          =0224 VVBLKD        =0014 CLOCKLSB      =00CE PLAYADDR
=00FF CHDR          =00FE CMDS         =00FD CMDN          =00FC CHDTV
=0000 CMDE          0600 INSTALL    0603 GOOF           =0608 INSTALL1
060A WAITVB        06C2 REPEAT    063C PLAYIT        0626 NOWINSTALL
0636 INSTALLED     06C4 SAVEVBLK    06C7 DURATION      066A EXIT
0641 SAM           06B7 GETCMD    069B DOEND         06AA DORPT
068F DOSTOP        067E DOTV      066D DONUM         0658 DODURATION
06C6 NUMVCS        0660 FREQLP    067B NUMOK         0683 TVLP
0693 STOPLP        06C1 GCEXIT
```

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string in Atari BASIC are its DIMension, LENgth, and address. Since your program presumably DIMensioned the string, you know that value and may pass it as an expression. And the address and length are available from the ADR and LEN functions!

Would you like your assembly language routine to modify your string, affecting its length? Try something like this:

```
DIM XX$(XXDIM)
XX$(USR(addr,ADR(XX$),XXDIM)+1)=""
```

Recall that the USR function may return any 16-bit value to the BASIC program, which is automatically converted to floating point as needed. Assume that this USR routine puts something in the XX\$ string and returns the number of characters it put in. The above will then set the LENgth of XX\$ properly for use by other BASIC statements and functions.

Finally, there is floating point. How about writing a matrix inversion program? If we are limited to passing 16-bit integers, how do we pass a floating point number via USR? Simple: we pass the address of the number, just as we do with a string. And how do we get the address of a number, when the ADR function only works with strings? Like this:

```
DIM FF$(1),FF(dim1,dim2)
JUNK = USR(addr,ADR(FF$)+1,dim1,dim2)
```

A little published fact about Atari BASIC is that DIMensioning of both strings and arrays proceeds in an orderly fashion according to the DIM statements encountered. And you are guaranteed that the order you DIM strings and arrays is the order they will occur in memory! So, by DIMensioning that one-byte string, FF\$, directly before the DIMension of the array, FF(), we know that the address of the array is one greater than the address of the string. Thus we can pass all the pertinent information about the array (its address and dimensions) to our assembly language routine. Incidentally, if you don't want to waste a one-byte string for this purpose, there is no reason FF\$ can't be any DIMension you need: just adjust the '+ 1' to reflect the actual DIM you use.

One last note on this subject: the fact that you can predict the memory order of strings and arrays has fascinating possibilities in regards to record structures, etc. But (and how many times have you read this from me) that's a topic for another article.

Program 1.

```
10 AUDCTL=53768:DBL=120
20 AUF1=53760:AUDC1=53761
30 SOUND 1,10,10,15:SOUND 3,10,10,15
40 POKE AUDC1,0:POKE AUDC1+4,0
50 POKE AUDCTL,DBL
60 FOR J=10 TO 15:POKE AUF1+2,J:POKE AUF1
+6,20-J
```

```
70 FOR I=0 TO 255:POKE AUDF1,I:POKE AUDF1+4
,255-I:NEXT I
80 NEXT J
```

...VERY SMOOTH GLIDES...

Program 2.

```
10 AUDCTL=53768:DBL=120
12 OSC=1789790/2
20 AUDF1=53760:AUDC1=53761
30 SOUND 1,10,10,0
40 POKE AUDC1,0:POKE AUDC1+4,0
50 POKE AUDCTL,DBL
60 P2=2^(1/12)
70 NTE=16:REM C IN THE REAL BASS
80 FOR I=1 TO 109
90 FREQ=INT(OSC/NTE-7+0.5):F0=INT(FREQ/256)
92 F1=FREQ-256*F0
100 POKE AUDF1,F1:POKE AUDF1+2,F0
102 POKE AUDC1+2,175
103 PRINT "NOW PLAYING ";INT(NTE+0.5);" HZ"
105 FOR J=1 TO 100:NEXT J
110 NTE=NTE*P2
120 NEXT I
130 GOTO 70
```

...9 OCTAVE CHROMATIC SCALE...

Playit From BASIC

```
1000 REM *****
1020 REM *
1040 REM * PLAYIT FROM BASIC, SAM
1060 REM *
1080 REM * This routine is a simple
1100 REM * sound "compiler", which
1120 REM * takes DATA statements and
1140 REM * converts them into command
1160 REM * strings suitable for use by
1180 REM * the interrupt-driven PLAYIT
1200 REM * routine.
1220 REM *
1240 REM *
1260 REM * Written by Bill Wilkinson
1280 REM *
1300 REM * for March, 1982, COMPUTE!
1320 REM *
1340 REM *****
1360 REM
1380 REM First, constants, routine addresses, etc.
1400 REM
1420 DIM HX$(2),CMD$(11),PLAY$(1000),HEX$(23),TYPE$(1),
PLAYIT$(1000)
1440 HEX$="@ABCDEFGHIJKLMNO"
1460 DOCMD=2300:LOOP=1800:HEXDEC=2600
1480 AGAIN=1700:EXITLOOP=2100
1500 PLAYIT=6*256:REM or wherever you put the routine
1520 REM
1530 SOUND 0,0,0,0:REM needed to initialize properly
1540 REM The command equates...
1560 REM notice that these match the
1580 REM assembly language routine
1600 CHDR=255:CMDS=254:CMDN=253:CMDTV=252:CMDE=0
1620 REM
1640 REM *****
1660 REM
1680 REM This is the AGAIN of
1700 REM PLAY IT AGAIN, ATARI
1720 REM
1730 PRINT " <processing...please wait>"
1740 PLAY$="":PLAY=0
1760 REM
1780 REM This is LOOP
1800 PLAY=PLAY+1:REM to next cmd byte
1820 READ CMD$:REM a bunch of commands
1840 REM
1860 TYPE$=CMD$:REM use the command character
1880 IF TYPE$="R" THEN PLAY$(PLAY)=CHR$(CHDR):GOTO EXIT
LOOP
```

```
1900 IF TYPE$="S" THEN PLAY$(PLAY)=CHR$(CMDS):GOTO LOOP
1920 IF TYPE$="N" THEN NUMVCS=1:CMD=CMDN:GOSUB DOCMD:NUM
VCS=DEC:GOTO LOOP
1940 IF TYPE$="T" THEN CMD=CMDTV:GOSUB DOCMD:GOTO LOOP
1960 IF TYPE$="E" THEN PLAY$(PLAY)=CHR$(CMDE):GOTO EXIT
LOOP
1980 REM *** IF TO HERE, ASSUME DURATION & FREQ ***
2000 HX$=CMD$:GOSUB HEXDEC:CMD=DEC:REM command is
duration
2020 CMD$=CMD$(2):REM to fool DOCMD
2040 GOSUB DOCMD:GOTO LOOP
2060 REM
2080 REM exitloop
2100 REM
2120 REM do the sound playing
2140 REM
2150 PLAYIT$=PLAY$:REM else we alter what we are playing
2160 JUNK=USR(PLAYIT,ADR(PLAYIT$))
2180 REM
2200 PRINT "HIT RETURN FOR NEXT SOUND ";:INPUT TYPE$
2220 GOTO AGAIN
2240 REM
2260 REM
2280 REM *****
2300 REM THE SUBROUTINES
2320 REM
2340 REM first, DOCMD
2360 REM
2380 PLAY$(PLAY)=CHR$(CMD):REM The command byte
2400 IF NUMVCS=0 THEN RETURN
2420 REM we process NUMVCS bytes
2440 FOR I=2 TO NUMVCS+NUMVCS STEP 2
2460 HX$=CMD$(I):GOSUB HEXDEC:REM convert the byte
2480 PLAY=PLAY+1:PLAY$(PLAY)=CHR$(DEC):REM and stuff it
away
2500 NEXT I
2520 RETURN
2540 REM
2560 REM .....
2580 REM *****
2600 REM and now HEXDEC
2620 REM
2640 DEC=0:REM our accumulator
2660 FOR L=1 TO LEN(HX$)
2680 DEC=DEC*16+ASC(HEX$(ASC(HX$(L))-47))-64
2700 NEXT L
2720 RETURN
8999 REM ...a siren-like sound...
9000 DATA N01,TCF,1408,1412,R
9099 REM ...a fanfare of sorts...
9100 DATA S,N01,TA2,30F3
9102 DATA N02,TA3A3,30F3C1
9104 DATA N03,TA4A4A4,30F3C1A1
9106 DATA N04,TA5A5A5A5,60F3C1A17A
9108 DATA T00000000
9110 DATA N00,C0,R
9199 REM ...beeping off the seconds...
9200 DATA S,N01
9202 DATA TAE,0130
9204 DATA TAC,0130
9206 DATA TAA,0130
9208 DATA TAB,0130
9210 DATA TA6,0130
9212 DATA TA4,0130
9214 DATA TA2,0130
9216 DATA T00,3500
9218 DATA R
9299 REM ...choo-choo ??? ...
9300 DATA S,N01
9302 DATA T0E,010E
9304 DATA T0C,010C
9306 DATA T0A,010A
9308 DATA T08,0108
9310 DATA T06,0106
9312 DATA T04,0104
9314 DATA T02,0102
9316 DATA T00,0300
9318 DATA R
9400 DATA S,N01,TAC
9402 DATA 3051,3058,3044,183C,182D,3035
9404 DATA ^3C,182D,3035,3044,303C,3051,3058
9406 DATA r04,TACA4A4A8
9408 DATA 30516C89A2,3058799086,30446C89A2
9410 DATA 183C4879B6,182D4879B6,3035485BD7
9412 DATA 183C4879B6,182D58B686,30354458B9
9414 DATA 3044516CA2,38325179F3
9416 DATA 423C4858B6,5044586C89
9418 DATA S,N00,F0,R
9898 REM ...stop and end...to quit...
9999 DATA S,E
```

PART I

Disk Checkout For 2040, 4040, And 8050 Disks

Jim Butterfield
Toronto, Canada

Editor's Note: In Part I of this article Jim explains disk manipulations via machine language. Next month, in Part II, he concludes with a machine language disk routine and a program that can analyze the condition of files and blocks on the disk. — RTM

The disk doesn't know or care who's giving it instructions: BASIC or Machine Language. All that's needed is to send or receive the same information as BASIC uses.

For all input and output, I recommend opening the necessary channels from BASIC. It's easier and works the same in all systems. Machine language may then take over and use the previously opened files as it wishes, connecting and disconnecting at will.

You'll often want to check the status byte ST. It's located at hexadecimal 96 in PET's memory. It's especially important for checking end-of-file on sequential records and end-of-record on relative records. You can also detect IEEE problems here, especially timeouts.

Let's take a simple example. We might want to do a Block Read of a given track and sector from disk and then dump part of the contents to the screen. To make our example easy, we'll display only bytes one through eight. Byte zero is sometimes hard to get on early disk systems due to a bug in the Buffer-Pointer routine; we'll sidestep that question.

The BASIC Program

We're planning to read bytes one through eight of track 18, sector 0. That might be the BAM (Block Availability Map) block, but perhaps not: these programs will also work on 8050 disks.

We must: Open the Command channel, secondary address 15; Initialize the disk, in case it's a

2040; Open a direct access channel; Cause the block read; Set the Buffer pointer; and, finally, read the channel. At the finish we should close our channels. Our BASIC program would read:

```

100 OPEN 6,8,15           (Command Channel)
110 PRINT#6,"I0"         (Initialize)
120 OPEN 2,8,3,"#"       (Direct Access
                          channel)
130 PRINT#6,"U1:";3;0;18;0 (Read Block)
140 PRINT#6,"B-P:";3;1   (Set Buffer Pointer)
150 GET#2,X$             (Get a byte)
160 PRINT ASC(X$ + CHR$(0)); (Print it)
170 C = C + 1            (Count them)
180 IF C < 8 GOTO 150    (Do more?)
190 CLOSE 2:CLOSE 6     (Quit)

```

You might like to try this to see it work. If you like, change the buffer pointer (line 140), the number of values displayed (line 180) or the track and sector (line 130). Now let's try the same thing in machine language.

The BASIC Driver

It's convenient to OPEN from BASIC, so we type NEW and enter the following BASIC program which will set things up for Machine Language:

```

100 OPEN 6,8,15
110 PRINT#6,"I0"
120 OPEN 2,8,3,"#"
125 SYS 1200
190 CLOSE 2:CLOSE 6

```

Don't run this yet, since the Machine Language is not in place.

Planning The Machine Language Program

We want to send exactly the same stuff as was sent by BASIC, to the same logical channels. We know that the ML equivalent of PRINT#6... is LDX #\$06, JSR \$FFC9 ... JSR \$FFCC. Note that we use the logical file number, 6. Similarly, we know the equivalent of GET#2 is: LDX #\$02, JSR \$FFC6, JSR \$FFE4,... JSR \$FFCC. So we can code:

```

LDX    #$06
JSR    $FFC9    (Open channel 6)
LDA    #$55    (Letter U)
JSR    $FFD2    (.. print it)
LDA    #$31    (Digit 1)
JSR    $FFD2    (.. print it)
LDA    #$3A    (Colon)
JSR    $FFD2
LDA    #$20    (Space)
JSR    $FFD2
LDA    #$33    (Digit 3)
JSR    $FFD2
LDA    #$20    (Space)
JSR    $FFD2
LDA    #$30    (Digit 0)
JSR    $FFD2
LDA    #$20    (Space)

```

JSR \$FFD2
 LDA # \$31 (Digit 1)
 JSR \$FFD2
 LDA # \$38 (Digit 8)
 JSR \$FFD2
 LDA # \$20 (Space)
 JSR \$FFD2
 LDA # \$30 (Digit 0)
 JSR \$FFD2
 LDA # \$0D (Return)
 JSR \$FFD2
 JSR \$FFCC (End transmission)

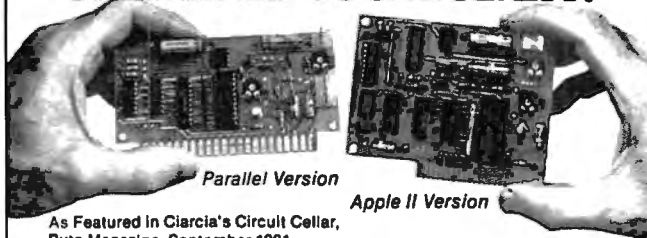
Note that we are sending exactly what BASIC sent from line 130. Most programmers would quickly realize that a program loop would save a good deal of memory here. In Part II of this article, we'll rewrite the code and complete it.

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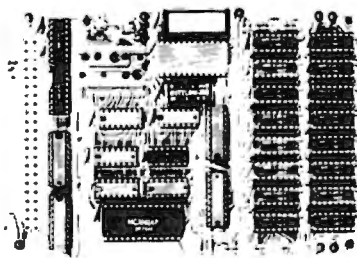
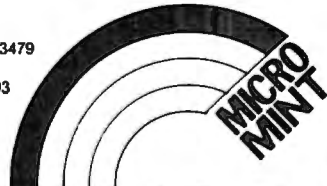
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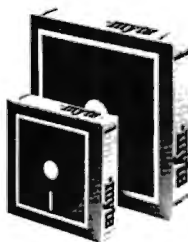
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Organizing Data Storage

John Hudson
Los Angeles, CA

There are many storage media available to mini-computer users. Minicomputer users with a disk unit know that the disk unit enhances the storage and retrieval powers of their minicomputer. One type of file that can be created for the purposes of storage and retrieval is a text file (for storage of such things as mailing addresses, telephone numbers, receipts, etc.).

For small text files, the time involved in disk retrieval and storage is not a problem. However, when a text file becomes larger than 2,000 records, the retrieval and storage of information can become time consuming.

Large text files can be organized in one of two ways: sequentially, and randomly. In sequentially organized text files, fields are stored back to back, where the beginning character of a new field immediately follows the return character ending the previous field. Information is retrieved in a linear fashion, i.e., from the beginning to the end of the file.

Disk Can Also Be Slow

When a text file does not require much updating or ongoing revision, sequential organization of the text file is indicated. However, if a large text file is ordered sequentially, and there is need for frequent updating or revision of the file, or frequent retrieving of information from end of text file, a disk unit is not much better than a cassette unit. This accessing of information at end of file may take a couple of minutes, due to the reading and verification of each record, each time.

In this type of situation, the random method of text file organization is more effective. A random-access text file is like a collection of equally-sized records; the records may be full, or they may be empty, but the length of each record in a random text file is fixed. Thus, a record at the end of the file can be accessed at approximately the same speed as records in any other location in the file.

However, the controlling program needs to know where in the file a specific record is located. Most random files are organized by 'keying' a field within the record. For example, a mailing address text file can be organized by last names. The problem when using a random text file keyed to a specific field in the record is *collision*. Collision is when two

or more records address the same location within the text file, as, for example, when two people have the same last name (B. JONES and J. JONES).

A method of reducing collision is called *hashing* the key field. The basic idea of hashing, or hash addressing, is that each stored record occurrence is placed in the text file at a location whose address may be computed as some function (the hash function) of a value which appears in the occurrence — usually the primary key value.

One of the disadvantages of hash-addressing is that the sequence of stored record occurrences within the text file will almost certainly not be the keyed field sequence. In addition, there may be gaps of arbitrary size between consecutive occurrences of records.

In fact, a text file in a hash-addressing organization is usually, though not invariably, considered to have no particular sequence.

Using Mod To Hash

The following is an example of a hash function: given that the number of unique records is 1,000; the "mod" arithmetic function can be used to assign unique address locations. The mod function divides one number by another and returns the remainder. The mod parameter used in this function should be the prime number closest to the number of the records in the text file (see Table 1 for prime numbers). For this example, the closest prime number is 997. (Note: if the key field is alphabetic, it should be converted to numeric.) The function will be (key field) MOD 997. The hash function thus minimizes collision.

There are text files, such as a monthly inventory file, that require multiple entries of the same record over a period of time. Inventory may be taken at the end of each week, and the quantity stored into a text file. This presents a different type of collision problem — same record hash to same location in text file.

In the case where hashing records into a text file still causes collision, the controlling program needs to be able to insert the colliding record into another location and, when it goes to retrieve this record, it needs to know where it is located. A solution to this problem is to link the records in the text file. From the previous example, you have 1,000 unique records; in addition, each record is entered more than once.

A link field (LF) can be added to the end of each record to allow the linking of records. For example:

RECORD	LINK FIELD
--------	---------------

This LF is used to point to successive entries of the

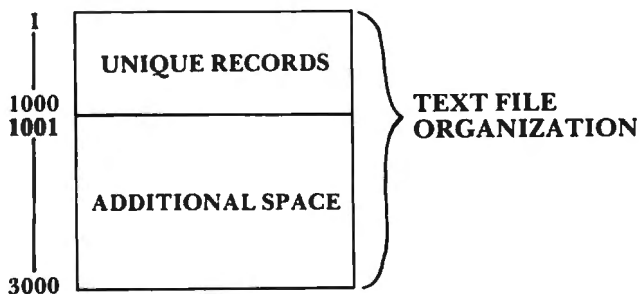
same type of record, and contains the address locations of the successive record entries. The first record, A1, hashed into the text file at location 100 has '0' in the link field.

TEXT LOCATION		LF
100	RECORD A1	0

When the controlling program tries to hash another record, A2, into record location 100, it notes that there already exists a record at that location, and inserts the new record, A2, at another text address. It changes the LF of the record A1 from 0 to the next text address of record A2 (in this case, 1972), inserts 0 into the LF of record A2, and the results are as follows:

TEXT LOCATION		LF
100	RECORD A1	1972
1972	RECORD A2	0

Thus, in this example, record A1 points to record A2. However, a problem arises with this type of organization: how to set up the text file? The text file can be organized with 1,000 unique hashing locations, occupying text address locations 1-1000. Any additions to a unique record can be located at text address locations 1001-3000.



This type of text file organization needs to be initialized, since the Apple system does not allow reading of a text file that does not contain records, and will produce an "END OF DATA" error message. An example of an initialization routine follows:

```

5 D$=" "
10 DLOC=66:DDTE=9999:DBS=1:DSN=2:DLP
   =333:DTRK=444:DCAST=555:DLINK=8888
11 PRINT D$;"OPEN RECORD,L29"
20 I=2001
30 PRINT D$;"WRITE RECORD,R0"
40 PRINT I: PRINT DDTE: PRINT DBS: PRINT
   DSN: PRINT DLP: PRINT DTRK: PRINT
   DCAST: PRINT DLOC:

```

```

1001 FOR J=1 TO 4200
1006 PRINT D$;"WRITE RECORD,R";J
1007 PRINT DLOC: PRINT DDTE: PRINT DBS:
   PRINT DSN: PRINT DLP: PRINT DTRK:
   PRINT DCAST: PRINT DLINK:
1009 NEXT J
1010 PRINT D$;"CLOSE RECORD"
1013 END

```

This routine initializes enough space for 4,200 records of length 29. It writes into every record a set of dummy values.

When you wish to insert a record into the main text area, the controlling program will read the text address and check a specific field for 9999, (DDTE). If it finds 9999, the controlling program can insert the record into the read text location. If it does not, then it will insert the record into the additional text area. After inserting the record, the LF of the main record is updated to point to the location of the additional record(s).

A method of keeping track of available space in the additional text area is to store this address location and length of records into address location 0 of the text file. After each "additional text area" insertion, the available address is incremented. At the start, the controlling program will read this information, update it as needed, and, upon completion of the program, will rewrite the record 0 with the new address location.

The following is an example of a program using the link organization of a text field:

Line 70 reads text location 0 to determine the next available additional space, which is indicated by the variable "FREESPACE."

Lines 120 through 140 determine the location where the new record will be inserted. Note that this is not a hashing function.

Line 190 checks to see if the text field location DDTE has the dummy value of 9999, or if it is filled.

Lines 191 through 200 insert the new record into the unique text space.

Lines 212 through 214 traverse the link lists to get to the last record in the link.

Lines 220 through 260 update the last record in the link, and insert the new record into the additional text space area.

Lines 280 through 290 update record 0 when the program is completed.

2	3			
5	7	11	13	17
19	23	29	31	37
41	43	47	53	59
61	67	71	73	79
83	89	97	101	103
107	109	113	127	131


```

137      139      149      151      157
163      167      173      179      181
191      193      197      199      211
223      227      229      233      239
241      251      257      263      269
271      277      281      283      293
307      311      313      317      331
337      347      349      353      359
367      373      379      383      389
397      401      409      419      421
431      433      439      443      449
457      461      463      467      479
487      491      499      503      509
521      523      541      547      557
563      569      571      577      587
593      599      601      607      613
617      619      631      641      643
647      653      659      661      673
677      683      691      701      709
719      727      733      739      743
751      757      761      769      773
787      797      809      811      821
823      827      829      839      853
857      859      863      877      881
883      887      907      911      919
929      937      941      947      953
967      971      977      983      991
997      1009     1013     1019     1021
    
```

```

171 INPUT DCAST: INPUT DLINK
190 IF DDTE#9999 THEN GOTO 212
191 PRINT D$;"WRITE RECORD,R";LOC
200 PRINT LOCA: PRINT DTE: PRINT BS
    : PRINT SN: PRINT LP: PRIN
    T TRK: PRINT CAST: PRINT L
    INK
210 GOTO 90
212 IF DLINK=0 THEN GOTO 220:LOC=DL
    INK
213 PRINT D$;"READ RECORD,R";DLINK
214 GOTO 170
220 PRINT D$;"WRITE RECORD,R";LOC
225 DLINK=FREESPACE
230 PRINT DLOCA: PRINT DDTE: PRINT ~
    DBS: PRINT DSN: PRINT DLP:
    PRINT DTRK: PRINT DCAST: ~
    PRINT DLINK
240 FREESPACE=FREESPACE+1
250 PRINT D$;"WRITE RECORD,R";DLINK

260 GOTO 200
270 PRINT D$;"WRITE RECORD,RO"
280 PRINT FREESPACE: PRINT DDTE: PR
    INT DBS: PRINT DSN: PRINT ~
    DLP: PRINT DTRK: PRINT DCA
    ST: PRINT DLOCA
290 PRINT D$;"CLOSE RECORD"
300 INPUT "DO YOU WISH TO CONTINUE
    .. Y/N ",K$
310 IF K$="Y" THEN GOTO 10
320 END
    
```

```

10 INPUT "PLEASE ENTER STORE
    NUMBER ", SN
11 CALL - 936: FOR X = 1 TO 9
    : CALL - 922: NEXT X
15 PRINT:PRINT"      I N S E R
    T      D I S K      ";SN
16 FOR X=1 TO 3000: NEXT X
17 CALL -936
20 INPUT "PLEASE ENTER DATE .
    . MMDD .. ",DTE
30 INPUT "PLEASE ENTER PURCHA
    SE OR SELL 1 = PURCHASE ..
    2 = ~ SELLS ",BS
40 D$=""
50 PRINT D$;"OPEN RECORD,L29"
60 PRINT D$;"READ RECORD,RO"
70 INPUT FREESPACE: INPUT DDT
    E: IN PUT DBS: INPUT DSN:
    INPUT ~ DLP: INPUT DTRK
71 INPUT DCAST: INPUT DLINK
80 IF FREESPACE>=5000 THEN GO
    TO 320
90 PRINT D$;"CLOSE RECORD"
100 INPUT "PLEASE ENTER RECOR
    D CODE,LPS,TRK8S,CASSETTES
    ",LOC,LP,TRK,CAST
110 IF LOC=9999 THEN GOTO 270
120 LOCA=LOC/100
130 LOCA=LOC-LOCA*100
140 LOC=LOC/100:LINK=0
150 PRINT D$;"OPEN RECORD,L29"
160 PRINT D$;"READ RECORD,R";
    LOC
170 INPUT DLOCA: INPUT DDTE:
    INPUT ~ DBS: INPUT DSN:
    INPUT DLP: INPUT DTRK
    
```

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Machine Language Sort Utility

Ronald and Lynn Marcuse
Freehold, NJ

There have been occasional articles in the various personal computer magazines concerning the sorting of data files. Some of these have presented sort routines coded in BASIC that can be utilized by existing programs. The complex string handling required by the sort logic is not really suitable for BASIC's rather slow execution speed. Clearly, any type of repetitive string manipulations (as performed by sorting or searching functions) would benefit from machine language code. If you continue reading you will find out how much faster it really is.

Before we get into the programs themselves, it would probably be beneficial to include some background information. The verb *sort* is defined: "to put in a certain place or rank according to kind, class or nature; to arrange according to characteristics." This comes pretty close to what we sometimes want to do with the data we store in our computers and files; put it in some kind of order. Once we have arranged it we can search it quicker (imagine a disorganized phone book), list it in a more readable format, or even match it to other files that have been sorted the same way.

The Main Questions

First we must decide where will we do the actual sorting. All of us have arranged things on a desk or table. Our sort area is, therefore, the desk or table that we used. In a computer system we have a choice of using the memory within the machine (internal) or our disk drive (external). There are problems with both of these. Computer memory is limited in size and this, in turn, will limit the number of records that can be read in. The disk drive may be able to hold more data, but the speed of the device is snail-like when compared to memory. We could use both: divide the file up into smaller chunks which can be sorted in memory, store these on disk as temporary files, and then merge all of them together. This process is usually referred to as "sub-listing" or "sort-merge."

The next question involves the type of sort logic (there are many ways of putting things in

order). The algorithm used here is called a *bubble* sort. The file or list is examined two records at a time. If the second has a lower sort key than the first, the two will exchange places within the file. Why then, you ask, is it called a bubble sort. Because records appear to "bubble" upward in memory (I didn't coin the phrase so don't blame me). Although this is not a very exotic methodology, it does offer several advantages. It requires no other memory allocations for sorting and is fast if the file is not too disorganized. It will also not disturb the relative positioning of records that have equal sort keys.

There are numerous other types of sort algorithms. A *selection* sort would go through a list of (n) items (n-1) times, pulling out the next lowest record and adding it to the current end of a new list. This would need double the memory, though. A *selection and exchange* would perform a similar function within the main sort area, selecting the lowest element during each pass, moving it upward in the list to be exchanged with the element occupying its new position. This method tends to upset the existing relative positioning. Other types involve binary tree searches and more complex algorithms.

Why Machine Language

The choice of language is, as stated above, rather clear. Unless you have a lot of time to kill, your sort must be in executable object code (machine language). When you're doing several hundred thousand (or million ?) character comparisons and swaps, you don't have time to pull out a "BASIC dictionary" for each line in the program (this, in essence, is what the BASIC does).

Here are some representative execution times, based on some testing we did last winter. The speeds are approximate and do not include disk input/output time. The test file consisted of 200 records, each 75 characters in length. The sort key occupied ten positions:

BASIC selection/exchange sort (in memory) – 8 minutes

BASIC bubble sort (in memory) – 12 minutes

BASIC selection sort (on disk) – 2 HOURS plus (hit BREAK key)

Machine Language bubble (memory) – 3 seconds

The sort program was developed with flexibility in mind. It will sort fixed length records up 150 bytes in size. The sort key itself may be located anywhere in the record and can be any length (up to the size of the record). It will sort in either ascending or descending order. The records themselves must be comprised of ASCII (ATASCII) characters. While in memory, they need not be terminated by end-of-line (\$9B) characters.

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The nominal limit of 150 characters is imposed by a possible bug in ATARI's DOS II. The second half of page five (memory addresses 0580-05FF Hex, 1408-1535 Decimal) appears to be utilized as an internal I/O buffer. When more than 128 bytes are input, the excess winds up on page six. The sort program also resides in the safe (?) user area of page six (beginning at \$0620 or 1568). There is a physical law that states: two things cannot occupy the same place at the same time. This also holds true in computer memory. The program has been pushed as far into page six as it can go (there is data stored behind it).

Using The Sort

In order to use the sort, you must feed it certain parameters. The record length must be POKEd into location 205 (\$00CD). The sort type (0-Ascending, 1-Descending) would be POKEd into 206 (\$00CE). The starting and ending positions of the sort key will also have to be POKEd into locations 203 (\$00CB) and 204 (\$00CC). The program is expecting to see the offset of the sort key. The offset is the number of positions in front of that byte. For example; the first position of a record has a 0 offset, the second has an offset of 1, and the 100th has an offset of 99. The USR function that calls the sort will also pass the address of the string containing the file and the record count. For those who are a little unsure of what this is all about, there are a few examples coming up.

Now that you have a routine that will sort your data faster than you can say Rumpelstiltskin, how do you use it? Here are several suggestions. The best method is to link through our sort/file loader in Program 3. Your existing program that is processing the data file is probably much, much longer than the short loader. The main advantage of using a small program is that you wind up with more free memory. And, since memory is our sort area, the more that is free, the larger the file. If you don't type the REMark statements, you'll have even a larger sort area. The disk file must be fixed length records terminated by end-of-line characters. Your existing processing program must contain the POKEs mentioned above. It may look something like this:

