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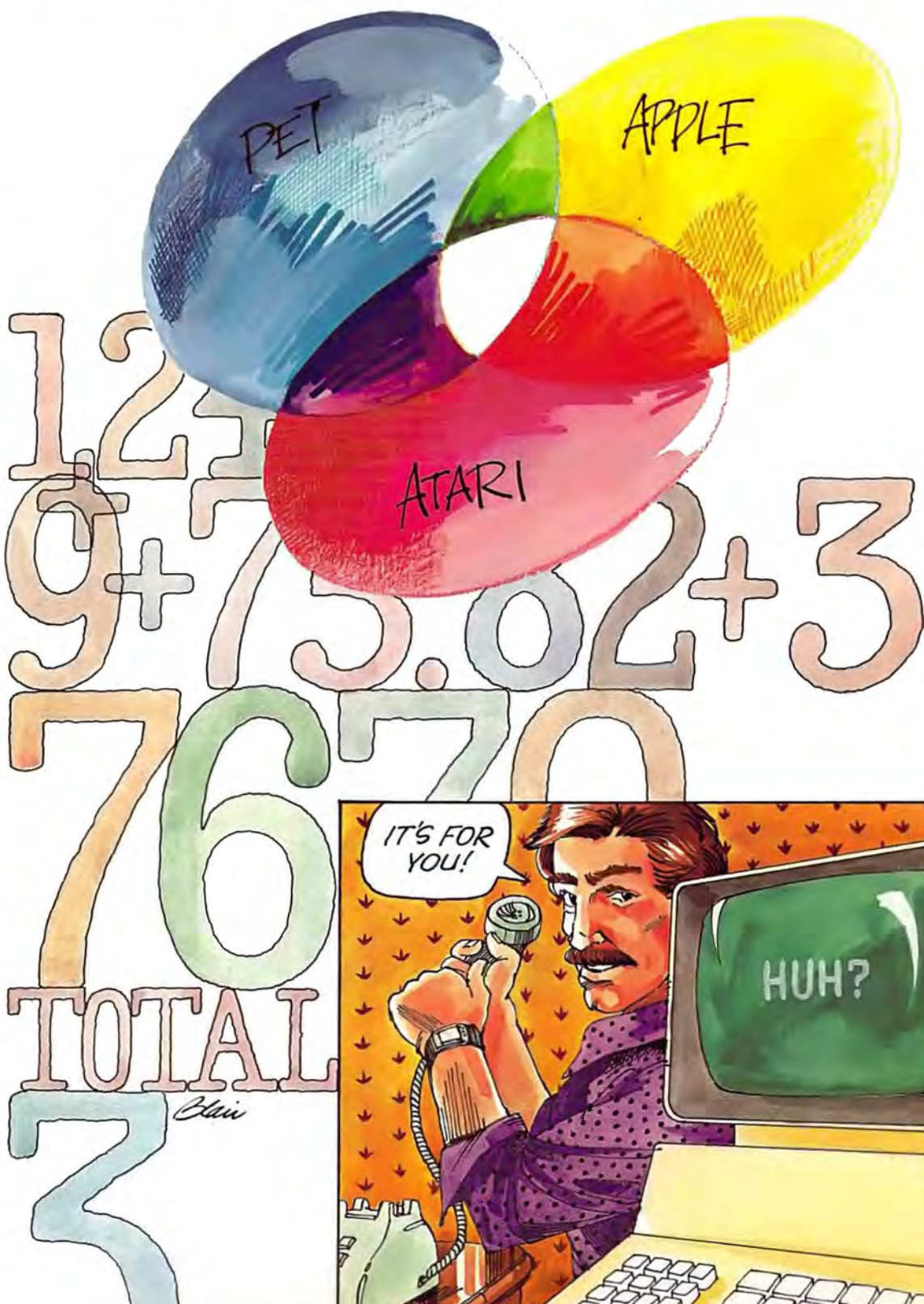
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The Journal For Progressive Computing™

**PET, APPLE,
ATARI: On
Speaking Terms**
Converting BASIC
Programs

**The Column
Calculator**
A Screen Scrolling
Calculator For
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**What Is A
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An exciting new monthly column from some of the authors of Atari Basic.



Comprehensive

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COMPUTE!

The Editor's notes...

Robert Lock, Editor/Publisher

THANKS! ... for your response with the Authors' Feedback cards. As you know, we've been slowly (but surely!) moving our production schedule up. We've been undergoing other expansion as well, and welcome Charles Brannon to our staff as Editorial Assistant.

Our general section has been tremendously enhanced this issue by the addition of in-house generated versions of programs for multiple machines.

Computers And Society

Regardless of your interests, don't miss David Thornburg's column this issue. The program presented is fascinating and intriguing. After you test it for a while, drop us a note. We'll put together some of your reactions in an issue later in the fall.

The Power Of Brevity

We've used David's introductory program to help define the rest of our issue this time. You'll find short, extremely powerful programs in the later articles.

And The Beauty Of Length

Our Atari readers will be happy to find what we feel is the most comprehensive Atari memory information ever published by a magazine. It's all embedded in the program titled SHOOT, and we're quite excited by the wealth of information. We had planned to hold it for *COMPUTE!'s First Book of Atari*, but Richard and Charles were too excited to wait and I deferred to their enthusiasm.

Writing For COMPUTE!

On page 54 you'll find our style sheet, with instructions and guidance for those of you interested in adding your contribution to **COMPUTE!** Needless to say, your contribution as readers is appreciated. We recently sent reader surveys out to 1,352 randomly selected subscribers. The response? Overwhelming. As of this writing, our return rate is approaching 70%. Thank you all for taking the time to answer, and a special thanks to the three of you who somehow, missing the postage paid return envelope, supplied your own.

Bit Copiers Revisited — A Resurgence?

Several months back we noted some of the problems

associated with the wave of duplicating software coming into the marketplace. At that time we also discussed the needs the user/consumer regarding the right of back-up. The revised copyright law (amended December 12, 1980) clearly reinforces the right of the owner of a copy of a program to make "archival" or back-up copies. (See full text from last issue's editorial.)

If the software houses currently marketing copy-protected software don't move to establish clearly consumer-protective back-up rights, we would expect to see a growing, and quite legitimate market for programs such as Locksmith. We'd be interested in hearing of existing vendor approaches to the problem of user back-up. ©

Coming In October: COMPUTE! Overviews

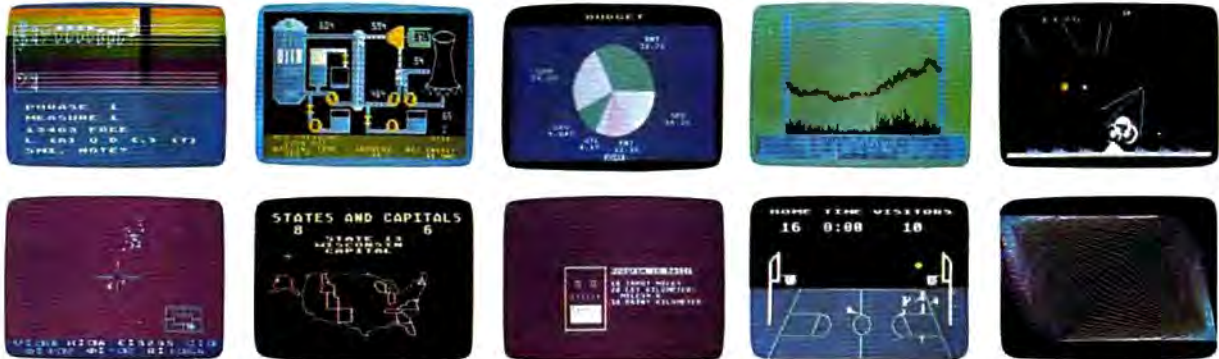
COMPUTE! has a new idea in software reviews. We call it the Overview. The October **COMPUTE!** will feature a comparative review of two major word processors for the Atari: Letter Perfect and Text Wizard. **COMPUTE!**, in an effort to provide useful, objective reviews, has assembled panels of reviewers whose independent opinions will be merged into a single, large review, a **COMPUTE!** Overview.

The panelists were selected for their special knowledge of the target environments of the software they will test and analyze: doctors will examine medical packages, lawyers legal software, and so forth. We hope that the new, multiple-reviewer Overview will offer the readers of **COMPUTE!** the most balanced and comprehensive analysis possible. We expect that **COMPUTE!** readers will then be able to make informed, cost-effective software purchases. Look for the Atari word processors Overview in the October **COMPUTE!**.

Kathleen Martinek
Review Coordinator

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*ATARI 800™ computer only.

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Ask The Readers

Robert Lock, Richard Mansfield
And Readers

Thanks to the many **COMPUTE!** readers who sent in answers, this month's column contains both new questions and answers to questions raised in previous issues.

Answers:

"I am writing in response to the question posed by "A Reader" about how to modify 'Index' by David Wilcox to work on the new 4.0 CBM machines (**COMPUTE!** #14). I use this program extensively on my C-30 cassettes and, when I got a new CBM machine recently, I had the same problem. The fix only requires two changes on line 210 of the 'Index' program. Line 210 checks the #1 cassette status switch with a PEEK(519) and sets it and the cassette motor control register so the motor is off. The problem with the new 4.0 machines is that the cassette status switch has been moved. The only change needed to fix 'Index' for new machines is to change the PEEK(519) and POKE 519,52 on line 210 to PEEK(249) and POKE 249,52 respectively." David Swaim

"I would like first to respond to Tracy Principio's question about full screen graphics on the ATARI: creating any sort of graphics display in machine language requires rewriting the display list, which unfortunately, is a topic which is beyond the scope of my letter. (Boy, that sounds like a cop out, doesn't it?) I would refer Tracy to issue #6 of **COMPUTE!** page 71 for an excellent article on the subject.

Another question is particularly bothersome to me because I own an APPLE myself and I don't believe it is possible to make the "mistake" of buying an APPLE. Several things can be done to reduce radio frequency (rf) interference on APPLES. Most interference comes from the use of rf modulators. Often, using a video monitor with a short, shielded cable will cure the problem." Erann Gat

Questions:

"I recently got a Commodore VIC-20 computer and I have been absolutely delighted with it (even with the limitation of a twenty-two character line). However, I ran into a problem that perhaps somebody can help me with.

I have a program that executes in two phases. Phase I is 'saved' on a cassette tape and is followed immediately with Phase II which has also been 'saved.' During execution, Phase I completely finishes and at the end, the last instruction executed is:

9999 LOAD "PHASE II"

Everything seems to work alright except that it doesn't

completely load the second phase and I end up with 'undefined errors' because of the truncated program. Yet, if I load the second phase manually, (i.e., by entering the immediate command, "LOAD PHASE II"), it will load successfully.

Does anybody know what's wrong? I have tried everything but cannot get it to work. Please help!" Stanley Berlin

When one program "overlays" another, the first program must be longer than the second. When you ask for a ?FRE(1), the number must be larger for the program which calls a second program in.

"Can anyone tell me where to locate the producers or a copy of the manual for Altair 8800b Microcomputer System operating under Altair's Revision 4.1 of their Disk Extended BASIC?" Reinaldo Jimenez

"I have an interesting question to raise. As we have all come to accept by now, there isn't going to be a next generation 6502; a 6516, a 6509, or whatever you want to call it. There are some who feel that it will be around for a long time to come. Others think it will fade rapidly in the face of newer machines that have finally begun to emulate some of its advanced features, and outperform it.

The question is, then, should 6502 fans go down with their ship, or hop a ride on another? If the choice is the latter, is there a better alternative than the 6809? Already there is at least one 6809 card available for the APPLE II. The TRS-80 model III uses the 6809. Commodore is making a 6809 card available for its new mini-mainframe computers. Synertek is now offering a plug-in module to replace the 6502 in the SYM board, complete with the SYM's beautiful operating system.

For those using assembly language, the change from 6502 to 6809 is not that traumatic, since both descend from the 6800. In some ways, 6502 users will adapt easier than 6800 users to the 6809, since they are already used to indirect addressing. For those using BASIC or another High Level Language (HLL), the change is painless, since the HLL is transparent to the processor anyway.

For both kinds of users there are some definite performance advantages to the 6809. The trend in hardware is to build processors that can more directly handle HLLs. While the 6809 is still rather conventional, its second "user" stack provides a significant edge over the 6502 for implementing threaded languages like FORTH.

The next logical question is: should **COMPUTE!** expand its horizons and begin to provide information and articles about the 6809 and 6809-based systems? That's a tough one. Perhaps the readers should be allowed to respond and say what they think. The time to start considering this question is now." Eugene M. Zumchak

We're not necessarily prepared to accept the point that there will be no second generation 6502; nonetheless Gene Zumchak, a **COMPUTE!** columnist, raises an important issue here. Let us know what you think. Anyone voting for the Motorola 68000? ©



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Computers And Society

David D. Thornburg
Los Altos, CA

A Few Thoughts On Thinking ...

As readers of this column may have noticed, I have thus far avoided writing about machine intelligence. There are several reasons. For one thing, this topic is discussed with great regularity in other magazines ranging from highly technical computer and psychology journals to mass market magazines such as *Time*. Hardly a week goes by, it seems, without some solemn pronouncement emanating from the University of Wherever that the medium for the next evolutionary step in intelligence will be the silicon chip.

Many of those who forecast this extraordinary development have been making the same prediction for years. The controversy surrounding the mechanization of intelligence is not new. In fact, one of the earliest major discussions on this topic took place between Charles Babbage (inventor of the Analytical Engine — the precursor of the modern digital computer) and Ada Byron (Lady Lovelace) in 1842. Lady Lovelace worked closely with Babbage, and became the world's first "systems programmer." Babbage was of the opinion that his machine would have a feeling for numbers, that it could someday be made to think. Ada Bryon disagreed with him most strongly on this issue.

Many of you are probably saying to yourselves, "So what?" After all, the philosophical issue of machine cognition doesn't affect the utility of computers, so the "mechanized brain" controversy doesn't have much practical impact on anyone.

Well, maybe it doesn't, and then again maybe it does. One of the characteristics of human beings which separates us from toadstools is our ability to question the origins and nature of our own existence. The fervor with which people agree (or disagree) with the idea that computers can be made to think suggests that, regardless of practical issues, this philosophical question is quite important to many people.

I have two reasons for spending some time on this subject this month. First, it was my pleasure to be a panelist on this topic at the National Computer Conference held in Chicago last May. The spirited debate between David Ahl, Ernest Kent, and myself gave me much to think about. Second, I recently read a short story which resulted in a computer program which raises some interesting questions on the nature of intelligence — human or otherwise.

The question, "Can Machines Think?" was the topic of a panel chaired by Abby Gelles at the Personal Computing Festival held in conjunction with the NCC in Chicago. David Ahl, publisher of *Creative Computing*, presented the view that machines couldn't think because the richness and depth of human experience was too great for any machine to handle. Basically, the absence of a social, historical, and evolutionary context creates fundamental limitations on the capability of mechanized thought. Furthermore, Ahl suggested that thought and "feeling" are related. To have a conscious thought first requires consciousness. It is as ridiculous to suggest that a machine could "think" as it is to suggest that a machine could "feel" loneliness or love.

The controversy surrounding the mechanization of intelligence is not new.

The second speaker on the panel was Ernest Kent, a professor of psychology and psychopharmacology at the University of Illinois (Chicago). Kent's view (which is also expressed in his fine book *The Brains of Men and Machines* (Byte Books, 1981)) is that the brain is a machine, and that the mind and the brain are one and the same thing. Kent's book presents a model of the human brain which is quite understandable to computer-literate readers, since it deals with an electronic computer simulation for the brain's activity. Even if one rejects the idea that computers can be made to exhibit conscious thought, there is merit in exploring the limits of mechanized models of the brain. After all, our knowledge of the aerodynamics of bird's wings helped man to build flying machines, even though these machines do not fly the way birds do.

In opposition to David Ahl, Kent suggested that there was much evidence for the mind and the brain being one and the same thing. For example, electrical measurements of brain activity can be traced to specific thoughts. Furthermore, Kent said that feelings were not as mysterious as Ahl would have us believe. He said that he knew just where to probe in Ahl's brain to elicit a "feeling," and that, if the probe signal were strong enough, he would never experience that feeling again.

While I found much of Kent's work on a model for the brain quite fascinating — especially his idea that the model consists of many millions of processors all highly interconnected with thousands of

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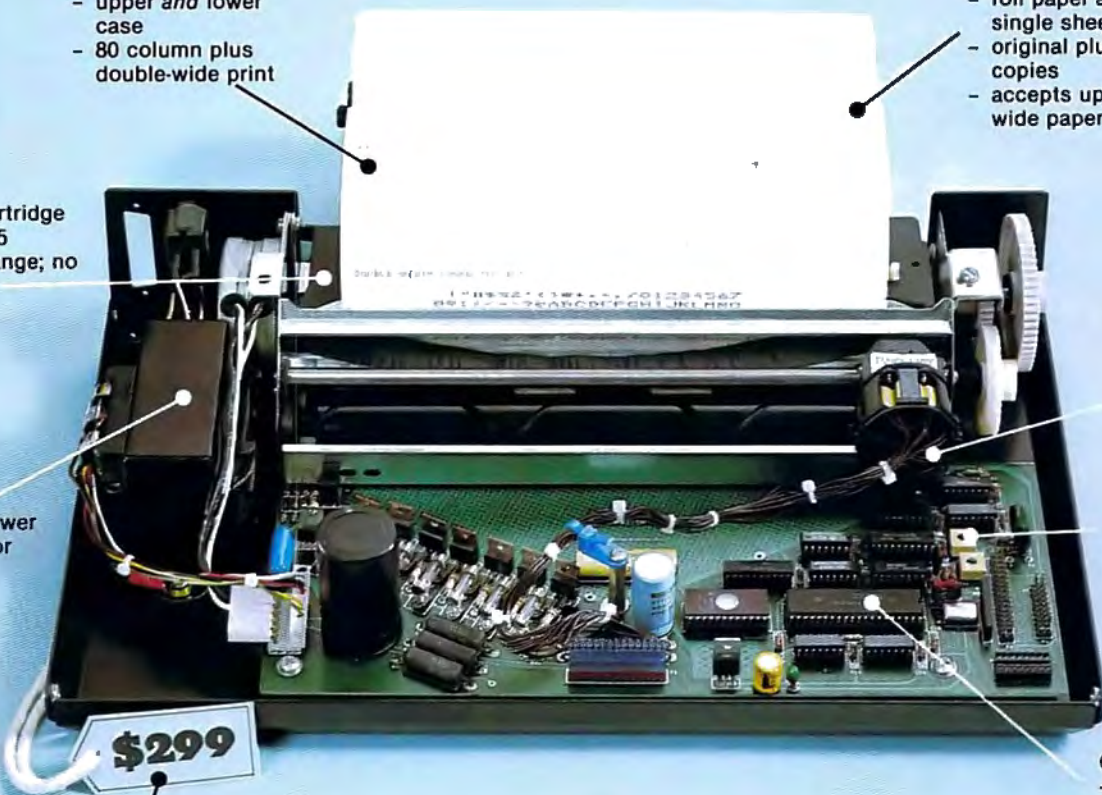
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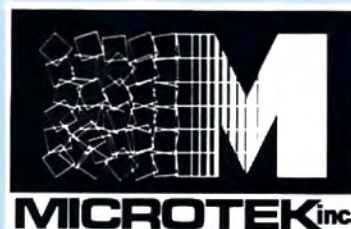
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their neighbors — his suggested connection between the brain and the mind bothered me.

In my talk, I suggested that someone who had no prior knowledge of radios could study one and draw a most interesting conclusion. To someone who knew nothing about radio transmission, the radio appears to have two parts — its physical embodiment, and the programming which comes out of the loudspeaker. After careful study, our naive person has decided that the radio and its programming are one and the same thing. For

Twenty Questions: Atari Version

```

100 REM *20 QUESTIONS
105 DIM A$(40),B$(6)
110 PRINT "WELCOME TO THE GAME OF TWENTY"
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

```

example, the music coming out of the loudspeaker can be traced throughout the radio as it is being played. Furthermore, our new radio expert may have discovered that a probe signal in certain areas of the radio will elicit a response and that, if the signal is large enough, the radio will never have that response again.

I am not suggesting that the radio/program brain/mind analogy is perfect. After all, we can isolate the radio from its programming in a special room called a Faraday cage. But my point is that just because "thoughts" can be traced in that portion of the brain which we can model, we still have no proof that the mind and the brain are one.

**... we still have no
proof that the mind
and the brain
are one ...**

As usual, this panel didn't resolve anything; but did raise some challenging issues. I would have been happy to let the topic die at this point had I not received another interesting book, *Tales of the Marvelous Machine, 35 Stories of Computing*, edited by Robert Taylor and Burchenal Green (Creative Computing Press, 1980). This book is a collection of short stories, some of which first appeared in *Creative Computing*. While much of this book is very interesting, I was particularly taken by the story "XX?S" by Brian McCue. In this story, a computer science teacher is asked to run a program which plays the game of "twenty questions." In an effort to find the object chosen by the computer, the teacher asked quite detailed questions which the computer answered with a YES or a NO, as appropriate. As the play continued, the teacher became intrigued with the apparent cognitive skills being displayed by the machine. The computer was able to answer a complex question like: WAS THE OBJECT INVENTED PRIOR TO THE YEAR OF OUR LORD MCX. The machine's ability to respond, NO, startled the teacher. Even the use of Roman numerals and elaborate dating schemes couldn't throw the computer off track. Finally, after finding the correct answer (The Wright Brother's airplane), he tried unsuccessfully to list the program. What he *did* discover was that the program was only one disk sector long.