```
POKE 203,SKEYA-1:POKE 204,SKEYB-1:POKE 205,
RECLen:POKE 206,0 (for Ascending).
```

The call to the loader would be a RUN "D: SORTLOAD" (give the loader this file name when you save it). The sort/file loader must have your file name in the variable F\$ and your program name in P\$. If your processing program handles several files, you can also pass the file name by using the following statements. First, your program:

```
FOR I=0 TO 14:POKE 1776+I,32:NEXT I
FOR I=0 TO LEN(F$):POKE 1776+I,ASC(F$(I,I)):
NEXT I
```

Note: F\$ is your file's name.

The sort/file loader will require the following lines to be added:

```
70 FOR I=0 TO 14:F$(I,I)=CHR$(PEEK(1776+I)):
NEXT I
80 IF F$(1,2)<>"D:" THEN ? "ERROR":END
```

If your processing program or file is small, you may do all of the above from within your program. Besides the same POKEs as above (you wouldn't need the file name, of course), you will need the following line added to your program:

```
IF RC>1 THEN A=USR(1568,ADR(X$),RC)
```

(RC is the number of records stored in the string X\$.) Substitute your names where applicable.

Program 4 is a sort/merge utility that uses the same sort routine. This will give you the ability to handle much larger files. With a 40 or 48K machine you will be able to sort files that are 60,000 bytes long (If the record length is 60 characters, that will translate to 1,000 records). This particular version divides the file into two manageable sub-files, sorts each, and then merges them. Be careful with your disk space; the temporary file will need room also. If you have more than one drive, you can modify the program to split it three or more ways and sort even more records. For example, put the temporaries on drive 2 and the new file on drive 3. Who said micros can't handle larger files?

Your Options

The sort/merge program is a stand-alone. By swapping the front end with the sort loader (Program 3), you can do a sort/merge from a call (RUN "D: SORTMERG") in your existing software.

Now that you know how to feed the sort its required parameters and call it, you must still get it into memory. Once again, you have several options. If you have the Assembler/Editor cartridge (or a similar assembler), the source appears in Program 1. Please feel free to modify it if you so desire. If you're limited to BASIC, Program 2 will load the machine language code when it is run. After doing either of these, you should go directly to DOS (DOS II only) and do a binary save (option K) with the following parameters:

```
D1:AUTORUN.SYS,0620,069D
```

Saving the code as AUTORUN.SYS will enable the program to auto-boot when you power up with the disk (You *must* power up with that disk). Do *not* append an INIT or RUN address to the file unless you want the machine to lock up every time you turn it on.

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Program 1.

```

; RON MARCUSE, FREEHOLD NJ 11/29/81
;
; CALLED FROM BASIC WITH:
;
; A=USR(1568,ADR(X$),RC)
;
; NOTE: X$ IS THE STRING THAT CONTAINS
THE FILE
;
; RC IS THE NUMBER OF RECORDS
;
; THE FOLLOWING ARE POKED BY BASIC PROG
RAM:
;
; SS - BEGINNING OF SORT KEY (DECIM
AL- 203)
;
; SE - END OF SORT KEY (DECIMAL - 2
04)
;
; RL - RECORD LENGTH (DECIMAL - 205
)
;
; TYPE - ASCENDING (0) OR DESCENDI
NG (1)
;
; (DECIMAL - 206)
;
; THE ROUTINE WILL LOOP THROUGH "FILE" S
WAPPING UNSORTED
; ADJOINING MEMBERS UNTIL THE "SWAP FLAG
" HAS NOT BEEN SET
; IN A GIVEN PASS, THE ZERO PAGE ADDRESS
ES "FST" AND "SEC"
; POINT AT THE INDIVIDUAL MEMBERS BEING
COMPARED. THE Y
; REGISTER IS USED AS AN INDEX POINTER F
OR TESTING OR
; MOVING BYTES WITHIN THE TWO RECORDS.
;
;
;
; *= $0620 START AT PAGE 6
; MEMBER n ADDRESS (LSB,MSB)
FST = $04
; MEMBER (n+1) ADDRESS (LSB,MSB)
SEC = $06
; BASE ADDRESS OF LIST (LSB,MSB)
BASE = $08
; FIRST POSITION OF SORT KEY
SS = $0B
; LAST POSITION OF SORT KEY
SE = $0C
; RL = $0D ELEMENT LENGTH
SWAP = $0A SWAP SWITCH
;
; NUMBER OF ELEMENTS (LSB,MSB)
RC = $00
; RECORD COUNTER (MSB, X REG IS LSB)
CNTH = $CF
; SORT TYPE, 0-ASC 1-DES
TYPE = $CE
;
;
; POP # OF ARGUMENTS FROM STACK
PLA
PLA
STA BASE+1 SET BASE ADDRESS
PLA
STA BASE
PLA
STA RC+1 SET ELEMENT COUNT
PLA
STA RC
;
;
; START EACH PASS THROUGH FILE
BEGIN LDA #$00
STA SWAP SET SWAP TO 0
STA CNTH SET HIGH COUNT TO 0
;
; SET X REGISTER TO 1 (LOW COUNT)
LDX #$01
;
; SET POINTER (n) TO BASE
LDA BASE
STA SEC
LDA BASE+1
STA SEC+1
;
;
; CONT CLC
LDA SEC RESET POINTERS-
STA FST (n) to (n+1)
ADC RL
STA SEC (n+1) to (n+2)
LDA SEC+1
STA FST+1
ADC #$00
STA SEC+1
;
; ASCII STRING COMPARISON
LDY SS
;
;
; ASCENDING OR DESCENDING?
COMP LDA TYPE
BEQ ASC SORT IS ASCENDING
LDA (SEC),Y TYPE = DESCENDING
;
; COMPARE ADJOINING MEMBERS
CMP (FST),Y
BCC BACK (n)<(n+1)
BEQ INCR (n)=(n+1) TRY AGAIN
BCS FLIP (n)>(n+1)
;
;
; ASC LDA (SEC),Y TYPE = ASCENDING
; COMPARE ADJOINING MEMBERS
CMP (FST),Y
BCC FLIP (n)<(n+1)
BEQ INCR (n)=(n+1) TRY AGAIN
BCS BACK (n)>(n+1)
;
; INCR INY ADD 1 TO POINTER
CPY SE END OF SORT KEY?
BEQ COMP NO
BCS BACK YES, NEXT ELEMENT

```

```

;      BCC COMP NO
;
;      SWAP ELEMENTS (n),(n+1)
FLIP   LDA  #01
      STA  SWAP SET SWAP SWITCH ON
      LDY  RL   LOAD LENGTH
;
;      MOVE DEY SET DISPLACEMENT
      LDA  (SEC),Y EXCHANGE BYTES
      PHA
      LDA  (FST),Y
      STA  (SEC),Y
      PLA
      STA  (FST),Y
      CPY  #000 MORE BYTES TO SWAP?
      BNE  MOVE YES
;
;      INCREMENT RECORD COUNTER
BACK   INX
      CPX  #000 CHECK FOR >255
      BNE  TEST
      INC  CNTH ADD 1 TO HIGH COUNT
;
TEST   CPX  RC END OF FILE?
      BNE  CONT NO
      LDA  RC+1 CHECK HIGH EOF
      CMP  CNTH
      BNE  CONT NOT END OF FILE
      LDA  SWAP TEST FOR END OF SORT
      CMP  #000 ANY SWAPS?
      BNE  BEGIN YES, START OVER
      NO, RETURN TO CALLING PROGRAM
      RTS
      .END

```

Program 2.

```

100 FOR I=1568 TO 1693:READ A:POKE I,A:N
EXT I
1568 DATA 104,104,133,217,104,133
1574 DATA 216,104,133,209,104,133
1580 DATA 208,169,0,133,218,133
1586 DATA 207,162,1,165,216,133
1592 DATA 214,165,217,133,215,24
1598 DATA 165,214,133,212,101,205
1604 DATA 133,214,165,215,133,213
1610 DATA 105,0,133,215,164,203
1616 DATA 165,206,240,10,177,214
1622 DATA 209,212,144,44,240,12
1628 DATA 176,19,177,214,209,212
1634 DATA 144,13,240,2,176,30
1640 DATA 200,196,204,240,227,176
1646 DATA 23,144,223,169,1,133
1652 DATA 218,164,205,136,177,214
1658 DATA 72,177,212,145,214,104
1664 DATA 145,212,192,0,208,241
1670 DATA 232,224,0,208,2,230
1676 DATA 207,228,208,208,172,165

```

```

1682 DATA 209,197,207,208,166,165
1688 DATA 218,201,0,208,144,96

```

Program 3.

```

10 REM SORT LOAD PROGRAM LYNN MARCUSE 1
1/27/81
11 REM
12 REM CALLING PROGRAM MUST:
13 REM
14 REM * POKE RECORD LENGTH INTO LOCATI
ON 205
15 REM * POKE BEGINNING OF SORT KEY INT
0 LOC 203
16 REM * POKE END OF SORT KEY INTO LOCA
TION 204
17 REM * POKE TYPE (ASCENDING - 0 OR DE
SCENDING - 1) INTO LOC 206
18 REM
19 REM THIS PROGRAM WILL LOAD FILE INTO
MEMORY AND CALL MACHINE
20 REM LANGUAGE ROUTINE. WHEN COMPLETED,
YOUR PROGRAM MAY BE
21 REM RE-CALLED BY EQUATING P$ TO YOUR
PROGRAM NAME.
22 REM
50 DIM X$(FRE(0)-600),R$(130),F$(15),P$(
15),I$(1)
58 REM
59 REM REPLACE X'S WITH YOUR FILE & PROG
RAM NAMES
60 P$="XXXXXX":F$="XXXXXX"
99 REM GET RECORD LENGTH
100 RET=100:R=PEEK(205)
109 REM OPEN FILE AND INPUT RECORDS
110 ? " LOADING ";F$:TRAP 600:OPEN #2,4,
0,F$:L=1
120 TRAP 140:INPUT #2,R$:TRAP 40000
130 X$(L,L+R-1)=R$:L=L+R:GOTO 120
140 CLOSE #2:L=L-1:N=L/R:" RECORDS LOA
DED=";N
149 REM CALL MACHINE LANGUAGE SORT ROUTI
NE
150 IF N>1 THEN ? " BEGIN SORT":A=USR(15
68,ADR(X$),N)
160 RET=170:" COMPLETED SAVING ";F$
169 REM ERASE OLD FILE AND SAVE NEW ONE
170 TRAP 600:XIO 36,#2,0,0,F$:OPEN #2,8,
0,F$
180 FOR I=1 TO L STEP R:R=X$(I,I+R-1):?
#2;R$:NEXT I
190 CLOSE #2:XIO 35,#2,0,0,F$
199 REM RETURN TO YOUR PROGRAM ?
200 RET=200:TRAP 600:IF P$(3,4)<>"XX" TH
EN ? " LOADING ";P$:RUN P$
210 END
600 ? " ERROR - ";PEEK(195):CLOSE #2
610 ? " PRESS RETURN TO CONTINUE";:INPUT

```

I\$:GOTO RET

Program 4.

```

10 REM SORT MERGE PROGRAM  RON MARCUSE 1
2/01/81
11 REM
12 REM THIS PROGRAM WILL LOAD FILE INTO
MEMORY AND CALL MACHINE
13 REM LANGUAGE ROUTINE. IF FILE IS TOO
LARGE, THE SORTED DATA
14 REM WILL BE SAUED AS "D:TEMP" AND BAL
ANCE OF FILE WILL BE
15 REM READ AND SORTED. WHEN THIS STEP I
S FINISHED, THE TEMPORARY
16 REM FILE WILL BE MERGED WITH THE SOR
TED DATA IN MEMORY.
17 REM
20 GRAPHICS 0:DIM F$(15):? :? ,"SORT/MER
GE UTILITY":POKE 82,1
30 ? :? "ENTER:":? :? "FILENAME (D:name.
ext) " ;:INPUT F$
40 ? "RECORD LENGTH " ;:TRAP 40:INPUT R:T
RAP Q3:IF R<2 OR R>150 THEN 40
50 ? "SORT KEY (1st,2nd) " ;:TRAP 50:INPU
T SS,SE:TRAP Q3
55 IF SS>=SE OR SS<0 OR SE>R THEN 50

```

```

60 ? "ASCENDING - 0 OR DESCENDING - 1 "
;:TRAP 60:INPUT T:TRAP Q3
65 IF T<0 OR T>1 THEN 60
70 POKE 205,R:POKE 203,SS-1:POKE 204,SE-
1:POKE 206,T
80 XL=FRE(0)-600:DIM X$(XL),R$(R),T$(R),
D$(6)
90 Q1=210:Q2=600:Q3=40000:D$="D:TEMP"
100 ? "LOADING " ;F$:TRAP Q2:OPEN #2,4,0,
F$:M=0
120 L=1:? "PASS 1 - " ;:GOSUB 500:IF M=0
THEN 160
140 ? "WRITING " ;D$:OPEN #3,8,0,D$:GOSUB
560
150 ? "PASS 2 - " ;:L=1:GOSUB 500
160 CLOSE #2:? "DELETING " ;F$
170 TRAP Q2:XIO 36,#3,0,0,F$:OPEN #3,8,0
,F$
180 ? "WRITING " ;F$:IF M=0 THEN GOSUB 56
0:GOTO 400
200 TRAP Q2:OPEN #2,4,0,D$:J=1:A=1:B=1:A
E=1:BE=1
210 IF A=1 THEN TRAP 330:INPUT #2,R$:TRA
P Q3
220 IF B=1 THEN TRAP 340:T$=X$(J,J+R-1):
J=J+R:TRAP Q3
230 IF AE=0 AND BE=0 THEN 390
240 IF AE=1 AND BE=0 THEN 300

```

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```

245 IF AE=0 AND BE=1 THEN 310
250 IF T=1 THEN 280
260 IF R$(SS,SE)>T$(SS,SE) THEN 310
270 GOTO 300
280 IF R$(SS,SE)<T$(SS,SE) THEN 310
300 ? #3;R$:A=1:B=0:IF AE=0 THEN A=0:B=B
E
302 GOTO Q1
310 ? #3;T$:A=0:B=1:IF BE=0 THEN B=0:A=A
E
312 GOTO Q1
330 AE=0:GOTO 220
340 BE=0:GOTO 230
390 CLOSE #2:? "DELETING ";D$:XIO 33,#2,
0,0,D$
400 CLOSE #3:XIO 36,#3,0,0,F$
410 END
500 TRAP 530:INPUT #2,R$:TRAP Q3
510 X$(L)=R$:L=L+R:IF (L+R)>X$(L) THEN 500
520 M=1
530 L=L-1:N=L/R:? "RECORDS LOADED = ";N
540 IF N>1 THEN ? "BEGIN SORT ";:A=USR(
1568,ADR(X$),N)
550 ? "END SORT":RETURN
560 FOR I=1 TO L STEP R:R=X$(I,I+R-1):?
#3;R$:NEXT I:CLOSE #3:RETURN
600 ? "ERROR - ";PEEK(195):END

```

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R. D. Young
Ottawa, Ontario

Program line renumbering is often more than just cosmetic. Afterthoughts, frequently called *bugs*, invariably use up all those spaces left between original program lines. There are a number of line renumbering programs/utilities available for PET (and other computer) owners. Unfortunately, those that I have seen, including Toolkit, renumber the entire program, once invoked. It is therefore impossible to retain blocks of subroutines, as might be initially intended.

Blocks of subroutines, 1000-1999 or 2000-2999 for example, are particularly helpful during program development. It is easier to remember a thousand-line block while debugging (and leaving lots of space between blocks) than, for example, something like 760-790. At the same time, the mainline program or a subroutine block of lines may require renumbering during the debugging stage. A segment of the program can now be renumbered with Dynamic Renumber.

This program is a modified version of Resequencer by Joe Trimble from PET User Notes, Issue 5, July-August 1978, which was modified by Jim Russo and Henry Chow in PET User Notes, Issue 7, November-December 1978.

Dynamic Renumber will renumber the selected range of lines beginning with the desired new line number and using the desired increments. It will abort if the highest renumbered line overlaps a line not selected for renumbering, but it will give erroneous line numbers if the overlap occurs at the

beginning of the renumbered segment. The program will then locate all GOTO's, GOSUB's, THEN's, ON...s, and RUN's, and insert the new target line number if required. If, however, the new target line number is longer than the old line number, only part of the new line number will be inserted. When such an event occurs, the line number of the line in which the shortened insertion is being made and the proper target line will be printed side-by-side on the screen. An asterisk is printed as each program line is being analyzed for required changes.

This program will function quite nicely as a utility stored in and run from a 4K memory partition. The program to be renumbered must, of course, reside in the normal low end of memory. Alternatively, this program can be readily appended to a program already in memory.

Dynamic Renumber can be easily converted to other than PET BASIC, provided that line numbers are stored in the same manner (see also "Program Compactor," **COMPUTE!** #11). The first four bytes of each line are defined as follows:

Pointer to next line – low byte
Pointer to next line – high byte
Line number – low byte
Line number – high byte

Changes to Dynamic Renumber, required before implementation with other BASIC's, are the start-of-BASIC pointer and the GOTO, GOSUB, etc. token values. The start-of-BASIC in the PET is 1025 decimal; this is the number that must be changed in lines 63895, 63933, and 63937. The applicable statement tokens are in line 63940 (assigned to variable P).

As one last precaution, you may wish to retain the space between the variable LE and the statement THEN in the associated IF...THEN statements, thus avoiding BASIC confusion with the LET statement.

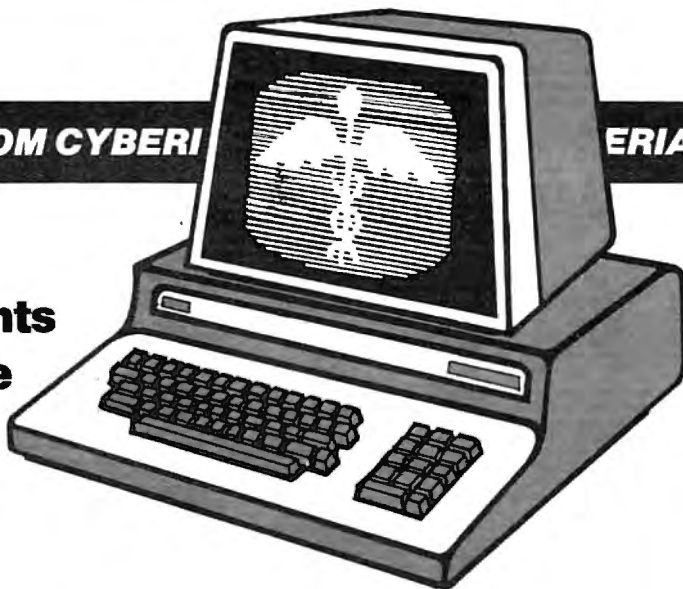
```
63776 REM END RENUMBER
63887 REM LINE RENUMBER - RUN63888
63888 PRINT"RENUMBER":INPUT"START AT LINE #":LS
63889 INPUT"END AT LINE #":LE:IFLE>=63776THENLE=63775
63890 IF LS>= LE THEN63888
63891 INPUT"FIRST NEW LINE #":Z
63892 INPUT"INCREMENT NEW LINES BY":K
63895 DIML(500):L=1025:DEFFNR(X)=PEEK(X)+256*PEEK(X+1):REM*OLD ROM DIM L
(255)*
63900 DEFFNM(X)=INT((K*X-K+Z)/256)
63902 N=FNR(L):X=FNR(L+2):IFX<LSTHENL=N:GOTO63902
63904 L1=L
63910 N=FNR(L):X=FNR(L+2):IFX<= LE THENA=A+1:L(A)=X:L=N:IFN=0THEN63920
63912 IFX<=LE THEN63910
63915 Y=INT(K*A-K+Z):IFX<=YTHENPRINT"MAX. LINE OVERLAP - CK. PGM":END
```

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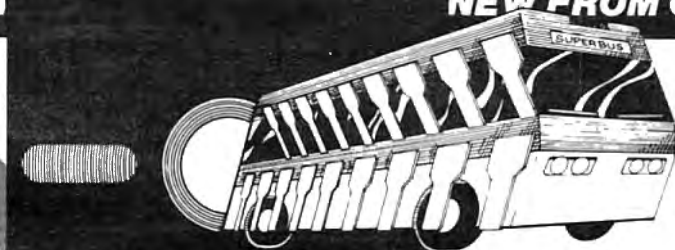
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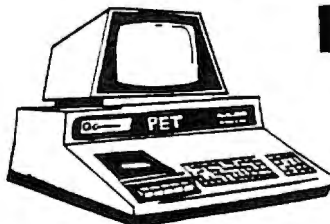
*WordPro is a trademark of Professional Software, Inc.

```

63920 L=L1:FORB=1TOA:N=FNR(L):POKE(L+3),FNM(B)
63930 POKE(L+2),K*B-K+Z-256*FNM(B):L=N:NEXT
63933 L=1025
63935 N=FNR(L):X=FNR(L+2):IFX<63776 THENAA=AA+1:L=N:IFN<>0 THEN 63935
63937 L=1025:FORB=1TOAA:N=FNR(L):X=FNR(L+2)
63940 F=0:FORC=L+4TON-1:P=PEEK(C):IFP=137ORP=141ORP=167ORP=138 THENF=1:GOTO63999
63950 IFF>0THENF=0:IFP<58THENF=1:G=G+1:IFP>47THEND=10*D+P-48:GOTO63999
63960 IFD=0GOTO63999
63970 FORE=1TOA:IFD=L(E)GOTO63990
63980 NEXTE:D=0:G=0:GOTO63999
63990 D=0:E$="" "+STR$(E*K-K+Z):H=LEN(E$):C=C-G:IFP<48THENG=G-1:C=C+1
63995 IFH-6>GTHENPRINTX:E*K-K+Z:
63997 FORI=1TOG:POKEC,ASC(MID$(E$,I+H-G,1)):C=C+1:NEXTI:G=0
63999 NEXTC:L=N:PRINT"*":NEXTB:END
READY.

```

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Disk Data Structures: An Interactive Tutorial

David Young
Richardson, TX

The floppy disk is a marvelous and yet mysterious medium for mass storage of data. Indeed, understanding exactly how a bit of data is stored and retrieved from the surface of the disk requires a good knowledge of physics. However, to learn about the data structures found on a disk requires mathematics no more complex than hexadecimal arithmetic. The manual supplied with the computer usually does an adequate job of supplying all the technical details, but wouldn't it sink in better if the actual data on the media could be viewed while it is being described?

The program that is presented here, Diskpeek, was created just for that purpose. Though this program was written for the Atari Personal Computer (DOS 2.0S), the interactive tutorial which follows contains information which should apply, in one form or another, to most other disk based computer systems. Those with a disk based Atari computer should type in Diskpeek before proceeding. This program is used to demonstrate the disk data structures as they are being described. The instructions integrated into the program should make its use self-explanatory.

The Disk Medium

The first disk structure to be aware of is the sector which, on any computer system, consists of a group of contiguous bits recorded at a specific location on the disk. The disk drive hardware always operates on whole sectors, that is to say, it is not possible to read or write partial sectors. Groups of sectors are organized into tracks forming concentric rings about the center of the disk.

The Atari system divides the disk into 40 tracks with 18 sectors per track for a total of 720 sectors. This is best visualized by taking the lid off of the disk drive and watching the read/write head move as certain sectors are addressed. On the Atari 810 disk drive this is accomplished by removing the four phillips head screws hidden under gummed tabs at each corner of the lid. While inside the case, a bit of lubrication on the 2 cylindrical

guide rails supporting the head will make the drive less noisy.

If sectors 1 through 18 are read with Diskpeek, the head remains fixed on the outermost track. When sector 720 is read, the head moves in to the innermost track. When a disk is formatted, the head can be seen to bump sequentially through all 40 tracks. It is laying down the patterns on the oxide surface which will be recognized by the drive hardware as the sectors. The sectors are all initially empty (128 bytes of 0), but at the end of the formatting routine, as described in the next section, the Atari DOS records special data into certain sectors. The top of the drive can now be resecured. No more information about the hardware is needed to understand the higher level disk data structures of the software.

Boot Sector

At the end of the formatting process, DOS reserves and initializes certain sectors for special tasks. Into sectors 1 through 3 is stored the bootstrap for DOS. On power-up the Atari operating system reads sector 1 to determine how many sectors to read and where into memory to load them. After it has loaded in the specified number of sectors, DOS starts executing the new code at the load address + 6. Put Diskpeek into the hex mode and read sector 1 of any DOS disk. Byte 0 says that 3 sectors are read (sequentially) and bytes 1 and 2 specify a load address of \$700. (A 2 byte number is always specified with the least significant byte first.) Byte 6 is the first instruction to be executed (a \$4C1407 is a JMP \$714). In this case the code which follows sets up to load the File Management System of DOS into memory. This is called the second stage of the boot. Look at the first sector of any other boot disk available (any game or program which loads in from disk on power-up). It might be seen that the program loads in entirely during the first stage of the boot, i.e. byte 1 of sector 1 has a sector count which represents the entire program. For more details on the disk boot process, see the Atari *Operating System User's Manual*.

Volume Table Of Contents

Besides the first three boot sectors, DOS sets up sectors 360 to 368 as the directory of the disk. DOS uses the directory to keep track of where files are stored on disk and how much disk space remains. Read sector 360 of a DOS disk with Diskpeek in the hex mode and view a part of the directory called the Volume Table of Contents (VTOC). Information pertaining to the availability of every sector on the disk is stored in this sector. Bytes 1 and 2 specify the maximum number of user data sectors on the disk (\$2C3 = 707) and bytes 3 and 4 specify the number of free sectors remaining on

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the disk (707 for an empty disk, 0 for a full one). Starting in bit 6 (the second to highest order bit) of byte \$0A, each bit up through byte \$63 corresponds to a sector. A 1 corresponds to a free sector while a 0 means the sector is being used.

When a file is stored on the disk, the bits corresponding to the sectors used are set to 0. When the file is erased, the bits are set back to 1. That is why DOS, when it deletes a file, can be heard reading the entire file. It is determining which sectors were being used by the file so that it can free them back up. Notice that even on a newly formatted disk, sector bits 1, 2 and 3 (bits 6, 5 and 4 of byte \$0A) are set to 0. These correspond to the 3 boot sectors. Likewise, the nine bits starting in byte \$37 are 0 because they correspond to the sectors of the directory. These 12 sectors are thus kept from being overlaid by user files.

If the VTOC is viewed on an older disk which has had many file additions and deletions, it may be noted that the VTOC has become quite fragmented. Any file added to the disk may get stored into sectors scattered about the disk. How DOS keeps track of files spread over multiple sectors will be discussed shortly. By the way, even though the operating system recognizes sector 720 (try reading it; should be all zeroes), DOS never makes use of it. True to Murphy's Law, it adopted the number scheme of 0 to 719 instead of 1 to 720. No need to bother trying to read sector 0!

The Directory

Of all the disk data structures, probably the most important one to be acquainted with is the directory. The eight sectors following the VTOC (361-368) contain a list of all the files on the disk along with their size, starting sector, and status. Put Diskpeek into character mode and read sector 361 of the DOS disk that has several files on it. It can be seen that the name of the first file starts in byte \$05 and the extension (if any) starts in byte \$0D. If any of the 11 character positions of the filespec are unused, it contains a blank. Notice that the filenames start every 16 bytes, allowing eight directory entries per 128 byte sector. Thus, the maximum number of entries for the eight sectors of the directory is 64.

Now put Diskpeek in hex mode and read sector 361. The first byte of each 16 byte entry contains the status of the file. For a normal file that byte is \$42, unless it is locked, in which case it has a status of \$62. A deleted file has a status of \$80. An anomaly occurs whenever a file is opened for output (from BASIC, perhaps) but is not closed before the computer is powered down or glitched. Since the status of an open file is \$43, DOS will neither recognize the entry as "in use" nor "deleted." Even the sectors which may have been written out will not

really exist on disk because the VTOC is not updated until the file is closed. The only harm done is that this bogus entry will take up space in the directory until the disk is reformatted. The second and third bytes of each entry contain the size in sectors of the file (low order byte first) while the fourth and fifth bytes specify the first sector of the file. DOS only needs to know the first sector of a file because each sector points to the next sector of the file in a process called "linking."

Linking

At this point it would be best to explain how DOS forms a data file on disk. First, the user must open an I/O channel for output to the disk, perhaps with the BASIC "OPEN" command. DOS responds by creating an entry in the directory with the specified filename and a status of \$43. DOS reads the VTOC into memory and searches the disk map for the first free sector. If a free sector is found, its number is used as the starting sector in the directory entry. Now, when the user begins to output data via this I/O channel, perhaps with the BASIC "PUT" command, DOS waits until it has collected 125 bytes of user data in a buffer. Then DOS adds three special bytes of its own and outputs the sector to the disk. I call these three bytes the "sector link."

The sector link, bytes 125 to 127 of the sector, contains three pieces of information. The high order six bits of byte 125 contain a number which represents the position of the file's entry within the directory (0 to 63). DOS uses this number to check the integrity of the file. If ever this number should fail to match the position of the file's directory entry, DOS generates an error. The low order two bits of byte 125 and all of byte 126 form a pointer to the next sector of the file. A pointer is the address of a record in the computer's memory or, in this case, the address of a record on disk, the sector number.

The next sector of the file is determined by scanning the bit map of the VTOC for the next free sector, which may or may not be the next sequential sector of the disk. Thanks to the link pointers, all sectors of a file need not be contiguous sectors on the disk. The last byte of the sector link (byte 127 of the sector) contains the number of bytes used within the sector. This byte will always be \$7D (125) except for the last sector of a file, which will probably be only partially filled. DOS writes out this partial sector only when the user closes the file, perhaps with the BASIC "CLOSE" command.

When an output disk file is closed, DOS writes the newly updated VTOC back out to sector 360. It then updates the file's directory entry by changing the status to \$42 and filling in the file size (bytes 1

and 2) with the number of sectors used by the file. This completes the process of creating a file on disk. Now, when DOS is requested to read a file from disk, it finds the directory entry of the specified file to determine the start sector. Then, following the link pointers, it reads the file, sector by sector, until EOF (end of file) is reached, indicated by a link pointer of 0.

Equipped with a basic understanding of how a file is stored on disk, try looking at a file with Diskpeek. In character mode, first locate the name of the desired file in the directory (sectors 361-368). Then put Diskpeek in hex mode and look at the fourth and fifth byte of the entry to determine the start sector. For example, if these two bytes were "01 02" then type "\$201" to read the first sector.

Observe the last three bytes of the sector and verify that the high order six bits of byte 125 correspond to the directory entry position and that byte 127 is the number of bytes used (probably \$7D). Then determine the next sector of the file from the low order two bits of byte 125 and byte 126. For example, if bytes 125 and 126 are "06 02" then the next sector of the file is \$202 and the file is the second entry of the directory (the first entry being entry zero). If the file is not too long, it would be instructive to follow the sector links to EOF. Once the ability of finding a file on disk and following the sector links is mastered, all that remains is to become familiar with the three types of files used by DOS.

File Types

The first type of file is not a true file, per se, because there is no entry in the directory for it. This file type includes the boot record and the directory itself. And, since the sectors which make up these files are not linked, but, instead, are related to each other sequentially, I call these records "sequentially linked files." When examining a sector of the boot record or directory, merely increase the sector number by one to get to the next sector of the record.

An example of the second type of file is that which is created with the BASIC LIST or SAVE command. This file consists of ASCII characters which either represent straight text, as in a LISTed file, or a sort of condensed text, as in a tokenized or SAVED file. Except when viewing the sector links, the character mode of Diskpeek is best suited for examining this type of file. At this point it would be instructive to locate (in the directory of a DOS disk) a file created with the BASIC LIST command.

Upon determining the start sector, observe the file in the character mode. The BASIC program can be easily recognized. It may be noted that the carriage return-line feed character (CRLF) is dis-

played in its ATASCII representation (an inverse escape character) instead of being executed. Now observe a file that consists of a program that was SAVED from BASIC. Since the text has been tokenized, the program is harder to recognize. However, certain parts of the program are not altered during the tokenization process, notably text following REM and PRINT statements. Now, having investigated ASCII files, it is time to discuss the last file type, the *binary load* file.

The binary load file is primarily used to load 6502 machine code into memory for execution. However, its format is so general that it can be used just as easily to load any type of data, including ASCII text. Locate a game or other program which is run with the BINARY LOAD option of DOS. Alternatively, create a binary load file by saving any part of memory (except ROM) with the BINARY SAVE option. Now observe the first sector of the file with Diskpeek in the hex mode.

First, notice that all binary load files start with two bytes of \$FF. The next four bytes are the start and end addresses, respectively, where the data to follow will be loaded into memory. If these four bytes were "00 A0 FF BF" then the data would be loaded between the addresses of \$A000 and \$BFFF. I call these four bytes a *load vector*. After DOS has loaded in enough bytes to satisfy the load vector, it assumes (unless EOF is reached) that the next four bytes specify another load vector. DOS will continue inputting the file at this new address.

Upon completion of a BINARY LOAD, control will normally be passed back to the DOS menu. However, DOS can be forced to pass control to any address in memory by storing that two byte address at location \$2E0. To store the two bytes, it is necessary to specify another load vector as part of the file. If, for example, it were desired to execute the program loaded in at \$A000, the following load vector would be part of the file: E0 02 E1 02 00 A0. I call this specialized load vector an *autorun vector*. It achieves the same result as the RUN AT ADDRESS option of DOS. Try to find the autorun vector in the file being viewed. Although it could be at the beginning, it is most likely located at the very end of the file.

```

10 REM DISKPEEK: David Youne 11/10/81
20 SETCOLOR 1,0,4:SETCOLOR 2,10,10
30 DIM HEXCHAR$(16),HEXBYTE$(2)
40 DIM HEXNUM$(113),SECTRM$(68)
50 DIM TEMP$(3),DFORM$(1)
60 ? CHR$(125):? "WAIT A FEW SECONDS..."

70 GOSUB 1130:GOSUB 970
80 GOSUB 660:RESTORE 90

```

```

90 DATA @123456789ABCDEF
100 READ HEXCHAR$:OPEN #1,4,0,"K"
110 DFORM$="H"
120 ? CHR$(125):? "      DISKPEEK by Da
vid Youngs":?
130 ? "This is a disk utility for viewin
s"
140 ? "individual sectors of a disk. It"
150 ? "reads the sector specified by the
"
160 ? "user and then displays it's conte
nts"
170 ? "as a matrix of hex bytes or ATASC
II"
180 ? "characters.":?
190 ? "The sector number can be specifie
d in"
200 ? "decimal ('361') or hex ('$169').
Type"
210 ? "RETURN to toggle from one displa
y"
220 ? "format to the other."
230 POSITION 2,20: ? CHR$(156): ? "Sector
#";
240 INPUT HEXNUM$:IF LEN(HEXNUM$)<>0 THE
N 280
250 IF DFORM$="C" THEN DFORM$="H":GOTO 2
70
260 DFORM$="C"
270 GOSUB 770:GOTO 230
280 GOSUB 500:IF BYTE<0 OR BYTE>720 THEN
GOSUB 350:GOTO 230
290 SECNUM=BYTE
300 GOSUB 880:IF X=1 THEN GOSUB 770
310 GOTO 230
320 REM
330 REM *** PRINT ERROR MESSAGE ***
340 REM
350 POSITION 2,19: ? CHR$(156):CHR$(156);
CHR$(156): "NOT LEGAL NUMBER!":RETURN
360 REM
370 REM **** PRINT HEX BYTE ****
380 REM
390 GOSUB 430:PRINT HEX$BYTE$:RETURN
400 REM
410 REM *** HEX CONVERSION ***
420 REM
430 TEMPB=BYTE:BYTE=INT(BYTE/16)+1
440 HEX$BYTE$(1,1)=HEXCHAR$(BYTE, BYTE)
450 BYTE=(TEMPB-(BYTE-1)*16)+1
460 HEX$BYTE$(2,2)=HEXCHAR$(BYTE, BYTE)
470 BYTE=TEMPB:RETURN
480 REM
490 REM *** NUMBER CONVERSION ***
500 REM
510 TRAP 630:IF HEXNUM$(1,1)<>"$" THEN G
OTO 620
520 HEXNUM$=HEXNUM$(2)
530 IF LEN(HEXNUM$)=3 THEN HEXNUM$(4)=HE
XNUM$(3):HEXNUM$(3,3)=HEXNUM$(2,2):HEXNU
M$(2,2)=HEXNUM$(1,1):HEXNUM$(1,1)="0"
540 IF LEN(HEXNUM$)=2 THEN HEXNUM$(4)=HE
XNUM$(2):HEXNUM$(3,3)=HEXNUM$(1,1):HEXNU
M$(1,2)="00"
550 IF LEN(HEXNUM$)=1 THEN HEXNUM$(4)=HE
XNUM$(1):HEXNUM$(1,3)="000"
560 IF ASC(HEXNUM$(1,1))>64 THEN HEXNUM$(
1,1)=CHR$(ASC(HEXNUM$(1,1))-7)
570 IF ASC(HEXNUM$(2,2))>64 THEN HEXNUM$(
2,2)=CHR$(ASC(HEXNUM$(2,2))-7)
580 IF ASC(HEXNUM$(3,3))>64 THEN HEXNUM$(
3,3)=CHR$(ASC(HEXNUM$(3,3))-7)
590 IF ASC(HEXNUM$(4,4))>64 THEN HEXNUM$(
4,4)=CHR$(ASC(HEXNUM$(4,4))-7)
600 BYTE=(ASC(HEXNUM$(4,4))-48)+16*(ASC(
HEXNUM$(3,3))-48)+256*(ASC(HEXNUM$(2,2))
-48)+4096*(ASC(HEXNUM$(1,1))-48)
610 TRAP 40000:RETURN
620 TRAP 630:BYTE=VAL(HEXNUM$):GOTO 610
630 GOSUB 350:BYTE=-1:GOTO 610
640 REM
650 REM *** DISK READ/WRITE ***
660 REM
670 RESTORE 680:FOR K=1 TO 68:READ @:SEC
TRW$(K,K)=CHR$(@):NEXT K:RETURN
680 DATA 104,104,104,201,83,169,82,144
690 DATA 2,169,87,72,169,0,72,169
700 DATA 1,72,169,0,72,169,128,72
710 DATA 169,6,72,72,104,104,141,5
720 DATA 3,104,141,4,3,104,104,141
730 DATA 1,3,104,104,141,2,3,104
740 DATA 141,11,3,104,141,10,3,32
750 DATA 83,228,173,3,3,133,212,169
760 DATA 0,133,213,96
770 REM
780 REM *** DISPLAY SECTOR ***
790 REM
800 BYTE=INT(SECNUM/256): ? CHR$(125)
810 ? "SECTOR # = ";SECNUM;
820 ? " ($";:GOSUB 370
830 BYTE=SECNUM-256*INT(SECNUM/256)
840 GOSUB 370: ? ") "
850 IF DFORM$="H" THEN GOTO 870
860 X=USR(ADR(MEMCHAR$),1536+128):RETURN

870 X=USR(ADR(MEMHEX$),1536+128):RETURN

880 REM
890 REM *** READ SECTOR ***
900 REM
910 X=USR(ADR(SECTRW$),82,SECNUM)

```

```

920 IF X=1 THEN 950
930 POSITION 2,19
940 ? "CAN'T READ SECTOR ";SECNUM;"!"
950 RETURN
960 REM
970 REM *** DISPLAY MEM IN HEX ***
980 REM
990 DIM MEMHEX$(122)
1000 RESTORE 1010:FOR K=1 TO 122:READ Q:
MEMHEX$(K,K)=CHR$(Q):NEXT K:RETURN
1010 DATA 104,104,133,229,104,133,228,16
9
1020 DATA 0,72,104,72,16,7,169,155
1030 DATA 32,164,246,104,96,169,155,32
1040 DATA 164,246,104,72,74,74,74,74
1050 DATA 201,10,48,2,105,6,105,48
1060 DATA 32,164,246,104,72,41,15,201
1070 DATA 10,48,2,105,6,105,48,32
1080 DATA 164,246,169,32,32,164,246,169
1090 DATA 32,32,164,246,104,72,168,177
1100 DATA 228,74,74,74,74,201,10,48
1110 DATA 2,105,6,105,48,32,164,246
1120 DATA 104,72,168,177,228,41,15,201
1130 DATA 10,48,2,105,6,105,48,32
1140 DATA 164,246,169,32,32,164,246,104
1150 DATA 24,105,1,72,41,7,208,204
    
```

```

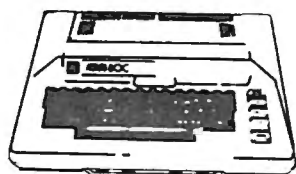
1160 DATA 240,144
1170 REM
1180 REM *** DISPLAY MEM IN CHAR FORMAT
***
1190 REM
1200 DIM MEMCHAR$(122)
1210 RESTORE 1220:FOR K=1 TO 122:READ Q:
MEMCHAR$(K,K)=CHR$(Q):NEXT K:RETURN
1220 DATA 104,104,133,229,104,133,228,16
9
1230 DATA 0,72,104,72,16,7,169,155
1240 DATA 32,164,246,104,96,169,155,32
1250 DATA 164,246,104,72,74,74,74,74
1260 DATA 201,10,48,2,105,6,105,48
1270 DATA 32,164,246,104,72,41,15,201
1280 DATA 10,48,2,105,6,105,48,32
1290 DATA 164,246,169,32,32,164,246,169
1300 DATA 32,32,164,246,169,1,141,254
1310 DATA 2,104,72,168,177,228,201,155
1320 DATA 208,11,169,0,141,254,2,169
1330 DATA 219,133,93,169,31,32,164,246
1340 DATA 169,32,32,164,246,169,32,32
1350 DATA 164,246,169,0,141,254,2,104
1360 DATA 24,105,1,72,41,7,208,204
1370 DATA 240,144
    
```

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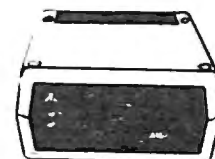
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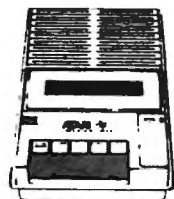


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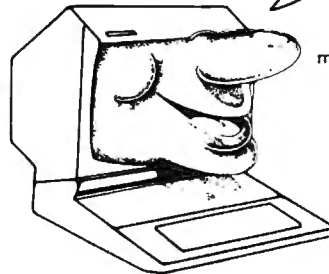
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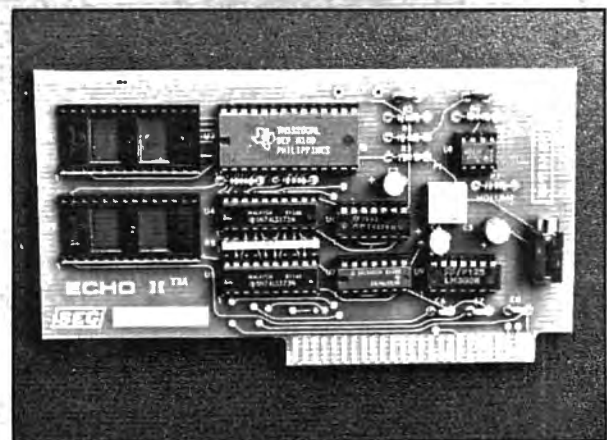
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Apple Addresses

Bill Grimm
Mountain View, CA

The Apple II uses three types of addressing depending upon the language being used. Apple's machine language uses hexadecimal addresses in the range from \$0000 to \$FFFF. Its Floating Point BASIC language uses decimal addresses in the range from 0 to 65535. Its Integer BASIC uses decimal addresses in the range from 0 to 32767 to -32767 to -1. This means that, if you want to address a particular memory location, you must choose the correct address for the language you are using. Since I program in all three languages and my references are a mixture from all three, I needed an address cross-reference program. So I wrote "Apple Addresses."

"Apple Addresses" can be used "as is" to convert one language's address to another's, and to give the high and low byte values which need to be poked into a BASIC program to store that address. Alternatively, you could extract the subroutines in Apple Addresses which convert between hex and decimal numbers and insert them in your own program. See the last paragraph of this article for more details.

The program begins by asking the user which of the six possible conversions he would like to make. This is followed by a request to select the way the results of the conversions are to be displayed. There are four possible displays:

1. single conversions displayed on the monitor one at a time.
2. Single conversions printed out on a Silentyper printer* one at a time.
3. a range of conversions displayed on the monitor.
4. a range of conversions printed out on a Silentyper printer*.

*With slight program modifications other printers could be used.

Subroutines

"Apple Addresses" makes extensive use of subroutines. This helps in organizing the program as well as making it shorter and easier to debug. The controlling or EXECutive routine is called Apple Addresses - Exec. It starts on line 100 and goes to line 310. Since a picture is worth a thousand words, I made what I call a *balloon diagram* (Figure 1) to

show how data flows through the program. These are the conventions I used to make the diagram;

1. Each balloon represents a subroutine. The name of the subroutine and the line numbers where it is located are placed in the balloon.
2. Data flows through a subroutine in the direction of the arrows on the outside of the balloon.
3. Data flows between subroutines in the direction of the arrows on the *strings*.
4. If conditions are placed on what data flows through a subroutine, these conditions are written in along the *strings*.

As an additional aid for understanding how the program works I have included the following variable descriptions list:

A(I) — each A(I) holds the decimal equivalent value of the Ith hexadecimal numeral in the hex number being created from a decimal number — appropriate numbers are then added to convert these to ASCII codes.

A\$() — holds the characters represented by the ASCII codes in A().

CHOICE — holds the number of the conversion chosen — see lines 120 to 178.

DVL — holds the decimal value of the number being converted — may be either FP or INT decimal.

DVL\$ — is the string equivalent of DVL and is used in the output routines.

FLAG — if flag = 1 then an invalid number was entered and the program returns to get a new number.

FRST — holds the FP Basic address equivalent of the lowest address in the selected range.

FRST\$ — holds the smallest address chosen — this address is then processed and stored in FRST.

HVL\$ — holds the hex number selected or the hex number resulting from the conversion — if no hex numbers are involved then it holds the converted decimal number.

LST — holds the FP Basic address equivalent of the largest address in the selected range.

LST\$ — holds the largest address chosen — this address is then processed and stored in LST.

N — holds the decimal equivalent of each hex numeral in a hex number being converted to a decimal number.

PHI% — holds the number that would be poked into the high byte when placing the address into memory.

PLO% — holds the number that would be poked into the low byte when placing the address into memory.

POK — holds the address from which PLO% and PHI% are derived.

SELECT — holds the type of output selected — see lines 462 to 470.

STP — holds the positive decimal stepping interval chosen.

STP\$ — holds the stepping interval chosen which is later changed and stored in STP.

TB — the horizontal tab value desired.

TN — holds the intermediate numbers of the decimal address that is being converted into a hex address.

VTB — used to control the vertical tabbing of the monitor output.

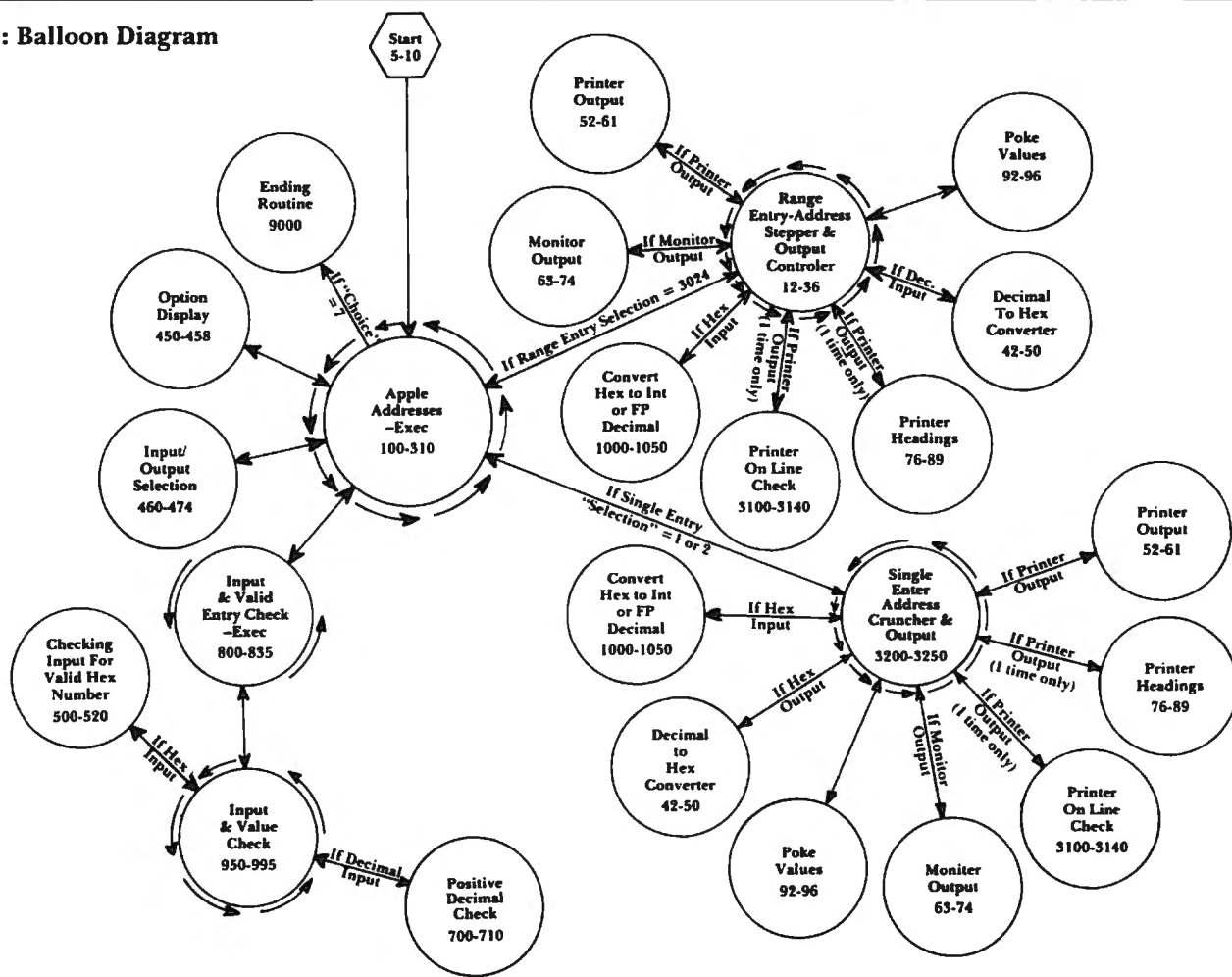
gram while I am entering it is to first type in the EXEC program. Then, if I place return statements at all the branching locations, I can check the EXEC for bugs. Once the EXEC is free of bugs, I add one subroutine at a time in the order that the EXEC uses them, checking for bugs as I go.

If you have a need for subroutines which convert numbers from hex to decimal or from decimal to hex, two subroutines in this program may be of help. The first is called "decimal to hex converter" (lines 42 to 50). The input to this routine is TN which must hold a positive decimal number <65536. The output is HVL\$ which holds the hex equivalent to the number in TN. The second is called "convert hex to INT or FP decimal" (lines 1000 to 1050). The input to this routine is HVL\$ which must hold a hex number <= \$FFFF and choice. If choice = 1 then you get the positive decimal equivalent. Otherwise you get Int BASIC's equivalent. The output is a decimal number in DVL.