This seemed most strange, since programs which purport to have some understanding of natural language are typically too large to run on any microcomputer.

After finding the key to the solution, I wrote my own version of this program. A typical run is

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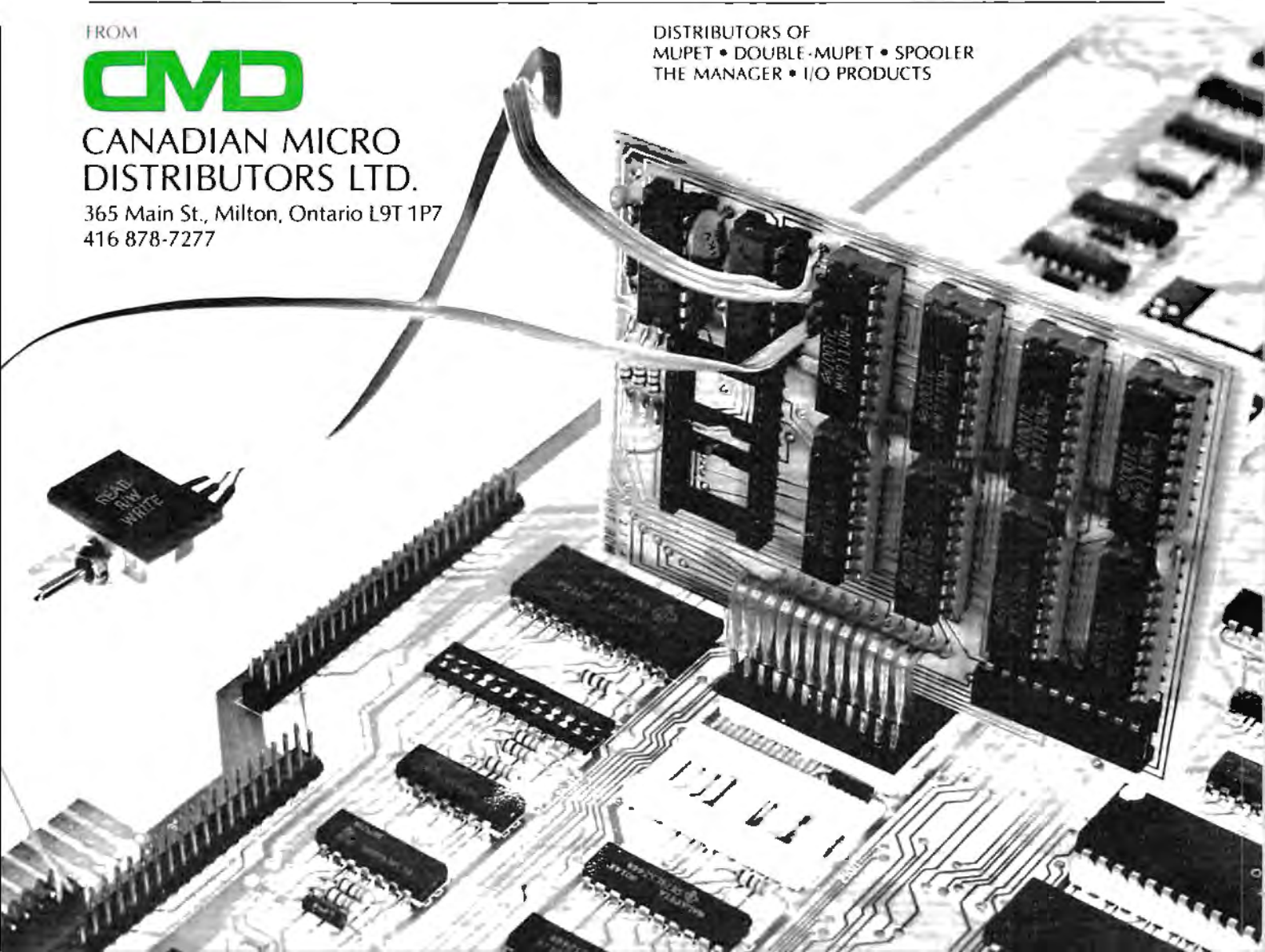
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shown below:

ENTER QUESTION 1

Is it mineral?
NO

ENTER QUESTION 2

Is it vegetable?
YES

ENTER QUESTION 3

Does it grow under the ground?
NO

ENTER QUESTION 4

How about above?
YES

ENTER QUESTION 5

Are you sure?
YES

ENTER QUESTION 6

OK, is it coniferous?
NO

ENTER QUESTION 7

Does it grow on a tree?
YES

ENTER QUESTION 8

Is it green?
NO

ENTER QUESTION 9

Are people likely to make juice from it?
NO

ENTER QUESTION 10

Is it a black olive?
YES

As you can see, the right answer was found in only ten tries. The apparent language-understanding ability of this program has startled many of the people to whom I have shown it. For example, most computer scientists know that it is non-trivial to have a computer figure out that our question 4 is a modification of question 3. Some people have felt that, except for the occasional lengthy pauses between question and answer, they couldn't tell if they were playing against a computer or a human player.

By what magic does one generate artificial intelligence in such a tiny program?

By not doing anything of the sort!

The following is the complete listing (in Atari PILOT) of the program I wrote:

***20 QUESTIONS**

T:WELCOME TO THE GAME OF TWENTY QUESTIONS. BY ASKING/

T:QUESTIONS WHICH HAVE YES OR NO ANSWERS, TRY TO GUESS THE/

T:OBJECT WHICH HAS BEEN SELECTED.

T:

T:BE SURE TO END EACH QUESTION WITH A QUESTION MARK.

T:

T:

C:#C=0

***ROUND**

C:#C=#C+1

***QUESTION**

T:ENTER QUESTION #C

A:

M:?

TN:THAT ISN'T A QUESTION. PLEASE ASK A QUESTION.

JN:*QUESTION

M:A?,E?,I?,O?,U?,Y?

PA:? 150 [random program delay of up to 149 "jiffies"]

TY:YES

TN:NO

T:

J(#C<20):*ROUND

T:END OF TWENTY QUESTIONS. PRESS RETURN TO START AGAIN.

A:

J:*20QUESTIONS

E:

As you can see, the program is quite simple. Each question is first examined for a question mark, and is then examined (by the match command in the 17th line) to see if it ends in any of the letters A, E, I, O, U, or Y. After a random pause (the machine's "thinking" time) the answer YES is printed if a match was found. Otherwise the computer prints the word NO. (If you convert this program to BASIC, you might just want to check for words ending in E, as McCue did in his story.)

Once people see how simple this program is, they realize that they *were* playing twenty questions with an intelligent being — themselves. After all, if you asked if the object was a person and the computer said NO, you wouldn't be very inclined to ask if it was a person named Dave (to which the com-

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puter would, of course, say YES). The "sense" of this program perfectly matches that of the player. It is your knowledge of objects such as trees, and that olives grow on trees, and that olives can be black, which makes the game work. The computer doesn't know anything.

The reason this is relevant is because some people who have seen programs of this type, and programs which produce computer generated poetry, feel that this is an example of mechanized "creativity," and thus an example of artificial intelligence.

There is not much effort required to write a program which generates certain poetic forms, choosing words from the appropriate parts of speech at the right time, *etc.* But, if the result is "poetry," it is only because the human reader has decided that it is. It is the stimulation of the reader's feelings by the computer-generated text strings which gives life to a poem.

As for my personal feelings on the likelihood of there ever being a "thinking" computer, I have to agree with Ada Bryon who, in a note to Charles Babbage, writes:

It is desirable to guard against the possibility of exaggerated ideas that might arise as to the powers of the Analytical Engine. In considering any new subject, there is frequently a tendency, first, to overrate what we find to be already

interesting or remarkable, and secondly, by a sort of natural reaction, to undervalue the true state of the case when we discover that our notions have surpassed those that were really tenable. The Analytical Engine has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform. It can follow analyses; but it has no power of anticipating any analytical relations or truths. Its province is to assist us in making available what we are already acquainted with.

Now *that's* something to think about!

Twenty Questions: Microsoft Version (Pet, Apple, etc.)

```

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.
```

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The Beginner's Page

Richard Mansfield
Assistant Editor

Initialization

As you begin to develop a feel for programming, you will probably notice that there are four parts to most programs: initialization, main loop, subroutines, and data. In the last issue (**COMPUTE!** #14) we examined subroutines. Let's take a look at the other three parts.

If you picked several programs at random, spread them out on a table, and compare them, you would probably see certain similarities. Programs usually require some preliminary setups: variables need to be defined or DIMensioned, REM statements document (explain) what the program is going to do, the screen needs to be cleared, and so on. Before getting on with its main task (the main loop), a program will frequently need to perform preliminary jobs. This first part of a program is called *initialization*. Here is a little program which prints the names and addresses of people to whom you want to send Christmas cards. It will illustrate the four divisions of computer programs:

```

10 ADDRESSES = 3                (Initialization)
20 FOR I = 1 TO ADDRESSES      -----
30 GOSUB 1000                  (Main Loop)
40 GOSUB 2000
50 NEXT I
60 END -----
1000 READ NAME$(I)
1010 PRINT NAME$(I)
1020 RETURN                    (Subroutines)
2000 GET K$
2010 IF K$ = "" THEN GOTO 2000
2020 RETURN -----
5000 DATA MYRTLE FACE / 121 TYRONE PIKE /
      NEW YORK NY 10020
5010 DATA CARL MENEFFEE / 36 HAWERD ST. /
      ALAMEDA CA 92171
5020 DATA FELICE MONTREAL / 15 ACE ST. /
      RAMADA IL 80221

```

(For the Atari, add 15 DIM NAME\$(80) and change lines: 1000 READ NAME\$ 1010 PRINT NAME\$).

Some aspects of initialization are obvious: if the program is designed to organize your Christmas card mailing list, it will need to know the total number of addresses it has on file. Part of the initialization can involve the definition of a variable which "knows" this total (line 10). Program initialization includes putting necessary information into variables, clearing the screen, defining sound, color, format (how the video or printed output will appear), and so on.

Main Loop

Often the largest section, and certainly the heart of every program, is the main loop. Like a business

executive, the main loop has a job to do and sees that the assistants (the subroutines) perform their tasks correctly and in the correct order. The main loop moves down its list of subroutine jobs until the primary goal is achieved. In our example program (Christmas Card List), the primary goal is a screen display of addresses to be handwritten on the envelopes. To achieve this, the program must: 1) Read a name from the DATA table, 2) print the name and address on the screen, 3) wait until you press any key to allow it to continue, and 4) loop back to job number one.

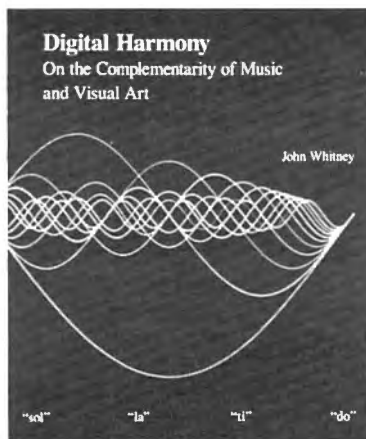
These four jobs can be thought of as subroutines which are governed by the main routine (main loop). This executive routine, ordering and supervising its several subroutines, is often a true "loop," but need not be. That is, it often does its job over and over, looping (cycling) through the subroutines each time. Some programs only do one thing after another down a list. They do not loop. But looping is one of our major programmer's tools and most tasks lend themselves to the loop structure.

Data

Lists, arrays, tables, data base, data, DATA statements, fields, records — each of these terms are taking on specific meanings as computer jargon slowly evolves into a vocabulary of fixed meanings. But at this point in the creation of a universal terminology for computing, words are somewhat imprecise. The terms above, nonetheless, have something in common — all refer to *raw information*. The accepted word is *data*. Raw information is to a computer what raw materials are to a factory. Visualize a paper factory. Imagine that somewhere in the building (or stored nearby) is a pile of logs to be processed by the factory. At the other end of the building, the finished product, paper plates, drop onto trucks. In the same way, computers *process* information. Somewhere in the program (or stored nearby on tape or disk files) is a pile of raw information — names and addresses in our example program.

The data are *input* into the program and are processed into some computer-made product. This product is then *output* somewhere. Our Christmas program sends its product to the screen, but it could easily output to a printer which would address the cards for us. In any case, data sits in piles waiting to be computed. One of the advantages which information processing has over log processing is the ease with which new products can be generated. Inserting an alphabetizing subroutine into the Christmas program, and making a slight change to the main loop, will result in an alphabetized product. Likewise, slight changes would transform the Christmas Card Address Factory into a birthday list, a telephone directory, a record of gifts sent and received, etc..

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John Whitney is on the Faculty of the Department of Art at the University of California, Los Angeles

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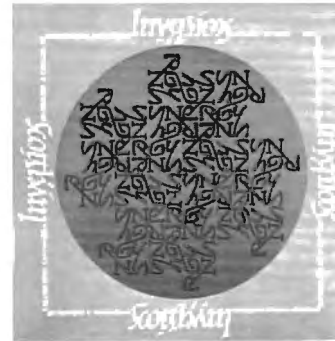
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What Is A MODEM, And Why Do I Need One?

Michael E. Day
West Linn OR

Getting The Information Across

MODEM is a descriptive acronym for the device that the name is applied to. MODEM stands for MODular-DEModulator. A MODEM is used to transmit digital information such as that used by computers to a remote location. Remote in this case meaning a device not directly connected to a computer, as the remote connection can be anywhere from 6 inches away to 6 billion miles away.

Digital information, in its own controlled environment has the highest form of redundant reliability of any means of signal processing. This is because, since the signals consist of 1's and 0's (on or off), any interference which might cause a slight change of signal level so that it becomes "slightly on" is ignored, as the level is still not above the point where a 1 is assumed. This differs from an analog system where any interference is propagated through the entire system.

Since the computer only recognizes a 1 or a 0, there can be no percentage errors encountered in the signal. The information is either right or it is wrong.

An error can be detected by adding an additional piece of information to the transmission. This is called parity. Under parity control the digital information is divided up into small groups (normally on a per-character basis), and the number of 1 bits in the group are added up. In the even parity system, if there were an even number of 1 bits, then an additional 1 bit is added to the group, otherwise a 0 bit is added. In odd parity a 1 bit is added if there were an odd number of bits and a zero otherwise.

At the receiving end the receiver adds up the bits and compares its answer to the parity bit that was sent, and if there was a difference, it flags the receiving device that an error has occurred.

The parity method will catch the loss of single bits. However if more than one bit is lost, it will not always catch it. So, for large blocks of information a checksum is sometimes used. In checksumming, as each character is received it is added to the sum of the previous characters with the final sum being

transmitted after the last character in the block has been transmitted. The receiver then compares this with its own sum and flags the receiving device that an error has occurred if there is a difference between the two. This type of error checking will catch about 99% of the errors encountered.

This is fine if an occasional error can be accepted. Sometimes this is not the case and every possible error must be detected to ensure the highest possible reliability. This might be required in a binary coded program being transmitted. In this case a CRC check is used. CRC (Cyclic Redundancy Check) is a special coding scheme that is different than the checksum, and can achieve better than 99.9% error detection.

**Digital information...
has the highest form of
redundant reliability of
any means of signal
processing.**

In all of these cases only error detection is considered. In some cases it is desirable to be able to recover the lost information. This is often a requirement inside large computer systems where no loss of data can be tolerated. In this case a Hamming code is used. In this technique, instead of a single bit being added, the length of which is dependent upon how much correction is desired; for single bit recovery, 5 bits must be added to every 32 bits of information. This will also catch all possible 2 bit data losses, and most other combinations of losses. By looking at the codes the receiving device can reconstruct the lost information and thereby remove the need to retransmit.

Generally, even parity is used in asynchronous transmissions (such as that used with a 103 or 202 type MODEM) whereas odd parity is used in synchronous transmissions (such as that encountered with the special high speed MODEMs: 2400 baud and above).

In conversational type transmissions parity is quite often not used (the parity bit being replaced with a 1 bit; to simulate a stop bit).

In block text transmissions (such as a BASIC program) it is recommended that parity be used so that any errors that might occur will be caught.

When transmitting a hex dump it is also a good idea to add a checksum to the code, as it is very difficult to see errors in this type of text. (Note: normally parity is always used when checksumming is used.)

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When binary information is being sent (non-ASCII), such as a binary core dump, a CRC check should be used (parity is normally *not* used with CRC checking), as it is very important to catch all possible errors since this type of code is essentially unreadable.

The Hamming codes are normally used with stored information where recovery or retransmission of the data is not directly possible.

All this attention to error detection is important. The computer is a very controlled environment; it is built to prevent any interference from affecting its operation. Outside the computer however, we must deal with the real world where interferences abound. Since this interference cannot be prevented, a means of detecting must be used so that the errors generated can be corrected.

How The MODEM Works

Since the telephone network was designed for analog voice transmission, it is not possible to transmit digital information from a terminal or a computer in its binary form. The telephone network has a bandwidth of approximately 3000 Hz, so the modems used on the telephone network must condition signals to fit within this band.

Communications terminology can be confusing. When the term 'communication mode' is applied to modems the following nomenclature is used:

SIMPLEX: Transmission in one direction only with no way of responding. A TV set is a form of simplex communication.

HALF DUPLEX: Transmission in two directions, but only one way at a time. CB operators either transmit or receive, but cannot do both simultaneously on a single channel. At the end of transmission it is necessary to advise the other party when through transmitting and ready to receive by saying "over". Then the other operator can begin transmitting.

FULL DUPLEX: Transmission in both directions simultaneously. A personal face-to-face conversation is a form of full duplex communication, where both persons can speak and listen at the same time. (Note: ASCII standard full duplex implies that the same data rate exists in both directions simultaneously, i.e., 1200/150 bps is not full duplex, 300/300 is full duplex. When operating at two different speeds, the slower speed is usually referred to as the secondary or reverse channel, or sometimes as the supervisory channel, while the higher speed is the primary channel.)

The half duplex mode control signals are generally required to turn the modem transmitter on or off, and the receiver off or on depending on the direction of transmission, whereas this is generally not required when operating in the full duplex mode.

Terminal manufacturers often use the terms half duplex and full duplex to mean whether local copy is provided, or whether the far end loops back (echoplexes) that which was transmitted. The presence or absence of local copy has nothing to do with the communications mode of the data link.

The strength of the signal that is injected into the phone lines is important, as a weak signal will not have enough power to overcome the noise and interference inherent in the system, while too strong a signal will overdrive the capabilities of the system and cause the signal to become distorted. The signal strength (measured at the phone line) should not exceed 0 dbm (2 volts peak to peak into a 600 ohm load), and transmission levels below -12 dbm (0.5 volts peak to peak) should be avoided. A transmission level between -6 dbm (1.0 volts p-p) and -9 dbm (0.75 volts p-p) is recommended for the best transmission level with the least amount of interference to the received signal.

At the receiving end, the signal may be significantly reduced in strength, and may be received at full strength (0 dbm, 2.0 volts p-p) or at a very reduced strength (-50 dbm, 0.01 volts p-p). Signals below -50 dbm are generally not recoverable, as the signal drops below the background noise and becomes very difficult to detect. Some modems do not recover signals below -40 dbm (0.02 volts p-p) as it becomes much more difficult to recover the signal below this level and less than 10% of all calls require this much sensitivity. (Note: A signal at -40 dbm would be barely audible.)

The modem operates by changing the digital signal that is presented to it to an audio signal that can be placed on the phone line. The type of modem determines the exact method by which the signal is converted, and the frequencies that are used.

There are many different types of modems, with each type designed to perform its particular function most efficiently. Because of the large number of different modems, only those modems which are of particular interest to the hobbyist will be discussed, those being the BELL 103 compatible, and the BELL 202 compatible modems. The 103 type modems are the most common and are the type used on most timeshare systems. These modems are designed to operate at transmission rates from 0 to 300 bps, with some of them capable of operating as high as 600 bps. A substantial increase in error rate should be expected at these higher speeds. The 103 type modem operates by changing a digital 0 to a frequency of 1070 Hz if in the originate mode, or 2025 if in the answer mode. It changes a digital 1 to a frequency of 1270 Hz if in the originate mode, and 2225 Hz if in the answer mode.