Some Suggestions

I have found that the easiest way to debug a pro-

Figure 1: Balloon Diagram



```

10 GOTO 100
12 IF CHOICE < 3 THEN IN$ = STP$: GOSUB 1000:STP = DVL:IN$ = LST$: GOSUB
    1000:LST = DVL:IN$ = FRST$: GOSUB 1000:FRST = DVL: GOTO 16

```

```

14 STP = VAL (STP$):LST = VAL (LST$):FRST = VAL (FRST$)
16 VTB = 7:TB = 1: IF SELECT = 4 THEN GOSUB 3100: POKE - 12526,83: PR#
    1: PRINT : PRINT "CONVERTING FROM ";: ON CHOICE GOSUB 76,78,80,82,84
    ,86: POKE - 12526,80
18 IF LST < 0 THEN LST = LST + 65536: IF FRST < 0 THEN FRST = FRST + 655
    36
19 FOR DVL = FRST TO LST STEP STP: IF CHOICE < > 4 OR CHOICE < > 6 THEN
    TN = DVL: GOSUB 42
20 IF CHOICE = 3 AND DVL > 32767 OR CHOICE = 4 AND DVL > 32767 OR CHOICE
    = 2 AND DVL > 32767 OR CHOICE = 6 AND DVL > 32767 THEN DVL = DVL -
    65536
22 IF CHOICE = 4 THEN HVL$ = STR$ (DVL): IF DVL < 0 THEN HVL$ = STR$ (
    DVL + 65536)
24 IF CHOICE = 6 THEN HVL$ = STR$ (DVL): IF DVL < 0 THEN DVL = DVL + 65
    536
26 GOSUB 92
28 IF SELECT = 4 THEN GOSUB 52: GOTO 32
30 GOSUB 62
32 IF DVL < 0 THEN DVL = DVL + 65536
34 NEXT DVL: IF SELECT = 4 THEN PRINT : PR# 0
36 RETURN
42 HVL$ = "": FOR I = 4 TO 1 STEP - 1:A(5 - I) = INT (TN / (16 ^ (I - 1
    ))):TN = TN - (A(5 - I) * (16 ^ (I - 1))): NEXT I
44 FOR I = 1 TO 4: IF A(I) < 10 THEN A(I) = A(I) + 48: GOTO 48
46 A(I) = A(I) + 55
48 A$(I) = CHR$(A(I)):HVL$ = HVL$ + A$(I): NEXT I
50 RETURN
52 DVL$ = STR$ (DVL): IF CHOICE < 3 THEN 58
54 PRINT SPC( 6 - LEN (DVL$));DVL$;: IF CHOICE = 5 OR CHOICE = 3 THEN
    PRINT ">$";HVL$; SPC( 1);: GOTO 59
56 PRINT ">"; SPC( 6 - LEN (HVL$));HVL$;: GOTO 59
58 PRINT " $"; SPC( 4 - LEN (HVL$));HVL$;">"; SPC( 6 - LEN (DVL$));DVL
    $;
59 PRINT SPC( 9 - LEN (PLO$));PLO$; SPC( 14 - LEN (PHI$));PHI$;:TB =
    TB + 39: IF TB > 42 OR SELECT = 2 THEN TB = 1: PRINT
60 HTAB TB: IF TB = 40 THEN PRINT SPC( 3);
61 RETURN
62 REM
63 DVL$ = STR$ (DVL): VTB = VTB: HTAB TB: IF CHOICE < 3 THEN 68
64 PRINT SPC( 6 - LEN (DVL$));DVL$;: IF CHOICE = 5 OR CHOICE = 3 THEN
    PRINT ">$";HVL$; SPC( 2);: GOTO 70
66 PRINT ">"; SPC( 6 - LEN (HVL$));HVL$; SPC( 1);: GOTO 70
68 PRINT "$0000>";: HTAB TB + 5 - LEN (HVL$): PRINT HVL$;: HTAB TB + 12
    - LEN (DVL$): PRINT DVL$; SPC( 2);
70 PRINT SPC( 8 - LEN (PLO$));PLO$; SPC( 14 - LEN (PHI$));PHI$;VTB =
    VTB + 1: IF VTB > 23 THEN HTAB 3: INPUT "PRESS <RETURN> TO CLEAR SC
    REEN";IN$: HOME :VTB = 6:TB = 1: GOTO 72
71 GOTO 74
72 IF IN$ = "Q" THEN POP : GOTO 100
73 IF SELECT = 3 THEN VTB = 7
74 RETURN
76 PRINT "HEX TO FP DECIMAL": GOSUB 88: RETURN
78 PRINT "HEX TO INT DECIMAL": GOSUB 88: RETURN
80 PRINT "INT DECIMAL TO HEX": GOSUB 88: RETURN
82 PRINT "INT DECIMAL TO FP DECIMAL": GOSUB 88: RETURN
84 PRINT "FP DECIMAL TO HEX": GOSUB 88: RETURN
86 PRINT "FP DECIMAL TO INT DECIMAL": GOSUB 88: RETURN
88 IF SELECT = 2 THEN PRINT : PRINT " CONVERSION POKE LO BYTE POKE H
    I BYTE": RETURN

```

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89 PRINT : PRINT " CONVERSION   POKE LO BYTE   POKE HI BYTE   CONVERSION
   POKE LO BYTE   POKE HI BYTE": RETURN
92 POK = DVL: IF POK < 0 THEN POK = POK + 65536
94 PHI% = POK / 256:PLO% = POK - PHI% * 256
96 PHI$ = STR$(PHI%):PLO$ = STR$(PLO%): RETURN
100 POKE - 16298,0: TEXT : HOME :FLAG = 0
110 VTAB 7
120 PRINT " 1. CONVERT HEX ADDRESSES TO FP BASIC": PRINT
130 PRINT " 2. CONVERT HEX ADDRESSES TO INT BASIC": PRINT
135 PRINT " 3. CONVERT INT BASIC ADDRESSES TO HEX": PRINT
140 PRINT " 4. CONVERT INT BASIC ADDRESSES TO FP": PRINT
150 PRINT " 5. CONVERT FP BASIC ADDRESSES TO HEX": PRINT
160 PRINT " 6. CONVERT FP BASIC ADDRESSES TO INT": PRINT
162 PRINT " 7. QUIT": PRINT
165 PRINT : PRINT "NOTE: ENTERING A 'Q' AT ANY POINT           RETURNS
   YOU TO THIS MENU."
170 VTAB 4: INPUT "CHOOSE ONE: ";IN$
175 IF IN$ = "7" THEN 9000
178 CHOICE = VAL (IN$): IF CHOICE < 1 OR CHOICE > 6 THEN 100
180 GOSUB 450: GOSUB 460: HOME : VTAB 1: HTAB 13: ON SELECT GOTO 190,195
   ,200,210
190 PRINT ": SINGLE ENTRY : MONITOR": GOTO 220
195 PRINT ": SINGLE ENTRY : PRINTER": GOTO 220
200 PRINT ": RANGE ENTRY : MONITOR": GOTO 220
210 PRINT ": RANGE ENTRY : PRINTER"
220 HOME : IF SELECT < 3 THEN PRINT "ENTER NUMBER": GOTO 250
230 PRINT "FIRST NUMBER";: HTAB 22: PRINT "LAST NUMBER"
240 PRINT "STEPPING INTERVAL"
250 FOR I = 0 TO 39: PRINT CHR$(45);: NEXT I: PRINT " CONVERSION   POK
   E LO BYTE   POKE HI BYTE": POKE 34,6: IF SELECT < 3 THEN POKE 34,5
260 HOME
280 CNT = 0:TB = 1:VTB = 7: IF SELECT < 3 THEN VTB = 6
290 GOSUB 800
300 ON SELECT GOSUB 3200,3200,12,12: IF SELECT < 3 THEN 290
310 VTAB 24: HTAB 5: CALL - 868: INPUT "PRESS <RETURN> TO CONTINUE.";IN
   $: GOTO 100
450 HOME : HTAB 4: ON CHOICE GOSUB 452,456,458,455,454,457: FOR I = 0 TO
   39: PRINT CHR$(45);: NEXT I: POKE 34,2: RETURN
452 PRINT "HEX->FP": RETURN
454 PRINT "FP->HEX": RETURN
455 PRINT "INT->FP": RETURN
456 PRINT "HEX->INT ": RETURN
457 PRINT "FP->INT": RETURN
458 PRINT "INT->HEX": RETURN
460 HOME : VTAB 8
462 PRINT " 1. SINGLE ENTRY - MONITOR OUTPUT": PRINT
463 PRINT " 2. SINGLE ENTRY - PRINTER OUTPUT": PRINT
464 PRINT " 3. RANGE ENTRY - MONITOR OUTPUT": PRINT
466 PRINT " 4. RANGE ENTRY - PRINTER OUTPUT": PRINT
468 VTAB 6: INPUT "CHOOSE ONE: ";IN$: IF IN$ = "Q" THEN POP : GOTO 100
470 SELECT = VAL (IN$)
472 IF SELECT < 1 OR SELECT > 4 THEN 460
474 RETURN
500 FOR I = 1 TO LEN (IN$): IF ASC ( MID$( IN$,I,1)) > 70 OR ASC ( MID$(
   IN$,I,1)) < 48 THEN 520
510 IF ASC ( MID$( IN$,I,1)) > 57 AND ASC ( MID$( IN$,I,1)) < 65 THEN 520
512 NEXT I: RETURN
520 FLAG = 1: RETURN
700 FOR I = 1 TO LEN (IN$)

```



```

705 IF ASC ( MID$ ( IN$,I) ) > 57 OR . ASC ( MID$ ( IN$,I) ) < 48 THEN 710
709 NEXT I: RETURN
710 FLAG = 1: RETURN
800 IF SELECT > 2 THEN 815
805 VTAB 3: HTAB 13: CALL - 868: GOSUB 950: IF FLAG = 1 THEN FLAG = 0: GOTO
805
810 GOTO 835
815 VTAB 3: HTAB 13: POKE 33,21: CALL - 868: GOSUB 950:FRST$ = IN$: POKE
33,40: IF FLAG = 1 THEN FLAG = 0: GOTO 815
820 VTAB 3: HTAB 33: CALL - 868: GOSUB 950:LST$ = IN$: IF FLAG = 1 THEN
FLAG = 0: GOTO 820
825 VTAB 4: HTAB 18: CALL - 868: GOSUB 950:STP$ = IN$: IF DVL < 0 THEN
FLAG = 1
830 IF FLAG = 1 THEN FLAG = 0: GOTO 825
835 RETURN
950 IF CHOICE > 2 THEN 970
955 INPUT "=$";IN$: IF IN$ = "Q" THEN POP : POP : GOTO 100
957 IF IN$ = "" THEN FLAG = 1: GOTO 995
960 IF LEN ( IN$ ) > 4 THEN FLAG = 1: GOTO 995
965 GOSUB 500: GOTO 995
970 INPUT "=$";IN$: IF IN$ = "Q" THEN POP : POP : GOTO 100
972 IF IN$ = "" THEN FLAG = 1: GOTO 995
975 IF CHOICE < 5 AND VAL ( IN$ ) < - 32767 THEN FLAG = 1: GOTO 995
977 IF CHOICE < 5 AND VAL ( IN$ ) > 32767 THEN FLAG = 1: GOTO 995
980 IF CHOICE > 4 AND VAL ( IN$ ) < 0 THEN FLAG = 1: GOTO 995
983 IF CHOICE > 4 AND VAL ( IN$ ) > 65535 THEN FLAG = 1: GOTO 995
985 DVL = VAL ( IN$ ): IF DVL < 0 THEN IN$ = MID$ ( IN$,2 ): GOSUB 700:IN$ =
STR$ ( DVL + 65536 ): GOTO 995
990 GOSUB 700
995 RETURN
1000 HVL$ = IN$
1010 DVL = 0: FOR I = 1 TO LEN ( IN$ ): IF ASC ( MID$ ( IN$,I,1) ) > 64 THEN
N = ASC ( MID$ ( IN$,I,1) ) - 55
1018 IF ASC ( MID$ ( IN$,I,1) ) < 64 THEN N = ASC ( MID$ ( IN$,I,1) ) - 48
1020 DVL = DVL + N * 16 ^ ( LEN ( IN$ ) - I ): NEXT I
1030 IF CHOICE = 1 THEN 1050
1040 IF DVL > 32767 THEN DVL = DVL - 65536
1050 RETURN
3100 FOR I = 1 TO 7
3110 J = - 16384 + 256 * I
3120 IF PEEK ( J + 23 ) = 201 AND PEEK ( J + 55 ) = 207 AND PEEK ( J + 76 )
= 234 THEN RETURN
3130 NEXT I
3140 HOME : VTAB 10: PRINT "NO SILENTYPE PRINTER INSTALLED.": PRINT "SEL
ECTION ABORTED!": FOR K = 1 TO 3000: NEXT K: POP : RETURN
3200 IF CHOICE < 3 THEN GOSUB 1000: GOSUB 92: GOSUB 62: GOTO 3230
3210 IF CHOICE = 3 OR CHOICE = 5 THEN TN = VAL ( IN$ ): GOSUB 42: GOSUB 9
2: GOSUB 62: GOTO 3230
3220 HVL$ = IN$: IF CHOICE = 6 AND VAL ( IN$ ) > 32767 THEN HVL$ = STR$ (
DVL - 65536)
3225 GOSUB 92: GOSUB 62
3230 IF SELECT = 2 AND CNT = 0 THEN GOSUB 3100: POKE - 12526,83: PR# 1
: PRINT : PRINT "CONVERTING FROM " ; : ON CHOICE GOSUB 76,78,80,82,84,
86: CNT = CNT + 1
3240 IF SELECT = 2 THEN PR# 1: GOSUB 52: PR# 0
3250 RETURN
9000 POKE - 16300,0: POKE - 16298,0: TEXT : CALL - 936: POKE - 16368
,0: END

```

More VIC Maps

Jim Butterfield
Toronto, Canada

*Editor's Note: For more, see Jim's VIC maps in last month's issue, **COMPUTE!** #20. — RTM*

It's interesting to look at the innards of the VIC. In some ways, it's much like the PET/CBM and many things are quite recognizable. But new things have crept in, too: some are associated with new features such as color, others are there to implement advanced ideas such as an improved INPUT statement. Inner-space explorers will recognize many familiar landmarks.

The most noticeable new feature is the massive tables of vectors and links that have been implemented in page three. In hopes of explaining things better, I am using the terms rather carefully. Both vectors and links are addresses in RAM. An advanced application program can use these addresses, or even change them; and this gives the VIC remarkable programming flexibility. The term "Link" is used when the address is normally used to connect adjacent code; in this case, it doesn't affect the program flow until the link is broken with a new address. A vector, on the other hand, is used as a jump point, and the normal program jumps somewhere else through the vector. In other words, a ROM program hits a link point and normally keeps going; it hits a vector point and branches.

I wish Commodore had chosen to keep VIC

addresses compatible with those in the PET/CBM. If they had done so, many programs would have been portable between machines with no coding changes at all. But that's wishful thinking and, since many things are still the same style, it's not a serious hardship to trim up the PEEK and POKE addresses for transfer to the VIC.

I have inserted the "normal" address contents of many of the links/vectors in the brackets behind the description; they may not be valid for current machines, but a serious user can easily PEEK them himself.

The input and output ports are somewhat congested. There are almost as many I/O bits available as on the PET/CBM, but extra features such as joysticks and RS232 have caused a bit of a crunch.

The Video Interface Chip (VIC) itself is a remarkable piece of electronics. I hope my chart helps; but a full description can only be obtained in Commodore's technical reference.

I haven't noted the standard Jump Table in this map. Near the top of both the PET and the VIC are a series of standard locations to allow inputting, outputting, checking the stop key, and other jobs. Users familiar with their use in the PET/CBM will be pleased to know that the Jump Table is exactly the same in the VIC. All of the old favorites, such as FFD2 for PRINT and FFE4 for GET are still there.

Beginners shouldn't be scared by the mass of technical detail given here. The VIC can be used effectively without any of this information. But for those who love to tinker with the innards of the machine, there's a lifetime of experimental PEEKing and POKEing to be done; this map will help direct your efforts.

VIC Zero Page Memory Map

Hex	Decimal	Description
0000-0002	0-2	USR jump
0003-0004	3-4	Float-Fixed vector
0005-0006	5-6	Fixed-Float vector
0007	7	Search character
0008	8	Scan-quotes flag
0009	9	TAB column save
000A	10	0=LOAD, 1=VERIFY
000B	11	Input buffer pointer/# subscript
000C	12	Default DIM flag
000D	13	Type: FF=string, 00=numeric
000E	14	Type: 80=integer, 00=floating point
000F	15	DATA scan/LIST quote/memry flag
0010	16	Subscript/FNx flag
0011	17	0=INPUT; \$40=GET; \$98=READ
0012	18	ATN sign/Comparison eval flag
0013	19	Current I/O prompt flag
0014-0015	20-21	Integer value

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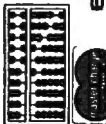
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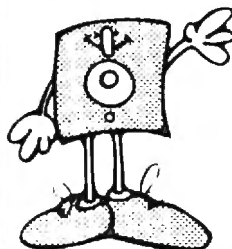
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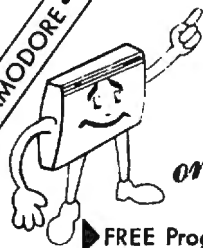
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0016	22	Pointer: temporary strg stack
0017-0018	23-24	Last temp string vector
0019-0021	25-33	Stack for temporary strings
0022-0025	34-37	Utility pointer area
0026-002A	38-42	Product area for multiplication
002B-002C	43-44	Pointer: Start-of-Basic
002D-002E	45-46	Pointer: Start-of-Variables
002F-0030	47-48	Pointer: Start-of-Arrays
0031-0032	49-50	Pointer: End-of-Arrays
0033-0034	51-52	Pointer: String-storage(moving down)
0035-0036	53-54	Utility string pointer
0037-0038	55-56	Pointer: Limit-of-memory
0039-003A	57-58	Current Basic line number
003B-003C	59-60	Previous Basic line number
003D-003E	61-62	Pointer: Basic statement for CONT
003F-0040	63-64	Current DATA line number
0041-0042	65-66	Current DATA address
0043-0044	67-68	Input vector
0045-0046	69-70	Current variable name
0047-0048	71-72	Current variable address
0049-004A	73-74	Variable pointer for FOR/NEXT
004B-004C	75-76	Y-save; op-save; Basic pointer save
004D	77	Comparison symbol accumulator
004E-0053	78-83	Misc work area, pointers, etc
0054-0056	84-86	Jump vector for functions
0057-0060	87-96	Misc numeric work area
0061	97	Accum#1: Exponent
0062-0065	98-101	Accum#1: Mantissa
0066	102	Accum#1: Sign
0067	103	Series evaluation constant pointer
0068	104	Accum#1 hi-order (overflow)
0069-006E	105-110	Accum#2: Exponent, etc.
006F	111	Sign comparison, Acc#1 vs #2
0070	112	Accum#1 lo-order (rounding)
0071-0072	113-114	Cassette buff len/Series pointer
0073-008A	115-138	CHRGET subroutine; get Basic char
007A-007B	122-123	Basic pointer (within subrtn)
008B-008F	139-143	RND seed value
0090	144	Status word ST
0091	145	Keyswitch PIA: STOP and RVS flags
0092	146	Timing constant for tape
0093	147	Load=0, Verify=1
0094	148	Serial output: deferred char flag
0095	149	Serial deferred character
0096	150	Tape EOT received
0097	151	Register save
0098	152	How many open files
0099	153	Input device, normally 0
009A	154	Output CMD device, normally 3
009B	155	Tape character parity
009C	156	Byte-received flag
009D	157	Direct=\$80/RUN=0 output control
009E	158	Tp Pass 1 error log/char buffer
009F	159	Tp Pass 2 err log corrected
00A0-00A2	160-162	Jiffy Clock HML
00A3	163	Serial bit count/EOI flag

00A4	164	Cycle count
00A5	165	Countdown, tape write/bit count
00A6	166	Tape buffer pointer
00A7	167	Tp Wrt ldr count/Rd pass/inbit
00A8	168	Tp Wrt new byte/Rd error/inbit cnt
00A9	169	Wrt start bit/Rd bit err/stbit
00AA	170	Tp Scan;Cnt;Ld;End/byte assy
00AB	171	Wr lead length/Rd checksum/parity
00AC-00AD	172-173	Pointer: tape bufr, scrolling
00AE-00AF	174-175	Tape end adds/End of program
00B0-00B1	176-177	Tape timing constants
00B2-00B3	178-179	Pntr: start of tape buffer
00B4	180	1=Tp timer enabled; bit cnt
00B5	181	Tp EOT/RS232 next bit to send
00B6	182	Read character error/outbyte buf
00B7	183	# characters in file name
00B8	184	Current logical file
00B9	185	Current secndy address
00BA	186	Current device
00BB-00BC	187-188	Pointer to file name
00BD	189	Wr shift word/Rd input char
00BE	190	# blocks remaining to Wr/Rd
00BF	191	Serial word buffer
00C0	192	Tape motor interlock
00C1-00C2	193-194	I/O start adds
00C3-00C4	195-196	Kernel setup pointer
00C5	197	Last key pressed
00C6	198	# chars in keybd buffer
00C7	199	Screen reverse flag
00C8	200	End-of-line for input pointer
00C9-00CA	201-202	Input cursor log (row, column)
00CB	203	Which key: 64 if no key
00CC	204	0=flash cursor
00CD	205	Cursor timing countdown
00CE	206	Character under cursor
00CF	207	Cursor in blink phase
00D0	208	Input from screen/from keyboard
00D1-00D2	209-210	Pointer to screen line
00D3	211	Position of cursor on above line
00D4	212	0=direct cursor, else programmed
00D5	213	Current screen line length
00D6	214	Row where curosr lives
00D7	215	Last inkey/checksum/buffer
00D8	216	# of INSERTs outstanding
00D9-00F0	217-240	Screen line link table
00F1	241	Dummy screen link
00F2	242	Screen row marker
00F3-00F4	243-244	Screen color pointer
00F5-00F6	245-246	Keyboard pointer
00F7-00F8	247-248	RS-232 Rcv pntr
00F9-00FA	249-250	RS-232 Tx pntr
00FF-010A	256-266	Floating to ASCII work area

[Additional VIC Maps appeared in **COMPUTE!**, January, 1982, #20, pgs. 181-3. — Ed]

FF8A-FFF5 65418-65525 Jump Table, Including:

FFC6 - Set Input channel
 FFC9 - Set Output channel
 FFCC - Restore default I/O channels
 FFCF - INPUT
 FFD2 - PRINT
 FFE1 - Test Stop key
 FFE4 - GET

c000	ROM control vectors	cble	Print message from (y,a)
c00c	Keyword action vectors	cb3b	Print format character
c052	Function vectors	cb4d	Bad-input routines
c080	Operator vectors	cb7b	Perform [GET]
c09e	Keywords	cba5	Perform [INPUT#]
cl9e	Error messages	cbbf	Perform [INPUT]
c328	Error message vectors	cbf9	Prompt & input
c365	Miscellaneous messages	cc06	Perform [READ]
c38a	Scan stack for FOR/GOSUB	ccfc	Input error messages
c3b8	Move memory	cdle	Perform [NEXT]
c3fb	Check stack depth	cd78	Type-match check
c408	Check memory space	cd9e	Evaluate expression
c435	'OUT OF MEMORY'	cea8	Constant - PI
c437	Error routine	cefl	Evaluate within brackets
c469	Break entry	cef7	Check for ')'
c474	'READY.'	ceff	Check for comma
c480	Ready for Basic	cf08	Syntax error
c49c	Handle new line	cf14	Check range
c533	Re-chain lines	cf28	Search for variable
c560	Receive input line	cfa7	Set up FN reference
c579	Crunch tokens	cfe6	Perform [OR]
c613	Find Basic line	cfe9	Perform [AND]
c642	Perform [NEW]	d016	Compare
c65e	Perform [CLR]	d081	Perform [DIM]
c68e	Back up text pointer	d08b	Locate variable
c69c	Perform [LIST]	d113	Check alphabetic
c742	Perform [FOR]	d1ld	Create variable
c7ed	Execute statement	d194	Array pointer subroutine
c81d	Perform [RESTORE]	dla5	Value 32768
c82c	Break	d1b2	Float-fixed conversion
c82f	Perform [STOP]	d1d1	Set up array
c831	Perform [END]	d245	'BAD SUBSCRIPT'
c857	Perform [CONT]	d248	'ILLEGAL QUANTITY'
c871	Perform [RUN]	d34c	Compute array size
c883	Perform [GOSUB]	d37d	Perform [FRE]
c8a0	Perform [GOTO]	d391	Fixed-float conversion
c8d2	Perform [RETURN]	d39e	Perform [POS]
c8f8	Perform [DATA]	d3a6	Check direct
c906	Scan for next statement	d3b3	Perform [DEF]
c928	Perform [IF]	d3el	Check FN syntax
c93b	Perform [REM]	d3f4	Perform [FN]
c94b	Perform [ON]	d465	Perform [STR\$]
c96b	Get fixed point number	d475	Calculate string vector
c9a5	Perform [LET]	d487	Set up string
ca80	Perform [PRINT#]	d4f4	Make room for string
ca86	Perform [CMD]	d526	Garbage collection
caa0	Perform [PRINT]	d5bd	Check salvageability

d606	Collect string	dfed	Perform [EXP]
d63d	Concatenate	e040	Series evaluate 1
d67a	Build string to memory	e056	Series evaluate 2
d6a3	Discard unwanted string	e094	Perform [RND]
d6db	Clean descriptor stack	e0f6	?? Breakpoints ??
d6ec	Perform [CHR\$]	e127	Perform [SYS]
d700	Perform [LEFT\$]	e153	Perform [SAVE]
d72c	Perform [RIGHT\$]	e162	Perform [VERIFY]
d737	Perform [MID\$]	e165	Perform [LOAD]
d761	Pull string parameters	e1bb	Perform [OPEN]
d77c	Perform [LEN]	e1c4	Perform [CLOSE]
d782	Exit string-mode	eld1	Parameters for load/save
d78b	Perform [ASC]	e203	Check default parameters
d79b	Input byte parameter	e20b	Check for comma
d7ad	Perform [VAL]	e216	Parameters for open/close
d7eb	Get params for poke/wait	e261	Perform [COS]
d7f7	Float-fixed	e268	Perform [SIN]
d80d	Perform [PEEK]	e2b1	Perform [TAN]
d824	Perform [POKE]	e30b	Perform [ATN]
d82d	Perform [WAIT]	e378	Initialize
d849	Add 0.5	e387	CHRGET for zero page
d850	Subtract-from	e3a4	Initialize Basic
d853	Perform [SUBTRACT]	e429	Power-up message
d86a	Perform [ADD]	e44f	Vectors for \$300
d947	Complement fac#1	e45b	Initialize vectors
d97e	'OVERFLOW'	e467	Warm restart
d983	Multiply by zero byte	e476	Program patch area
d9ea	Perform [LOG]	e4a0	Serial output '1'
da2b	Perform [MULTIPLY]	e4a9	Serial output '0'
da59	Multiply-a-bit	e4b2	Get serial input & clock
da8c	Memory to FAC#2	e4bc	Program patch area
dab7	Adjust FAC#1/#2	e500	Set 6522 addr
dad4	Underflow/overflow	e505	Set screen limits
dae2	Multiply by 10	e50a	Track cursor location
daf9	+10 in floating pt	e518	Initialize I/O
dafe	Divide by 10	e54c	Normalize screen
db12	Perform [DIVIDE]	e55f	Clear screen
dba2	Memory to fac#1	e581	Home cursor
dbc7	FAC#1 to memory	e587	Set screen pointers
dbfc	FAC#2 to fac#1	e5bb	Set I/o defaults
dc0c	FAC#1 to FAC#2	e5c3	Set vic chip defaults
dc1b	Round FAC#1	e5cf	Input from keyboard
dc2b	Get sign	e64f	Input from screen
dc39	Perform [SGN]	e6b8	Quote mark test
dc58	Perform [ABS]	e6c5	Set up screen print
dc5b	Compare FAC#1 to mem	e6ea	Advance cursor
dc9b	Float-fixed	e715	Retreat cursor
dccc	Perform [INT]	e72d	Back into previous line
dcf3	String to fac	e742	Output to screen
dd7e	Get ascii digit	e8c3	Go to next line
dddd	Float to ascii	e8d8	Do 'RETURN'
df16	Decimal constants	e8e8	Check line decrement
df3a	TI constants	e8fa	Check line increment
df71	Perform [SQR]	e912	Set colour code
df7b	Perform [POWER]	e921	Colour code table
dfb4	Perform [NEGATIVE]	e929	Code conversion

e975	Scroll screen	f20e	Input
e9ee	Open space on screen	f250	Get.. tape/serial/RS232
ea56	Move screen line	f27a	Output..
ea6e	Synch colour transfer	f290	..to tape
ea7e	Set start-of-line	f2c7	Set input device
ea8d	Clear screen line	f309	Set output device
eaal	Print to screen	f34a	Close
eaaa	Store on screen	f3cf	Find file
eab2	Synch colour to char	f3df	Set file values
eabf	Interrupt (IRQ)	f3ef	Abort all files
eble	Check keyboard	f3f3	Restore default I/O
ec00	Set text mode	f40a	Do file opening
ec46	Keyboard vectors	f495	Send SA
ec5e	Keyboard maps	f4c7	Open RS232
ed21	Graphics/text control	f542	Load program
ed30	Set graphics mode	f647	'SEARCHING'
ed5b	Wrap up screen line	f659	Print file name
ed6a	Shifted key matrix	f66a	'LOADING/VERIFYING'
eda3	Control key matrix	f675	Save program
ede4	Vic chip defaults	f728	'SAVING'
edfd	Screen line adds low	f734	Bump clock
eel4	Send 'talk'	f760	Get time
eel7	Send 'listen'	f767	Set time
eelc	Send control char	f770	Action stop key
ee49	Send to serial bus	f77e	File Error Messages
eeb7	Timeout on serial	f7af	Find any tape header
eec0	Send listen SA	f7e7	Write tape header
eec5	Clear ATN	f84d	Get buffer address
eece	Send talk SA	f854	Set buffer start, end pointers
eee4	Send serial deferred	f867	Find specific header
eef6	Send 'untalk'	f88a	Bump tape pointer
ef04	Send 'unlisten'	f894	'PRESS PLAY .. '
ef19	Receive from serial bus	f8ab	Check cassette status
ef84	Clock line on	f8b7	'PRESS RECORD ..'
ef8d	Clock line off	f8c0	Initiate tape read
ef96	Delay 1 ms	f8e3	Initiate tape write
efa3	RS232 send (NMI)	f8f4	Common tape read/write
efee	New RS232 byte send	f94b	Check tape stop
f016	Error or quit	f95d	Set timing
f027	Compute bit count	f98e	Read bits (IRQ)
f036	RS232 receive (NMI)	faad	Store characters
f05b	Setup to receive	fbd2	Reset pointer
f09d	Receive parity error	fbdb	New tape character setup
f0a2	Receive overrun error	fbea	Toggle tape
f0a5	Receive break error	fc06	Data write
f0a8	Receive frame error	fc0b	Tape write (IRQ)
f0b9	Bad device	fc95	Leader write (IRQ)
f0bc	File to RS232	fccf	Restore vectors
f0ed	Send to RS232 buffer	fcf6	Set vector
f116	Input from RS232 buffer	fd08	Kill motor
f14f	Get from RS232 buffer	fd11	Check read/write pointer
f160	Check serial bus idle	fd1b	Bump read/write pointer
f174	Messages	fd22	Powerup entry
f1e2	Print if direct	fd3f	Check A-rom
f1f5	Get..	fd52	Set kernal2
f205	..from RS232		


```
fd8d Initialize system constants
fdf1 IRQ vectors
fdf9 Initialize I/O regs
fe49 Save data name
fe50 Save file details
fe57 Get status
fe66 Flag ST
fe6f Set timeout
fe73 Read/set top of memory
fe82 Read/set bottom of memory
fe91 Test memory location
fea9 NMI interrupt entry
fed2 RESET/STOP warm start
fede NMI RS232 sequences
ff56 Restore & exit
ff5c RS232 timing table
ff72 Main IRQ entry
ff8a Jumbo jump table
fffa Hardware vectors
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EPROM Reliability

Michael E. Day
West Linn, OR

Although EPROMs are in widespread use, there are continuing problems with the use of the device affecting their overall reliability.

The following report describes how to obtain the maximum performance and reliability from the 2708 EPROM. The concepts involved, however, may be applied to most of the ultra-violet erasable PROMs on the market to date.

The EPROM 'cell' consists, basically, of a capacitor which either has a charge on it or does not. The charge is created by applying a high voltage pulse to the device, and is removed by exposing the device to high intensity ultra-violet light.

The cell is programmed by injection of high energy electrons through the oxide onto the floating gate. Once there, the charge is trapped, as there are no electrical connections to this floating gate. This action is similar to the action of a zener diode in that, as the voltage increases, it finally passes a point where it can overcome the barrier presented by the silicon oxide surrounding the gate and allows the electrons to flow to the gate and collect there. As the voltage is removed it finally drops to a point where it can no longer maintain the bridge through the oxide, and it again becomes isolated. However, the gate now has a charge of electrons on it.

The charge is removed from the cell by exposure with ultra-violet light of the correct wavelength (2537Å) and energy (10 watt seconds/cm²) which will impart sufficient photon energy to the trapped electrons to allow the floating gate to be fully discharged.

The presence of charge on the floating gate causes a shift of the cell threshold. In the discharged state (no charge on the floating gate) the cell has a low threshold, and selection of the cell turns on the transistor. Storing a charge on the gate shifts the threshold of the cell above the select voltage so that the transistor will not turn on when it is selected. The amount of charge on the gate determines the level of select voltage at which the transistor will change from a non-conducting to a conducting state. The cell is designed so that the discharged threshold and charged threshold are equally above and below the select voltage. This provides for maximum immunity against marginal cells.

Data retention can be measured by baking the device at an elevated temperature (250°C). 168 hours at this temperature is equivalent to 10 years at 70°C. Test samplings have shown that the time to 5% batch failure is 100 years.

Experiments have been made to determine the effects of prolonged exposure to UV light. Through the first 20 hours the threshold voltage increased slightly after which it stabilized out to 30 days at which time the test was terminated. Although no study has been made to determine what is causing the initial change, it is thought to be caused by some radiation damage caused by the UV.

It is believed that UV lamps with short wavelengths (less than 1800Å) and high intensity can ionize oxide with long exposure. The theory is that this will shift the threshold until the part will not function properly. This is not a permanent shift and a bake at 150° for 24 hours should correct the problem.

Some EPROMs exhibit a sensitivity to ambient light. This does not erase them, but they may not function properly. This is a common phenomenon with most semiconductors. Covering the lid with some sort of opaque material will prevent this.

For a given device, given that the programming equipment is operating at factory specifications, the failure to take a charge is device-related, and attempts to bring the charge level higher by reprogramming will seldom be successful. Failure to erase is the most common problem. There are many factors which can cause inadequate erasure; among them are weak UV lamp due to age, dirt on the IC (both internal and external), dirt on the UV lamp, erase requirements outside of normal specifications, or a defective component.

The EPROM is read by determining if the charge on the capacitor of the cell is above or below the threshold of the sensing transistor (the threshold being that level of applied voltage which causes the transistor to change from a non-conducting state to a conducting state). This threshold can be affected by shifts in the -12 volt and -5 volt supplies at the device and temperature. Due to this, if the charge on the cell is near the threshold of the sensing transistor, a shift in the supply voltage or temperature can cause the cell to appear to change state, have an excessive access time, or be intermittent. A cell which is sufficiently near the threshold of the sensing transistor so that it can be affected by temperature or voltage shifts is called "marginally programmed" or "marginal."

One failure of the EPROM is a "leaky cell" (a cell that loses its charge after a short period of time). A leaky cell can be found several ways. One way is to bake the device at 250° after programming it, and then test for lost data.



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M/C

Another method of testing for leaky cells is to make an erase profile for the suspect EPROM. This is done by programming the device, and then erasing it in one to two minute increments, measuring the number of erased bits after each increment. Making a graph with this information will give you a profile of the erasure characteristics of the EPROM. Any cell that erases twice as fast as the overall average should be considered suspect.

Another failure mode of the EPROM is the "sticky cell" (a cell which is difficult to program or erase). Although a sticky cell can be overcome by a longer program or erase time, in a production environment it is not acceptable to adjust these times for each device. Therefore, any device which requires more than three times the normal time to program or erase should be considered defective.

The major source of problems with the 2708 EPROM is inadequate erasure. In testing the EPROM to determine if it has been adequately programmed or erased, it is not acceptable to simply read the PROM and compare the information read against the true data, since marginal cells may not be found with this method. A more reliable method of verifying if an EPROM has been properly programmed or erased is to measure the depth of the charge at each cell. This can be done by shifting the threshold level of the sensing transistor

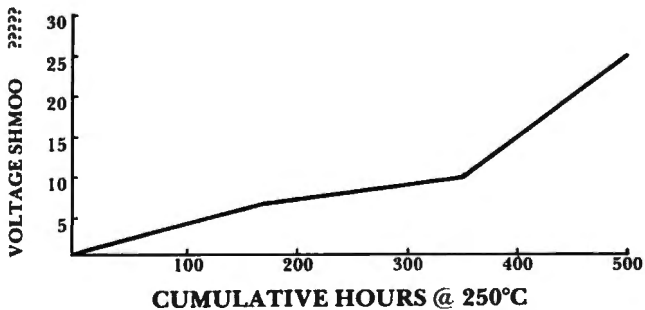
above and below the normal level and by doing a normal read and compare.

In this way, a map of the charge level of the cells in the EPROM can be generated by observing the level at which the output changes state.

The threshold level of the 2708 EPROM can be shifted by adjusting the -5 volt supply (VBB). Causing the -5 volts to go more negative will determine how deep the cell has been charged; bringing it more positive will determine how much it has been erased.

The charge limits will vary greatly not only from manufacturer to manufacturer, but from device to device. Therefore, an acceptable limit must be determined at which the device may be considered good or bad. For the 2708 this is greater than twice the tolerance for the -5 volt supply. This can be simply generated by using the forward voltage drop across the diode (.7 volts) above and below the -5 volt level. In more critical applications a two-diode level drop (1.4 volts) might be considered.

More is not always better. Just because the charge on one device is deeper than on another does not mean that it will retain the charge longer. Data retention is related to cell isolation and not necessarily to the level of the charge.



TEMPERATURE	FAILURE RATE 60% CONFIDENCE (% / 1000 hours)	FAILURE RATE 90% CONFIDENCE (% / 1000 hours)
70°C	0.013	0.027
55°C	0.006	0.013

Operating Life Test Results

TEMPERATURE	SAMPLE SIZE	HOURS	EQUIVALENT DEVICE HOURS @ 70°C	FAILURES	FAILURE MODE
160°C	64	2243	39.9×10^6	1	Charge Loss
160°C	49	2028	27.6×10^6	0	
160°C	51	2028	28.7×10^6	1	Charge Loss
160°C	40	2830	31.4×10^6	2	Charge Loss
160°C	80	1176	26.1×10^6	1	Charge Loss
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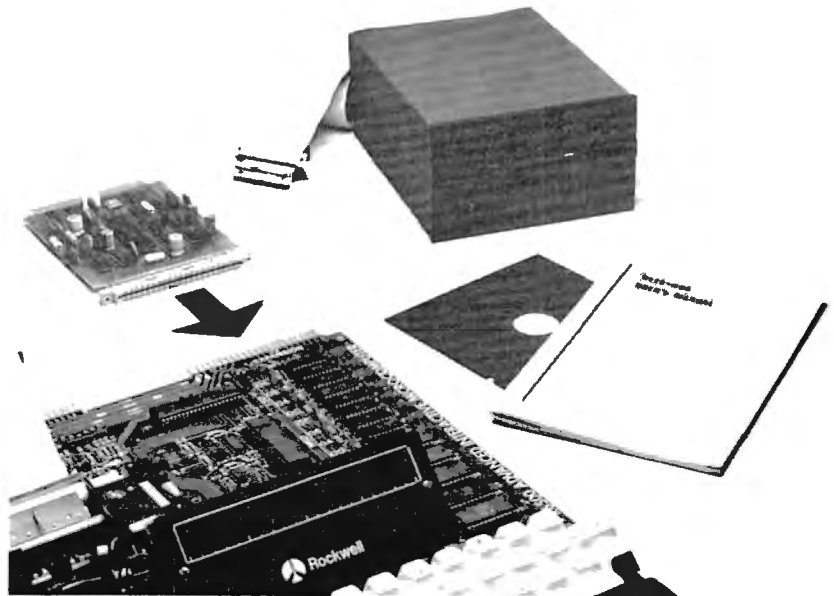
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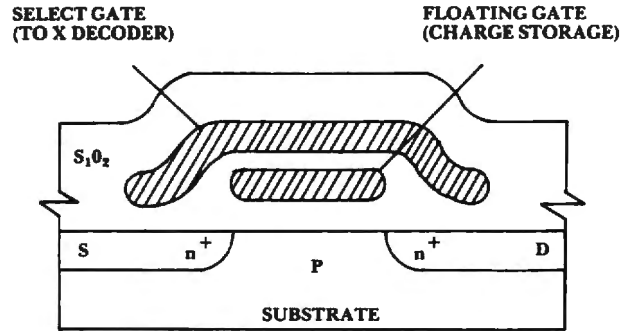
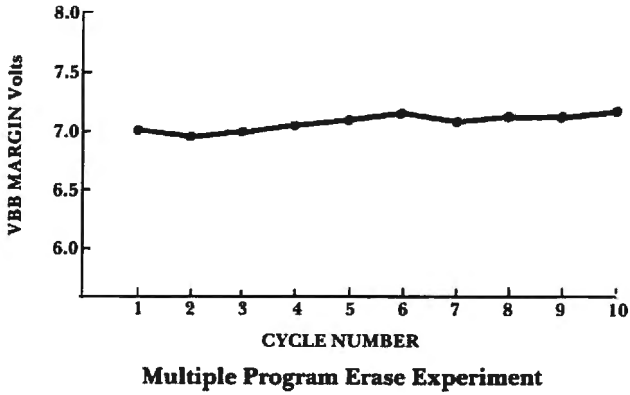
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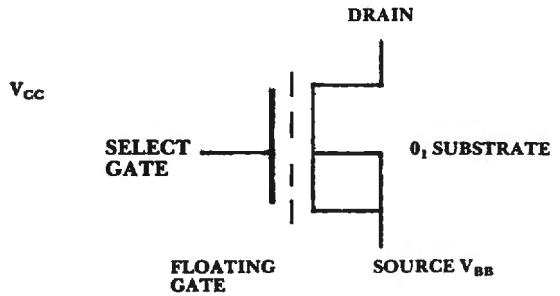
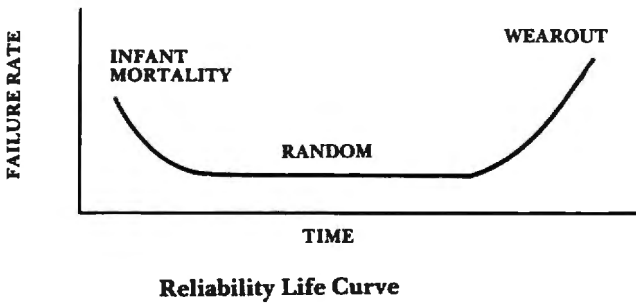
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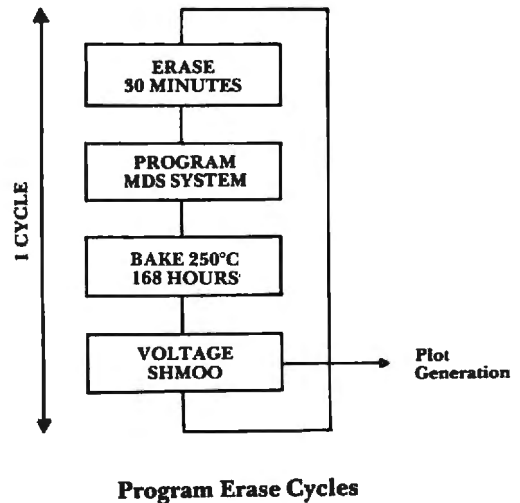
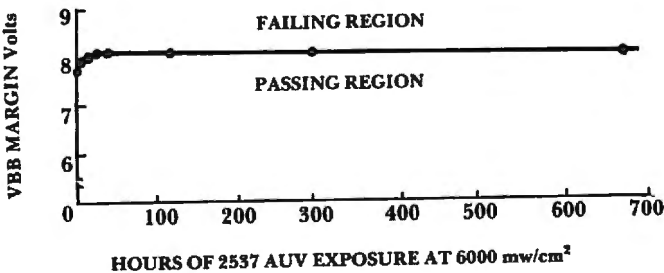
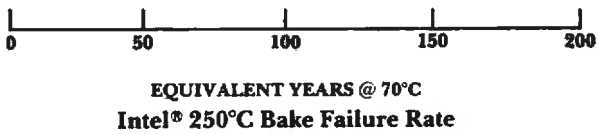
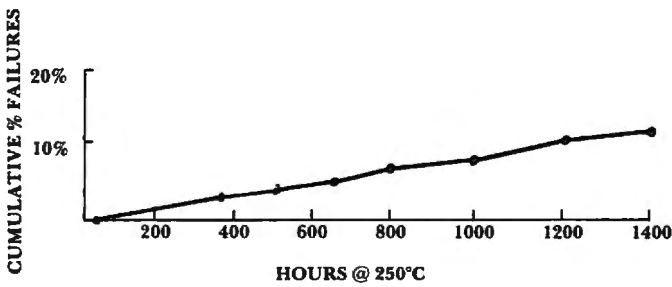
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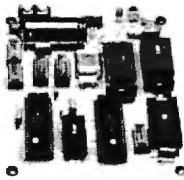
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Random Music Composition On The PET

Alfred J. Bruey
Jackson, MI

This program, MUSICOMP, lets the PET computer compose and play music. MUSICOMP was written to provide the user with an introduction to computer generated music. The music is output using the CB2 method of music generation which is described many places in PET literature. Attachments A and B give descriptions of the hardware that you can use if you don't already have CB2 sound. Figure 1 shows the connections necessary to output sounds from the PET to an audio amplifier. Figure 2 shows a simple audio amplifier that you can make if you don't have one.

Program Description

MUSICOMP generates three kinds of music: white music, brown music, and 1/f music. For a complete description of these three types of music, see Martin Gardner's Mathematical Games column in the April, 1978, issue of *Scientific American* magazine.

A. White music: White music is a sequence of completely random sounds. In this program, you have your choice of two different types of white music:

1. Option 1 on the menu allows any of 256 different frequencies to be generated. The notes are not correlated with each other in any way. It is unlikely that you will want to go away humming the tunes you generate using this option.
2. Option 2 also generates random sounds, but these sounds are restricted to: the 25 piano notes (well-tempered scale) beginning with the B below middle C.

B. Brown Music: The second type of music is called brown music (Option 3). It is similar to the Brownian motion of particles. In brown music, each note can vary by only one tone (half-step) from the preceding note. The only randomness is in choosing the

starting note and in determining whether each note is one tone higher or lower than its predecessor. You will probably find this music boring. It sounds something like a finger exercise for a violinist.

To get brown music, enter a 1 when you are asked for the maximum variation. Entering some other number, a 3 for example, will allow each note to vary three tones from its predecessor. True brown music allows only a one tone variation from note to note. The option of choosing a maximum variation is given so you can experiment with sounds.

C. 1/f Music: The final type of random music in this program is 1/f music. This music is somewhere between the randomness of white music and the boring regularity of brown music. 1/f music was discovered by an investigator who was trying to find music in nature. The algorithm used in this program is the same as the one described in the previously mentioned article except five different colored dice were used instead of three so that tunes 32 notes long could be created. Most listeners agree that 1/f music is much more musical than either white or brown music.

Extensions

I assume that anyone who knows BASIC and a minimum of music will want to change this program. That's why an annotated listing of the program is provided.

You might want to add options which impose different rules on the composition. You might also want to add the coding to save the composition on tape or disk. The place where you might do this is marked in the listing.

Using The Program

Load the program in the usual way. The main menu will be displayed on the screen as follows. Press the proper key from 1 to 5 to make your selection, but do not press RETURN. (If you press RETURN accidently and get the READY signal, type CONT and press RETURN and you'll be right back where you left off.)

COMPOSITION SELECTION

- 1 RANDOM TUNE
- 2 RANDOM TUNE, WELL-TEMPERED
- 3 RANDOM TUNE, WELL-TEMPERED WITH STEP SIZE LIMIT
- 4 1/F MUSIC
- 5 END PROGRAM

A brief description of each of the options follows:

Option 1: Random notes – This option will compose and play tunes based on 256 different tones, ranging from a tone slightly below the B below middle C to a tone that's probably even too high for your dog

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SCREEN OUTPUT: the commands FIND, DUMP, TRACE and DIRECTORY display on the CRT while you hold the RETURN key (display pauses when the key is released). Continuous output is selected with shift-lock.

OUTPUT CONTROL to DISK or PRINTER: in addition to displaying on the CRT, you can direct output to either disk or printer.

HARDCOPY allows screen displays to be either printed or stored on disk.

FIND searches all or any part of a program for text or command strings or variable names. Either exact search or wild card search supported.

RENUMBER: the SM-KIT can renumber all or any part of a program. The selective renumbering allows you to move blocks of code within your program.

VARIABLE DUMP displays the contents of floating point, integer, and string variables (both simple and array). Can display all variables or any selected variables.

TRACE: SM-KIT can trace program execution either continuously or step by step starting with any line number. Selected program variables can be displayed while tracing.

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to hear. When you press the 1 key, a series of questions will be displayed (Press RETURN after each answer):

HOW LONG IS THE TUNE

(Answer with a number from 1 to 150)

DIFFERENT LENGTH NOTES (Y OR N)

(If you enter a Y, each note length will be one second long. If you answer M it will be $\frac{1}{2}$ second long. If you answer F it will be $\frac{1}{4}$ second long. All other note lengths will be scaled accordingly.)

REPEAT NOTES (Y OR N)

(If you reply N, the tune will play one time and then the main menu will reappear. If you reply Y, the tune will repeat. In either case, you can stop the tune while it is playing by

holding down the X key. You will return to the main menu.)

After you have answered these four questions, there will be a short pause while time values are being calculated for all the notes. Then the tune will begin to play.

Option 2: Random notes, well-tempered. This is the same as Option 1 except that all notes are chosen randomly from one of 25 tones. These tones are the 25 piano notes beginning with the B below middle C.

Option 3: Random notes, well-tempered, with step-size limit. You will be asked the same questions as in Options 1 and 2. After you answer them, you will receive an additional question:

MAX. VAR. FROM LAST NOTE

This question is asking you for the maximum variation in tone (half-steps) that are permissible from one note to the next. If you reply 1, you will get brown music. You may enter any other value just to see what kind of tune the PET will compose.

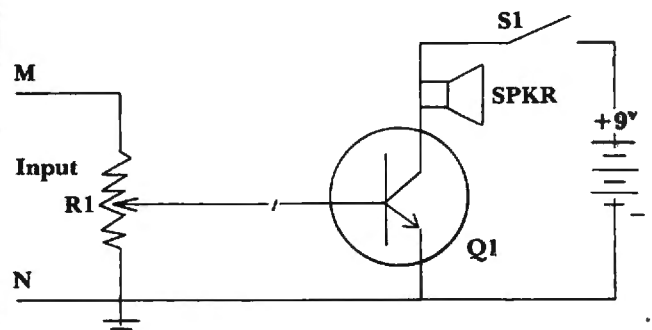
Option 4: 1/f Music. Pressing the 4 key will generate 1/f music. The 1/f tunes will all be 32 notes long, so you will not be asked for the length of the tune. Otherwise, you will be asked the same questions as in Options 1 and 2.

Option 5: End Program. Select Option 5 when you are ready to quit.

A Circuit For A PET Amplifier

Below is a circuit for a PET amplifier for making music or adding sound effects to your games. Use an RCA phono jack as the input and you'll be able to use the same connector cable as described previously.

Figure 2.



R1 - 100K potentiometer with switch

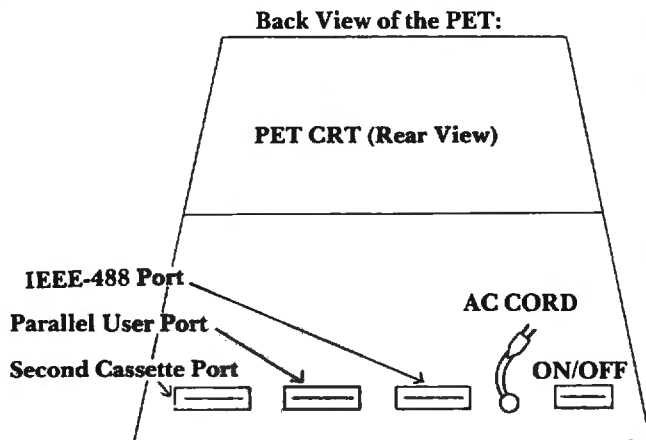
S1 - Part of R1

Q1 - RS2031 (Radio Shack 276-2031)

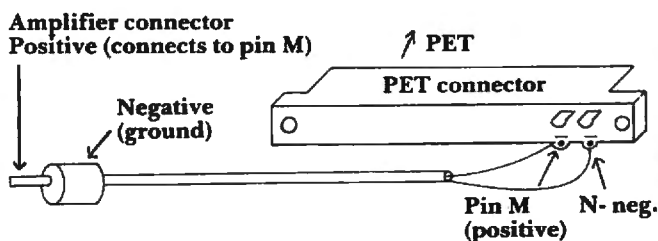
SPKR - 8 ohm SPEAKER

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Figure 1.



The edge connector that you need plugs into the Parallel user port of the PET. Do not attach it to the IEEE-488 port. (It's not a bad idea to put a strip of masking tape across the IEEE port so you don't accidentally plug into it.) Here's what the completed cable should look like. The amplifier end might look different if your system doesn't use the RCA type jack.



You should use shielded cable for the line between the PET and the amplifier. *Be sure you don't put the PET connector on upside down!*

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Program 1.

```

150 DIM SN(150),ST(150),PI(25),PN(1
    50)
160 FORI=1TO25:READPI(I):NEXTI
170 DATA251,237,223,211,199,188,177
    ,167,157,148,140,132,125,1
    17,111,104
180 DATA98,93,87,82,78,73,69,65,61
190 REM *****
****

200 REM VARIABLE LIST:      *
210 REM T=TIME OF NOTE IN 60THS OF ~
    SECOND
220 REM P=POKE NUMBER FOR NOTE
230 REM TY$=TYPE OF SONG
240 REM      1=RANDOM
250 REM      2=RANDOM, WELL-TEMPERED
260 REM      3=RANDOM, WELL-TEMPERED,
    LIMIT ON STEP SIZE
270 REM      4=1/F MUSIC
280 REM      5=STOP
290 REM L%=LENGTH OF SONG
300 REM L$="Y" NOTES DIFFERENT LENG
    TH
310 REM      "N" NOTES SAME LENGTH
320 REM S$="S" SLOW SONG,S=1
330 REM      "M" MEDIUM SPEED SONG,S=
    2
340 REM      "F" FAST SONG,S=4
350 REM *****
****

360 PRINT"{CLEAR}{03 RIGHT}{03 DOWN
    DOWN}{REV}COMPOSITION SELE
    CTION"
370 PRINT"{DOWN}{04 RIGHT}{REV}1{OF
    OFF} RANDOM TUNE
380 PRINT"{DOWN}{04 RIGHT}{REV}2{OF
    OFF} RANDOM TUNE, WELL-TEM
    PERED"
390 PRINT"{DOWN}{04 RIGHT}{REV}3{OF
    OFF} RANDOM TUNE, WELL-TEM
    PERED
400 PRINT"{DOWN}{04 RIGHT}      WITH ~
    STEP SIZE LIMIT"
410 PRINT"{DOWN}{04 RIGHT}{REV}4{OF
    OFF} 1/F MUSIC
420 PRINT"{DOWN}{04 RIGHT}{REV}5{OF
    OFF} END PROGRAM
430 GET TY$:IFTY$=""THEN430
440 ONVAL(TY$)GOTO500,590,690,980,4
    60
450 GOTO430
460 REM *****
****
470 REM EXIT ROUTINE *****
****
480 REM *****
****
490 PRINT"{CLEAR}{03 RIGHT}{04 DOWN
    DOWN}{REV}ROUTINE ENDED":E
    ND
500 REM *****
510 REM PLAY RANDOM *****
520 REM *****
530 GOSUB 1190 :REM GET SONG DATA
540 FORI=1TOL%
550 SN(I)=INT(RND(3)*255+1)
560 NEXTI
570 GOSUB1410:REM GENERATE NOTES AN
    D PLAY
580 GOTO360
590 REM*****
****
600 REM RANDOM, WELL-TEMPERED *****
****
610 REM *****
****

620 GOSUB 1190 :REM GET SONG DATA
630 FORI=1TOL%
640 SN(I)=INT(RND(5)*25+1)
650 SN(I)=PI(SN(I))
660 NEXTI
670 GOSUB 1410
680 GOTO360
690 REM *****
****

700 REM RANDOM,WELL-TEMP,STEP-SIZE ~
    ****
710 REM *****
****

720 GOSUB 1190 :REM GET SONG DATA
730 SN(1)=INT(RND(6)*25+1):PN(1)=PI
    (SN(1))
740 IFMV>1THEN850
750 REM BROWNIAN MOVEMENT
760 FORI=2TOL%
770 IFSN(I-1)=1THENSN(I)=2:PN(I)=PI
    (2):GOTO830
780 IFSN(I-1)=25THENSN(I)=24:PN(I)=
    PI(24):GOTO830
790 KR=RND(7)
800 IFKR<.5THENSN(I)=SN(I-1)+1
810 IFKR>=.5THENSN(I)=SN(I-1)-1