Since it is not possible to transmit two signals at once at the same frequencies and derive any intelligence from the received signal, the available

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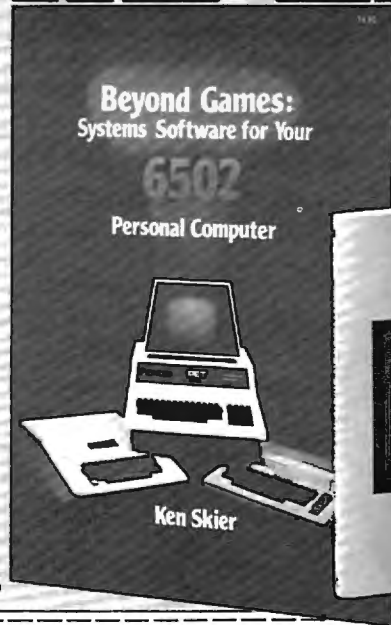
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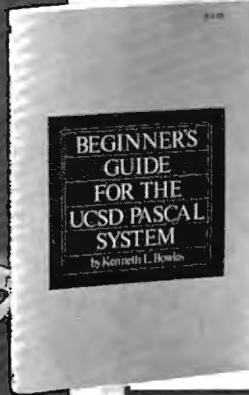
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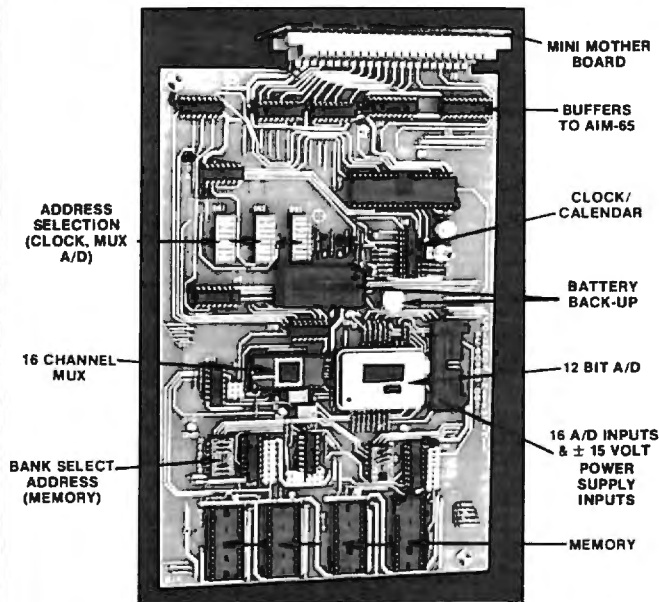
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An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high, the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice. See the software review in 80 Software Critique.

HEARTS 1.5 (Available for all computers) Price: \$15.95 Cassette/\$19.95 Diskette

An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies. HEARTS 1.5 is an ideal game for introducing the uninitiated (your spouse) to computers. See the software review in 80 Software Critique.

STUD POKER (Atari only) Price: \$11.95 Cassette/\$15.95 Diskette

This is the classic gambler's card game. The computer deals the cards one at a time and you (and the computer) bet on what you see. The computer does not cheat and usually bets the odds. However, it sometimes bluffs! Also included is a five card draw poker betting practice program. This package will run on a 16K ATARI. Color, graphics, sound

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 these players (you will get to know them) has a different personality in the form of a various 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.

CRIBBAGE 2.0 (TRS-80 only) Price: \$14.95 Cassette/\$18.95 Diskette

This is simply the best cribbage game available. It is an excellent program for the cribbage player in search of a worthy opponent as well as for the novice wishing to improve his game. The graphics are superb and assembly language routines provide rapid execution. See the software review in 80 Software Critique.

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Atari, North Star and CP/M only) Price: \$19.95 Cassette \$23.95 Diskette

This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which 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 airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS.

VALDEZ (Available for all computers) Price: \$15.95 Cassette/\$19.95 Diskette

VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 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 region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software review in 80 Software Critique

BACKGAMMON 2.0 (Atari, North Star and CP/M only) Price: \$14.95 Cassette/\$18.95 Diskette

This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play 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 is played in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

CHECKERS 3.0 (PET only) Price: \$16.95 Cassette/\$20.95 Diskette

This is one of the most challenging checkers programs available. It has 10 levels of play and allows the user to change skill levels at any time. Though providing a very tough game at level 4-8, CHECKERS 3.0 is practically unbeatable at levels 9 and 10.

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 castling, 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.

LEM LANDER (32K Apple Disk only) Price: \$16.95 Diskette

Pilot your LEM LANDER to a safe landing on any of nine different surfaces ranging from smooth to treacherous. The game paddles are used to control craft attitude and thrust. This is a real-time high res challenge!

FOREST FIRE! (Atari only) Price: \$16.95 Cassette/\$20.95 Diskette

Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Lift-like variables are provided to make FOREST FIRE! Very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty

NOMINOES JIGSAW (Atari, Apple and TRS-80 only) Price: \$16.95 Cassette/\$20.95 Diskette

A jigsaw puzzle on your computer! Complete the puzzle by selecting your pieces from a table consisting of 50 different shapes. NOMINOES JIGSAW is a virtuous programming effort. The graphics are superlative and the puzzle will challenge you with its three levels of difficulty. Scoring is based upon the number of guesses taken and by the difficulty of the board set-up

MONARCH (Atari only) Price: \$11.95 Cassette/\$15.95 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.

CHOMP-OTHELLO (Atari only) Price: \$11.95 Cassette/\$15.95 Diskette

CHOMP-OTHELLO? It's really two challenging games in one. CHOMP is similar in concept to NIM, you must bite off part of a cookie, but avoid taking the poisoned portion. OTHELLO is the popular board game set to fully utilize the Atari's graphics capability. It is also very hard to beat! This package will run on a 16K system.

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STARTREK 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 when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

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 TILT (Apple and Atari only) Price: \$18.95 Cassette/\$14.95 Diskette

Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple! Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

MOVING MAZE (Apple only) Price: \$10.95 Cassette/\$14.95 Diskette

MOVING MAZE employs the game paddles to direct a puck from one side of a maze to the other. However, the maze is dynamically (and randomly) built and is continually being modified. The objective is to cross the maze without touching (or being hit by) a wall. Scoring is by an elapsed time indicator, and three levels of play are provided.

ALPHA FIGHTER (Atari only) Price: \$14.95 Cassette/\$18.95 Diskette

Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems

THE RINGS OF THE EMPIRE (Atari only) Price: \$16.95 Cassette/\$20.95 Diskette

The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) Price: \$16.95 Cassette/\$20.95 Diskette

This is a fast paced graphics game which places you in the middle of the "Dreadnaught" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

GIANT SLALOM (Atari only) Price: \$14.95 Cassette/\$18.95 Diskette

This real-time action game is guaranteed addictive! Use the joystick to control your path through slalom courses consisting of both open and closed gates. Choose from different levels of difficulty, race against other players or simply take practice runs against the clock. GIANT SLALOM will run on 16K systems.

TRIPLE BLOCKADE (Atari only) Price: \$18.95 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(s), 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/\$14.95 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/\$14.95 Diskette

GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded on one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

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DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 40 countries). During the past two 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 and A.N.A.L.O.G. 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.

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- DYNACOMP also supplies THE COMMUNICATOR with an Atari 830 modem for a combined price of \$219.95. The modem is available separately for \$189.95.
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EDUCATION

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- TEACHER'S PET I (Available for all computers)** Price: \$11.95 Cassette/\$15.95 Diskette
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MISCELLANEOUS

- CRYSTALS (Atari only)** Price: \$ 9.95 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 are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari.
- NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY**
DYNACOMP now distributes the 21 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

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 computer). Additionally, most programs can be obtained on standard IBM format 8" CP/M floppy disks for systems running under MBASIC.

STATISTICS and ENGINEERING

- DIGITAL FILTER (Available for all computers)** Price: \$34.95 Cassette/\$33.95 Diskette
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter (function or choice from a menu of filter forms). The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In evaluation design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.
- DATA SMOOTHER (Not available for Atari)** Price: \$14.95 Cassette/\$18.95 Diskette
This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.
- FOURIER ANALYZER (Available for all computers)** Price: \$14.95 Cassette/\$30.95 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/\$33.95 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: \$34.95 Cassette/\$38.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.
- FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of \$49.95 (three cassettes) and \$39.95 (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 and curve plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.
- REGRESSION II (PARAFIT) (Available for all computers)** Price: \$19.95 Cassette/\$33.95 Diskette
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A11, A21, etc.) as one or more BASIC statement lines. Data and results 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 least regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.
- REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for \$51.95 (three cassettes) or \$43.95 (three diskettes).
- ANOVA (Available for all computers)** Price: \$39.95 Cassette/\$43.95 Diskette
In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those concerned with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{k-p} fractional design. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.
- BASIC SCIENTIFIC SUBROUTINES, Volume I (Not available for Atari)**
DYNACOMP is the exclusive distributor for the software keyed to the popular text BASIC Scientific Subroutines, Volume I by F. Ruckdeschel (see the BYTE/McGraw-Hill advertisement in BYTE magazine, January 1981). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.
Collection #1: Chapters 2 and 3: Data and function plotting, complex variables
Collection #2: Chapter 4: Matrix and vector operations
Collection #3: Chapters 5 and 6: Random number generators, series approximations
Price per collection: \$14.95 Cassette/\$18.95 Diskette
All three collections are available for \$39.95 (three cassettes) and \$49.95 (three diskettes).
Because the text is a vital part of the documentation, BASIC Scientific Subroutines, Volume I is available from DYNACOMP for \$19.95 plus 75¢ postage and handling.
- ROOTS (Available for all computers)** Price: \$19.95 Cassette/\$14.95 Diskette
In a nutshell, ROOTS simultaneously determines all the zeros of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No manual games are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.
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- LOGIC SIMULATOR (Apple only; 48K RAM)** Price: \$24.95 Cassette/\$28.95 Diskette
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signal bandwidth of the phone line must be divided into two bands (high band and low band) so that the signals present the minimum amount of interference to each other within the available bandwidth. The high band is referred to as the answer mode. This is because the station being called, the one that answers the call, is placed in this mode. The low band is referred to as the originate mode, as the station that originates the call uses this band.

	TX 1	TX 0	RX 1	RX 0
Originate:	1270 Hz	1070 Hz	2225 Hz	2025 Hz
Answer:	2225 Hz	2025 Hz	1270 Hz	1070 Hz

Because of the narrow frequency shift that is required for full duplex operation, it is very difficult to receive signals faster than 300 bps, and not practical to receive signals faster than 600 bps. The frequencies used were chosen to present the minimum amount of interference possible.

To receive a signal with the minimum amount of errors at 300 bps, the modem should be designed to operate at 400 bps. The frequency shift from a 1 to a 0 should be equal to or greater than $\frac{1}{2}$ the maximum speed of transmission (200 Hz for 400 bps). The receive bandwidth should be equal to or greater than the maximum speed of transmission (400 Hz for 400 bps). A guard band should be maintained between the upper and lower bands equal to or greater than the maximum speed of transmission (guard band equals 555 Hz for the above indicated design). Using the above information, it would be possible to increase the receive bandwidth to 480 Hz and have a modem that operates up to 400 bps with a minimum error rate. To allow operation to 600 bps, the receive bandwidth is increased to allow the reception of the higher speed which causes a decrease in the guard band and then an increase in interference from the adjacent channel. This can be offset to some extent by providing more filtering at the receiver and transmitter to reduce the out of band signals as much as possible. This is, however, only a partial fix, and the signal will still be subject to a greater amount of distortion than the slower speed signals. The frequency shift could be increased to 300 Hz to match the 600 bps rate, however this causes the channel signals to be closer together, thus causing an increase in interchannel distortion. The channel spacing could be increased, but, due to phone line characteristics, a significant increase in delay distortion occurs outside the indicated bands. One way that the error rate can be reduced is to operate with local echo rather than echoplexing (half duplex operation as opposed to full duplex operation). This allows the guard band to extend down to the transmitter carrier frequency rather than the first sideband.

A problem that is encountered when using the phone lines for data communications over long distances are the echo suppressors. When calling

long distance, signal delays as long as 180 ms can be encountered within the continental United States and even longer delays can be encountered outside the US. These long delays can cause severe echoing which can be very disturbing to the caller. The phone company has provided a means of reducing this disturbance with a device called an echo suppressor. An echo suppressor inserts an amount of loss in the opposite direction of the loudest signal to reduce the echo to an acceptable level. This can affect proper modem operation. However, the phone company has recognized this problem and provided for a means to disable the

**With a private
fixed line with C2
conditioning it is
possible to achieve 1800 bps.**

echo suppressors. This is done by providing a signal of $2125 \text{ Hz} \pm 115 \text{ Hz}$ for 100 ms if no signal has occurred. As can be seen, the disable signal falls within the answer modem's transmit frequency range, so that the echo suppressors are automatically disabled when the answer modem begins transmitting. Even with this improvement, a significant amount of errors can be encountered. If data is to be transmitted over long distances with minimum errors it is recommended that half duplex operation be used (local copy rather than echoplexing). By having only one frequency shift occurring at any one time a minimum amount of interference will be generated.

Another type of modem that is sometimes used is the BELL 202 type modem. This is a 0 to 1200 bps half duplex only type modem. Operation at 1200 bps is provided by using the full usable phone line bandwidth for transmission instead of dividing it into two bands. The frequency shift between a 1 and a 0 is expanded to 1000 Hz. With the wide frequency difference between the two states it becomes much easier to recognize when a change has occurred which allows the change to be made more quickly. Although the bandwidth and frequency shift range allows for operation to 2000 bps, due to phone line envelope delay distortion and attenuation, the standard dial-up line is limited to 1200 bps. With a private fixed line with C2 conditioning it is possible to achieve 1800 bps.

Since the 202 type modem is a half duplex modem, a greater amount of control over the modem is required than over the 103 type modem. Since transmission can only occur in one direction at any one time, a means to indicate to the other end of the link that you are through transmitting and it should begin transmitting, must be provided. This is generally performed by sending a final character (ASCII EOT) indicating this after which the transmitter must be turned off and the receiver

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For insight into some of the basic principles underlying **ISAAC NEWTON** see **GODEL, ESCHER, BACH** by Douglas R. Hofstadler, Chapter XIX and Martin Gardner's **MATHEMATICAL GAMES** column in *Scientific American*, October, 1977 and June, 1959. \$24.95.



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enabled. (This is most often referred to as turnaround.) Another problem that must be considered when turnaround is initiated: a delay of 200 ms must be allowed for the echo suppressors to stabilize. This delay can significantly eat into transmission time when large amounts of data are to be transferred, particularly when short transmission blocks are being used.

One way to reduce this delay is to maintain a reverse channel or supervisory link. The 202 modem has an optional reverse channel arrangement which consists of a 387 Hz amplitude modulated signal with a maximum transmission rate of 5 bps. It maintains the echo suppressors in the off condition and thereby reduces turnaround time to less than 100 ms, the time now being limited by the time it takes for the transmitted signal to die out and the signal from the other end to be acquired by the modem. The reverse channel also provides the ability to use supervisory signals, which allows for the early termination of a block of data. This can be useful especially when the transmission, turnaround can be requested by the receiving station by dropping the reverse channel. This way the transmission can be terminated, thereby eliminating the time lost by having to transmit the rest of the block before turnaround could be done. The reverse channel should not be used when the primary channel is in use as errors in the primary channel's data can be generated. In addition, errors in the received primary channel should be expected when the reverse channel is modulated. (Turned off or on).

So far the modems that have been discussed were of the asynchronous type. Asynchronous means that the digital information may be presented to the modem in any form or at any speed as long as the maximum bit rate (minimum duration of a stable state) is not exceeded. This is very useful, as it allows the modem to be transparent to the data being transmitted. Because at least one cycle is needed to determine a frequency change, the absolute maximum transmission speed of the available bandwidth cannot be achieved.

In applications where throughput is of the greatest importance, synchronous modems are generally used. In the synchronous modem, transparency is sacrificed for the greater speed capability. The synchronous modem synchronizes itself to the remote modem, and requires that the data sent to it be in synchronization with its transmissions. This is done with a signal that is provided either by the modem, or by the connecting device called a clock. The clock insures that all transmissions occur in sync by providing a master reference for those actions. Although asynchronous protocols are not efficient enough for maximum throughput, special protocols have been developed to obtain the maximum throughput possible, the more common of these being SDLC and HDLC.

It should be noted that SDLC and HDLC can be used with synchronous type modems also. The type of modem only refers to the hardware configuration required for the modem and not the transmission protocols.

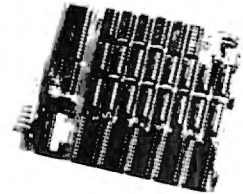
Some of the synchronous modems in use are the BELL 201 (2400 bps), the BELL 208 (4800 bps), and the BELL 209 (9600 bps). There are many other type modems. 9600 bps is presently the maximum transmission rate being used on the standard BELL phone lines.

All digital modems, whether synchronous or asynchronous, high speed or low speed, perform the same job, they convert digital information that is presented to them to a form that can be transmitted on the phone lines, and convert the received information back to its digital form. ©

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stat

STATISTICS APPLICATIONS FOR TECHNICIANS

Here is a package that is so state-of-the-art that many of the statistical techniques implemented here are not even in the textbooks yet. STAT is a set of programs for performing a large portion of the most frequently used statistical inference methods. Data can be entered and stored on four different types of data files. These data files can be modified also. The statistical procedures available in the package include the following parametric inference procedures: **SUMMARY STATISTICS** for each data file and date set, including the mean and standard deviation.

CONFIDENCE INTERVALS for the following: (1) the mean of a normal population (both with and without the variance known), (2) the variance of a normal distribution (both with and without the mean known), (3) the parameter (mean time to failure) of an exponential distribution, (4) the parameter (proportion) of a binomial distribution, (5) the difference of two normal means (for various combinations of assumptions about the variances of the populations) and (6) for the ratio of two normal variances.

TESTS OF HYPOTHESES about (1) a normal mean, with various cases corresponding to possible assumptions about the variance, (2) the difference in two normal means (various cases) and (3) the ratio of two normal variances.

TESTS OF THE EXPONENTIAL MEAN (mean time to failure) and **RATIO OF MEANS**.

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ANALYSIS OF VARIANCE for one-way and balanced two-way designs, including interaction.

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A notable feature of the package is inclusion of very efficient routines for the computation of probabilities and quantiles for the most common statistical distributions including normal, binomial, chi-square t and F. Thus the user is not required to furnish "tabular values" from outside sources when performing statistical analyses with this package. STAT complete with all documentation is \$200.

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COMMODORE 32K with 4040/8050 drive
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calc

MACHINE SPEED "BASIC"

CALC was designed to provide programmers of microcomputers with a portable language that combines the programming ease of the higher languages with the speed and flexibility of assembler programming. CALC is totally portable on the Commodore and APPLE II computers. This means that CALC source code written on an APPLE II will run as is on a Commodore machine and vice versa.

When possible, CALC makes direct use of the BASIC ROM machine language routines in the Commodore and APPLE II. In essence, CALC provides access to the power in the BASIC ROMs without the overhead of the BASIC interpreter. This includes floating point arithmetic and all library functions. In addition, we have added features that BASIC does not have. These include true integer arithmetic and machine speed string handling with search and replacement features.

CALC can fetch and replace BASIC variables and arrays by name. The programmer indicates what is to be done using simple keyword commands (ADD, MULT, SINE, etc.) and leaves all register set-up, bit-format and the like to CALC. The object code resulting from CALC programs is very compact and consists of direct calls to the BASIC ROMs or to the CALC runtime package.

CALC comes in 4K of PROM containing a relocatable runtime package and a very complete Trace Window feature for debugging CALC programs. CALC produces portable 6502 code that does not require the CALC development PROM to function. Programs written in CALC will run on any stock PET or APPLE. CALC comes with a 60-page manual.

CALC PROM on Commodore is \$115.; indicate 3.0 or 4.0 BASIC, 40/80 column screen and rom sockets \$9000, \$A000 or \$B000.

CALC on APPLE II via quality slot independent board is \$160.

CALC manual by itself is \$10.

CALC requires Moser Mae Macro Assembler (Tape or Disk version).

sort

MULTI-KEY MACHINE LANGUAGE

A 6502 machine language in-memory sorting algorithm of commercial quality is available as part of a new utility eeprom for PET and APPLE owners. Most sorts are accomplished in less than a second and very large sorts take only a few seconds. The algorithm is a diminishing increment insertion sort, with optionally chosen increments. This algorithm has the advantage of being significantly faster (but not much longer) than simpler ones, and significantly smaller (but not much slower) than more complicated ones. Moreover, unlike some of the more complicated algorithms, there are no conditions under which the performance of this sort degenerates or fails.

SORT is intelligent to the degree that almost no user set-up operations are required. SORT handles integer, floating-point and string arrays, as well as multiple dimensioned arrays with equal ease. In addition, multi-key sorting of string arrays has been enabled. The user may specify the character within a string to begin sorting on and how many characters are to be evaluated. SORT is capable of performing up to twenty of these multi-key sub-sorts (on matches found) at the same time. This multi-level 20-KEY capacity for string arrays greatly increases the uses to which SORT can be put.

SORT comes as part of a utility EPROM that also includes a hi-speed machine language text screen dump. Complete instructions for installation and use are included.

SORT is available for large-keyboard PETS. Only One ROM will work for BASIC 3.0 & 4.0, 40 or 80 column screens. When ordering you need only to indicate which ROM socket address in PET you prefer EPROM (\$9000, \$A000 or \$B000). PET SORT EPROM at hex \$9000 location if you do not specify PET EPROM price is \$55.00 (postpaid).