```

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```

820 PN(I)=PI(SN(I))
830 NEXTI
840 GOTO950
850 FORI=2TOL%
860 MX=SN(I-1)+MV
870 IFMX>25THENMX=25
880 MN=SN(I-1)-MV
890 IFMN<1THENMN=1
900 NO=MX-MN+1
910 CG=INT(RND(6)*NO)
920 SN(I)=MN+CG
930 PN(I)=PI(SN(I))
940 NEXTI
950 FORI=1TOL%:SN(I)=PN(I):NEXTI
960 GOSUB 1410:REM SET TIMES AND PLAY NOTES
970 GOTO360
980 REM *****
***
990 REM 1/F MUSIC *****
***
1000 REM *****
***
1010 GOSUB 1190 :REM GET SONG DATA
1020 L%=32
1030 FORI=1TO5:D(I)=INT(RND(8)*6+1):
NEXTI
1040 SN(1)=D(1)+D(2)+D(3)+D(4)+D(5)-
5
1050 IFSN(1)<1THENSN(1)=1
1060 SN(1)=PI(SN(1))
1070 FORI=2TOL%
1080 IFI=17THEND(1)=INT(RND(8)*6+1)
1090 IFINT((I-1)/8)=(I-1)/8THEND(2)=
INT(RND(8)*6+1)
1100 IFINT((I-1)/4)=(I-1)/4THEND(3)=
INT(RND(8)*6+1)
1110 IFINT(I/2)<>I/2THEND(4)=INT(RND
(8)*6+1)
1120 D(5)=INT(RND(8)*6+1)
1130 SN(I)=D(1)+D(2)+D(3)+D(4)+D(5)-
5
1140 IFSN(I)<1THENSN(I)=1
1150 SN(I)=PI(SN(I))
1160 NEXTI
1170 GOSUB1410
1180 GOTO360
1190 REM *****
1200 REM ASK FOR SONG DATA
1210 REM *****
1220 PRINT"{CLEAR}{03 RIGHT}{03 DOWN
DOWN}{REV}COMPOSITION DATA
"
1230 IFTY$="4"THEN1270
1240 INPUT"{02 RIGHT}{DOWN}ENTER LEN
GTH, IN NOTES";L%
1250 IFL%<=0THENPRINT"{DOWN}TOO SHOR
T":GOTO1240
1260 IFL%>150THENPRINT"{DOWN}MAXIMUM
LENGTH 150":GOTO1240
1270 INPUT"{02 RIGHT}{DOWN}DIFFERENT
LENGTH NOTES (Y OR N) ";L
$
1280 IFRIGHT$(L$,1)<>"Y"ANDRIGHT$(L$,
1)<>"N"THENPRINT"{DOWN}EN
TER Y OR N":GOTO1270
1290 INPUT"{DOWN}{02 RIGHT}SLOW, MED
IUM, FAST (S,M,F)";S$
1300 IFS$<>"S"AND S$<>"M"ANDS$<>"F"
HENPRINT"{DOWN}S,M, OR F":
GOTO1290
1310 IFS$="S"THENS=1
1320 IFS$="M"THENS=2
1330 IFS$="F"THENS=4
1340 INPUT"{DOWN}{02 RIGHT}REPEAT NO
TES (Y OR N) ";RP$
1350 IFRP$<>"Y"ANDRP$<>"N"THENPRINT"
{DOWN}ENTER Y OR N":GOTO13
40
1360 IFTY$<>"3"THEN1400
1370 INPUT"{02 RIGHT}{DOWN}MAX. VAR.
FROM LAST NOTE ";MV
1380 MV=INT(MV)
1390 IFMV<=0THENPRINT"{DOWN}INVALID ~
VALUE ":GOTO1370
1400 RETURN
1410 REM *****
1420 REM GENERATE TIMES AND PLAY NOT
ES
1430 REM *****
***
1440 IFL$="Y"THEN1490
1450 FORI=1TOL%
1460 ST(I)=16/S
1470 NEXTI
1480 GOTO1540
1490 W=64/S
1500 FORI=1TOL%
1510 R=INT(RND(4)*5+1)
1520 ST(I)=W/R
1530 NEXTI
1540 POKE59467,16:POKE59466,15
1550 FORI=1TOL%
1560 POKE59464,SN(I)
1570 T=TI
1580 IFTI-T<ST(I)THEN1580
1590 POKE59464,0
1600 GETA$:IFA$="X"THEN1630
1610 NEXTI .
1620 IFRP$="Y"THEN1550
1630 POKE59467,0:POKE59466,0
1640 RETURN

```

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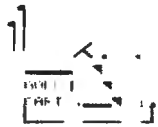
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Ghost Programming

Aric Wilmunder
Los Angeles, CA

I will show how it is possible for 16K Atari users to write and run BASIC programs normally requiring 24 or even 32K. This method is not at all like the method given to us in the BASIC manual where small programs simply call each other and passing of variables and arrays is difficult. Instead, this method is many times more powerful than chaining. Passing of variables is easy, and chaining is unnecessary.

In this article, I will explain how it is possible to write lines of code, subroutines, even entire programs without using any memory except for the space necessary for variables, arrays, and strings. How it is even possible to call and execute programs without changing or destroying the currently stored program. However, like every silver lining, mine too has a dark cloud — there are a number of restrictions involved. I will try to cover these restrictions thoroughly, but only after explaining the technique.

I should mention that, although all of the programming examples are disk oriented, all of the techniques used can be easily modified for cassette users.

After spending nearly four weeks trying to cram close to 40K worth of program into a 32K machine, I began to re-examine the problem of conserving memory. There are many ways to save memory space on the Atari, from removing I/O buffers on the DOS to complete recoding (of which I have done quite a bit). (A list of memory conservation techniques is included as part of *De Re Atari*, and anyone interested in writing large programs should become familiar with them.)

Instant Exec

What kept nagging me were the fifty or more lines of initialization code that were executed only once during my entire program. After their execution, these lines simply took up precious memory space which could be used for other purposes. Also, many of these lines are simply variable assignment statements like `J = 12` or `I = 1`, or string assignments like `A$ = "PHASERS."` These statements must be executed at the beginning of each execution, but could be forgotten during execution.

Of the two types of assignments, variable and

string, the string assignments concerned me the most. The statements `DIM A$(26):A$ = "ABCD...Z"` does not use only the 26 bytes for storing the string, but you are also using another 26 or more bytes for the assignment. The result is that your program is using more than twice the memory that is necessary in order to store a string. This may be no problem with smaller strings of up to fifty bytes, but, when using larger strings in a program where memory is already scarce, it can be quite alarming.

The method that has solved most of my problems goes something like this: create a file with all of the assignment statements used in the opening of the program in the same structure as a LIST file but minus the line numbers. For example: rather than having a LIST file that, when dumped, looks exactly like a program listing. You have the same line of code, but with commands only. The line:

```
1000 FOR I = 65 TO 90: ?CHR$(I):: NEXT I
```

would read:

```
FOR I = 65 TO 90: ?CHR$(I):: NEXT I
```

When entered, this line would act exactly as if it were typed on the keyboard by hand. At the beginning of my main program I use the command `'ENTER"D: <filename>'`. This command causes the system to enter each line of code from my Exec program and execute it using virtually no memory space.

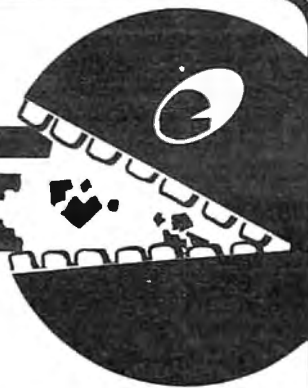
You can create a file with only an initialization routine, or go so far as to write an entire program with this method. To execute any of these programs you simply type `'ENTER'` or `'E.'`, the extension and the file name. BASIC will treat this Exec Program exactly as if you were typing in each statement from the keyboard, thereby using no memory space for lines used only once. The amount of memory that can be saved from this method ranges from 5% to virtually an entire program's space.

One of the restrictions with this technique is that programs must be single step or step by step executable. The program must step one line at a time executing each line separately for the entire length of the program. Another restriction is that you cannot have multi-line FOR/NEXT loops (where both the FOR and the NEXT do not reside on the same line). The difficulty is in that, by the time the NEXT is encountered, BASIC will have discarded the FOR statement, giving the loop nowhere it can return to, and causing an error. The lines:

```
FOR I = 65 TO 90
?CHR$(I);
NEXT I
```

would have to be restructured into one single line. A simple test for writing and developing Exec Programs is to try to write the program by typing

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each statement directly into the machine without using line numbers and then checking the results.

Another Restriction

Still another restriction is that, because EXEC programs have no line numbers, GOTOs and GOSUBs to points within the EXEC program are not allowed. However, if you currently have a program in memory, you can call outside routines that exist in your main program without affecting program control. Say you have a delay routine at line 100 in your main program; you can have your Exec Program GOSUB that line and then return to the next line of the EXEC program. If you want, you can even have a loop that will repeatedly call that routine. This technique is shown in Program 3.

In order to create EXEC program files like the one I described, I have written a simple demo program which will write them. In this demo, you write your own program starting at line 1000 and continuing anywhere up to line 9999. The program writes itself out to disk in a LIST file containing only the lines between 1000 and 9999. This LIST file is then opened as an input file and each line is read individually, the line numbers are removed, and the line is rewritten to a new file. When the program ends, you can test your file by typing: E."D:NOMEM.EXE.

If your Exec Program was properly written, the file should be executed and your original program will remain unchanged. If you tried the disk directory program, (Program 1), you would now have a program on disk which could be called at any time and would leave no leftover lines to be deleted later.

One feature which I should mention about this demo program is the ability to test your program before making a file. By typing GOTO and the line number of the first line of your program, you can follow the program execution and even make changes where necessary before creating an Exec Program. This is important because, if an error occurs anytime during execution, the EXEC program will stop and control will return to the monitor. For testing, type E."D:<Filename> and check for proper program flow. If problems arise, you can list the line numbers, make changes, and RUN the program again until all bugs are removed.

Transfer Of Control

Two aspects of using this method merit close attention. The first is that if you wish to enter this program from a running program, it is necessary to have a GOTO (next line in Main program) as the last statement. This will turn program control over from your Exec program to your Main program when the Exec is over. If this is forgotten, when the EXEC program is over, execution will stop.

Since variables, arrays, and strings are passed on, the Main program can use variables from the Exec and vice versa.

The other interesting aspect is that keyboard input will be changed while the machine is reading from the file. The problem arises from the fact that, while the EXEC program is running, the machine acts as if all commands are being typed in directly on the keyboard. When a regular INPUT command is encountered, rather than inputting from the keyboard, the next piece of information will be read in from the disk. If a string is being input, that string will look like the next series of commands. The way around this is to open the keyboard as an input buffer. (OPEN #1,4,0,"K:") Strings and numeric values would then be entered in a loop using repeated GET commands and ending when a <CR> is encountered. The routine given will automatically terminate after a specified number of characters have been entered. (In the sample program, 20 characters are entered, but this can be changed by replacing both 20's in the routine with whatever you like.) The routine also tests for DELETE characters and modifies the string accordingly. For numeric values, you can simply let A=VAL(A\$). This is shown in Program 2.

After you have tried a number of programs, you will notice that the prompt READY will appear after each line is executed. So far, I have no cure for this problem, but if one is found I'll be sure to let you know.

In a short period of time, you can build a substantial library of Exec functions. By changing the name of the output file, you can label the functions any way you find convenient. For example; E."D:DIR would display your current directory, and E."D:HEXDEC would convert hex values to decimal. Except for variable declarations, none of these would affect the current program in memory.

All in all, I have shown only a handful of the potential uses of Exec Programs. Other uses might include complex Batch jobbing and self-deleting line numbers. Any new ideas or feedback about this technique would be greatly appreciated. Like many aspects of the Atari, I feel that we are still only beginning to understand the full potential of this fantastic machine.

Main Program

```
100 DIM A$(500)
110 TRAP 200
120 LIST"D:XYZZY.TMP",1000,9999
130 OPEN#1,4,0,"D:XYZZY.TMP"
140 OPEN#2,8,0,"D:NOMEM.EXE"
150 INPUT#1;A$
160 PRINT#2;A$(6)
170 GOTO 150
200 IF PEEK(195)<>136 THEN ?"ERROR -";
```

```

PEEK(195)
210 CLOSE#1
220 CLOSE#2
230 END

```

Program 1: Disk Directory

```

1000 GRAPHICS 0:CLOSE#1:OPEN#1,6,0,"D:*. *"
: FOR I=1 TO 999:GET#1,A: ?CHR$(A);:
IF A<>155 OR B<>83 THEN B=A: NEXT I

```

Program 2: Input A Value

```

1000 CLOSE#1:?"ANSWER?";:OPEN#1,4,0,"K:":
FOR I = 1 TO 20: GET#1,A: ?CHR$(A);:
A$(I) = CHR$(A): I=I+20*(A=155)-2*(A=
126): NEXT I

```

Program 3: Calling Outside Routines

```

500 FOR I=0 TO 127
510 PRINT CHR$(27);CHR$(I);
520 NEXT I
1000 FOR J = 1 TO 5: GOSUB 500: NEXT J

```

Program 4: List Program Variables

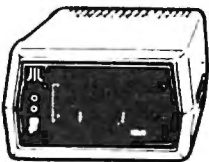
```

1000 J=PEEK(130)+256*PEEK(131)
1010 FOR J=J TO PEEK(132)+256*PEEK(133)-1:
?CHR$(PEEK(J)-128*(PEEK(J)>127));CHR$(
(27+128*(PEEK(J)>127));:NEXT J
1020 I=0: FOR J=PEEK(130)+256*PEEK(131) TO
PEEK(132)+256 * PEEK(133)-1: I = I +
(PEEK(J)<127):NEXT J: ? I;" VARIABLES "

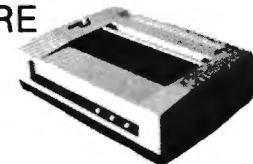
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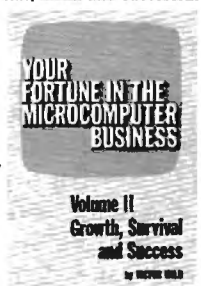
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BASIC 4.0 To Upgrade Conversion Kit

Elizabeth Deal
Malvern, PA

Q: When is a NEXT not a NEXT?

A: When it's a DCLOSE command from Basic 4, of course.

This article is intended primarily for users of the Upgrade PET/CBM systems. It discusses several BASIC 4 disk commands, as they appear on the Upgrade screen.

BASIC 4 programs can often run in the upgrade system with or without conversion. But, to convert, one must know the author's intent in the program and the Upgrade system obliterates the necessary information. Reflect on a three way analogy you might, some day, see on your screen:

NEXT = RETURN WITHOUT GOSUB = DCLOSE

It looks curious, but it makes sense.

A Bit Of History

Some time ago, I had the pleasure of using a BASIC 4 CBM. I was writing a relative file program. At one point I *had* to renumber the program, CBM couldn't do it for me, and the only sensible solution was to load the program into my trusty old Upgrade PET equipped with Toolkit™. I listed the program to see how the disk commands would behave in a new environment.

Assorted quotes from BASIC 4:

```
300 FOR I=1TONF:RECORD#(DF),(CR),(FP%(I))
310 PRINT#DF,F$(I):GOSUB230:NEXT:RETURN
READY.
```

```
2020 DOPEN#(DF),(FF$),D(DD),L(RS) :GOSUB230
2030 RECORD#(DF),(NR):GOSUB230:PRINT#(DF),
CHR$(255):GOSUB230
2040 CLOSEDF:GOSUB230:OPENDF:GOSUB230:FR
=1:RETURN
```

READY.

```
3090 SCRATCH(KY$)
READY.
```

```
4020 DCLOSE
READY.
```

As seen by the Upgrade system:

```
300 FORI=1TONF:DATA#(DF),(CR),(FP%(I))
310 PRINT#DF,F$(I):GOSUB230:NEXT:RETURN
```

READY.

```
2020 FOR#(DF),(FF$),D(DD),L(RS) :GOSUB230
2030 DATA#(DF),(NR):GOSUB230:PRINT#(DF),
CHR$(255):GOSUB230
2040 CLOSEDF:GOSUB230:OPENDF:GOSUB230:
FR=1:RETURN
```

READY.

```
3090 GOSUB(KY$)
READY.
```

```
4020 NEXT
READY.
```

The screen showed FOR# where DOPEN# should have been (line 2020), and DATA# where a relative file statement RECORD# should have been (lines 300 and 2020). Worse still, it translated SCRATCH(KY\$) into GOSUB(KY\$) in line 3090. Finally, a conversion of a simple DCLOSE into NEXT (line 4020) seemed incredible.

Both the Toolkit and the PET left those keyword tokens intact (I did not retype the BASIC 4 keywords, doing that would have destroyed them). The program worked fine after transfer to the BASIC 4 computer. And that was that.

Recently, I had to look at that undocumented mess of code. I remembered some of the nasties, but couldn't recall them all. Several of these commands leaped out in a listing as invalid ones, but I didn't catch NEXT, of course. It seemed to belong. However, Power didn't let this one slip by.

While scrolling through the program, back and forth, looking for additional trouble, I noticed that GOSUB(KY\$) translated into STRING TOO LONG(KY\$) and there appeared a strange looking 4020 RETURN WITHOUT GOSUB statement. That was my NEXT. (I cannot provide a printout, because to print we use the LIST command, whereas these two long sentences were not done by LIST, they resulted from scrolling.)

I was lucky in that I was looking at a program I had written and had a vague idea of what it did. But imagine, for an instant, that somebody sends you a program containing BASIC 4 disk commands. How can you go about finding out which are used? How can you distinguish the true Upgrade commands, like NEXT from BASIC 4 disk commands?

Solution

It always helps to understand the process. The Power manual was useful in solving this one for me, because it explained where and how Power, and the PET for that matter, pick up the keywords and error messages contained within ROM.

One way to get at the keywords is to look in ROM in both Upgrade and BASIC 4 systems and produce a side-by-side listing of tokens and messages. The search addresses were taken from memory maps.

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I used this routine:

```

140 N=0:F=1:M=128:P=127:TP=PEEK(50003)
150 S=49298:E=49812:REM UPGR & ORIG
160 IFTP=160THENS=45234:E=45858:REM 4
    80 COLUMN
170 FORJ=STOE
180 IFFTHENF=0:PRINT:PRINTN;N+M;N=N+1
190 V=PEEK(J):IFVANDMTHENV=VANDP:F=F+1
200 PRINTCHR$(V);
210 NEXTJ
READY.

```

The results are shown in Figure 1. A list nearly identical to the BASIC 4 listing was in **COMPUTE!** #15, and the list of the Upgrade tokens was in **COMPUTE!** #1. The list presented here also adds the messages which follow the list of tokens.

Note that tokens on the Upgrade PET range in number from 128 to 203. From 204 down we have the PET-people interface. On the BASIC 4 systems, tokens range from 128 to 218 with tokens 128-203 being common between the two systems. Messages follow the tokens and begin at number 219.

The tokens that give us trouble are the ones in BASIC 4 numbered 204-218. They line up with Upgrade PET's messages or with the beginning of the token list, depending who is doing the lining up, LIST or Power's scroller.

The Logic Of It All

The reason behind it goes like this (I think) : The program that runs the PET, the BASIC interpreter, takes a BASIC 4 token that was loaded in, for instance token 206 (DCLOSE). In order to print it on the screen, it scans the table looking for 206. But the Upgrade PET knows that the highest valid token number in its list is 203. When the list is exhausted, it wraps around and starts at the top of the list, goes down three more items and, consequently, returns an inconspicuous NEXT. Power, on the other hand, doesn't wrap around. When a token, invalid for the system, exists in the program, it goes down the list to number 206 and finds a clearly visible RETURN WITHOUT GOSUB message, equivalent to DCLOSE. All quite logical. And simple.

The conversion kit, therefore, consists of a list of tokens and messages. By some careful work on your part, BASIC 4 programs can be read on an Upgrade screen. If you see a strange looking command, you can find out what it means by aligning the tokens and messages.

Try to guess what BASIC 4 statement is intended when the LIST command says END and Power's scroller says NEXT WITHOUT FOR? How about LIST showing GOTO and the scroller showing REDIM'D ARRAY?

Subsequent to the disk commands having been decoded from their curious appearance, the only

remaining job is to rewrite those commands into words Upgrade PET can understand (to achieve reverse compatibility). Relative file commands cannot be converted that easily. For this you might consult reference (4) below. If you see RECORD # scattered in the BASIC 4 program, you'll need to do some work. In any case, make sure that you add a semicolon at the end of all PRINT statements. Other commands can be translated with little difficulty by consulting the disk manual, once you know what they are supposed to be.

Don't Jump To Conclusions

WARNING: Trying to write a BASIC 4 program on an Upgrade PET cannot work easily. Writing FOR#4 will not result in DOPEN#4, unless you scan the program and add 75 to the selected FOR token value leaving intended FORs alone. It makes no sense to try to do it, because you couldn't debug your hybrid creation anyway.

REFERENCES:

- 1) Butterfield's Memory maps in **COMPUTE!** issues 2 and 7.
 - 2) POWER Manual (Professional Software).
 - 3) User's Manual for CBM 5 1/4-inch Dual Floppy Disk Drives, Commodore Business Machines, part # 320899.
 - 4) Butterfield's Mixing and Matching Commodore disk system.
- I am grateful to COMPUTER FORUM of FRAZER, PA for permitting me to use their BASIC 4 equipment.*

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UPGRADE

```
0 128 END
1 129 FOR
2 130 NEXT
3 131 DATA
4 132 INPUT#
5 133 INPUT
6 134 DIM
7 135 READ
8 136 LET
9 137 GOTO
10 138 RUN
11 139 IF
12 140 RESTORE
13 141 GOSUB
14 142 RETURN
15 143 REM
16 144 STOP
17 145 ON
18 146 WAIT
19 147 LOAD
20 148 SAVE
21 149 VERIFY
22 150 DEF
23 151 POKE
24 152 PRINT#
25 153 PRINT
26 154 CONT
27 155 LIST
28 156 CLR
29 157 CMD
30 158 SYS
31 159 OPEN
32 160 CLOSE
33 161 GET
34 162 NEW
35 163 TAB<
36 164 TO
37 165 FN
38 166 SPC<
39 167 THEN
40 168 NOT
41 169 STEP
42 170 +
43 171 -
44 172 *
45 173 /
46 174 ↑
47 175 AND
48 176 OR
49 177 >
50 178 =
51 179 <
52 180 SGN
53 181 INT
54 182 ABS
```

BASIC 4

```
0 128 END
1 129 FOR
2 130 NEXT
3 131 DATA
4 132 INPUT#
5 133 INPUT
6 134 DIM
7 135 READ
8 136 LET
9 137 GOTO
10 138 RUN
11 139 IF
12 140 RESTORE
13 141 GOSUB
14 142 RETURN
15 143 REM
16 144 STOP
17 145 ON
18 146 WAIT
19 147 LOAD
20 148 SAVE
21 149 VERIFY
22 150 DEF
23 151 POKE
24 152 PRINT#
25 153 PRINT
26 154 CONT
27 155 LIST
28 156 CLR
29 157 CMD
30 158 SYS
31 159 OPEN
32 160 CLOSE
33 161 GET
34 162 NEW
35 163 TAB<
36 164 TO
37 165 FN
38 166 SPC<
39 167 THEN
40 168 NOT
41 169 STEP
42 170 +
43 171 -
44 172 *
45 173 /
46 174 ↑
47 175 AND
48 176 OR
49 177 >
50 178 =
51 179 <
52 180 SGN
53 181 INT
54 182 ABS
```


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UPGRADE

55	183	USR
56	184	FRE
57	185	POS
58	186	SQR
59	187	RND
60	188	LOG
61	189	EXP
62	190	COS
63	191	SIN
64	192	TAN
65	193	ATN
66	194	PEEK
67	195	LEN
68	196	STR\$
69	197	VAL
70	198	ASC
71	199	CHR\$
72	200	LEFT\$
73	201	RIGHT\$
74	202	MID\$
75	203	GO
76	204	NEXT WITHOUT FOR
77	205	SYNTAX
78	206	RETURN WITHOUT GOSUB
79	207	OUT OF DATA
80	208	ILLEGAL QUANTITY
81	209	OVERFLOW
82	210	OUT OF MEMORY
83	211	UNDEF'D STATEMENT
84	212	BAD SUBSCRIPT
85	213	REDIM'D ARRAY
86	214	DIVISION BY ZERO
87	215	ILLEGAL DIRECT
88	216	TYPE MISMATCH
89	217	STRING TOO LONG
90	218	FILE DATA
91	219	FORMULA TOO COMPLEX
92	220	CAN'T CONTINUE
93	221	UNDEF'D FUNCTION
94	222	ERROR IN

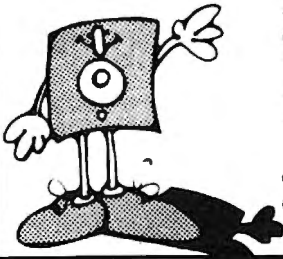
BASIC 4

55	183	USR
56	184	FRE
57	185	POS
58	186	SQR
59	187	RND
60	188	LOG
61	189	EXP
62	190	COS
63	191	SIN
64	192	TAN
65	193	ATN
66	194	PEEK
67	195	LEN
68	196	STR\$
69	197	VAL
70	198	ASC
71	199	CHR\$
72	200	LEFT\$
73	201	RIGHT\$
74	202	MID\$
75	203	GO
76	204	CONCAT
77	205	DOPEN
78	206	DCLOSE
79	207	RECORD
80	208	HEADER
81	209	COLLECT
82	210	BACKUP
83	211	COPY
84	212	APPEND
85	213	DSAVE
86	214	DLOAD
87	215	CATALOG
88	216	RENAME
89	217	SCRATCH
90	218	DIRECTORY
91	219	NEXT WITHOUT FOR
92	220	SYNTAX
93	221	RETURN WITHOUT GOSUB
94	222	OUT OF DATA
95	223	ILLEGAL QUANTITY
96	224	OVERFLOW
97	225	OUT OF MEMORY
98	226	UNDEF'D STATEMENT
99	227	BAD SUBSCRIPT
100	228	REDIM'D ARRAY
101	229	DIVISION BY ZERO
102	230	ILLEGAL DIRECT
103	231	TYPE MISMATCH
104	232	STRING TOO LONG
105	233	FILE DATA
106	234	FORMULA TOO COMPLEX
107	235	CAN'T CONTINUE
108	236	UNDEF'D FUNCTION
109	237	ERROR IN



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Screen Save Routine

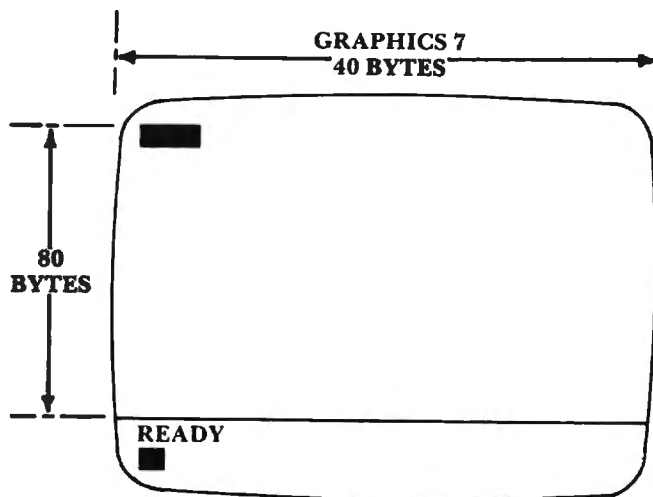
Joseph Trem
Garfield Heights, OH

A while back, **COMPUTE!** published an excellent article for drawing pictures entitled "SUPER CUBE" (**COMPUTE!** #11). Pictures are drawn to look 3-dimensional. After playing with this program, some very interesting pictures developed... all to be lost when the computer was turned off! Gee, it sure would be nice to save those Rembrandts!

The following utility program can be appended to the end of your favorite drawing programs and will enable you to save those Rembrandts. A sample drawing is included at the beginning of this utility.

The Atari computer is fascinating indeed. The more you delve, the more intriguing it becomes. This program is based on three screen-related memory addresses - 87, 88, & 89. Location 87 contains the graphics mode presently in use. Type "GRAPHICS 7", then type "PRINT PEEK(87)". The computer will respond with "7". Locations 88 and 89 store the starting addresses of screen memory. 88 contains the low byte and 89 contains the high byte. Again, type "GRAPHICS 7", then type "PRINT PEEK(88) + PEEK(89)*256". This will return the memory starting address for Graphics 7. Note that each computer may return a different number depending on the memory size of the machine. Now type "POKE(memory start), 255". This will light up one full byte at the top left corner of the screen (Figure 1).

Figure 1.



Type "POKE(memory start + 40,255", and this will light up the next full byte directly under the first byte. Knowing this, it is possible to keep track of every byte on the screen. There are 40 bytes horizontally and 80 bytes vertically in Graphics 7. In the utility program, line 33240 locates the starting address of your picture. Lines 32125 and 32225 scan and set screen memory locations. You may adapt these lines to any graphics mode using the chart provided. For example, if you happen to be using graphics 5, change the "40*80" in those lines to "20*40"

	HORIZONTAL BYTES	VERTICAL BYTES
GR.8	40	160
GR.7	40	80
GR.6	20	80
GR.5	20	40
GR.4	10	40
GR.3	10	20
GR.2	20	10
GR.1	20	20
GR.0	40	24
(full screen)		

After running this program, you may want to append only the utility part to your favorite drawing program. Here's how to do it. First, make sure your drawing program does not exceed line 30999. Now type LIST"C:",31000,32240 or LIST "D:filename", 31000,32240. This will save only lines 31000 through 32240. When completed type NEW and load your drawing program (e.g. SUPER CUBE). Now load your utility program back in. This is done by typing ENTER"C:" or ENTER "D:filename". This will append your utility to the end of any drawing program.

Some programs may have to be modified slightly, but with a little effort you may find it worth it. Run your program. Draw your masterpiece. When you are satisfied with your creation, press the BREAK key and type "GOTO 31000". This will initialize the save and load routine. Then sit back, relax and surprise someone with a genuine work of art worthy only of the great masters.

- 10 Initializes SCREEN SAVE ROUTINE
- 40-195 Draws sample picture (e.g. Space game playfield)
- 200 Reinitializes menu after drawing
- 30000 Sets GR.2 & title
- 31000 Opens IOCB for keyboard
- 32000
- to Prints menu. Gets keyboard input and directs to appropriate line.
- 32060
- 32100
- to Prints save menu. Gets keyboard input and directs to appropriate line.
- 32103

```

32105 to Prints disk instructions.
32208
32110 to Prints cassette instructions.
32210
32200 Prints load menu.
32122 Stores graphics mode and color register data.
32125 Stores screen RAM data.
32222 Reads graphics mode and color register data and
pokes it into correct location.
32225 Reads screen RAM data and pokes into correct
locations.
32240 Determines start address of screen.

```

```

10 GOTO 30000
40 GRAPHICS 7:SETCOLOR 0,6,6:REM *SET GR
APHICS 7 MODE
60 INC=49:CO=1:COLOR 1
65 INC=INC+0.05
70 X=SIN( INC)*20:Y=COS( INC)*20
75 PLOT X+80,Y+35:SOUND 1,X+50,10,8
80 CO=CO+1:IF CO<130 THEN 65
100 CO=1
110 COLOR 3
130 INC=INC+0.05
140 X=SIN( INC+1)*30:Y=COS( INC)*30
145 IF CO>49 AND CO<70 THEN 160
150 COLOR 2:PLOT X+80,Y+35:SOUND 1,X+50,
6,8
155 COLOR 3:PLOT X+81,Y+38:COLOR 1:PLOT
X+79,Y+32
160 CO=CO+1:IF CO<130 THEN 110
170 COLOR 1:FOR X=1 TO 159:PLOT X,79:DR
AWTO X,79-RND(0)*5:SOUND 1,X,10,8:NEXT X
180 FOR X=1 TO 20:COLOR RND(0)*1+1:PLOT
40,40:DRAWTO RND(0)*10,RND(0)*10:SOUND 1
,X+20,8,8:NEXT X
183 FOR X=120 TO 159:COLOR RND(0)*2+1:PL
OT X,20:DRAWTO X,RND(0)*20:NEXT X
185 COLOR 2:PLOT 130,30:DRAWTO 130,24:DR
AWTO 134,24:DRAWTO 134,30:PLOT 130,27:DR
AWTO 134,27
186 PLOT 142,25:DRAWTO 142,24:DRAWTO 138
,24:DRAWTO 138,30:DRAWTO 142,30:DRAWTO 1
42,29
187 PLOT 150,24:DRAWTO 146,24:DRAWTO 146
,30:DRAWTO 150,30:PLOT 146,27:DRAWTO 149
,27
190 COLOR 2:PLOT 0,0:DRAWTO 159,0:DRAWTO
159,79:DRAWTO 0,79:DRAWTO 0,0
195 COLOR 1:PLOT 30,70:PLOT 40,10:PLOT 1
40,30:PLOT 150,70:PLOT 105,35:SOUND 1,0,
0,0
200 GOTO 32000

```

```

30000 GRAPHICS 2:? #6;" SCREEN SAVE ROUT
INE"
31000 CLOSE #1:OPEN #1,4,0,"K:"
32000 SCRN=32240:GOSUB SCRN:POKE 752,1:?
" 1...DRAW PICTURE"
32010 ? " 2...SAVE PICTURE"
32020 ? " 3...LOAD PICTURE"
32050 GET #1,A:IF A<49 OR A>51 THEN 3205
0
32060 ON A-48 GOTO 40,32100,32200
32100 ? :? " SAVE TO 1...CASSETTE?":?
" 2...DISK?"
32101 GET #1,A:IF A<49 OR A>50 THEN 3210
1
32103 ON A-48 GOTO 32110,32105
32105 ? :? " PLEASE INSERT DISKETTE AN
D PRESS (RETURN)":GET #1,A:OPEN #2,
8,0,"D:PICTURE":GOTO 32120
32110 ? :? "PLEASE PLACE CLEAN TAPE IN R
ECORDER AND PRESS (RETURN)"
32115 OPEN #2,8,0,"C":REM *OPEN FILE TO
SAVE
32120 ? :? "SIT BACK AND RELAX... (SAVIN
G PICTURE)"
32122 MODE=PEEK(87):PUT #2,MODE:FOR I=0
TO 4:COL=PEEK(708+I):PUT #2,COL:NEXT I
32125 FOR I=SCREEN TO SCREEN+(40*80)-1:L
OC=PEEK(I):PUT #2,LOC:NEXT I:CLOSE #2
32130 GOTO 32000
32200 ? :? " LOAD TO 1...CASSETTE?":
? " 2...DISK?"
32201 GET #1,A:IF A<49 OR A>50 THEN 3220
1
32203 POKE 752,1
32205 ON A-48 GOTO 32210,32208
32208 ? :? " PLEASE INSERT DISKETTE AND
PRESS (RETURN)":GET #1,A:OPEN #2,4
,0,"D:PICTURE":GOTO 32220
32210 ? " PLEASE INSERT TAPE AND PRESS (
RETURN)"
32215 OPEN #2,4,0,"C":REM *OPEN FILE TO
LOAD
32220 ? :? :? "RELAX AND ENJOY... (LOADI
NG PICTURE)"
32222 GET #2,MODE:GRAPHICS MODE:GOSUB SC
RN:FOR I=0 TO 4:GET #2,COL:POKE 708+I,CO
L:NEXT I
32225 FOR I=SCREEN TO SCREEN+(40*80)-1:G
ET #2,LOC:POKE I,LOC:NEXT I:CLOSE #2
32230 GOTO 32000
32240 SCREEN=PEEK(88)+PEEK(89)*256:RETUR
N
32500 REM **WRITTEN BY JOSEPH TREM**
32501 REM ** SCREEN SAVE ROUTINE **
32502 REM ** 7/81 **

```

Part I: A Superboard II Monitor

Frank Cohen
Pacific Palisades, CA

In the last article I stated my opinion of the OSI Superboard II's video output. The result was an advanced cursor routine to supplement the powerful ROM-based Microsoft BASIC. Super-Cursor adds many functions to the output routine of BASIC. However, Super-Cursor is a very long routine (almost 500 bytes long) and entering it into the Superboard can take forever using the existing monitor program. This gave me the inspiration to write the next couple of programs.

Upon turning on the Superboard and pressing the BREAK key, one is presented with a choice of entering the BASIC, disk or monitor programs. Unless one knows enough about how BASIC works to write a machine code interface, using the monitor program is the only way to program the computer in machine language. It only takes one look at the monitor program to know that one is very limited in the things that can be done.

The monitor will perform only three different things with the Superboard. First, it allows the viewing of one memory location at a time. This gives the capability of seeing one whole byte of memory for every given keyboard entry. Imagine trying to look through a program like Super-Cursor one byte at a time, keeping in mind there are over 500 instructions. Finding one byte incorrectly entered would take hours. Second, the monitor allows the modification of only one location at a time. After a byte has been entered, the next address is displayed. A problem will occur here if you are not sure the byte you just entered was correct. In this case you would have to go back and look at the last memory location. It then becomes necessary to retype the four digits of the previous address. Finally, the monitor allows the entry of a machine language program from a cassette recorder. Of course, it doesn't allow one to store a program on a cassette recorder (which leads one to wonder what one would be loading to begin with).

An Advanced Monitor

It doesn't take long after you start programming in machine language to realize the necessity of a more advanced monitor program. This program (and

two others to follow) form an advanced monitor routine. To be quite original I have named the total program Super-Monitor. It is intended for the type of person who knows the basics of machine language programming and wants to expand his knowledge. The three programs are fully documented and in assembly language format. They are written in three separate packages so that you, the user, can modify to your specifications while, at the same time, learn some simple machine language programming techniques.

Before we start, an outline of what a monitor program should do will make the whole thing come together at the end. First, the monitor should be able to display as few or as many memory locations at one time as is desired. Second, it should allow easy entry of many bytes into the Superboard's memory along with the ability to see what was just entered. Third, it should allow the user to fill many memory locations with certain strings or combinations of bytes. Fourth, it should be able to move a whole block of data from one location to another in memory. Fifth, we should have a routine to store memory onto tape. Finally, we should have a routine to read a program from tape to memory with verification. Once all this is accomplished, entering and editing machine language programs will be a snap.

Hexdump

This program allows us to see many locations of memory at once. It will ask you for a beginning memory address and then it will print one line of eight bytes of data from the memory address specified. It will then wait for your command. If you want the next line of eight bytes to be listed, you simply hit the carriage return key. If you want to list another part of memory, you hit the line feed key and HEXDUMP will start again by asking for a new beginning address.

Before we get into seeing just how Hexdump works, here is a small word of warning. If you read the article describing Super-Cursor V1.3 in **COMPUTE! #18** you should have noted that my Superboard II has had the video modifications added to give a video display of 26 lines with 48 characters per line, using the Super-Cursor program. The modifications are simple and well described in conversion plans which can be purchased from Elcomp Publishing (Silver Spur Electronics, Chino, California.)

Hexdump does use some of the routines in Super-Cursor so it is necessary that you load Super-Cursor as well. If you don't want to use Super-Cursor, you will have to write your own output routines to allow Hexdump to display information onto the screen. Writing these routines is not very difficult and you probably could copy the individual routines out of Super-Cursor with only a few modifications.

The assembly listing of Hexdump shows that it loads into locations 1D20 through 1E38. This is the area in memory directly below Super-Cursor V1.3. There are seven bytes of memory which separate the two programs. These will be used later for another part of Super-Monitor. Hexdump may be moved to another location in memory by reassembling it; however, if you do not own an assembler, relocating Hexdump may become very difficult as it uses absolute addresses extensively.

Hexdump is an example of structured machine language programming. It uses a main supervisor routine which branches into other routines. The supervisor is labeled Hexdump in the assembly listing, and calls all of the other subroutines into play.

Upon starting Hexdump, the supervisor homes the cursor using the Home routine of Super-Cursor V1.3. This positions the solid block cursor in the upper left position of the screen. The program then goes to the subroutine labeled PAdr. This subroutine prints the two byte address held in location 00E7 and 00E8. This address is later used to find the memory location you want to display.

The program continues by jumping to another subroutine. This one called Inadr. This subroutine reads the keyboard four times, allowing the input of a four digit memory address. The resulting two byte address is put into locations 00E7 and 00E8 (ADR). Once the four numbers have been entered, the program jumps back to the supervisor which again homes the cursor. The program then jumps to another subroutine labeled Pline.

Up to this point you probably will not be modifying the program very much as the function of

the subroutines are very straightforward. However, Pline will probably need to be modified as it prints the start address of the desired memory locations and then prints the eight bytes of data contained in those locations. The number of data bytes printed is what may need to be changed, if you have not added the video modifications to your Superboard. On a 24 by 24 video display you can only print up to five bytes at a time unless you don't mind the information falling off one line and continuing on the next. The number of bytes printed is controlled by the byte at 1E24. In the assembly listing you can see that the program between 1E22 and 1E30 is concerned only with checking to see if Pline has printed eight characters and, if it has, to return back to the supervisor. To change the number of bytes printed per line, it is necessary to put the desired number at 1E23 and a copy of that number at 1E2B.

Now that Pline is finished and we have returned to the supervisor, you can see that Hexdump checks the keyboard and, if a carriage return is entered (ASCII value of 0D), it will branch back to print the next eight bytes of memory. If a line feed is entered (ASCII value of 0A), it will branch back to the part of the program which homes the cursor and starts it all again.

Next Month

We now have a program which is the first part of a very advanced monitor program. What comes next is two other routines which include the functions listed in our outline. They are smaller routines than Hexdump. The resulting Super-Monitor will allow you to enter large programs in a single bound.

```

;This program uses some subroutines from
;Super-Cursor V1.3 (COMPUTE! Nov. '81)
;
;Zero page usage is limited to only
;two bytes-
; 00E7 - ADR
; 00E8 - ADR+1
;which are the low and high bytes forming an
;address for which HEXDUMP looks into memory.
;
;
;Start of program and entry point.
;
*1D20
1D20 20 80 1E   HEXDUMP JSR HOME      ;Home the Cursor
1D23 20 3C 1D   DIA     JSR PADR     ;Print address
1D26 20 80 1E   JSR HOME   ;Home the cursor again
1D29 20 93 1D   JSR INADR  ;Input address
1D2C 20 00 1E   DAL     JSR PLINE  ;Print one line
1D2F 20 BA FF   BD     JSR KEYIN  ;Reads the keyboard result in A
1D32 C9 0D           CMP #$0D   ;Key pressed = CR?
1D34 F0 F6           BEQ DAL
1D36 C9 0A           CMP #$0A   ;Key pressed = LF?

```

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LABYRINTH - 8K - This has a display background similar to MINOS as the action takes place in a realistic maze seen from ground level. This is, however, a real time monster hunt as you track down and shoot mobile monsters on foot. Checking out and testing this one was the most fun I've had in years! - \$13.95. OSI

THE AARDVARK JOURNAL

FOR OSI USERS - This is a bi-monthly tutorial journal running only articles about OSI systems. Every issue contains programs customized for OSI, tutorials on how to use and modify the system, and reviews of OSI related products. In the last two years we have run articles like these!

- 1) A tutorial on Machine Code for BASIC programmers.
- 2) Complete listings of two word processors for BASIC IN ROM machines.
- 3) Moving the Directory off track 12.
- 4) Listings for 20 game programs for the OSI.
- 5) How to write high speed BASIC - and lots more -

Vol. 1 (1980) 6 back issues - \$9.00
Vol. 2 (1981) 4 back issues and subscription for 2 additional issues - \$9.00.

ADVENTURES!!!

For OSI, TRS-80, and COLOR-80. These Adventures are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer commands like "Look in the Coffin" and "Light the torch".)

Adventures require 8K on an OSI and 16K on COLOR-80 and TRS-80. They sell for \$14.95 each.

ESCAPE FROM MARS (by Rodger Olsen)

This ADVENTURE takes place on the RED PLANT. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)

This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

TREK ADVENTURE (by Bob Retelle)

This one takes place aboard a familiar starship. The crew has left for good reasons - but they forgot to take you, and now you are in deep trouble.

DEATH SHIP (by Rodger Olsen)

Our first and original ADVENTURE, this one takes place aboard a cruise ship - but it ain't the Love Boat.

VAMPIRE CASTLE (by Mike Bassman)

This is a contest between you and old Drac - and it's getting a little dark outside. \$14.95 each.

OSI NEW-NEW-NEW TINY COMPILER

The easy way to speed in your programs. The tiny compiler lets you write and debug your program in Basic and then automatically compiles a Machine Code version that runs from 50-150 times faster. The tiny compiler generates relocatable, native, transportable machine code that can be run on any 6502 system.

It does have some limitations. It is memory hungry - 8K is the minimum sized system that can run the Compiler. It also handles only a limited subset of Basic - about 20 keywords including FOR, NEXT, IF THEN, GOSUB, GOTO, RETURN, END, STOP, USR(X), PEEK, POKE, =, *, /, <, >. Variable names A-Z, and Integer Numbers from 0-64K.

TINY COMPILER is written in Basic. It can be modified and augmented by the user. It comes with a 20 page manual.
TINY COMPILER - \$19.95 on tape or disk OSI

SUPERDISK II

This disk contains a new BEXEC* that boots up with a numbered directory and which allows creation, deletion and renaming of files without calling other programs. It also contains a slight modification to BASIC to allow 14 character file names.

The disk contains a disk manager that contains a disk packer, a hex/dec calculator and several other utilities.

It also has a full screen editor (in machine code on C2P/C4) that makes corrections a snap. We'll also toss in renumbering and program search programs - and sell the whole thing for - SUPERDISK II \$29.95 (5%") OSI

BARE BOARDS FOR OSI C1P

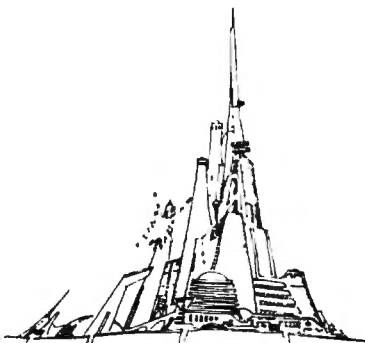
MEMORY BOARDS!!! - for the C1P - and they contain parallel ports!

Aardvarks new memory board supports 8K of 2114's and has provision for a PIA to give a parallel port! It sells as a bare board for \$29.95. When assembled, the board plugs into the expansion connector on the 600 board. Available now!

FROM BURNER FOR THE C1P - Burns single supply 2716's. Bare board - \$24.95.

MOTHER BOARD - Expand your expansion connector from one to five connectors or use it to adapt our C1P boards to your C4/8P. - \$14.95.

16K RAM BOARD FOR C1P - This one does not have a parallel port, but it does support 16K of 2114's. Bare Board \$39.95.



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This is only a partial listing of what we have to offer. We offer over 120 games, ROMS, and data sheets for OSI systems and many games and utilities for COLOR-80 and TRS-80. Send \$1.00 for our catalog.

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WORD PROCESSING THE EASY WAY - WITH MAXI-PROS

This is a line-oriented word processor designed for the office that doesn't want to send every new girl out for training in how to type a letter.

It has automatic right and left margin justification and lets you vary the width and margins during printing. It has automatic pagination and automatic page numbering. It will print any text single, double or triple spaced and has text centering commands. It will make any number of multiple copies or chain files together to print an entire disk of data at one time.

MAXI-PROS has both global and line edit capability and the polled keyboard versions contain a corrected keyboard routine that make the OSI keyboard decode as a standard typewriter keyboard.

MAXI-PROS also has sophisticated file capabilities. It can access a file for names and addresses, stop for inputs, and print form letters. It has file merging capabilities so that it can store and combine paragraphs and pages in any order.

Best of all, it is in BASIC (0S65D 51/4" or 8" disk) so that it can be easily adapted to any printer or printing job and so that it can be sold for a measly price.

MAXI-PROS - \$39.95. Specify 5 1/4" or 8" disk.

SUPPORT ROMS FOR BASIC IN ROM MACHINES - C1S/C2S.

This ROM adds line edit functions, software selectable scroll windows, bell support, choice of OSI or standard keyboard routines, two callable screen clears, and software support for 32-64 characters per line video. Has one character command to switch model 2 C1P from 24 to 48 character line. When installed in C2 or C4 (C2S) requires installation of additional chip. C1P requires only a jumper change. - \$39.95

C1E/C2E similar to above but with extended machine code monitor. - \$59.95 OSI

ARCADE GAMES FOR OSI, COLOR-80 AND TRS-80 (8K OSI, 16K TRS-80 AND COLOR-80)

TIMETREK - A REAL TIME, REAL GRAPHICS STARTRECK. See your torpedoes hit and watch your instruments work in real time. No more unrealistic scrolling displays! \$14.95.

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BATTLEFLEET - This grown up version of Battleship is the toughest thinking game available on OSI or 80 computers. There is no luck involved as you seek out the computers hidden fleet. A topographical toughie. \$9.95

QUEST - A NEW IDEA IN ADVENTURE GAMES! Different from all the others, Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. 16K COLOR-80 OR TRS-80 ONLY. \$14.95



OSI



COLOR-80

```

1D38 F0 E9          BEQ DIA
1D3A D0 F3          BNE BD

1D3C A5 E8          PADR   LDA ADR+1          ;Print address on screen
1D3E 29 F0          AND  #$F0          ;Start with high 4 bits of
1D40 4A             LSR              ;ADR +1  (00E8)
1D41 4A             LSR
1D42 4A             LSR
1D43 4A             LSR
1D44 20 72 1D       JSR  CVHA          ;Convert Hex to Ascii
1D47 20 40 1E       JSR  CURSOR        ;Part of Super-Cursor
1D4A A5 E8          LDA  ADR+1          ;Now do the low 4 bits of ADR+1
1D4C 29 0F          AND  #$0F
1D4E 20 72 1D       JSR  CVHA
1D51 20 40 1E       JSR  CURSOR
1D54 A5 E7          LDA  ADR              ;Now work on high 4 bits of ADR
1D56 29 F0          AND  #$F0
1D58 4A             LSR
1D59 4A             LSR
1D5A 4A             LSR
1D5B 4A             LSR
1D5C 20 72 1D       JSR  CVHA
1D5F 20 40 1E       JSR  CURSOR
1D62 A5 E7          LDA  ADR              ;work on low 4 bits of ADR
1D64 29 0F          AND  #$0F
1D66 20 72 1D       JSR  CVHA
1D69 20 40 1E       JSR  CURSOR
1D6C A9 2D          LDA  #$2D           ;Print '-' on screen after address
1D6E 20 40 1E       JSR  CURSOR
1D71 60             RTS

1D72 A2 00          CVHA   LDX  #$00          ;Convert whats in A from Hex to
1D74 8E 78 1D       CVST   STX  CON+1        ;ASCII
1D77 C9 00          CON    CMP  #$00          ;This value is changed in CVST
1D79 F0 04          BEQ  CFIN
1D7B E8             INX
1D7C 4C 74 1D       JMP  CVST
1D7F BD 83 1D       CFIN   LDA  CDATA,X      ;Put result in A
1D82 60             RTS
1D83 30 31 32       CDATA  DATA          ;Data used in both CVHA and CVAHX
1D86 33 34 35       DATA          ;to convert Hex to Ascii and back.
1D89 36 37 38       DATA
1D8C 39 41 42       DATA
1D8F 43 44 45       DATA
1D92 46             DATA

1D93 20 80 1E       INADR  JSR  HOME          ;Input 4 digit (2 byte) Address
1D96 20 BA FF       JSR  KEYIN         ;Read Keyboard Routine from ROM
1D99 20 40 1E       JSR  CURSOR        ;Super-cursor
1D9C 20 F3 1D       JSR  CVAHX         ;Convert Ascii to Hex
1D9F 0A             LSL
1DA0 0A             LSL
1DA1 0A             LSL
1DA2 0A             LSL
1DA3 8D AC 1D       STA  INADC+1       ;Pokes A into 1DAC
1DA6 A5 E8          LDA  ADR+1
1DA8 29 0F          AND  #$0F
1DAA 18             CLC
1DAB 69 00          INADC  ADC  #$ 00
1DAD 85 E8          STA  ADR+1

```



```

1DAF 20 BA FF      JSR KEYIN          ;Get second digit
1DB2 20 40 1E      JSR CURSOR
1DB5 20 F3 1D      JSR CVAHX
1DB8 8D C1 1D      STA INBDC+1        ;Pokes A into 1DC1
1DBB A5 E8         LDA ADR+1
1DBC 29 F0         AND #$F0
1DBF 18           CLC
1DC0 69 00         INBDC  ADC #$00
1DC2 85 E8         STA ADR+1
1DC4 20 BA FF      JSR KEYIN          ;Get third digit
1DC7 20 40 1E      JSR CURSOR
1DCA 20 F3 1D      JSR CVAHX
1DCD 0A           ASL
1DCE 0A           ASL
1DCF 0A           ASL
1DD0 0A           ASL
1DD1 8D DA 1D      STA INCDC+1        ;Pokes A into 1DDA
1DD4 A5 E7         LDA ADR
1DD6 29 0F         AND #$ 0F
1DD8 18           CLC
1DD9 69 00         INCDC  ADC #$00
1ddb 85 E7         STA ADR
1DDD 20 BA FF      JSR KEYIN          ;Get the last digit
1DE0 20 40 1E      JSR CURSOR
1DE3 20 F3 1D      JSR CVAHX
1DE6 8D EF 1D      STA INDCD+1       ;Poke A into 1DEF
1DE9 A5 E7         LDA ADR
1DEB 29 F0         AND #$F0
1DED 18           CLC
1DEE 69 00         INDCD  ADC#$00
1DF0 85 E7         STA ADR
1DF2 60           RTS

1DF3 A0 00         CVAHX  LDY#$00          ;
1DF5 D9 83 1D      CVCON  CMP CDATA,Y        ;Convert contents of A from
1DF8 F0 04         BEQ CVFIN          ;Ascii to Hex
1DFA C8           INY
1DFB 4C F5 1D      CVFIN  JMP CVCON
1DFE 98           TYA          ;Put result in A
1DFF 60           RTS

1E00 20 3C 1D      PLINE  JSR PADR          ;
1E03 A0 00         LDY #$ 00         ;Print one line of eight bytes
1E05 B1 E7         PBYTE  LDA (ADR),Y   ;Print one byte from ADR
1E07 29 F0         AND #$F0
1E09 4A           LSR
1E0A 4A           LSR
1E0B 4A           LSR
1E0C 4A           LSR
1E0D 20 72 1D      JSR CVHA          ;Convert A to Ascii
1E10 20 40 1E      JSR CURSOR        ;Super-cursor
1E13 B1 E7         LDA (ADR),Y        ;Print low 4 bits on screen
1E15 29 0F         AND #$0F
1E17 20 72 1D      JSR CVHA
1E1A 20 40 1E      JSR CURSOR
1E1D A9 20         LDA #$20          ;Print a space " " to separate
1E1F 20 40 1E      JSR CURSOR        ;the bytes
1E22 C8           INY          ;Are we finished?
1E23 C0 08         CPY #$08
1E25 D0 DE         BNE PBYTE        ;If not display another byte

```

```

1E27 A5 E7          LDA ADR          ;If yes add 08 to ADR
1E29 18             CLC
1E2A 69 08          ADC # $08
1E2C 85 E7          STA ADR
1E2E 90 02          BCC RCOM
1E30 E6 E8          INC ADR+1
1E32 20 95 1E      RCOM JSR CR          ;Were finished printing one line
1E35 20 AB 1E      JSR LF          ;so carriage return and line feed
1E38 60             RTS

;
;
;

;Statistics
;
*= 1D20             ;Start
1D3C PADR          ;Print ADR and ADR+1 on screen
1D72 CVHA          ;Converts Hex to Ascii
1D93 INADR         ;Input a two byte address for ADR and ADR+1
1DF3 CVAHX         ;Converts Ascii to Hex
1E00 PLINE         ;Print a line of 8 bytes from ADR
1E40 CURSOR        ;Prints what ever is in A to where the cursor is
1E80 HOME          ;Home the cursor
1EC2 CLS           ;Clear screen
    
```

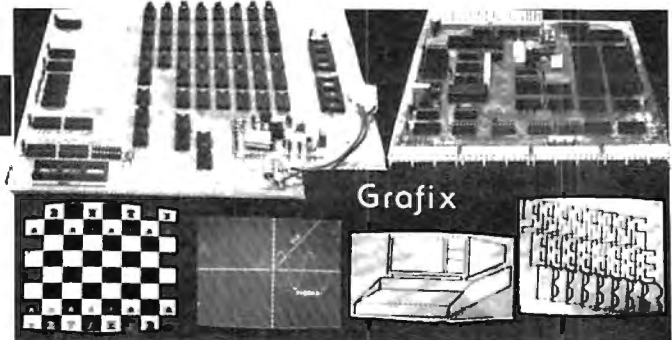
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FOR OSI 1P, 2-4P, 2-8P, C4P, C8P

If your Challenger can't generate displays like those shown above WHAT ARE YOU WAITING FOR? The SEB-1 High Resolution Graphics and Memory Board (for CIP and Superboard II) and the SEB-2 High Resolution Graphics and Disk Controller Board (for C2/4/8) simply 'plug-in' to your computer and give you instant access to over 4900 individually addressable pixels in up to 8 colors! Your Hi-Res screen can go from 32x16 alphanumeric to 256x192 point graphics in 11 software selectable modes. The standard video of your computer is left intact, so that none of your current software library is outmoded. Use the graphics for Business, Scientific, Education, or Gaming displays that were impossible—until now!

Installation of either board requires absolutely NO modification of your computer—they just 'plug-in'. Nor do they preclude your using any other OSI-compatible hardware or



software. In addition to the Hi-Res Graphics the SEB-1 gives C1 & Superboard II users 16K of additional user memory (over and above that memory devoted to the graphics), two 16 bit timers/counters, an on-board RF modulator, and a parallel port with handshaking. The SEB-2 gives OSI 48-pin BUS users an OSI hardware/software compatible Disk controller, and an RF modulator that can be user-populated.

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Bare Board & Manual				
Manual only				

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An action-packed, super fast arcade game where you try to destroy Ram ships and the Evil Spectre inside the Crystal city. 8K.
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Your computer generates contour maps of the surface of a strange planet as you descend looking for the landing pad. As you make your final approach, the computer displays side and top views of the terrain and your ship as you try to land while avoiding the swarms of asteroids above the planet's surface. 8K.
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Programma-Tank is a complex simulation of a battle between two robot tanks as well as a fairly painless way to learn assembly language. The opponents program their tanks in 'Smalltank' a miniature programming language, which is much like assembly language. The two strategies are then pitted against one another until a victor emerges. 8K.

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New Products



Good News For Alkemstone Seekers

Level-10 has increased the reward for the return of the Alkemstone from \$5,000 to \$7,500.

Alkemstone is a computer adventure which now offers a \$7,500 cash reward to the first person who can find the missing Alkemstone.

The Alkemstone is actually hidden somewhere on the planet

The quest for the Alkemstone will lead the player through underground paths of the lair of the original owner. There are unusual messages, fragments of words, sketches and other clues written on the walls. Some items are distributed randomly, so that one may be visible numerous times while some will only appear once in several trips. Each trip will result in a different combination of possible hints. If all bits of information are pieced together correctly, then the location of the Alkemstone will be obvious.