SORT is available on the APPLE II via a top quality, fully socketed, EPROM board that is slot independent. The MATRIX APPLE board includes a function driver that supports up to 16 EPROM based functions in case you would like to use your own EPROM in place of ours. EPROM board with SORT, text screen dump and function driver are all slot independent and may be used in any slot except 0. Price APPLE CARD \$110.00 (postpaid).

bookkeeper

TOTAL BUSINESS SYSTEM

BOOKKEEPER was designed by a team of accountants and businessmen, and then programmed especially for microcomputers. This is not hand-me-down software from mainframe computers. BOOKKEEPER is a totally integrated management and accounting system that is available now on the more popular micro systems.

This series of interlocking programs is menu-driven and self-prompting with relative file structure implemented throughout. In some versions, machine language routines have been used to provide more efficient operation. The system employs state-of-the-art techniques and has been designed to be user-friendly. No knowledge of accounting or computers is required.

We believe the system can be operated using little more than the screen prompts. But for completeness, our MATRIX User Guide (two-inch ring binder) contains almost 200 pages of details on the BOOKKEEPER system plus a helpful introduction to business accounting principles. We suggest that you send for a more complete description of BOOKKEEPER or invest in a copy of the User Guide. There is room here only for a general description.

BOOKKEEPER is available for both SERVICE and RETAIL/WHOLESALE firms. This total business system contains the following: 375 General Ledger accounts (ten departments with accompanying revenue and expense accounts), Accounts Receivable file with maintenance and report capabilities (1000 accounts), Payroll with all federal withholding computed, state and local income tax capabilities for all fifty states (100 employees); Cash Receipts and Cash Disbursements programs that keep track of inventory sales by department, Sales Tax computations, Receipts, and Invoices, Accounts Payable file with maintenance and report capabilities (100 accounts). The system also generates and prints valuable management reports such as Departmental Budgeting, Profit and Loss Statements by Department, the traditional Chart of Accounts Summation (Trial Balance) and Financial Reports.

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BOOKKEEPER is available now on the COMMODORE 8032/8050, 48K APPLE II+ and RADIO SHACK Model III computers. CP/M compatible version available by September.

The BOOKKEEPER system retails at \$1000.00.

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The Column Calculator

James L. Simonson
Gunnison, CO

*Editor's Note: This program suggests many additional applications. If you add interesting expansions to it, send them in to **COMPUTE!** — RM*

When I first got the idea to write a program for a column calculator, I imagined a very short time would be spent on the project. Sure, I had seen similar programs published in magazines and I knew there were some very sophisticated programs on the market, but I had some special problems. Principal among them was only 8K of RAM. Also, there were no programs in print that would run on my Atari 800. With this constraint, I knew I had to design a bare bones framework for my column calculator. This program is the column calculator framework that I came up with. First, I will describe the operation of the basic calculator — then we can explore the fun part.

This program provides a 12 row by 12 column matrix for data entry. Two additional rows and three additional columns are used for totals and to store other summary calculations. The program is written to provide row and column totals in column 13 and row 13. Of course, the grand total is in box 13, 13. The basic menu choices are:

1. View data columns (scan left or right in array or go directly to summary columns).
2. Enter data (choose column and number of rows).
3. Do calculations.
4. Zero the matrix.

Figure 1 illustrates the arrangement of the column calculator. Screen limitations permit only three columns on the screen at one time, thus the option to scan left and right in the array.

		COLUMNS											TOTALS			
		1	2	3	4	5	6	7	...	12	13	14				
ROWS	1															
	2															
	3															
	4															
	5															
	6															
	7															
	8															
	9															
	10															
	11															
	12															
Total	13															
	14															

Figure 1. Total arrangement of the column calculator.

Program 1. Microsoft version.

```

20 DIM J(14,15)
30 GOTO 510
35 REM VIEW DATA COLUMNS
40 X=1
50 PRINTCHR$(147);;PRINT
60 PRINT,;FOR K=X TO X+2;PRINTK,;NEXT K;PRINT
70 RESTORE;FOR I=1 TO 14;READ A$
80 PRINTI;A$,J(I,X),J(I,X+1),J(I,X+2)
90 IF I=12 THEN GOSUB 550
100 NEXT I
110 PRINT;PRINT"DO YOU WANT TO SEE COLUMNS"
115 PRINT"LEFT OR RIGHT? (L/R),"
117 INPUT "'S' FOR SUMMARY,;"D$
120 IF D$<>"R" THEN 150
130 IF X<=10 THEN X=X+3;GOTO 50
140 GOTO 110
150 IF D$="L" AND X>1 THEN X=X-3;GOTO 50
160 IF D$="M" THEN GOSUB 510
170 IF D$="S" THEN X=13;GOTO 50
180 PRINT"INVALID DIRECTION";GOTO 110
200 REM ENTER DATA
210 PRINTCHR$(147);;PRINT
212 PRINT "WHAT COLUMN NUMBER DO YOU WISH TO"
215 PRINT"ENTER DATA IN (1-12).";;INPUT C
220 IFC=13THENPRINT"RESERVED FOR TOTALS";GOTO210
230 PRINT;PRINT "HOW MANY ROWS DO YOU WANT"
235 RESTORE
237 PRINT "TO WORK WITH (1-12)";;INPUT K
240 PRINT;PRINT"ROW","CURRENT","COLUMN ";C
250 FOR I=1 TO K;IF I=13 THEN GOSUB 550
255 READ A$
260 PRINT I;A$,J(I,C),;INPUT J;J(I,C)=J
270 NEXT I
280 PRINT "ENTER 'C' FOR ANOTHER COLUMN"
285 PRINT "'M' FOR THE MENU,;"INPUT D$
290 IF D$="C" THEN 210
295 GOTO 510
300 PRINTCHR$(147);"      ***CALCULATING***"
310 FOR I=1 TO 14
315 J(I,13)=0;J(13,I)=0
320 NEXT I;J(13,15)=0
380 FOR X=1 TO 12
385 FOR Y=1 TO 12
387 IF D$="4" THEN J(Y,X)=0
400 J(Y,13)=J(Y,13)+J(Y,X)
410 J(13,X)=J(13,X)+J(Y,X)
420 NEXT Y;NEXT X
430 FOR X=1 TO 12
435 J(13,13)=J(13,13)+J(X,13);NEXT X
510 PRINTCHR$(147);TAB(11);"COLUMN CALCULATOR"
511 PRINT " 1) VIEW COLUMNS
512 PRINT " 2) ENTER DATA
513 PRINT " 3) DO CALCULATIONS
514 PRINT " 4) ZERO THE MATRIX";PRINT
515 INPUT "WHAT IS YOUR CHOICE (1-4)";D$
520 IF D$="1" THEN 40
530 IF D$="3" OR D$="4" THEN 380

```


CREATE-A-BASE

CREATE-A-BASE is a data base file management system that enables the user to choose the number of fields needed in a file, and add or delete fields without disturbing any of the existing data. Once a file is created you can perform any of 30 functions. Such as:

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You don't have to be a programmer to operate **CREATE-A-BASE** on your COMMODORE computer. Its menu driven and asks you questions at each step as you perform any of its many functions.

WORD-CHECK

WORDCHECK is a poor spellers dream come true. Designed to interact with WORDPRO, it has 2100 root words and suffixes. In addition for the business and scientific user it has the capacity for 900 industrial or scientific terms which you load in yourself. You have a total vocabulary of approximately 7500 words at your fingertips. It simply goes through the text and flags any words that it doesn't recognize.

WORDCHECK is the ideal program to proof your spelling, whether it is one paragraph or a 100 page manual. The dictionary is versatile, allowing the user to add or delete words. You can design the program with the technical terms your profession uses, even duplicating the table and tailoring it for each person in your office. Let WORDCHECK do the work for you quickly and accurately.

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80 COLUMN GRAPHICS



The image on the screen was created by the program below.

```
10 VISMEM: CLEAR
20 P=160: Q=100
30 XP=144: XR=1.5*3.1415927
40 YP=56: YR=1: ZP=64
50 XF=XR/XP: YF=YP/YR: ZF=XR/ZP
60 FOR ZI=-Q TO Q-1
70 IF ZI<-ZP OR ZI>ZP GOTO 150
80 ZT=ZI*XP/ZP: ZZ=ZI
90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ*P
180 Y1=YY-ZZ*Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

The Integrated Visible Memory for the PET has now been redesigned for the new 12" screen 80 column and forthcoming 40 column PET computers from Commodore. Like earlier MTU units, the new K-1008-43 package mounts inside the PET case for total protection. To make the power and flexibility of the 320 by 200

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NOW 80 COLUMN PETS CAN HAVE MTU HIGH RESOLUTION GRAPHICS

estimated annual costs and returns for up to 12 years in alternate rows (1, 3, 5 ...). The steps below will then discount each value and store the result in the row below (2, 4, 6 ...). In this case, the totals in column 13 will represent the total present net worth of each cost or return. If the returns are entered as positive values and costs as negative values, the grand total in (13, 13) will indicate the present net value of the contemplated investment. Investments with a negative total should normally be avoided.

```
325 ? "ENTER 1 + (INTEREST RATE IN DECIMAL)":
  INPUT R
330 FOR X=1 TO 12: FOR Y=1 TO 11 STEP 2
340 NEXT Y: NEXT X
385 FOR Y=2 TO 12 STEP 2
800 DATA -COST, -NPW, -RTNS, -NPW, -COST,
  -NPW, -RTNS, -NPW, *,*,*, NA, NA
```

To change from this option to another, delete lines 325 thru 340 and enter:
385 FOR Y=1 TO 12

As a novice programmer, writing this program taught me the power of two dimensional arrays. Now you, too, have a framework for a column calculator. I have given you a few options I thought might be helpful. The fun begins when you start brainstorming your own options.

Program 2. Atari version.

```
1 TRAP 1000
5 REM *****"THE COLUMN CALCULATOR"*****
6 REM -----VERSION 1.2
7 REM -----BY JAMES L. SIMONSON-----
8 REM *****JUNE, 1981*****
20 DIM J(14, 15), D$(1), A$(5)
30 GOTO 510
35 REM VIEW DATA COLUMNS
40 X=1
50 GRAPHICS 0: ? : ? "          COLUMN CAL
  CULATOR": ?
60 ? " ", :FOR K=X TO X+2: ? K, :NEXT K: ?
70 RESTORE :FOR I=1 TO 14: READ A$
80 ? I; A$, J(I, X), J(I, X+1), J(I, X+2)
90 IF I=12 THEN GOSUB 550
100 NEXT I
110 ? : ? "DO YOU WANT TO SEE COLUMNS LEF
  T OR": ? "RIGHT? (L/R), 'M' FOR MENU, 'S'
  FOR": ? "SUMMARY.": INPUT D$
120 IF D$(">R") THEN 150
130 IF X<=10 THEN X=X+3: GOTO 50
140 GOTO 110
150 IF D$="L" AND X>1 THEN X=X-3: GOTO 50

160 IF D$="M" THEN GOSUB 510
170 IF D$="S" THEN X=13: GOTO 50
180 ? "INVALID DIRECTION": GOTO 110
200 REM ENTER DATA
210 GRAPHICS 0: ? : ? "WHAT COLUMN NUMBER
```

```
DO YOU WISH TO ": ? "ENTER DATA IN (1-12)
  .": INPUT C
220 IF C=13 THEN ? "RESERVED FOR TOTALS"
  : GOTO 210
230 ? : ? "HOW MANY ROWS DO YOU WANT TO "
  : ? "WORK WITH (1-12)": INPUT K
235 RESTORE
240 ? : ? "ROW", "CURRENT", "COLUMN "; C
250 FOR I=1 TO K: IF I=13 THEN GOSUB 550
255 READ A$
260 ? I; A$, J(I, C): INPUT J: J(I, C)=J
270 NEXT I
280 ? "ENTER 'C' FOR ANOTHER COLUMN, 'M'
  FOR ": ? "THE MENU.": INPUT D$
290 IF D$="C" THEN 210
295 GOTO 510
300 GRAPHICS 0: ? "          ***CALCULATING
  ***"
310 FOR I=1 TO 14
315 J(I, 13)=0: J(13, I)=0
320 NEXT I: J(13, 15)=0
330 FOR X=1 TO 12
335 FOR Y=1 TO 12
337 IF D$="4" THEN J(Y, X)=0
400 J(Y, 13)=J(Y, 13)+J(Y, X)
415 J(13, X)=J(13, X)+J(Y, X)
420 NEXT Y: NEXT X
430 FOR X=1 TO 12: J(13, 13)=J(13, 13)+J(X,
  13): NEXT X
510 GRAPHICS 0: ? : ? "          COLUMN CALCUL
  ATOR"
511 ? "          1) VIEW COLUMNS"
512 ? "          2) ENTER DATA"
513 ? "          3) DO CALCULATIONS"
514 ? "          4) ZERO THE MATRIX"
515 ? : ? "WHAT IS YOUR CHOICE (1-4)": IN
  PUT D$
520 IF D$="1" THEN 40
525 IF D$="2" THEN 200
530 IF D$="3" OR D$="4" THEN 300
540 GOTO 515
550 FOR D=1 TO 38: ? "-": NEXT D: RETURN
800 DATA -, -, -, -, -, -, -, -, -, -, -, -, -, *, *
1000 TRAP 1000
1010 EL=PEEK(187)*256+PEEK(186)
1020 GOTO EL
```

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1-THE HOUSE OF USHER- Haunted house type adventure game with scrolling in the Atari version. Wander the creepy hallways of the three story castle based on Edgar Allen Poe's short story of the same name. Written in graphics, of course, with animation and sound. We have introduced a new mystery for another \$100 prize. \$29.95/1 disk

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3-GLAMIS CASTLE- Yes, Pat and I are on our way to Britain to stay in the dreaded Glamis Castle. If we survive our real life adventure, we'll be measuring it and will be able to provide you with a 3-D game based on this ancient haunted site where King Duncan met his end at the hands of Macbeth. Our good friend, Mark Benioff, after much research, said there's a mystery room that has never been found in this castle and a half beast, half-man creature that guards a treasure therein. Our stay will be covered by the British media and we hope to share our experience with you through the writing of this game. \$49.95/2 disks

4-BENEATH THE PYRAMIDS- You are an archaeologist in 1932 and must find your way through the perilous chambers beneath the pyramids to discover a golden statue of the cat goddess Bast. This game is in hires graphics, includes sound, your little man actually moves through the corridors which you can see on the screen. The monsters are animated and very aggressive. There is a new \$100 prize for the first to solve the mystery; which is a toughie! \$29.95/1 disk

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5-GALACTIC QUEST- An excellent combination of Star Trek and Space Trader. Battle the animated Vegan fighters as you warp from galaxy to galaxy. At the same time, you may land on and trade with hundreds of planets. Super hires graphics and lots of sound. This has been one of our most popular games. \$29.95/1 disk

6-SANDS OF MARS- Take an exciting voyage to the planet Mars via the Starship Herman. This game compared to the rest, is second only to Fantasyland 2041 A.D. It includes scrolling on the Atari and hundreds of full screen graphics. You can move your little man through the terrain of Mars; if, of course, you survive the exciting journey to Mars, which occupies the whole first disk. There is a new mystery and another \$100 prize just waiting for some clever adventurer out there. Good luck! \$39.95/2 disks

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7-WORLD WAR III- You Atari gamers will have to see this in the Atari version to believe it! If your tired of war games which take 15 minutes a move and have a manual the size of a telephone book; but still want a complex, real-time action war game-this is it! It is designed for two arm-chair generals which may maneuver up to 128 separate type of units at a time. The game displays a map of Iran & Iraq in the first scenario and later on you will find yourself moving nuclear submarines and battleships through two world wars. This is not a boring copy of a board based game but an original war game which takes a lot of skill and may take weeks to play. \$29.95/1 disk

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Pet, Atari, Apple: On Speaking Terms

Charles Brannon
Editorial Assistant

It would be terrific if all microcomputers spoke the same language, or at least could interpret a "universal language," but, alas, this is not the case. There are many reasons why there are so many languages and versions of the same languages: economy, memory size, expected audience, individual preference, and speed. Perhaps most responsible for this multiplicity is *progress*. "If they can do it, we can do it better." While this progress is often for the best it usually makes the process of standardizing programs difficult.

The goal of this article is to offer some suggestions on how to transport programs from one machine to another. Specifically, we'll discuss the translation from Microsoft BASIC to Atari BASIC, and vice versa. The techniques and ideas are also applicable to other program conversion problems.

The essence of translating programs is this: figure out what the foreign BASIC's statement is supposed to do, and then find a way to perform the same function in *your* BASIC. This requires that you rewrite parts of the program (it would be more accurate to say re-phrase since you don't change the logic of the statements, just their syntax). In order to effectively handle this, you must be familiar with both BASICs, and know one of the BASICs rather well. Ideally, you would be expert in both BASICs, and you really wouldn't need this article.

What I'll do is explain the differences between Atari BASIC and Microsoft BASIC, and show how incompatible statements can be re-phrased. I'll also give some specific tips on the really knotty problems.

We'll start out with the easier conversions. First, we'll work with converting algebraic statements. It is indeed easy, but there are some complications... Atari BASIC permits you to have long variable names, with every variable name being unique. Microsoft BASIC, however, only recognizes the first two characters of a variable name as significant. The problem is similar to converting "Atari Date Routines" (this issue) to Microsoft BASIC. The date routines make use of the meaningful

long variable names, but as written, the program will not run properly on the PET or Apple. Microsoft BASIC will let you have long variable names like BINDATE, GREGYEAR, and LEAPYEAR, but it will interpret all references to GREGYEAR, GREGMONTH, and GREGDAY as the single variable GR, and BINDATE, BINWORK, and BININDEX as BI. The program, though, expects that these all be unique variables. The solution is to rename the conflicting variable names. GREGYEAR, GREGMONTH, and GREGDAY, become GY, GM, and GD. The other variables are similarly changed.

Incidentally, the converted program, although less readable, is completely portable, and should run on *any* BASIC. We'll go back to mathematical conversions at the end of the article.

Another area of incompatibility is INPUT/OUTPUT. We won't get too specific here, since I/O isn't even standard in Microsoft BASIC. Instead, we'll work on general I/O (like PRINT) for all machines, and focus on the similarity of PET/CBM and Atari input/output. PRINT seems to be the most standard of all BASIC statements. PRINT "HELLO" will do the same thing on all BASIC-speaking machines. It is in the special formatting of a PRINT statement that problems appear. For example, the program:

```
10 FOR I=1 TO 20
20 PRINT I;SQR(I)
30 NEXT I
```

will produce a list of the square roots from one to twenty. On the PET, it works fine, e.g.:

```
1 1
2 1.41421356
3 1.7320581
4 2
5 2.23606798 etc.
```

The semicolon ";" causes the value of I and the square root of I to be printed on the same line. The PET will add a space to the front of any number and a skip (cursor-right) after, so the two fields are nicely separated, but on the Atari or APPLE, they run together.

```
21.41421356
```

Instead, just change line 20 to:

```
20 PRINT I;" ";SQR(I)
```

This will insert the needed gap.

When the comma is used to separate fields, it causes much larger gaps. On most computers, the comma causes the cursor to skip to the next print position, where each print position is a set division of the screen, perhaps every 10 spaces. Keep in mind that the width between each field is different on each computer, so watch the formatting. One other item on PRINT. On the PET, and some other Microsoft BASICs, the semicolon can be left out in certain situations, but you'll get a syntax error if you try to leave it out of Atari statements.

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```
PRINT I;A$C$D(I)
  should be
PRINT I;A$;C$;D(I)
```

The INPUT statement is used to get information from a human operator. It can have the form INPUT variable name, or INPUT "prompt"; variable name. The Atari does not let you include a prompt as part of the INPUT statement. Instead, PRINT the message first, and then INPUT the data. Also, you can not INPUT directly into an array, for example, INPUT MX(Z), as you can on a Microsoft machine. Instead get the value with a temporary variable, and then assign it to the matrix variable. So instead of typing in this Microsoft statement:

```
INPUT "How many hours";HR(I)
  use
PRINT "How many hours";:INPUT T:HR(I)=T
```

Also, both the PET and the Atari automatically print a question mark after the prompt, while the APPLE prompt should include the question mark if appropriate, and the PET, Atari, or other machine should delete any extraneous question marks. The last I/O statement we'll discuss is the infamous GET. This command is supposed to fetch a single keystroke from the keyboard, but the manner in which it is implemented is completely non-standard. For example, let's say we want to get a YES/NO response by letting the user type Y or N. On the APPLE, we would code:

```
130 GET A$
```

This statement will wait for the user to type a key, and then A\$ will contain the character that they typed. The PET does not wait for a key to be pressed, its GET statement just attempts to fetch a key from the keyboard. If no key has been pressed, A\$ will be null (no character), and we must loop until A\$ actually contains a keystroke:

```
130 GET A$:IF A$="" THEN 130
```

Other machines use one of the above, or like the Atari, use something far different. On the Atari, you must first OPEN a file to the keyboard (yes, the keyboard is treated as a peripheral device), and then wait until a value is returned via the GET# command. What is returned is a number, the ASCII equivalent of the character.

```
100 OPEN#1,4,0,"K:"
130 GET#1,A
```

```
And instead of: IF A$="Y" THEN 1000, use
IF A=ASC("Y") THEN 1000.
```

The *most* incompatible aspect of computer languages are cassette and disk input/output. Printer output usually uses some variant of the PRINT command, like LPRINT, but some computers treat all output the same way. We'll now concentrate on Atari and PET input/output, since they are remarkably similar, almost to the point of compatibility.

Before any action can be performed, a file must be "opened." This declares the type of the

file, and its name, if applicable. For example, to open a file to the Commodore 2040 disk, the BASIC statement might look like this:

```
100 OPEN1,8,8,"0:PAYROLL,S,R"
```

The number one is the file number, used for further access to the file. The second number is the "device number." It tells the computer which device the file is to be opened to.

PET Device Numbers	Atari Device Names
0 = keyboard	K: = keyboard
1 = cassette drive 1	C: = cassette
2 = cassette drive 2	S: = screen
3 = screen	E: = editor
4 = printer	P: = printer
8 = disk drive	D: = disk drive

The third number is an optional "secondary address" which gives special information to the device. In this case, it declares which one of eight disk buffers are to be used. Inside the quotes, the 0 means drive zero, since the drives are numbered 0 and 1. The colon separates the number from the file name that follows. The file name identifies the file uniquely, and can consist of up to sixteen characters. After the file name is a comma, and then S,R. The S stands for Sequential, which distinguishes it from Program files and other types of files, and the R indicates the "direction" of the OPEN: R FOR Read, and W for Write. The same statement on the Atari would look like:

```
100 OPEN#1,4,0,"D1:PAYROLL"
```

The pound sign should be pronounced "file." The one is the file number, just like on the PET. The four specifies the direction of the OPEN. Whereas R means Read on the PET, 4 means Read on the Atari.

```
4 = Read
6 = Directory Read
8 = Write
12 = Read and Write
```

The zero corresponds to the secondary address of the PET, and is device-specific. Here a zero is used, as no number is needed by the disk drive. Inside the quotes: D1 specifies on which drive the file should be accessed. Drives can be numbered from D1 to D4, with D by itself meaning D1. (You can go up to D8 with the 815 disk drive.) The colon separates the drive number from the file name. The file name can be up to eight characters long. The first character has to be a capital letter. The remaining characters can be either a capital letter or a number. There can be an optional three-letter extension that can identify the type of file, like ADVEN.PRG, or QUICKDRAW.OBJ. Remember the difference in file name length — if necessary, abbreviate PET file names for the Atari.

Above is a list of the device numbers associated with each device for the PET. The Atari uses the first letter of the device instead (like D: or C:). To read or write to a file, the PET uses the INPUT#

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and PRINT# commands. They have the form:

```
INPUT#1,A$ or INPUT#1,A$,E,B$
PRINT#1,"HELLO" or PRINT#1,A$,CHR$(13);E;
CHR$(13);B$;CHR$(13);
```

The PRINT# command must place carriage returns (CHR\$(13)) between each item to be printed on the same line. The INPUT# statement can either read the variables singly, or as a list. The comma immediately after the # sign is mandatory, and does not perform the usual skipping function. Atari also uses the INPUT# and PRINT# commands:

```
INPUT#1,A$ or INPUT#1,A$,E,B$
PRINT#1,A$ or PRINT#1,A$,CHR$(155);E;CHR$(155);B$
```

The INPUT# command is identical, but notice that the Atari has a semicolon after PRINT#. A comma would cause the usual skipping, wastefully writing spaces to the disk. Also, Atari's ASCII value for the carriage return is 155, not 13. Atari has two other commands: PUT# and GET#. PUT# will write a single byte to the output device. What it sends is the ASCII value of the character to be written, e.g. PUT#1,155. GET# behaves as explained earlier (GET from the keyboard). It gets an ASCII byte, usually generated by PUT#. The PET would use PRINT#1,CHR\$(A); to "PUT" a byte, and GET#1,A\$ to GET a byte.

The CLOSE statement wraps it up. On the PET use CLOSE 1, on the Atari, CLOSE#1. The file is now closed, and the file number can be re-used for other files.

Another incompatibility is screen formatting. Atari lacks a TAB command. On the PET or APPLE, PRINT TAB(10);"X" will print an X at the tenth character position of the screen. It is most useful when the argument of the TAB is a variable or computed value, like PRINT TAB((40-LEN(L\$))/2);L\$, which will center the string L\$ on a forty-column screen. The APPLE also has VTAB x which skips x lines down from the top of the screen to provide vertical positioning, and HTAB x which is like PRINT TAB(x);. Atari combines the two into the POSITION command, which will place the cursor at any (X,Y) location on the screen (e.g. POSITION 10,2). So if you know the vertical position where you're printing, POSITION 10,Y:PRINT "X" will do the same thing as the Microsoft TAB. If you don't know what line the cursor's on, just use POSITION 10,PEEK(84). Memory location 84 keeps track of the vertical position of the cursor. Alternatively, you could modify the horizontal position of the cursor without changing the vertical with POKE 85,10.

Most 6502 BASICs don't provide PRINT USING, so I won't go into that, but you can use Jim Butterfield's "Simulated PRINT USING" (**COMPUTE!** #9) or "Formatted Output for Atari BASIC" (**COMPUTE!** #10). Incidentally, if you want

to simulate PRINT #1;TAB(30);N\$ on your Atari printer, just send out thirty spaces, and then the string, e.g. FOR I = 1 TO 30:PUT#1,32:NEXT I:PRINT#1;N\$.

Almost all programs clear the screen at times. The PET uses the PRINT command to print a special character that causes the screen to clear. It looks like a reverse-field heart in program listings. The Atari also can print a special clear screen character, or use the command GRAPHICS 0 to do the same thing. The APPLE uses a machine language ROM routine to do the job: CALL -936.

We'll now go on to the most difficult conversion — strings. I'll use the PET as the Microsoft computer reference (because it's such a small word!), but the comments apply to Microsoft BASIC in general. (Apple, OSI, and SBC BASIC, too).

Almost all computers permit you to use and manipulate strings, but the method and efficiency of this string-handling differs widely (wildly?). A string is a sequence of characters, like pearls on a necklace. Get it! *Strung* together. Both the PET and the Atari permit you to use strings easily. When you want to use a string on the PET, the string is always available — it's just another variable type. You can have any number of strings. The limitation is that the length of the string cannot exceed 255 characters. This freedom with strings results in their being used carelessly and abundantly in many programs. This can waste memory and cause the dreaded "garbage collection" delay. The Atari, on the other hand, requires that you declare each string and its length at the start of the program. It sets aside a block of memory for that string, so the memory that the string uses is allocated even before a string is filled. The command used is DIM, since it is similar to DIMensioning an array. DIM A\$(20) will permit the string A\$ to be used, but only 20 characters can be accessed. For your conversion, make note of each string used in the PET program. Then write a series of DIM statements at the start of the program. What length should you use? Since the PET permits up to 255 characters, 255 would be a conservative number, but it is not conservative of memory. Eighty characters would seem to be sufficient for most strings, since that's the most that can be entered via the INPUT statement. If you can discover the maximum string length, use that. If K\$ is only used to get a YES or NO answer, DIM K\$(1) will only permit K\$ to be one character long, so that if the user types in YES, K\$="Y", conveniently enough. String manipulation poses another problem. It might be used to pull the slashes out of a date like 8/25/81, or to reverse the order of a person's name from JOHN DOE to DOE, JOHN. What I'll do now to show some specific examples of converting statements from PET BASIC to Atari BASIC. The reverse can be inferred.

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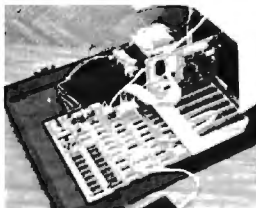
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M\$ = MID\$(L\$,I,1)	M\$ = L\$(I,I)
R\$ = MID\$(NAME\$,Z)	R\$ = NAME\$(Z)
F\$ = LEFT\$(NAME\$,Z)	N\$ = NAME\$(1,Z)
LN\$ = RIGHT\$(DATE\$,2)	LN\$ = DATE\$(LEN(DATE\$)-2)
B\$ = B\$ + N\$	B\$ = (LEN(B\$) + 1) = N\$
B\$ = A\$ + C\$	B\$ = A\$:B\$(LEN(B\$) + 1) = C\$

If you own an Atari, review the string documentation in the *Atari BASIC Reference Manual*. It will help a lot. Space does not permit a thorough discussion of string handling here.

Next, we'll briefly go into string-array simulation. You may want to refer to my article, "String Arrays in Atari BASIC" (**COMPUTE!** #11). Microsoft BASIC permits you to use string arrays. An array is much like a list; it lets you refer to a sequence of numbers by using a single variable name, using an index to specify the position of the number in the array. A string array is similar, but is a list of strings. For example, in a game of chance, you might want to have two lists — the names of the players of the game, and their current cash amount. You might use the statement:

```
PRINT "PLAYER #";I;NAME$(I);" HAS $";
CASH(I);"LEFT."
```

to print each player's name and his booty. If you remember the Atari BASIC string syntax, you'll realize the above statement can't work, because NAME\$(I) will return all the characters after and including the I'th position of the single string NAME\$. This syntax prevents normal string array notation. Instead, you need to partition a single large string into many different substrings. Each substring contains the contents of each "name" in the list. To access each substring, just specify the starting and ending positions of the substring within the main string. For example, if you reserved ten-character names for all the players, NAME\$(1,10) would return the name of player one. In order to use it with variables, you need a general purpose formula:

```
NM$ = NAME$((I-1)*10 + 1,I*10)
```

This will return the I'th name in the list. To assign a name to the array, just reverse the statement:

```
NAME$((I-1)*10 + 1,I*10) = NM$
```

In your use, change the ten to the maximum permitted length of each substring. Determine this as previously discussed, and change the DIM statement from something like:

```
35 DIM ARK$(20)
to
35 DIM ARK$(20*50)
```

where fifty-character substrings are allowed. This won't solve all your problems, however. Neither RUN nor CLR will clear out the contents of the string, so you will have to do this before storing a new value, or use the techniques discussed in "String Arrays in Atari BASIC" (using a numeric array to

keep track of the length of each substring, and only printing the specified number of characters).

If a program uses a lot of string arrays, your job will be arduous, but perhaps worth the trouble. (If you come across a three-dimensional string array — I once did — just give up!)

We'll finish up by going back on some mathematical incongruencies. Atari has dual-mode trigonometry — it can either interpret all arguments and return all results in either DEGRees or RADians. Microsoft BASIC treats all functions in radians, but can be changed to give degree results. If the Atari program is in the RAD mode, no changes are required, but if it has a preceding DEG statement, the following statement has to be multiplied times every argument: function (A*PI/180), where A is the argument, and PI has been defined as 3.1415927 or its equivalent. So Y = INT(150*SIN(ANG)) becomes: Y = INT(150*SIN(ANG*PI/180)). The PET offers an integer variable type, specified with a percent sign, e.g., A% = 18/3. To avoid conflict with the floating point variable A, it should be renamed in Atari BASIC as AINT = INT(18/3). It's too bad that the variable looks like bad English. The Atari has a function that Microsoft does not directly support: CLOG(x), or the base ten logarithm. Instead of L = CLOG(N*5), use L = LOG(N*5)/LOG(10). It works just as well.

While we're on the subject of functions, let's go into a slightly more sticky problem — how to implement defined functions on the Atari. Microsoft BASIC lets you create your own defined functions with the same syntax as built-in functions. For example, if this statement was executed at the start of a program:

```
DEF FNR(V) = INT(V*RND(1)) + 1
```

then N = FNR(X) would assign a random number from one to the value X to the variable N. When a program uses a defined function, it tends to use it a lot. What you want to do is to write the function as a subroutine. You can even label the subroutine with a meaningful variable name. So instead of defining a function, define the starting line number of the subroutine:

```
LET RANDOM = 5000,
```

and instead of using N = FNR(X), just use:

```
V = X:GOSUB RANDOM:N = V
```

The subroutine RANDOM would look like:

```
5000 V = INT(V*RND(1)) + 1:RETURN
```

There are other incompatibilities, such as graphics, but that's another article. I'll leave you with a bit of advice: when you convert a program, try to change as little of it as possible. Be especially careful with line numbering, or GO TOs and GOSUBs will confuse you into an early death. Be brave, computerists, and be hopeful — Atari is releasing a Microsoft BASIC this fall. ©

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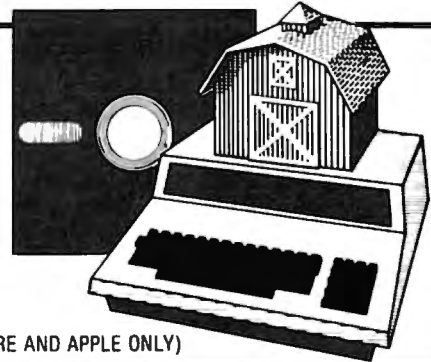
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DEALER INQUIRIES WELCOME

The Mysterious Age Guesser

Dr. Richard C Vile, Jr.
Ann Arbor, MI

When I was a teacher of mathematics, I taught a course entitled Functional Math to prospective elementary school teachers. In general, the course was dull, boring, uninteresting, soporific — you think of a rap to put on a course, that course deserved it! However, from time to time I would demonstrate some mathematical trickery that at least woke up the front row. This article presents one such piece of trickery, couched in the form of BASIC programs.

The Premise

Both Programs 1 and 2 will guess your age! That is, provided you are between the ages of 1 and 63 and provided that you answer the questions given by the programs truthfully. Try one out. The first is less than a page long and can be keyed into your computer in five minutes. It is written in fairly standard BASIC (actually APPLESOFT) and should run with minor mods on most micros. The second version is in APPLE Integer BASIC and is a little more "souped up" than the first. If you are satisfied with the trick, then read no further. However, if your curiosity is aroused, the remainder of the article will explain it to you.

The Plot

The program asks a series of questions about collections of numbers. Now someone who hasn't seen how short the program is will be tempted to claim that somehow the computer is using a process of elimination to guess the answer. This impression will be especially vivid for people who are 2,4,8,16, or 32 years of age!

However, you keyed the program in. You know how short it is and that it is impossible that it is performing some mysterious elimination process or using a fancy data base stored on disk. Well then, just how does it work?

The Culprit

No, the butler didn't do it! The whole scheme rests on the *binary* system of enumeration. What you are doing, in effect, with your yes and no answers to the computer's queries is telling it your age — *in binary!* Of course you had to be telling it your age — computers can't read peoples' minds.

When a number is expressed in binary, each digit of 1 in its numeral represents a specific power of two. The powers of two, for those of you who are *completely* non-mathematical, are:

1, 2, 4, 8, 16, 32, 64, ...

Program 1.

```

5 DEF FN MOD2(A) =
  INT ((A / 2 - INT (A / 2)) * 2 + .05)
10 HOME : VTAB 5: PRINT "I WILL GUESS YOUR AGE"
12 FOR I = 1 TO 2000: NEXT I
15 AGE = 0
20 POW = 1
40 HOME : VTAB 5: J = 1
50 X = INT (J / POW)
60 X = FN MOD2(X)
61 IF X < > 1 THEN 70
62 IF J < 10 THEN PRINT " ";
63 IF J >= 10 THEN PRINT " ";
65 PRINT J;
70 J = J + 1
75 IF J < 64 THEN 50
78 PRINT : PRINT : PRINT
80 INPUT "IS YOUR AGE HERE(Y/N)?" A$
85 IF (A$ = "Y") OR (A$ = "YES") THEN AGE = AGE + POW
90 POW = POW * 2
95 IF POW < 64 THEN 40
99 PRINT "YOUR AGE IS " AGE
100 END

```

Sound familiar? These were the ages suggested above. Any one of them will have but a *single* digit of 1 in its binary representation. That means that a person whose age is one of these numbers will only say "yes" once while playing the age guessing game.

Let's examine one example in particular detail. I happen to be 38. The number 38 may be expressed as the sum of powers of two as follows:

$$38 = 32 + 4 + 2$$

To make that a little more suggestive, let's put in the powers of two that are *not* used as well as those that are:

$$38 = 0 \cdot 1 + 1 \cdot 2 + 1 \cdot 4 + 0 \cdot 8 + 0 \cdot 16 + 1 \cdot 32$$

Now, reading left to right, this may be interpreted as answers to a series of questions as follows:

Does the number 38 require a 1 in its binary expansion?
No (the coefficient of 1 = 0).

Does the number 38 require a 2 in its binary expansion?
Yes (the coefficient of 2 = 1).

Does the number 38 require a 4 in its binary expansion?
Yes (the coefficient of 4 = 1).

Does the number 38 require an 8 in its binary expansion?
No (the coefficient of 8 = 0).

Does the number 38 require a 16 in its binary expansion?
No (coefficient of 16 = 0).

Does the number 38 require a 32 in its binary expansion?
Yes (the coefficient of 32 = 1).

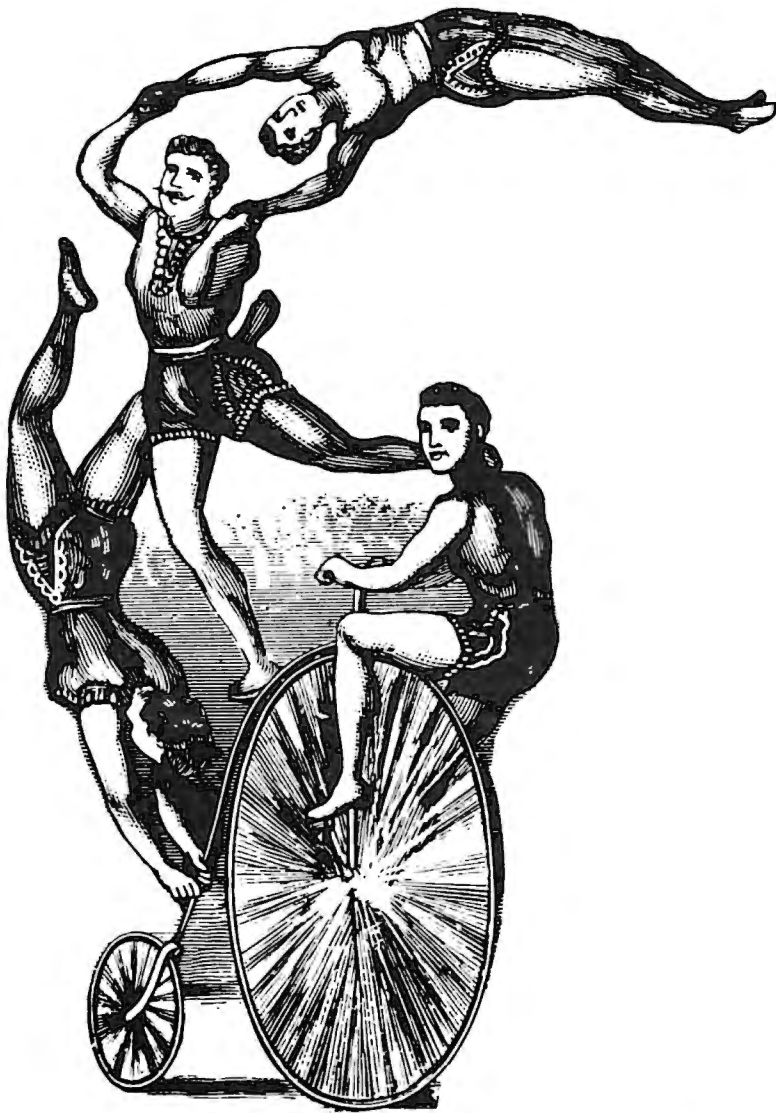
Reading the answers from top to bottom will give the exact pattern of answers to the program. Try it (pretend you're 38!).

The Corpus Delecti

Now that I've no doubt started you yawning a little, let me finish you off by explaining how the program produces the sets of numbers it displays in asking its silly little questions.

It's really very simple you see (yawn!). The

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Program 2.

```

1 REM =====
2 REM =
3 REM = AGE GUESSING GAME =
4 REM = BY =
5 REM =DR. RICHARD C. VILE, JR.=
6 REM =
7 REM =====
10 DIM TWOPOW(6)
11 DIM A$(40)
14 HOME=-936
15 INTRODUCTION=1100:POWERS=1000
16 DISPLAYCARD=2000:DIGITS=2100
99 GOSUB INTRODUCTION
100 GOSUB POWERS
102 AGE=0
105 FOR I=0 TO 5
110 T=TWOPOW(I)
115 SHOWN=0
120 GOSUB DISPLAYCARD
125 IF SHOWN THEN AGE=AGE+T
130 NEXT I
150 PRINT "YOUR AGE IS ";AGE
155 PRINT "SOMEONE ELSE CARE TO TRY"
160 INPUT A$
165 IF (A$="Y") OR (A$="YES") THEN 102
199 END
1000 REM =====
1001 REM = SET UP POWERS OF TWO =
1002 REM =====
1005 FOR I=0 TO 5
1010 TWOPOW(I)=0
1015 NEXT I
1020 POW=1
1025 FOR I=0 TO 5
1030 S= RND (7)
1035 IF TWOPOW(S)#0 THEN 1030
1040 TWOPOW(S)=POW
1042 POW=POW*2
1045 NEXT I
1049 RETURN
1100 REM =====
1101 REM = INTRODUCTION =
1102 REM =====
1105 CALL HOME:VTAB 5
1110 PRINT " IF YOU ARE BETWEEN THE AGES OF 1"
1115 PRINT "AND 63, THEN I'LL GUESS YOUR AGE!"
1120 PRINT "I WILL SHOW YOU SEVERAL SCREENS OF "
1125 PRINT "NUMBERS. SIMPLY TELL ME ON WHICH "
1130 PRINT "ONES YOUR AGE APPEARS, AND I'LL TELL"
1135 PRINT "YOU YOUR AGE."
1140 PRINT :PRINT "READY?"
1145 INPUT A$
1149 RETURN
2000 REM =====
2001 REM = DISPLAY AGE LIST =
2002 REM =====
2005 CALL HOME
2010 VTAB 5
2015 FOR J=1 TO 63
2020 GOSUB DIGITS
2025 IF ((J/T) MOD 2)#1 THEN 2050
2030 L=5-NUMDIG
2035 FOR M=1 TO L:PRINT " ";NEXT M
2040 PRINT J;
2050 NEXT J
2055 PRINT :PRINT "DOES YOUR AGE APPEAR ON THE LIST(Y/N)"
2060 INPUT A$: IF (A$="Y") OR (A$="YES") THEN SHOWN=1
2099 RETURN
2100 REM =====
2101 REM = COMPUTE DIGITS IN J =
2102 REM =====
2105 NUMDIG=1
2110 IF J>9 THEN NUMDIG=NUMDIG+1
2115 IF J>99 THEN NUMDIG=NUMDIG+1
2149 RETURN

```

program cycles through the powers of two from 1 to 32. For each power, it goes through all the numbers from 1 to 63 and asks:

Does this number require this power in its binary expansion?