Alkemstone is more than just a treasure hunt. It also has the challenge and intrigue of a fascinating computer game. It features hi-res color graphics, 3-D animation, sound effects and an illustrated short story. Alkemstone is written in machine language for any Apple Computer with 48K, one 16 sector disk drive and Applesoft or language card.

Level-10
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Denver, CO 80221

VIC-20 Timesharing With Printout

The MDM-1 is a MODEM driver module that plugs directly into the user port of the Commodore VIC microcomputer.

The MDM-1 has two additional serial ports for connecting a MODEM and a serial printer.

The MDM-1 does not require any external power. A terminal program supplied with the unit permits telephone line connections to large timesharing computers, and to various computer networks, such as source, Comuserve, Dow Jones, etc.

There are two indicators on the MDM-1 that illustrate the transmissions to and from the VIC. These transmissions are simultaneously recorded on the VIC TV screen and the serial printer.

The price of the MDM-1 is \$59, plus \$3 shipping. Delivery is two weeks after receipt of order.

RVR Systems
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MatheMagic™ The Ultimate Calculator

International Software Marketing, Ltd. (ISM) in Syracuse, New York has announced a unique software product for microcomputers. The product is called MatheMagic™. Essentially, the product transforms a microcomputer into a sophisticated programmable calculator with all of the power and facilities of the

computer system available to it.

"MatheMagic was created by ISM to fill a void which exists in mathematical microcomputer software," says Stephen T. Brightbill, ISM Director. "A wide variety of software is available, primarily for the business community, to manipulate numeric data in a spreadsheet format. MatheMagic is not a "spreadsheet." MatheMagic allows a wide range of users to easily handle an even wider range of mathematical applications. MatheMagic is completely programmable in commonly understood mathem-

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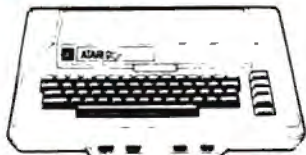
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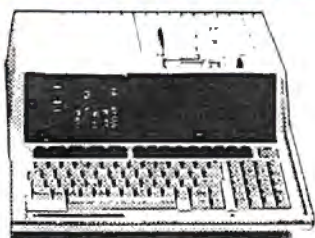
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- Rapid calculation or stepped calculation for viewing intermediate results.
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MatheMagic has been released on the Apple II and II+ and Z80 based micros running under CP/M 2.2 ISM plans to release versions for the Atari 800, TRS-80 I, II, and III, Commodore PET/CBM and the IBM PC during January and

February 1982.

ISM's Home Offices are located at:

*International Software Marketing, Ltd.
Suite 421, University Building
120 E. Washington Street
Syracuse, New York 13202
(315)474-3400*

The International Software Directory

The International Software Directory lists tens of thousands of software packages and classifies them by machine, operating system, subject, vendor and price. Review information is also included. It is independent of both machine manufacturers and software houses, and thus allows for comparison and one-stop shopping. It is backed by an excellent search service and regular updates are available from the publisher. In addition, an on-line service is available through Lockheed dialog.

The ISD is available in two volumes:

1) The International Microcomputer Software Directory which contains over 7000 programs and



is available at the extremely competitive price of \$34.95 plus \$2.95 postage and handling.

2) The International Minicomputer Software Directory which is available for \$65.00

*Imprint Editions
420 South Howes
Fort Collins, CO 80521
(303) 493-2710*

Commodore Canada Announces New Mailing List Software

Toronto - A versatile new electronic mailing list software package called Scratchpad has been announced by Commodore Business Machines Limited.

Intended for business applications, the program is easy to use, flexible and rapid in accessing required data. There are 20 different data items, each with a 30-character length. A great deal of data may be stored on file as a file can consist of any number of disks.

Some of the modes of operation in Scratchpad are Edit, Global Search, Format, Recreate, Print and Backup.

Any data created with the Scratchpad, developed by Richvale Telecommunications of Richmond Hill, Ont., may be interfaced with Wordpro software by the use of a small additional program.

Suggested retail price in Canada is \$295. For further information:

*Isobel McBurney
Software Manager
Commodore Business Machines Limited
3370 Pharmacy Avenue
Scarborough, Ont. M1W 2K4.
(416)449-4292*

Dragon's Eye Now Available

Mountain View, CA - Dragon's Eye, an EPYX game from Automated Simulations, Inc., is now available for the Atari 400 and 800 computers.

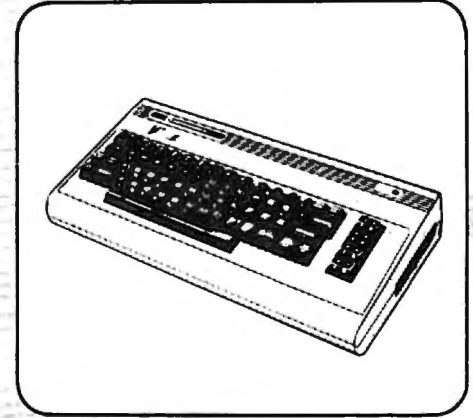
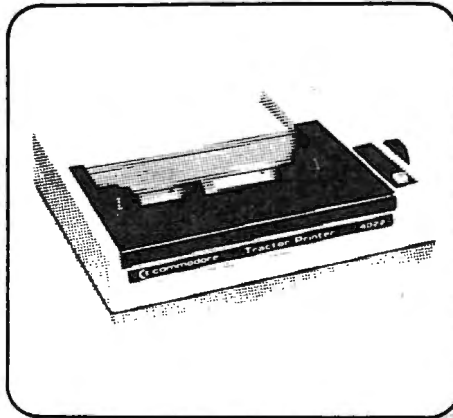
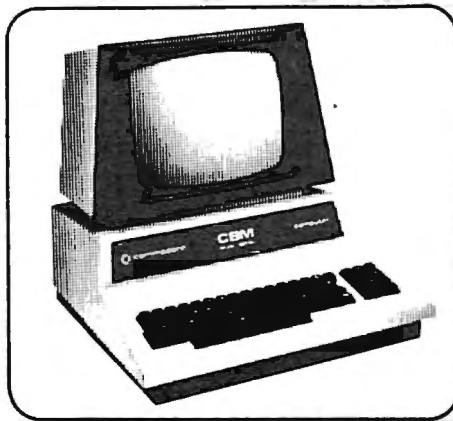
Dragon's Eye, an overland fantasy role playing game, challenges the player to find a magical gem, the Dragon's Eye, in 21 game-days (approximately half-an-hour playing time).



commodore

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The Eye is hidden somewhere within one of the seven provinces, and the player must find it and return it to Fel City, where his journey began.

The player chooses one of 16 characters and gains a set of magical abilities, such as healing, flying, time travel and teleport. Which spells he gets are different each time he plays. He is equipped with his choice of four swords, a bow and arrows, and magic bolts.

While searching, the player sees a detailed map of the provinces on the screen, along with his location, strength, health, and other information.

The player encounters dragons, bats, vampires, ghosts, golems, serpents, skeletons and other monsters. He can choose between 13 commands, from firing an arrow and fighting with sword to casting magic spells and searching for hidden paths.

When a battle is engaged, fully animated graphics display the action between player and beast.

Dragon's Eye is available on cassette for the ATARI 400/800 (32K) and PET (32K), or on disk for the APPLE (48K with ROM Applesoft), and ATARI 400/800 (32K), from:

Automated Simulations, Inc.
P.O. Box 4247
Mountain View, CA 94040
\$24.95

Commodore Introduces Lowest Priced Modem In The Computer Industry

Valley Forge, PA, January 7, 1982 – A low priced modem has been introduced by Commodore Business Machines, Inc.

The new "VICMODEM," which retails for \$109.95, is an easy-to-use plug-in cartridge that connects directly to the user port

of Commodore's VIC 20™ home computer, and may be used with any modular style telephone.

The VICMODEM, which is planned for retail sale in the Spring of 1982, allows users to communicate and exchange data with other computer owners over the telephone. This latest VIC peripheral also allows users to inexpensively access telecomputing networks such as the Source™ or Compuserve™, which provide services such as stock quotes and company reports, newswire stories, research data, sports scores, airline reservations, shopping services and more.

The VICMODEM is a direct connect, 300 baud modem with originate/answer and half/full duplex capabilities. The combined cost of the VIC 20 and a VICMODEM is less than \$410.00.

Microsette Introduces Mini-Diskettes

Microsette Co. is adding 5¼" diskettes to its line of computer and audio cassettes. The diskettes are useable with Apple, Atari, Commodore, Tandy TRS-80, PMC-80 and PMC-81 computers from Personal Micro Computers and many mini-computer and word processing systems.

The diskette surface is certified error free on one side and is for all soft-sectored, single or double density applications. The burnished diskette surface insures longer head life and excellent media durability. Furthermore, the diskettes feature a reinforced hub which gives longer diskette life in this high wear area.

Microsette MD-5 diskettes are attractively packaged in a sturdy green box with each of the 10 diskettes in a long-lasting Tyvek envelope. Each diskette has a corner label and each box of 10 contains 20 silver write



protect tabs and 20 large color coded labels.

Microsette MD-5 diskettes are sold by mail order in units of 10 (1 box) or 50 (5 boxes). Suggested list price is \$3.95 per diskette and mail order prices are \$2.50 each in the box of 10, or \$2.20 each in the box of 50. Prices include UPS shipping.

Further information and dealer pricing may be obtained from Microsette.

Microsette Co.
475 Ellis Street
Mountain View, CA 94043
(415)968-1604

Five New Programs From Atari

Sunnyvale, CA – January 5, 1982 – Three new home computer game programs, a bookkeeping package and a home filing system were introduced by the Home Computer Division of Atari, Inc.

Pac-Man is the Atari Home Computer version of a very popular coin-operated game. In this version, a player's character must negotiate a maze without being eaten by any of four pursuers. By eating an "energy" dot the player's character can gain the ability to attack and gobble up the pursuers. For use on both the Atari 400 and Atari 800 Home Computers, this \$44.95 game comes in cartridge form, and will be available in the second quarter of 1982.

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Centipede is another Atari Home Computer version of a best-selling coin-operated game. In this version, the player uses a "Bug Blaster" to defeat colorful legions of attacking spiders, fleas, scorpions, the Centipede itself, and poisonous mushrooms. The \$44.95 game can be used on both Atari 400 and Atari 800 Home Computers. It comes in cartridge form and will be available in the second quarter of 1982.

Caverns Of Mars is a fascinating new game that takes players beneath the surface of Mars. The player's character must penetrate several layers of defenses to reach the Aliens' stronghold. Floating mines, "enemy" ships on patrol and deadly laser fire menace the player constantly. This game was originally developed for the Atari Program Exchange and won a prize in the APX quarterly software contest for its 17-year-old author. This \$39.95 game can be used on both the Atari 400 and Atari 800 Home Computers with an Atari 810™ Disk Drive. It comes in diskette form and will be available in the first quarter of 1982.

The Bookkeeper is an accounting system designed to meet the needs of people who do business from their homes and for those who run their personal finances in a business-like fashion.

It is a low-cost, comprehensive accounting system that generates professional calibre reports, such as Profit and Loss Statements, Balance Sheets, Accounts Receivable and Payable. It will handle 1,000 transactions a month and up to 350 General Ledger accounts, vendors and customers.

The Bookkeeper consists of four diskettes, including a sample company data diskette that lets you familiarize yourself with The Bookkeeper before you start entering data of your own. The package requires an Atari 800 Home Computer with Atari BASIC language cartridge and 48K of Random Access Memory, an Atari 810 Disk Drive, an Atari 825™ 80-Column Printer and an Atari 850™ Interface Module.

Price and availability will be announced later.

The Home Filing Manager lets a user create, store, edit, retrieve and print information similar to that found on 3"x5" index cards. It provides a convenient way to catalog books, addresses, clothes, recipes, record collections, Christmas card lists, vocabulary words, term paper notes, and the like.

The user can search in alphabetical or reverse alphabetical order or locate an entry by its title or a phrase it contains.

Price and availability will be announced later.

Scheduled Educational Conferences

National Educational Computing Conference (NECC-82)
Kansas City, MO
June 28-30, 1982

The purpose of the conference is to provide a forum for discussion among those interested in educational computing. Based on previous conferences, approximately 1000 people from institutions at all levels are expected to attend. Between 50 and 75 vendors are expected to exhibit at the conference.

Papers will be presented which describe actual experiences with computer use in the classroom or consequences of such use on the educational process in general. The diversity of disciplines and participation by individuals from elementary, secondary, and post secondary education provide a unique opportunity for cross-pollination of ideas and experiences. Additional conference activities include pre-conference workshops, project presentations, vendor exhibits, special sessions, tutorials, and birds-of-a-feather sessions.

Additional information may be obtained from:

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Eclectic shortly will be announcing products that are designed to work with CBM systems.

1. ROMIO: two RS232 ports—three parallel ports—26K EPROM memory-managed alternate character set, software controlled—EDOS (extended DOS).

2. Terminal program (options with ROMIO)

3. EPROM programmer

4. Front-end processor

5. Additional firmware to be announced

Be sure to write the address below for more information; dealer inquiries welcome.

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E. Michael Staman
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 Campus Computing Services
 University of Missouri-Columbia
 305 Jesse Hall
 Columbia, MO 65211

Computers in Education
 Conference
 Seattle Pacific University
 Seattle, WA
 March 12 & 13, 1982

The annual conference will include talks, workshops, and exhibits with emphasis on the use of the microcomputer in K-12 classrooms of various disciplines.

Tony Jongejan
 Everett High School
 2416 Colby
 Everett, WA 98201

Microcomputer Conference
 The University of Victoria
 Victoria, British Columbia
 May 6-8, 1982

Moving Microcomputers Into The Mainstream Of Education will be an opportunity for both a formal and an informal sharing of ideas, information and experiences amongst educators. The major focus of the conference will be the integration of the microcomputer into the established curriculum into the classroom, and into the administrative offices of school districts.

The conference is designed to provide educators with information regarding applications that have been tried and tested in the schools to achieve this purpose. A series of keynote addresses, workshops, papers, and short presentations have been planned. A call for presentations can be found in the upcoming issue of *Micro-scope*.

The conceptual threads of the conference are:

1. Classroom applications.
2. Administration applications.
3. Courseware development and

evaluation.

4. Future implications of technology in instruction.

University housing will be available at reasonable rates.

University Extension
 Conference Office
 721-8475

Southern California
 Computers in Education
 Conference
 University High School
 Irvine, CA
 May 14-15, 1982

This second annual conference is sponsored by Computer-Using Educators.

Workshops and field trips will be held on Friday, May 14 at schools and industry scattered throughout Southern California. On Saturday all sessions will be held at University High School, Irvine starting at 9:00 a.m.

Classroom applications of computers to all areas of the curriculum will be presented covering all grade levels from kindergarten through two-year college. The major emphasis of the conference will be on getting started with microcomputers.

The Friday night banquet speaker will be Prof. Lud Braun, School of Engineering, University of New York. The keynote address on Saturday morning will be delivered by Dr. William "Sandy" Wagner.

Preregistration is \$10 for CUE members and \$16 for non-members. Preregistration must be received by April 30th, 1982. *No purchase orders accepted.* On-site registration will be available on Saturday for \$18. All checks should be made out to CUE (or Computer-Using Educators) and mailed to the address below.

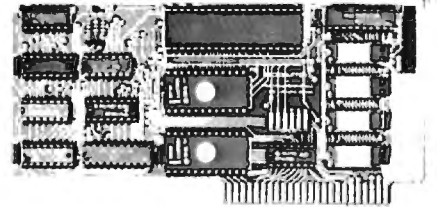
One unique feature of the conference will be several computer workshops held at sea. The unofficial slogan of the conference is "PET your APPLES in

Orange County."

Craig Walker
 1982 Conference Chairperson
 Arrowview Intermediate School
 2299 North "G" Street
 San Bernardino, CA 92405
 (714)886-9118

Buffered Parallel Printer Interface

The Microbuffer II is an intelligent buffered parallel printer interface for the Apple II computer. The Microbuffer II includes 16K of on-board RAM so the computer does not have to wait for the printer to finish before continuing with other



processing. Buffer memory size is user expandable to 32K using industry standard 64K RAM chips. The Microbuffer II is compatible with Applesoft, CP/M, and Pascal and includes advanced high resolution graphics print routines for the Epson MX-80 with Graphtrax, Anadex, IDS Paper Tiger, NEC Prowriter, as well as complete print formatting features. The Microbuffer II is available for \$259.

Practical Peripherals, Inc.
 31245 La Baya Drive
 Westlake Village, CA 91362
 (213)991-8200

MIT LOGO For Apple Computers

The Krell Software Corp. Stony Brook, NY is pleased to announce that MIT's LOGO for Apple II computers is now available. This is the authorized version of the LOGO language for Apple developed by MIT under the sponsorship of the National Science



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Microsoft Basic	74.95	Rescue at Rigel	25.95	Northstar Advantage	call
Pilot	64.95	Darstones of Ryn	15.95	Zenith Z-89	2149.00
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Atari Word Processor	119.95	Compu-Math/Fractions	31.95	Epson MX-80	459.00
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Asteroids	34.95	LISP 2.0	119.95	NEC 8023A	529.00
Caverns of Mars	31.95	Datasm -65	119.95	Diablo 630	2195.00
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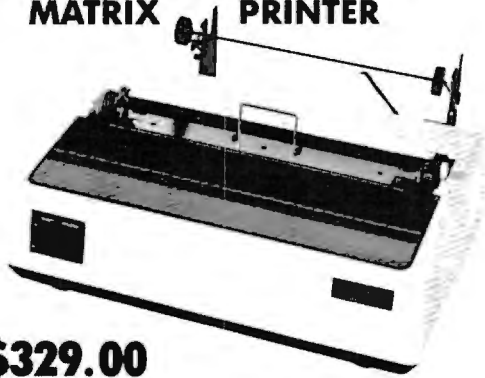
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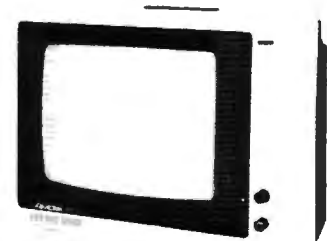
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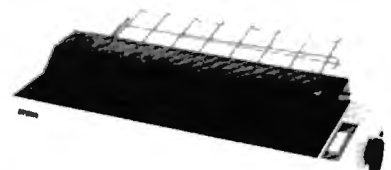
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Corrections And Amplifications

1. "Spacewar Part 2," *Home and Educational COMPUTING!*, Fall 1981, pg. 21: an ?Out Of Memory error can occur after several rounds of the game. The following changes will prevent this as well as the problem with the black hole option:

```
6 SX = 50:SY = 50:POKEV-9,255:?"[CLEAR]":X = S + A:
FORI = XTOX + 505:POKEI,T:NEXTI
```

And change lines 18 and 45 to contain GOTO 47 (instead of GOSUB47).

Change lines 59 and 70 to contain GOTO17 (instead of RETURN).

Changing line 140 to: 140 POKE52,28: POKE56,28:CLR will allow you to make modifications and debug the program without running out of memory. (Our thanks to Ken Denniston and Ronald Gruenzel for these suggested improvements.)

2. "Window Analysis," **COMPUTE!**, December, 1981, pg. 35, line 720: GOSUB FNTRC should read GOSUB FTRC.

3. "A Simple Printer Interface For Apple II," **COMPUTE!**, December, 1981, pg. 85: 220 OHMS should be 2200 OHMS (and vice versa).

4. "PET To PET Communication Over The User Port," **COMPUTE!**, December, 1981, pg. 142: The second paragraph on the second column of this page should begin, "Now the receiver can leave line 40 and read the data byte (on line 50). The transmitter is now stuck on line 90 . . ."

5. "File Recovery," **COMPUTE!**, December, 1981, pg. 164: to apply Program 1 to the 2040 Disk Drive, the following lines are required.

```
145 PRINT "ENTER TRACK NUMBER OF 1ST
DATA BLOCK": INPUT TT
```

```
414 PRINT#15,"B-P:"3;5 + 32*R-2
```

```
416 PRINT#1,CHR$(TT);
```

6. "The Beginner's Page," **COMPUTE!**, January, 1982, pg. 24: part of the Atari version of the program was missing. Here it is in its entirety:

```
100 DATA SUPER,ACNE,AMERICAN,RAINBOW,QUALITY,
INTERGALACTIC,RELIABLE,FOOLPROOF
110 DATA PROGRAMS,SOFTWARE,COMPUTERWARE,
CODE,LISTINGS,INFORMATION,MAGIC
120 DIM ADJECTIVE$(8*20),NOUN$(7*20),TEMP$(
20),L1(8),L2(7)
130 FOR I=1 TO 8:READ TEMP$:ADJECTIVE$(I*20-19,
I*20)=TEMP$:L1(I)=LEN(TEMP$):NEXT I
140 FOR I=1 TO 7:READ TEMP$:NOUN$(I*20-19,
I*20)=TEMP$:L2(I)=LEN(TEMP$):NEXT I
150 FOR I=1 TO 7
160 FOR J=1 TO 8
170 PRINT ADJECTIVE$(J-1)*20+1,(J-1)*20
+L1(J);" ";NOUN$(I-1)*20+1,(I-1)*20+L2
(I);
180 NEXT J
190 NEXT I
```

7. "Invest," **COMPUTE!**, January, 1982, pg. 39: the author suggests that the following changes be made to his program since equity buildup for an investment should be multiplied by the initial amount financed rather than the yearly payment amount. As the program stands, it makes an investment look a little better than it really is. The following will correct the problem:

```
7490 PN = PR - DP : REM THIS IS THE AMOUNT
YOU'RE FINANCING
```

```
7500 EB = PN * E1 (Y,I) : REM THIS IS THE EQUITY
BUILDUP FOR 12 MONTHS, 1ST YEAR
```

```
7502 EB = EB/12
```

```
7503 EB = EB * M : REM THIS IS THE EQUITY
BUILDUP FOR THE MONTHS YOU'LL OWN
IT, THE 1ST YEAR
```

```
7505 EB = EB/1000
```

```
7510 ET = PN * E2 (Y,I) : REM EQUITY BUILDUP
FOR THE 2ND YEAR
```

```
7515 ET = ET / 1000
```

8. "Apple Addresses," **COMPUTE!**, January, 1982, pg. 83: the program was missing from this article. The entire article is being reprinted in this issue, starting on page 163.

9. "Tinymon1," **COMPUTE!**, January, 1982, pg. 176: Jim Butterfield writes, "I bungled it! In my zeal to make the whole thing as painless and fool-proof (!) as possible, I added four bytes to the end of the program. This made the checksum straightforward, and made the hex entry a little simpler.

All of this would have been OK had I not added four bytes to the BASIC pointers, too. The 'first change' should have been:

```
∴ 0028 01 04 14 08 14 08 14 08
```

If you punched the whole thing up and it doesn't work, all is not lost. Reload the program, make the above change, go back to BASIC and SAVE...and you will find yourself with a working Tinymon.

My apologies for all those nights of lost sleep. I really was trying to make it easier and bug-free...." ©

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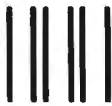


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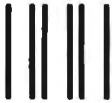
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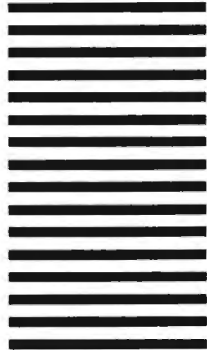
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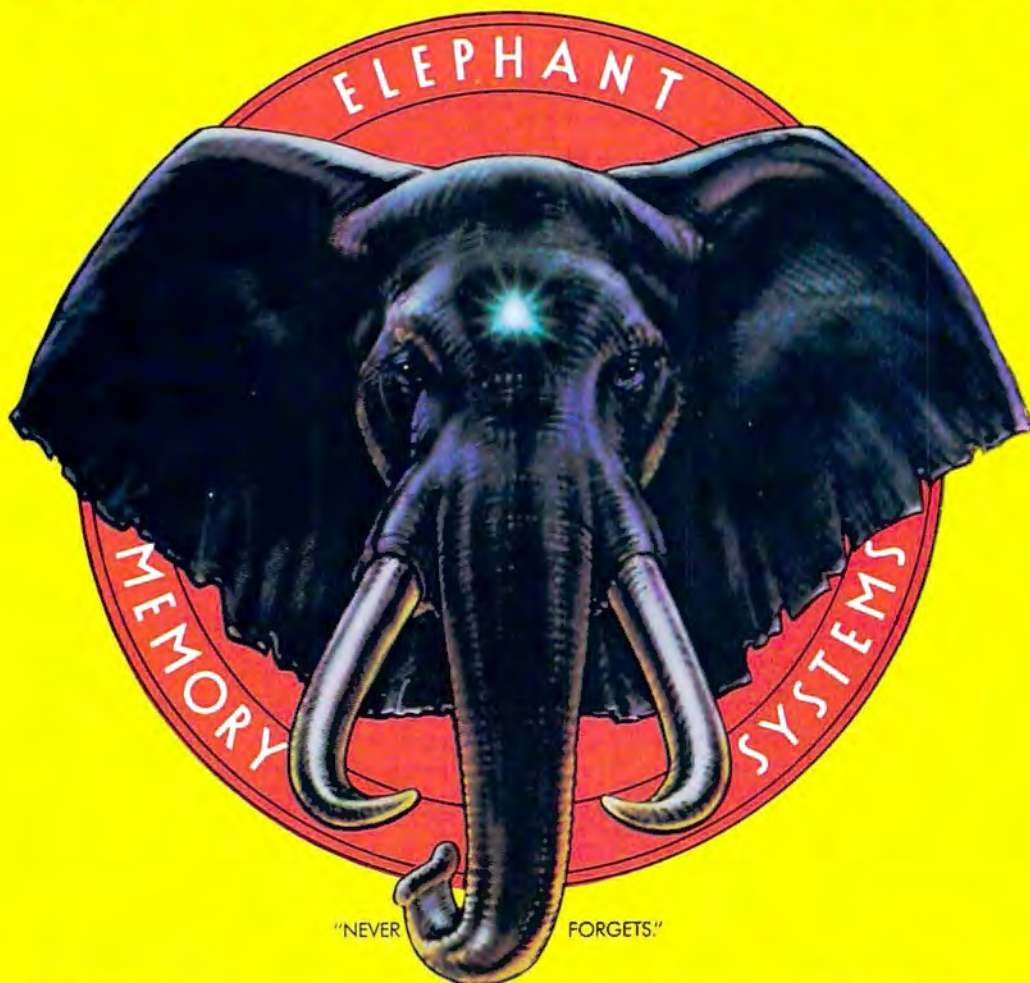
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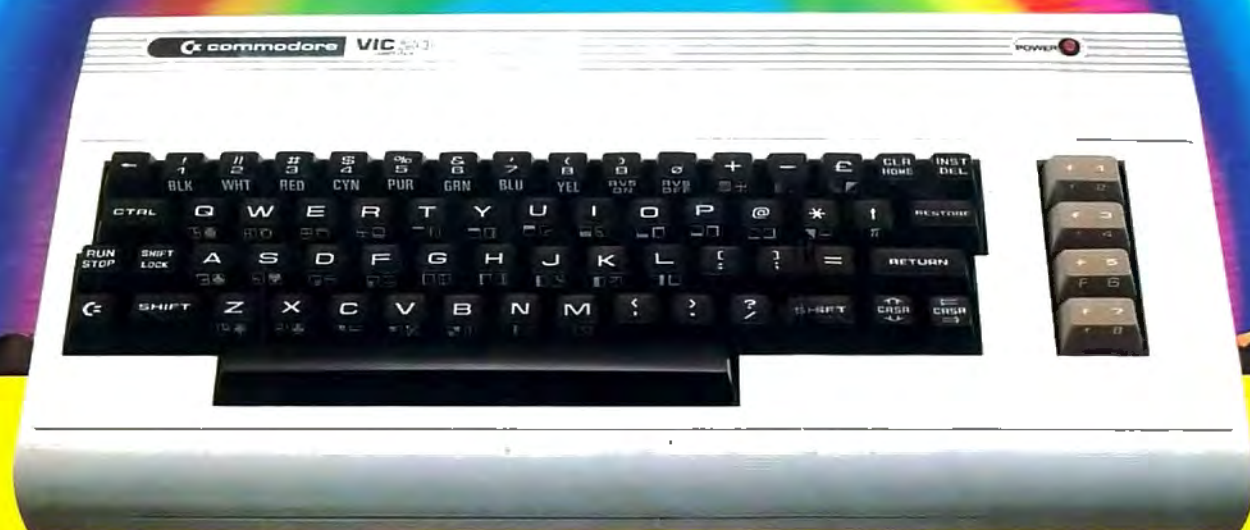
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