It asks this via the following rule, translated into suitable BASIC statements:

n requires p $\Leftrightarrow ((n \text{ divided by } p) \bmod 2) = 1$

If the power is required, then it is printed in the list preceding the question. If you answer yes to the question, the power is added in to your (ever-growing) age. When it's all over, you have told all!

Now that you are fully asleep, maybe it's time to wake up and try this out on your friends. Oh by the way, take out a piece of paper and a pencil, there's going to be a short quiz...

Just Kidding!

Program 3. Atari version.

```

100 DIM A$(1):GRAPHICS 0
105 FOR I=1 TO 5:? CHR$(127):CHR$(158):;
NEXT I:?
107 FOR I=1 TO 5:? " ";CHR$(159):;NEXT
I
110 PRINT CHR$(125):POSITION 2,5
120 PRINT "I WILL GUESS YOUR AGE"
130 FOR I=1 TO 1000:NEXT I
140 AGE=0
150 POW=1
160 PRINT CHR$(125):POSITION 2,5:J=1
170 X=INT(J/POW)
180 X=INT((X/2-INT(X/2))*2+.05)
190 IF X<>1 THEN 230
220 PRINT J;CHR$(127);
230 J=J+1
240 IF J<64 THEN 170
250 PRINT :PRINT :PRINT
260 PRINT "IS YOUR AGE HERE (Y/N)":;INPU
T A$
270 IF A$="Y" THEN AGE=AGE+POW
280 POW=POW*2
290 IF POW<64 THEN 160
300 PRINT "YOUR AGE IS ";AGE;"."
310 END

```

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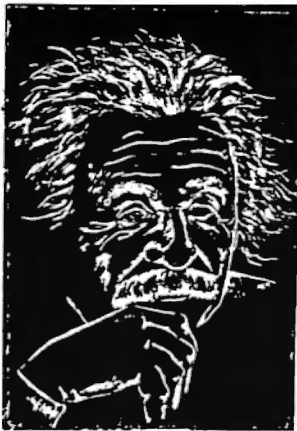
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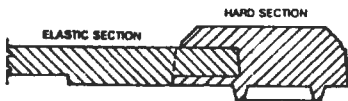
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The TYPRINTER 221 presents a new dimension in operator/machine communications. In the manual (typewriter) mode, the printer controls and verifies all entries before printing. The display exhibits the last 15 characters of the text, word-by-word, until the end of the line. The operator may control what will be printed before the actual printing takes place. This new found flexibility enables you to make modifications along the entire line and in both directions. This 20 character plasma display has the ability to scroll backwards as well as forwards, will give the operator a visual indication as to which print mode is currently being selected as well as the number of characters remaining before the right margin is reached. The display will also indicate to the operator:

The number of characters available in the memory

When the printer is in an error condition

When a pre programmed form lay out has been selected

When the printer is operating from the internal memory.

What characters will be inserted into an existing text.

When the memory for the previous line has been selected.

A warning message that the end of the page is being approached

That a hyphenation decision must be made

PRINT MODE

The TYPRINTER 221 will allow you to automatically highlight individual characters, words or complete sentences. Whatever is entered from the keyboard or from the computer, even an existing text file, can be printed in one or more of the five different modes:

- traditional printing;
- underlined characters;
- true bold characters where the horizontal component of the character is increased without disturbing the vertical component;
- characters which are both bold and underlined, and;
- a feature unique among computer printers - printing in reverse — white on black, sort of reverse video on paper.

MULTILINGUAL CAPABILITY

A unique and useful feature of the TYPRINTER 221 is its capability of being able to print in several languages without changing the daisy wheel. In addition to English, every standard daisy wheel has the ability and the necessary characters to print in French, Spanish, Italian and German.

THE FEATURES

Automatic justification of the right margin

The electronics of the TYPRINTER 221 have made right hand justification a simple, automatic operation.

Phrase and format storage

Phrases, dates, addresses, data, etc. that may be stored in your computer's memory may be sent over to the printer and stored in one of the "memory bins" of the printer. This information may then be used by the operator in the manual mode. This can save you hours when trying to get a form "just right."

Automatic centering

The TYPRINTER 221 will not only center any title between the pre-set margins, but will also center over one or more columns, or over any specific point and will even align copy with the right margin independent of the left margin.

Automatic vertical lines

A command from the computer enables an automatic feature which prints vertical lines at any point on the paper.

Automatic tab sequence recall

With the TYPRINTER 221 you may store and recall the most frequently needed margin and tab sequences for applications such as daily correspondence, statistical reports, etc. This guarantees consistent high quality appearance of each document.

Paragraph indent

A computer command instantly sets a temporary margin in order to print one or more indented paragraphs with respect to the right margin.

Automatic decimal point location

No matter how many figures to either the left or right of the decimal point, the TYPRINTER 221 will automatically line up the figures with the decimal point in any position you choose. Statistical printing has never been easier.

Column layout

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Book Review:

Video/ Computers: How To Select, Mix, And Operate

Richard Mansfield
Assistant Editor

Personal Computers and Home Video Systems, by Charles Sippl and Fred Dahl, proposed to examine the trends leading to the ultimate IVT (integrated video terminal). It is not excessively technical, yet it does examine its subject in enough detail to demonstrate, for example, why high frequency is a necessity for TV transmission. More importantly, the authors make such demonstrations clear for the less hardware-oriented readers.

The title is misleading: you are not going to really know how to select or operate video or computer devices after reading the book. Nor will you be able to jump up and interface your TV to your computer. The book is more general, more predictive. It attempts to follow two converging technologies — personal computing and video technology (including satellite, videocassette recording, data transmission, and other issues). The authors make a number of interesting and useful observations about the coming meld of computer and television devices.

For one thing, computers are digital and television is, essentially, analog. They explore this conflict and declare digital the winner — even given current transmission and memory-size constraints. Their reasoning is persuasive and much can be learned about several such issues by following their logic. Take the graphics problem: how much digital information is contained on an average 21" color TV screen? Let's say that you want to use your computer to draw a realistic, high resolution picture of the Grand Canyon or something. The TV screen has 1,200,000 bits (color dots) of information. Roughly, this would mean that you would need to program and store that many pieces of information. To simplify your drawing, you might take advantage of the fact that the bits are grouped by threes (color groups) so if you select green, then red and blue could be automatically turned off. This would bring you down to only 400,000 pro-

gramming decisions. Of course you might cheat (go analog) and use a light pen or something.

Animating your picture would bring in some extraordinary additional problems: you would need a new picture 30 times per second. To give you an idea of the memory storage squeeze, you would need a 60 minute cassette to store 12 seconds of animation. It might be better to just buy a postcard. Even the most diehard futurephile will conclude that pure digitalization has its limits.

The authors do have their weaknesses. They seem to know video in somewhat greater depth than they know computing. For instance, they mention (pg. 110) that the Commodore 8032 has a "built-in color monitor." They define the Atari 400 as "the general-purpose system" and the 800 as "a specialized system." What's more, their descriptions of the rest of the home computer market are either vague, wrong, or very close to promotional literature. They also focus more on Bally, Mattel, etc. than they do on CBM, Atari, or Apple. In sum, their chapter on computers is by far the weakest in the book.

Nonetheless, if you have ever wondered why such a thing as slow-scan TV exists, or what the future computer is likely to look like, or what effect CPU speed has on graphics — this book will explain these things and many others. It will not make you a hardware expert, but you will probably know much more than you did before. ©

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We feel that many excellent programs and articles are never mailed in. If you have not written for a magazine before — now is the time to start. By using the guidelines in COMPUTE!'s Style Sheet you will be following the format used by professional writers. Don't underestimate the possible value of your favorite programs and ideas. Send them to COMPUTE! for review. If we cannot immediately accept your work, perhaps we can offer some suggestions which will lead to later acceptance for publication.

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COMPUTE! Style Sheet

Most of the following suggestions are common to all magazines and serve to improve the speed and accuracy of publication. **COMPUTE!** is primarily interested in new and timely articles on APPLE, COMMODORE, ATARI, OSI, etc. — the entire family of 6502 computers. For this reason, we are much more concerned with the content of an article than with its style.

These guidelines, however, permit your good ideas and programs to be more easily edited and published:

1. The upper-left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, please indicate the memory requirements of programs.

COMPUTE! uses the Butterfield Convention when naming Commodore ROM versions: Original, Upgrade, and 4.0 ROMs are the correct names.

3. The title of the article, underlined, should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper-right corner there should be an

abbreviation of the title, your last name, and the page number.

For example: Memory Map/Smith/2.

5. Short, five to 20 line programs can easily be included within the text. Longer programs should be separate listings. Program listings help us to evaluate articles more easily and should be included with all articles. It is also essential that we have a copy of the program, recorded twice, on a tape or disk. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

If in spite of all your best efforts, you are unable to furnish a program listing, please don't hesitate to submit a manuscript because of that.

It is far easier for others to type in your program if you use CHR\$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I = 1 TO 5:PRINT :NEXT I is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program — making these substitutions — would be greatly appreciated by your editors and by your readers.

6. Where possible, please provide a sample of the program RUN output and, for machine language, a BASIC loader program.

7. If your article is accepted and you have since made improvements to the program, please submit an entirely new program listing, a new tape or disk, and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that the author send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version.

8. All lines within the text of the article should be spaced so that there is about 1/2 inch between them. A one inch margin should be left at the right, left, top, and bottom of each page. No hyphens should be used at the ends of lines to break words. And please do not justify. Leave the lines ragged.

9. Standard typing paper should be used (no onionskin or other thin paper) and typing should be on one side of the paper only (upper/lower case).

10. Sheets should be attached together with a paper clip. Staples should not be used.

11. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers out (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

12. For greater clarity, it is best to use all capitals when referring to computer languages (BASIC, ALGOL), keyboard references (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and computer names (APPLE, CBM, ATARI, OSI).

13. If possible, it is best to locate machine language programs in a memory area common to all machines. In

this way, JMP instructions and internal JSR's will not need modification. To illustrate, starting a machine language routine at 826 decimal is fine for all PETs except those using BASIC 4.0 which uses this memory area. Starting the routine at 864 will permit all PETs to run the program. Perhaps the best memory area, for the greatest number of computers, would be in the 8000 decimal area (above BASIC, yet under the 8K memory limit).

14. **COMPUTE!** pays between \$25 and \$250 for published articles. In general, the rate reflects the length of the article.

15. **COMPUTE!** welcomes the idea that authors of long programs will offer to make tape or disk copies to save other readers the typing time. However, we request that the copying fee be \$3.00. Such articles should conclude with the remark that interested readers must send a stamped, self-addressed mailer and a blank tape or disk. Be aware, though, that you might be inundated with requests.

16. Articles can be of any length — from a single-line routine to a multi-issue series. The average article is about four, double-spaced, typed pages.

17. If you want to include photographs, they should be 5x7, black and white glossies.

18. We purchase all rights to your manuscript and software. **COMPUTE!** will cooperate with authors on specific programs on a case-by-case basis to allow the author to share commercial rights in the software should any opportunities other than publication in printed form arise.

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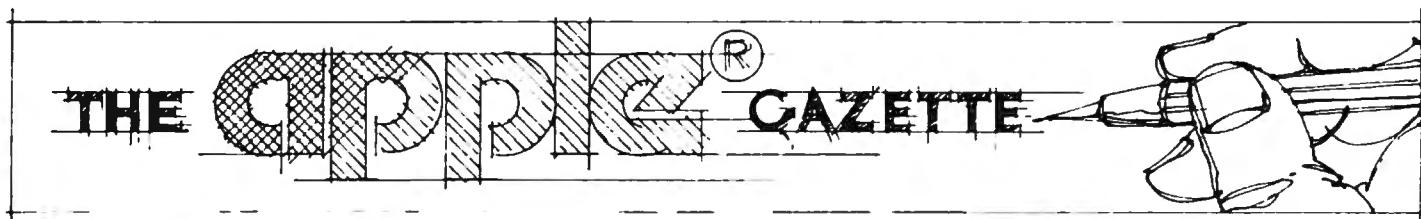
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A Tape "EXEC" For Applesoft: Loading Machine Language Programs

Sherm Ostrowsky
Goleta, CA

Apple owners with Disk systems have available a very powerful DOS command, "EXEC", which will effectively turn control of the computer over to a text file on the disk. The lines in this file are treated as if they had been typed in at the keyboard in Immediate mode, and are executed. Unfortunately, we owners of "obsolete" cassette-tape based systems don't have the benefit of this capability. But, in this article I will show you how to obtain some of the power of an "EXEC" file on tape. I'll demonstrate the method, which is actually quite general, by showing how to load Machine-Language (ML) programs just as easily as you now load Applesoft programs, and how to combine Applesoft and ML loads on one cassette in an effective manner. It has been said that most apple owners have disks, but I suspect that those who still use tape include a high proportion of relative beginners, so this article will be slanted toward them.

Some of the programs in my library are in Applesoft and others are in ML, but all of them are still on cassettes. As you are probably aware, these two different types of programs must be loaded into the computer by entirely different commands. An Applesoft program is loaded very simply, by typing LOAD. You don't have to know how long the program is or where in memory it is supposed to be stored; Applesoft takes care of all those details for you. But a ML program is a pain in the neck to load. First you have to enter the Monitor by typing CALL -151. Then you have to know the exact addresses of the beginning and end of the program, so you can type:

(Begin Address).(End Address)R

to start the loading process. And woe unto you if you are off by even one byte in remembering where the program is supposed to go: you'll get that dreaded "beep" and "ERR" message.

And, after it's loaded, the difference between Applesoft and ML programs continues to exist, to the discomfort of the latter. To run the Applesoft program, you type RUN — what could be simpler? To run the ML program you have to know its Entry Address, which may or may not be the same as its Begin Address; then you type (still in the Monitor)

(Entry Address)G

to get it started. You have to keep referring to written notes in order to load and run a ML program successfully.

Well, I got tired of all this. I wanted to load all my programs, whether in Applesoft or ML, in exactly the same way — by typing LOAD. And I wanted to run them all the same way — by typing RUN. The computer has a better memory than I have, so let *it* keep track of where the darn ML program begins and ends, and where to enter it. After a while, I found a way to do this, and I'll describe it to you below. In the process, I discovered that the method would also solve some other problems connected with how to combine Applesoft Programs with ML subroutines in a convenient fashion. These, too, I shall pass on to you.

Although the method I am about to describe is very easy to use, it is actually based upon some rather intimate details concerning the inner workings of Applesoft. So, as a byproduct, I hope this article will add to your knowledge in this area, so vital to making fullest use of the capabilities of the Apple.

Let us begin by solving the problem of how to simplify the loading and running of a single ML program. We'll assume that you start out with the program already in the computer's memory, having been loaded (for the very last time, let us hope) by the tedious old method. We must also assume that you can, if you wish, SAVE the ML program back onto a cassette tape by typing:

(Begin Address).(End Address)W

in the Monitor. This last assumption may be more of a stumbling block than you may think, since some commercial programs are "protected" so that they cannot easily be copied, i.e., SAVED onto another cassette. Sorry, folks, but if that is the case with your program, then I can't help you.

Now, leave the Monitor and enter the Applesoft level by typing Control-C (Return), and type in an Applesoft loader program like the one I'm going to show you below. The example is for a

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1978: Adventure

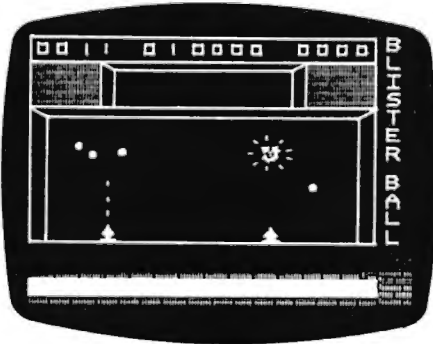
1979: Air Traffic Controller

1980: Super Invader

1981: Blister Ball
and Mad Bomber

Blister Ball

Blister Ball is the first completely original arcade-type game for a computer. Not a copy, not an adaptation, not a spinoff. **Blister Ball** is new—it's a new idea—better than Invaders, better than Circus, better than Asteroids, better than Galaxian. If you've played other games for hours, you'll play **Blister Ball** for days.



How does it work? Well, some mean but fun-loving aliens have produced some bouncing bombs. First they drop one and you've got to position yourself under it and zap it with your laser. If you miss, that's OK. It will bounce around, although each bounce is lower, and you have several chances to zap it. Got the hang of it? OK, here come two bouncing bombs. You zap them. Then you're faced with three, then four and five.

As they bounce longer and longer the walls begin to close in so you're faced with either zapping the bombs or being hit. Each hit knocks you a little further toward the gutter. But you can survive two hits which is usually enough to zap all the bombs.

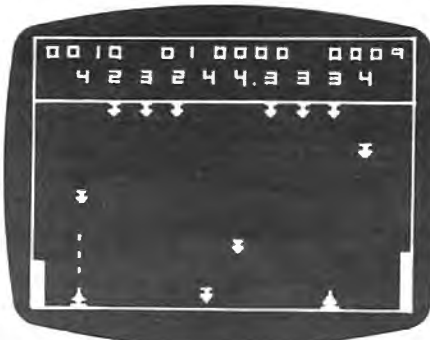
Feeling confident? Don't. Because after 5 bombs the murderous little devils drop 5 bonus bombs, worth ten times as much. These don't bounce, so you get only one shot. You need nerves of steel and the reflexes of a tail gunner.

After you complete one round, the game starts again with bombs that bounce faster and lower (and are worth more) than the previous ones.

Blister Ball is a fantastic solo game. But there are two-player options as well in which players can play as a team or as opponents. Each player can move the entire width of the screen and zap any of the bombs. Here, you're not only trying to survive, but trying to outscore your opponent. The game has two skill levels.

Mad Bomber

In **Mad Bomber** you are faced with aliens in a huge ship hovering overhead. They have bomb racks which they constantly fill with bombs. Your object is to move from side to side on the ground and zap the bombs in the bomb racks or as they fall.



As the game progresses, the aliens fill up their bomb racks more quickly and the bombs fall faster. You lose after ten bombs have hit the area which you are defending.

Mad Bomber can be played by one player solo or by two players as a team or as opponents. Two skill levels.

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Blister Ball and **Mad Bomber** are available together for \$29.95 on disk (DOS 3.2) only and require a 48K Apple with paddle controls. (We recommend using the Super Paddles from Peripherals Plus).

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specific program that I use a lot: my Assembler. And the example has had a few unnecessary bells and whistles added to it to enhance its convenience to me; you may want to leave these off for your application. Instead of describing the program in the usual way, with a lot of REM statements, I intend to do a far more thorough job of explaining it in the following text. So here's my Loader program, and the explanations come after it.

```

10 REM APPLESOFT LOADER FOR
20 REM THE S-C ASSEMBLER
30 :
40 HOME : VTAB 12: HTAB 8: PRINT
  "LOADING THE S-C ASSEMBLER"
50 PRINT :X = POS(0)
60 Y$ = "1000.24FFR D823G"
70 FOR I = 1 TO LEN(Y$): POKE 511 + I, ASC
  (MID$(Y$,I,1)) + 128: NEXT
80 POKE 72,0: CALL - 144
90 T = POS (0): IF T > X + 1 THEN 200
100 POKE 214,85
110 PRINT CHR$(7); "LOAD SUCCESSFUL —
  STOP TAPE": PRINT
120 FOR PAUSE = 0 TO 2000: NEXT
130 CALL 4096: END
199 REM LOADING-ERROR EXIT
200 PRINT CHR$(7); CHR$(7); CHR$(7);
  "**** LOADING ERROR ****": PRINT
210 END

```

Here is the explanation.

Lines 10–30 just tell what the program is for.

Line 40 is one of my "bells-and-whistles." It isn't necessary for proper operation of the program, but I find it comforting. It displays a message on the screen telling me what is going on, and keeps the message there for me to look at while the tape is being read. Some of these ML programs take a L-O-N-G time to load, and you sometimes begin to wonder if the computer is still doing anything.

Line 50 is also not strictly necessary, but it is very useful. It is part of an error detection scheme to keep me from trying to run the program if it didn't load in correctly. The Apple keeps a running tally of a checksum during the load process, and will give an "ERR" message if it fails to agree with the value that accompanies the program on the tape (thereby indicating that something has gone wrong in the loading), but, other than this message, the Apple doesn't set any error flags that can be read by a program. So here, before we even begin to load the tape, we record, in variable X, the horizontal position of the cursor. This will be used in line 90 (below) to determine if a loading error has taken place.

Lines 60–80 are the heart of the loader. They constitute a clever scheme by which an Applesoft program can, in effect, fool the computer into believing that you have typed in the line:

(Begin Address).(End Address)R

by way of the Monitor! It was invented by S.H. Lam. In line 60, the string variable Y\$ contains a sequence of literal Monitor commands, just as you

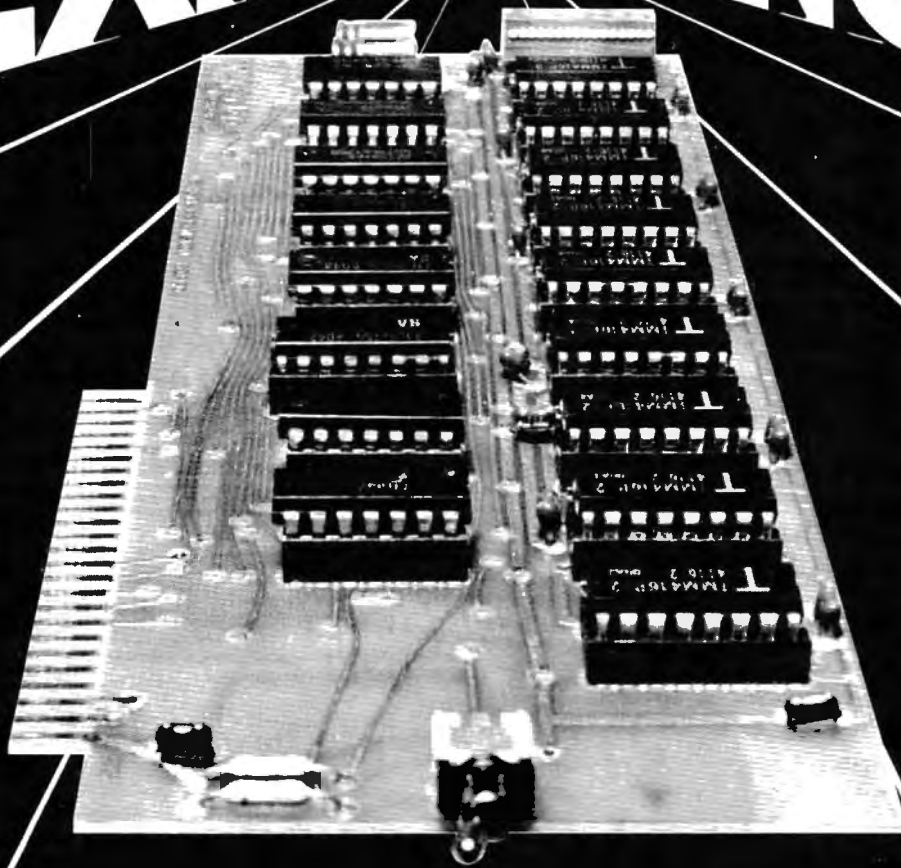
would have typed them in by way of the keyboard. The first part is the instruction to Load the ML program starting at address \$1000 and ending at address \$24FF (the "dollar sign" signifies a hexadecimal number, in 6502 notation). There follows an obligatory space, to separate this Monitor command from the next one. The second and last command on this line is "D823G", which tells the Monitor to execute an Applesoft subroutine located at \$D823. This particular subroutine happens to be the so-called "running return" to Applesoft, after which the computer will begin to execute whichever proper Applesoft command it encounters next.

You'll notice, however, that so far this Monitor command line is still resident in a string variable; how do we get the Monitor to see it and execute it? Well, line 70 pokes this string, one byte at a time, into memory starting at location 512 (in decimal). But 512 is equivalent to \$0200, the start of the Apple's keyboard input buffer where it goes to find every new line after you have typed it in. So the effect of line 70 is to place the pseudo-input line defined in line 60 into the input buffer. Those who are particularly observant may be wondering about the reason for adding 128 to the value produced by the ASC command, before POKEing it into the buffer. This is due to a little known incompatibility between Applesoft and the Monitor in the way they interpret ASCII character codes. Strangely enough, although Applesoft uses "true ASCII," in which the highest bit (bit 7) of each byte is off (i.e., = 0), the Monitor uses a different version of ASCII in which bit 7 of each byte has to be on (i.e., = 1). The addition of 128 (decimal) turns this bit from off to on.

Now line 80 gets the Monitor to look into the keyboard buffer and execute whatever commands it finds there. The POKE of 0 into location 72 is just a precaution, to make sure that no strange values have gotten into the location which will be stored in the Processor Status Register when the Monitor call is executed. Those of you who know something about the operation of the 6502 Microprocessor will understand what this means; for the rest of you it is of no great significance — it just needs to be done to prevent possible trouble. Finally, the command CALL-144 jumps to the Monitor subroutine referred to above: the one that scans the input buffer and executes whatever commands it sees there.

As I mentioned above, lines 60-80 are the heart of the technique being discussed in this article. But I want to emphasize that the procedure outlined in the past few paragraphs is *extremely* powerful and quite general. By using it, you can make the Apple execute any commands which can be input by way of the Monitor, such as moving ranges of memory around, storing machine language pro-

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grams wherever you wish, or any of the other things discussed on pages 39–60 of the *Apple II Reference Manual*. But you can do all this from *within* a running Applesoft program, without ever stopping to enter the Monitor or typing in any commands at the keyboard. To those with a fertile imagination, the possibilities inherent in such a capability are enormous — enough to fill several articles as long as this one. You can have some fun thinking up some ideas of your own.

Meanwhile, let's get back to the subject at hand. After executing line 80, the computer should have loaded the ML program from tape into the specified location in memory. Line 90 checks the horizontal position of the cursor after the load has been completed. If the loading failed, the computer will have printed out the message "ERR", and so the cursor will be three spaces farther to the right of where it was before the loading process began. In this case, line 90 causes a jump to line 200, the error exit. Here the "bell" is beeped thrice (those CHR\$(7)s) to wake me up, an appropriate message is printed on the screen, and the program ends, to let me rewind the cassette and try again.

But this doesn't happen very often — the Apple cassette system has been very reliable for me. So, usually, upon completing the tape load, the program goes to line 100. This is another very important line whose significance, however, cannot be easily explained at this point in the discussion. Let us put off the explanation of line 100 until we have finished looking at the remainder of the program. There's not much left to say. Line 110 lets me know, with a "beep" and a message, that the loading process has been successfully completed and reminds me to turn off the tape recorder. Line 120 causes a delay of about three or four seconds to give me time to see and act on that message, because line 130 causes the program to begin executing.

This may need a bit of comment. Although it is necessary, in Applesoft, to RUN to start a program after loading it, I think that most of the time the user would be just as happy to have the program begin running as soon as the load was completed, if only Applesoft had such a "LOAD-AND-GO" command. Certainly in the present example, since I know that the entry address to initialize my Assembler is at \$1000 (decimal 4096), I prefer to have the loader program do this for me by doing a "CALL 4096". You can "Load-and-Go" your own ML programs in the same way by putting an equivalent CALL to the entry address in your version of this loader.

However, if you insist on retaining the two-step process, and want to be able to start your program by typing RUN in the regular Applesoft manner, the program can easily be modified to do this instead. Just replace line 130 with the following:

```
130 DEL 10,130: END
```

```
140 CALL 4096: END
```

The new line 130 causes the whole front part of the loader to self-destruct (in memory only of course, not on your cassette), leaving only line 140 as the first active command. Now typing RUN executes just this one remaining line, making your ML program start running at its entry address.

This has been a rather exhaustive description of a short Applesoft program, but since it contains several techniques which may be new and unfamiliar to many readers and since these techniques seem to me to be of great usefulness, I thought it worthwhile to explain thoroughly.

One Of Applesoft's Least-Known Features

But we're not quite done explaining yet. There is one more technique which is required to make the loader perform properly. And this is perhaps the most mysterious and least-known of all the features of Applesoft, so even some of you semi-pros might be able to learn something new from the next few paragraphs.

As things now stand, the loader program and your ML program have not yet been joined together on tape so that the former can help you to load in the latter. You will recall that, before I started describing the loader program, I left you with your ML program already in memory. Now you should also have typed in a customized version of the loader program, with the beginning and ending addresses in string Y\$ replaced by the values appropriate to your ML program, and your entry address (in decimal) replacing my "4096" in line 130 (or 140 if you chose to go that route). (By the way, I hope that your ML program didn't occupy any of the memory spaces now containing the loader (from \$0800 to \$09A2 in my case), since I forgot to warn you about this unfortunate way to clobber the whole thing.) Assuming that all is still well, you now want to put both the loader and the ML program onto tape, with the loader first, of course. But, before you hasten to type SAVE to put the Applesoft loader program on tape, wait just a little longer while I explain the last secret.

The secret is this: *before* you SAVE the loader, type in the following Applesoft command in Immediate Mode (to be executed from the keyboard):

```
POKE 82,128
```

This seemingly innocuous command is the key to making the loader behave like an EXEC file — doing its job without human intervention. It represents an almost totally undocumented feature of Applesoft and works like this: any Applesoft program which is SAVED to tape after this POKE has first been executed will AUTO-RUN as soon as it has been LOADED! That is, if you rewind the SAVED tape and type LOAD, Applesoft will not only load in the program, but will also immediately

begin running it *without waiting for you to type RUN*. So Applesoft does, after all, have an AUTO-RUN command; you just have to know how to get at it.

Now the background for making the Tape-Exec loader is complete. Do the POKE, then SAVE the loader program, then enter the Monitor and SAVE your ML program by typing:


(Begin Address).(End Address)W

in the usual way. (In the case of my Assembler, for example, I used 1000.24FFW to SAVE it.) Now try it out. Rewind the tape, and type LOAD in the good old Applesoft way. The loader will be loaded and will immediately begin to run by itself, causing your ML program to be loaded too, in accordance with the instructions placed in its Y\$ string by you. From now on, it will be as easy to load this ML program as any Applesoft program.

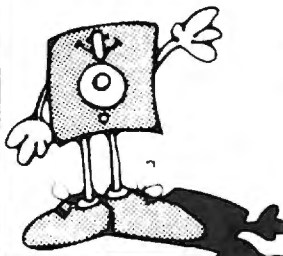
There is just one potential problem with all this, but I have taken care of it by the as-yet-unexplained POKE in line 100 of the loader. You see, the magic words "POKE 82,128" which you invoked before SAVEing the loader constitute a much more powerful spell than I have yet indicated. They do more than just cause an Applesoft program (in this case, the loader) to Auto-Run. They also completely lock up Applesoft so you can't use it very much. It will allow you to RUN the program in memory, but any other valid or invalid Applesoft command will be ignored. You won't be able to LIST, SAVE, alter, or do anything else to the program as long as the effects of that POKE remain active. This is a very powerful magic you have invoked here, but it would take us too far afield from the main topic to explain all its ramifications now.

Fortunately, however, it is not hard to undo the effects of that magic from within the loader program itself (although quite difficult, and sometimes impossible, to undo it from outside a running program!) Line 100 is the required antidote. It leaves everything just as you are accustomed to having it in an Applesoft environment. ©

(Continued in next issue.)



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Text Composition On The Apple II Plus

R. R. Hiatt, John Rustenburg and
Stefan Demmig
St. Catharines, ONT

Text composition on the Apple II Plus presents two problems, interfacing to some sort of printer and distinguishing between upper and lower case on both CRT and printer output. The first of these is readily solved by the Apple II Reference manual: We are pleased to report that the circuit given as Figure 1 on p. 118 requires no modification for interfacing a Decwriter II to the Apple II Plus. The software (TTYDRIVER, p. 119), does require a small change: deleting the text window width setting to 72 (replacing the code in \$378-\$37B with NOP's). This avoids the system crash that results when control is returned to the CRT with a text window greater than 40. Furthermore, text window setting is more flexible when incorporated in the BASIC calling routine.

Upper vs. lower case with the standard Apple keyboard is trickier. The shift key is live only for dual function keys such as @/p and / N. The CTRL key is also dual purpose; e.g., if CTRL M were to be interpreted as cap M, there would be no unambiguous signal for carriage return. Fortunately, the ESC key can be made to suit the purpose after a bit of fooling around to see how it affects code received at the keyboard inport (\$C000).

Programs 1 and 2 are short ESC demo routines. ESCDEMO1 shows the transient nature of the ESC effect. (Key ESC; then before all 16 27's are printed, key a letter.) ESCDEMO2 is a little more amusing. The ESC, (CHR\$(27)), is captured in an apparently infinite loop. Subsequent keying of a letter, however, breaks the loop and results in a print of *both* "UPPERCASE" and "LOWERCASE," as if both of the two mutually exclusive IF clauses were being followed. (Of course, they are, but not as it immediately appears. We leave it to the reader to figure out the logical paradox.)

Program 3 gives a simple text composition routine, employing both DECWRITER (our name for the modified TTY driver) and ESC for upper case letters. The main program, starting at line 400, augments the routine of Program 2 by capturing the ESC'ed ASCII code and then resetting

the keyboard strobe. (Resetting the strobe first de-ESC's the value.) To facilitate corrections, the text is echoed to the CRT, with left arrow (←) activated for erasure, and is sent to the printer only after a <CR> (end of line).

Training oneself to use ESC for upper case, rather than shift turns out not to be as difficult as it might seem, as long as upper case letters are distinguished on the CRT in some way. We have taken the route of setting upper case to FLASH via the code in the subroutine at 200.

The single character FLASH requires a POKE at the appropriate screen memory address. While the base vertical address can be worked out from the vertical cursor position (PEEK(37)) and a base 8 algorithm, it turns out that the base address for TEXT/LORES graphics is easily obtained by PEEK(40) + 256*PEEK(41). Adding PEEK(36) (horizontal) to this gives the cursor position.

Obviously Program 3 is not a text editor or even a proper front end for one. It does, however, solve what we have felt to be the major problems — those involving the system. The rest is simply a matter of creative BASIC.

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Program 1. ESCDEMO1

```

10 GET Q$
20 FOR I = 49152 TO 49167
30 PRINT PEEK (I), I: NEXT: GOTO 10

```

Program 2. ESCDEMO2

```

10 P = 49152
20 GET Q$
30 IF PEEK (P) = 27 THEN 30
35 CH = PEEK (P)
40 IF CH > 127 THEN PRINT "UPPER CASE":
   GOTO 20
50 IF CH < 128 THEN PRINT "LOWER CASE":
   GOTO 20

```

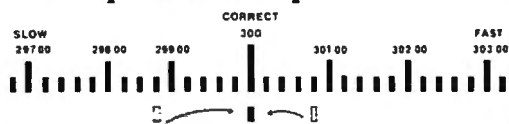
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```

10 REM SECRETARY
20 DIM LN$(200)
30 D$ = CHR$(4): B$ = CHR$(7): P =
  -16384: Q = -16368
40 PRINT "PROGRAM FOR WRITING HARD COPY
  TO DEC II": PRINT: INPUT "WANT
  INSTRUCTIONS ? "; Q$: IF Q$ >= "Y"
  THEN GOSUB 600
50 INPUT "LINE LENGTH FOR DEC II ? "; LW
60 IF PEEK(880) < > 169 THEN PRINT D$:
  "BLOOD DECRYPTER"
70 GOTO 400
100 REM SBR BACKSPACE
110 IF LL = 0 THEN RETURN
120 LL = LL - 1
130 PRINT CHR$(8);
140 RETURN
200 REM SBR FLASH CAPS
210 HZ = PEEK(36)
220 PN = 256 * PEEK(41) + PEEK(40) + HZ
230 POKE PN, CH - 128
240 POKE 36, HZ + 1
250 RETURN
300 REM SBR WRITE TO DEC II
310 CALL 880
320 POKE 33, LW
330 FOR I = 1 TO LL
340 PRINT CHR$(LN$(I));
350 NEXT
360 PRINT
370 POKE 33,40: PR# 0
380 PRINT
390 RETURN
400 REM CHARACTER INPUT
410 CALL - 936
420 LL = 0
430 UC = 0
440 GET Q$: CH = PEEK(P)
470 IF CH = 8 THEN GOSUB 100: GOTO 430
480 IF PEEK(P) = 27 THEN UC = 1: GOTO
  480
490 CH = PEEK(P)
500 POKE Q, 0
510 IF CH > 64 AND CH < 91 THEN CH = CH +
  32
520 LL = LL + 1: IF LL = LW - 8 THEN
  PRINT B$:
530 IF LL > LW THEN LL = LL - 1: GOSUB
  300: LL = 1
540 LN$(LL) = CH
550 IF UC THEN GOSUB 200: GOTO 430
560 PRINT Q$;: GOTO 440
600 REM INSTRUCTIONS
610 HOME: PRINT "TYPE NORMALLY, BUT USE
  ESC KEY FOR
620 PRINT "UPPER CASE LETTERS> (UPPER
  CASE ON": PRINT "SCREEN IS SET TO
  FLASH)": PRINT
630 PRINT "THE SHIFT KEY IS STILL USED
  FOR UPPER": PRINT "SYMBOLS ON DUAL
  FUNCTION KEYS": PRINT
640 PRINT "TO END PROGRAM KEY CTRL A"
650 FOR I = 1 TO 3000: NEXT: PRINT:
  RETURN

```

©

Algebra String

A Self-Altering Program For The Apple-II

Winston Cope
St. Petersburg, FL

BASIC is essentially an arithmetic language. Its symbol manipulating capability is used mainly to provide conveniences for the user, to provide instructions for the user, or to give headings. An algebraic expression is part of the program text, and is considered a calculation.

There is no easy way to operate on a mathematical expression itself, for example, to take a derivative. A program must be written which inputs a mathematical expression as a string and yields another string as output. Applesoft provides string manipulation commands which make this possible. The expression is still a string, however, and there is no easy way to derive numbers from it, to graph it, for example.

"ALGEBRA STRING" is a demonstration of how a mathematical string expression may be transformed into an arithmetic variable expression which can be used by the program. The concept behind this program is to take an algebraic string expression, Y\$, to expand it to a standard length, and to poke it back into the program text itself at the proper position. Care must be taken to translate operation symbols, such as +, into their token form.

This program considers a function Y of X, and subroutine 2000 performs a simple listing of an array Y(X), for X going from 1 to N. Subroutine 62100 inputs the expression as Y\$, and expands to a length of 50 characters, by concatenating "+"s and a final "0". Subroutine 62200 takes this expanded expression and POKES it into memory so that it appears at the proper place in the program text, here, at step 1020, beginning at memory location Z. Arithmetic operators are represented in strings as ASCII, but have token values when used for calculation, so this subroutine performs these substitutions. The arithmetic expression in the program whose place is taken by Y\$, in step 1020, must have the same length as Y\$, here 50.

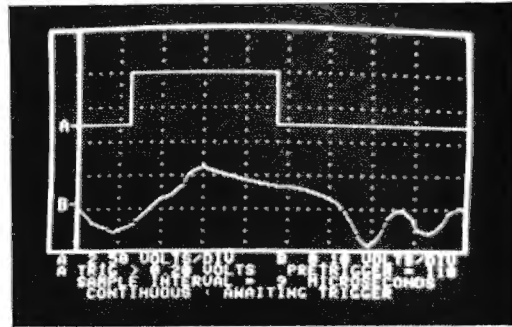
Subroutine 62000 determines Z. This is simply done by finding the memory location which contains a "+," such that the next 5 locations also contain "+." The odds are very small that this would happen anywhere else than Z. LO and HI could be 0 and 64000, but for a particular program one can markedly narrow the range of the search.

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ize itself by filling up the expression at 1020 with "+"s so it can be run again.

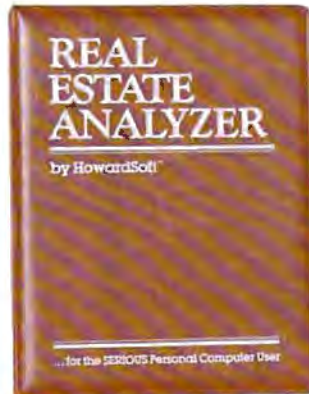
```

5 ALGEBRA STRING
10 PRINT "ENTER # OF POINTS": INPUT X
100 LO=2000:HI=2500
105 DIM Y(N)
110 GOSUB 62000
115 GOSUB 1000:GOSUB 2000
120 PRINT "ALL DONE? (Y/N)":GET C$
125 IF C$="N" THEN 115
130 Y$="+++++": GOSUB 62200
135 END
1000 REM LOAD ARRAY Y(X)
1005 PRINT "ENTER ALGEBRAIC WITH
DEPENDENT VARIABLE X":INPUT Y$
1010 GOSUB 62100:GOSUB 62200
1015 FOR X=1 TO N
1020 Y(X) = + + + + + + + + + + + + + + + +
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+ 0
1025 NEXT X
1030 RETURN
2000 REM DISPLAY Y(X)
2005 J=0
2010 FOR X=1 TO N
2015 PRINT X,Y(X):J=J+1
2020 IF J=20 THEN PRINT:PRINT "PRESS ANY
KEY":GET C$:J=0
2025 NEXT X
2030 RETURN
62000 REM FIND Z
62010 FOR J=0 TO 5
62015 IF PEEK(I+J) <> 200 THEN 62030
62020 NEXT J
62025 Z=I: RETURN
62030 NEXT I
62035 PRINT "CANNOT FIND Z": END
62100 REM STANDARD LENGTH FOR Y$
62105 IF LEN(Y$)<49 THEN Y$=Y$ + "+":GOTO
62100
62115 RETURN
62200 REM SUBSTITUTE Y$ INTO PROGRAM TEXT
62205 FOR I=1 TO LEN(Y$)
62210 Q= ASC(MID$(Y$,I,1))
62215 IF Q=43 THEN Q=200
62220 IF Q=45 THEN Q=201
62230 IF Q=47 THEN Q=203
62240 IF Q=94 THEN Q=204
62245 NEXT I
62250 RETURN

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Positioning Player-Missile And Regular Graphics In Memory

Fred Pinho
Valley Cottage, NY

Have you ever used PM graphics only to notice funny-looking colored lines or dots on the screen with your carefully crafted images. When you moved your player or missile, these lines and dots seemed to acquire a life of their own. While it was fascinating to watch this "extra" display, it also quickly became frustrating to your programming attempts. The problem is that all the instructional articles I've seen tell you that you must step-back in RAM a minimum of 1K (4 pages) for double-line resolution and 2K (8 pages) for single-line resolution. They either ignore, or barely mention in passing, the important fact that you must also allow for the screen display memory in this calculation. The Atari uses two blocks of memory to control the TV screen display. Residing at the very top of RAM is the Display Data. This block of memory contains a bit map for the TV screen in graphic modes 3-8 and a character map for text modes 0-2. Residing just below the Display Data is the Display List. This block of memory is essentially a short program that tells the Atari how to set up the TV screen for the desired mode. The total memory required for the Display List and Display Data varies with the graphics mode used. This is illustrated in Table 1. As you can see, the highest resolution mode, GR.8, requires the most RAM.

Thus, the explanation for the "extra bonus" lines or dots in your PM display is that the program did not step-back far enough into RAM and consequently located the PM data in the Display Data memory area. The Atari then obediently displayed this data both from the normal display and through the PM system. Since the Display Data is displayed

as a number of bytes per line (Table 2), you will see a line of varying colored dots. By contrast, the PM display is organized to display the bytes in a "stack" arrangement and so you see the desired figure (hopefully as you designed it).

To aid you in using PM graphics, Table 1 gives the number of pages that must be stepped back in memory (from the top of available RAM) to avoid interference between the two systems. For those not familiar with the concept of paging, the memory addressing system of the 6502 microprocessor within the Atari is based on the concept of a memory *page*. Each page is equivalent to 256 bytes of memory. Thus there are four pages of memory in each K (1024 bytes) of memory.

Note that, in calculating the step-back value for Table 1, a restriction must be observed: positioning for the PM RAM must be on a 1K Boundry for double-line resolution and on a 2K boundry for single-line resolution. If you position the PM memory incorrectly the PM data will not be displayed. Since Atari will be equipped with a varying amount of memory, it must be able to keep track of the amount available so that it knows where to locate the display data and display list. This is done at memory location 106 (RAMTOP). If you PEEK this location, you'll find the number of pages, *not the number of bytes*, in your machine. You can get the number of bytes by multiplying by 256. POKEing into this location can be very useful for the programmer. One example is the location of large machine language programs that must be placed in a secure location that is not touched by the BASIC system. One way to accomplish this is to POKE a lower number of pages into RAMTOP, fooling the computer into believing that it has less memory than is the case. Then you can load your machine code in this safe hiding place yet still access it when needed. Another use is as a safe location for a redefined Atari character set. Again, there is one restriction. The relocated Display Data cannot cross a 4K boundry (Graphics modes up to 7). If you don't observe this restriction, you'll find that you will be unable to plot and draw on part of the screen. Ramtop for Graphics 8 must be lowered in multiple 4K blocks. If you try it otherwise, you'll see wierd and unwanted displays on your screen.

I hope these tables aid you in using the PM and Graphics systems. The systems are powerful and unique to the Atari and their use will result in increasingly sophisticated displays.

GRAPHICS MODE	TOTAL MEMORY BYTES ALLOCATED TO						Total Bytes	Memory Step-Back To Be Added To PM Step-Back, ages
	DISPLAY DATA			DISPLAY LIST				
	Bottom Text Window	Unused Always	Bytes Conditional	Text or Graphics Screen	Unused Bytes	Used Bytes		
0	none	none	none	960	none	32	992	4
1	160	none	80	400	none	34	674	3
2	160	none	40	200	none	24	424	2
3	160	none	40	200	none	34	434	2
4	160	none	80	400	none	54	694	3
5	160	none	160	800	none	54	1174	5
6	160	none	320	1600	none	94	2174	9
7	160	none	640	3200	96	94	4190	17
8	160	16	1280	6400	80	176	8112	32

Notes: 1. RAMTOP is at extreme left of table. RAM decreases towards the right.

2. If 16 is added to the graphics mode number, then the conditional unused bytes are added to the screen memory block. The bytes formally used for the text window then become unused. Also the display list expands slightly.

3. The memory step-back in pages is calculated to the nearest, higher, whole page.

Table 1.

Graphics Mode	Number Of Bytes Of RAM Per Screen Mode Line
0	40
1	20
2	20
3	10
4	10
5	20
6	20
7	40
8	40

Example Of PM Positioning In Memory

Assume you wish to run PM in Graphics mode 7. You want to use all four players so all of the Player-Missile memory must be free and clear of the Screen-Display memory.

	Required Step-Back in Memory, pages
Graphics, 7, Screen-Display (Table 1)	17
PM Graphics, single-line resolution (requires 2K)	8
Total =	25 pages

However 25 pages is not on a 2K boundary:

6K = 24 pages

8K = 32 pages

Therefore you must step-back 32 pages for proper positioning of the PM system.

Table 2.

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INSIGHT: Atari

Bill Wilkinson
Cupertino, CA

Editor's Note: We're quite pleased to announce a new column this month for Atari owners. INSIGHT: Atari, written by Bill Wilkinson and other staff members of Optimized Systems Software, will bring you monthly programming insight and support.

We feel you'll be quite pleased. — RCL.

Hi, I'm Bill Wilkinson, and this is the premiere of what will be a regular feature in **COMPUTE!** magazine: a column dedicated to the *software* side of the Atari microcomputers. We may occasionally include little tricks to make better use of the hardware, but the intent is that this column will uncover the facts and foibles of Atari software.

This column will normally be written by some of the authors of Atari BASIC, Atari's Assembler-Editor, Atari's Disk File Manager, and BASIC A+ and OS/A+. We are not all experts in Atari hardware, but we know a lot about the software.

Addressable DATA or Who Needs String Arrays?

Perhaps the most frequent complaint made about Atari BASIC pertains to its lack of string arrays. In 10K bytes of ROM one can pack only so much program; long variable names and instant syntax checking take room; HP and DG have very successful BASICs that don't use string arrays; Atari-style strings are fast and flexible. All this doesn't mean much to you if you can't figure a way to convert that neat Applesoft program to Atari. There are many legitimate uses of string arrays, but the most common use is a kind of in-memory random access data file. Example: in an adventure game the various room descriptions are kept in elements of a string array. This is not the fullest exploitation of string arrays, since the data is static and the arrays merely provide a convenient method of addressing it.

Atari BASIC users, take heart! You have available to you an even more powerful and flexible method of randomly addressing static data. Did you ever notice that Atari BASIC supports the syntax "RESTORE line-number"? Did you ever notice that "line-number" can be either a constant number or (surprise) *any* arbitrary numeric expression? These two capabilities combine to allow some extremely powerful programming constructs in Atari BASIC. The following short program will serve to illustrate.

Let us go through this program carefully and search out the tricks. Lines 1000-1030 are fairly straightforward; the variable names were purposefully chosen to demonstrate that Atari BASIC considers *all* characters in a name to be significant. Lines 1100-1120 initialize the variables which will

```

1000 REM a demonstration of addressable DATA
1010 REM allocate some variables
1020 DIM ROOM$(100),GO$(1),DIRECTION(4),
      DIRECTION$(4)
1030 LET DIRECTION$="NESW"
1100 REM the following variables are used as line
      numbers, etc.
1110 LOOKROOM=3000:LOOP=2000:
      DESCRIPTIONS=9000
1120 DESCRIPTIONSIZE=10
1900 REM variables are set up — initialize player
      status
1910 ROOM=2:GOSUB LOOKROOM
2000 REM the main program loop
2010 PRINT "WHICH WAY?";:INPUT GO$
2020 DIRECTION=0
2030 FOR I=1 TO 4:IF GO$=DIRECTION$(I,1)
      THEN DIRECTION=I
2040 NEXT I
2050 IF NOT DIRECTION THEN GOTO LOOP
2060 GO=DIRECTION(DIRECTION)
2070 IF NOT GO THEN PRINT "CAN'T GO THAT
      WAY":GOTO LOOP
2080 IF GO>1000 THEN GOSUB GO:GOTO LOOP
2090 ROOM=GO:GOSUB LOOKROOM
2100 GOTO LOOP
3000 REM subroutine to get and print details of a
      new room
3010 RESTORE DESCRIPTIONS+ROOM*
      DESCRIPTIONSIZE
3020 FOR I=1 TO 4:READ TEMP:DIRECTION(I)
      =TEMP:NEXT I
3030 READ ROOM$:PRINT "YOU ARE IN";
      ROOM$
3040 RETURN
8000 REM special routines for special actions
8010 PRINT "YOU MADE IT OUT! CONGRATU-
      LATIONS!":END
9000 REM the room descriptions and connections
9010 DATA 3,5,0,0,A LARGE CAVERN
9020 DATA 0,4,5,3,A SMALL CAVERN
9030 DATA 0,2,1,0,A CURVING PASSAGEWAY
9040 DATA 0,8010,5,2,AN ANTECHAMBER
9050 DATA 2,4,0,1,A MAZE OF TUNNELS

```

be used for "address arithmetic" later in the program; "LOOP," for example, simply gives a name to the line number where all the action starts.

Line 1910 begins the start of the tricks: it GOSUBs to LOOKROOM. Notice how much more readable this is than simply coding GOSUB 3000, which tells you nothing of the purpose of the statement. Looking at routine LOOKROOM (lines 3000-3040), we note the usage of "RESTORE expression." As an example, assume that LOOKROOM is called with ROOM=2. Then line 3010 becomes equivalent to "RESTORE 9020." The subsequent READs then fill the array DIRECTION() with the numeric data of line 9020 and the string ROOM\$ with the string, "A SMALL CAVERN." Finally, the user is prompted with a message ("YOU ARE IN A SMALL CAVERN,") and the subroutine exists.

Continuing our main program at lines 2000-2040, we simply ask the user for a direction (from the choices 'N', 'E', 'S', and 'W'). An invalid answer

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causes DIRECTION to be zero and the question to be asked again. Let us assume we are still in room two and also assume that the WHICH WAY? query was answered by "E." GO then becomes 4 (from DIRECTION(2)); and, since it is nonzero (line 2070) and less than 1000 (line 2080), the current ROOM becomes number 4 and we GOSUB LOOK-ROOM again.

The only things left to note about this program are what happens if GO is zero (e.g., if we had tried to go "N" from room 2) or greater than 1000 (if we try to go "E" from room 4)? The case of GO=0 is easy: the program treats that as an illegal move, prints "CAN'T GO THAT WAY," and makes the player try again. For GO greater than 1000, another action unique to Atari BASIC happens: we GOSUB to the apparent room number contained in GO. In the particular example shown, the only GOSUB is to line 8010 which ends the "adventure," but this mechanism can be used to allow sophisticated checks on movement (e.g., you can only go from room 31 to room 33 if you have the Golden Fleece). The concept of addressable GOSUBs was heavily exploited, and we will try to cover those techniques in a future column.

Each of these columns will cover one or two programming topics and answer a few questions (presuming that you, the reader, will supply us with some questions). In this initial column, we would like to try to comment on some of the points raised in the "ASK THE READERS" column from **COMPUTE!** #14.

16K Memory

I. Regarding D. Gallagher's query about PRINT FRE(0) in his 48K machine.

When you plug the first (left, in an Atari 800) cartridge into an Atari, you "lose" the top 8K of the possible 48K of RAM. Thus your 48K does you no more good than 40K would. It can get worse: if Atari ever comes out with a dual cartridge product, you will lose the top 16K of your 48K. The reason: Atari's memory map simply doesn't leave any other place to put the cartridges, so Atari cleverly arranged the circuitry so that plugging in the cartridge disables any RAM at the same addresses. Does this mean that it is a waste to put 48K bytes of RAM into your Atari? Not at all! There are several products already available that use no cartridges at all (Visicalc, BASIC A+, Forth, etc.). In fact, look for Atari systems with 160K bytes of RAM, or more, in the near future. And by the way, it is not surprising to hear of the "foreign" memory board in the Atari: systems suppliers have been doing that in the minicomputer (DEC, HP, etc.) and S-100 (8080 and Z-80) markets for years! After all, if the dealer can give you more for less, why complain? Oh yes, for the curious, herewith the Atari memory map:

OS ROM (10K bytes)		FFFF
I/O hardware		D800
Reserved for future use		D000
48K of RAM	Left cartridge	C000
	Right cartridge	A000
		8000
		0000

II. Comments about the letter discussing RFI from an APPLE II.

Atari owners, stand up and be proud! Did you know that your machine is the only full-fledged computer that was able to pass the FCC's former (and very strict) RFI regulations? But thanks to TI, and some extensive lobbying with the FCC, the RFI rules are much relaxed and even the Apple II (with the help of some new shielding) can now pass the tests. But even so, the Atari has to be one of the quietest (in terms of RFI) machines ever produced. So while you owners are enjoying noise-free television, remember that the abysmally slow disk I/O speeds you also "enjoy" are part of Atari's solution to the RFI problem. That serial bus didn't just happen by accident: it was the result of some superb — but, alas, no longer necessary — engineering.

III. An answer to Tracy Principio about GR.X from assembly language.

Anyone contemplating writing in assembly language for the Atari is virtually required to purchase the *Hardware Manuals* (as did Tracy); but, even if you don't have a disk, the Atari DOS manuals and OS listings are *also de rigueur*. Any kind of I/O must go through CIO, the heart of the Atari OS, and graphics on the Atari are most easily done via I/O. Did you know that PLOT, DRAWTO, POSITION, FILL, and more are *not* in Atari Basic? They are actually routines in the I/O section of the OS ROM, and BASIC simply provides an interface to them. So, if you understand the I/O subsystem, you can do graphics in assembly language almost as easily as you can do them in BASIC. The whole subject of I/O and graphics from assembly language would make a beautiful *series* of columns (tell us if you'd like to see some), so we must "answer" Tracy's question by noting that GR.X is equivalent to:

OPEN #6,12,X-16,"S:" if X is greater than 16
(full screen graphics)
or OPEN #6,12+16,X,"S:" if X is less than 16
(mixed characters and graphics).

Note that the "12" is simply 8+4, read *and* write access, just as with a disk.

That's all for this month. We hope that by increasing your awareness of its capabilities we can convert you, too, into more informed and capable Atari users. ©

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The ATARI 825: An Assembler Interface

John Elliott
New York, NY

The ATARI 825 printer must be one of the most versatile in its price range. It offers three distinct character sets:

- Monospaced characters at 10 characters per inch (10 CPI)
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What is more, all of these features are completely under software control. That is, you, the programmer, control exactly how your data is to be printed, without any need for operator intervention. This is made possible by the fact that the printer has a built-in central processing unit (CPU), which can recognize and interpret printer control codes.

When the printer is powered on, the CPU automatically selects the 10 CPI monospaced character set. Any data characters sent to the printer will be printed using this default character set, which will stay in effect until the printer receives control codes which specify an alternate character set. Subsequent data will be printed in the new character set, until yet other control codes are received, or until the printer is power cycled (turned off, then back on).

The user manual which is supplied with the printer is also deserving of praise. It is comprehensive and very clearly written, with all kinds of tables, charts and diagrams, to help you understand the text, and to get the most out of the printer. It even includes a BASIC program for right-justifying text lines, another very useful capability of this printer. All in all, I have nothing but praise for both the printer and the manual.

Of course, if everything in the garden were rosy, then there would be no need for this article. There is just one slight hitch. Assembly language programmers have been somewhat ignored.

Neither the 825 manual, nor the ASSEMBLER/EDITOR manual describes how to make use of the special features of the printer from the ASSEMBLER/EDITOR, or from an assembly language routine. So, if you want to use a character set other than the default 10 CPI set, to print an assembly listing, for example, then you've got a problem. And, of course, just about the first thing I wanted to use the printer for was to print an assembly listing, using the neat, paper-saving condensed character set. I searched through the manuals for a clue as to how I might do this, but found none.

Necessity being the mother of invention, I set to work designing an assembly routine which would select a character set of my choice. The short program listed here is the result. It is a very simple routine, and, as coded, will select the 16.7 CPI condensed character set, which I use for printing my assembly listings.

I will now describe the program logic in more detail, and give instructions for executing it. Finally, I will describe how you can modify the program to select any print mode of your choice. I assume that the reader is familiar with the ASSEMBLER/EDITOR cartridge, and has access to an ATARI 825 printer user manual.

The program opens the printer (device code P:) using input/output control block #6 (IOCB #6). This establishes a link between our program and the central input/output (CIO) subsystem of the ATARI operating system (OS). The ATARI OS is the program in the 10K ROM module in your ATARI console. This program contains many routines written specifically for communicating with the input/output devices, such as printers, disks, cassettes, etc. These routines are referred to collectively as CIO routines, and they provide the application program with a means of accessing the peripheral devices in a standard, device-independent manner. There is a single entry point to the CIO routines, and the IOCB is the vehicle of communication between CIO and the application program.

Having established the link with CIO, our program then transmits a string of control codes to the printer, through CIO, to select the desired character set. In the listing shown here, the codes are those required for selecting the condensed character set. The program then closes the file, thereby breaking the link with CIO and freeing the IOCB for other I/O. It then issues the BRK instruction which will return control to the DEBUGGER.

And that's all there is to it.

To use the routine, first assemble it into RAM. Then, using the DEBUG program in the ASSEMBLER/EDITOR cartridge, execute the



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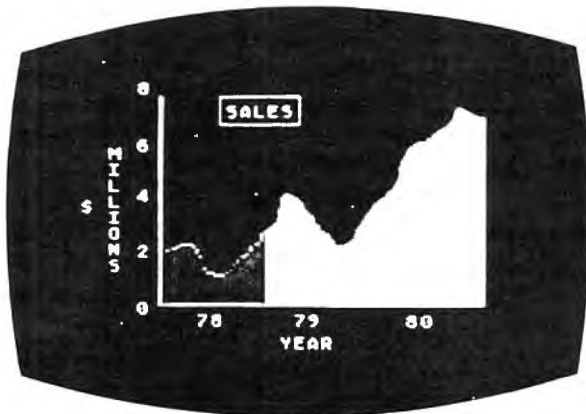
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program by typing G600 (assuming you assembled it into page 6). The program will transmit the control codes, as described above. Don't forget to have the printer properly connected and powered on.

After transmitting the control codes, the program gives control back to the DEBUG program. You will know that this has happened when the DEBUG prompt appears on the screen. You can then go back to the EDITOR (by typing X), and LIST, PRINT, or ASM output to the printer, using the character set selected by the assembler routine. The control codes will stay in effect until the printer is power cycled, or until you transmit some other control codes to the printer.

Changing the program to select a print mode of your choice is quite straightforward. Consult Table 2 in the 825 user manual. This table lists the

printer control codes. Note the codes needed to select the print mode you are interested in. Then change the constant labelled PCODE in listing to contain these codes. Reassemble, and you're ready to go. Just execute the program to select the mode of your choice.

Bear in mind that the program was specifically designed to execute in conjunction with the DEBUGGER. It is important to remember this, as the BRK instruction is used to terminate the program. In effect, this instruction relinquishes control to the DEBUGGER. If you want to use the program in some other environment, then you should change the exit logic to conform to the constraints of that environment.

However you decide to use the routine, I hope that you find it useful. Good printing, and good luck!

```

0100 ;+++++
0110 ;+ ASSEMBLER SUBROUTINE TO +
0120 ;+ INTERFACE TO THE +
0130 ;+ ATARI 825 PRINTER +
0140 ;+ J. ELLIOTT. APRIL/81 +
0150 ;+++++
0000 0160 IOCB   *=   $0340   ;I/O CONTROL BLOCKS
0340 0170      *=   *+2
0342 0180 ICCOM *=   *+1     ;COMMAND CODE
0343 0190      *=   *+1
0344 0200 ICBAL *=   *+1     ;BUFFER ADDRESS LSB
0345 0210 ICBAH *=   *+1     ;BUFFER ADDRESS MSB
0346 0220      *=   *+2
0348 0230 ICBL  *=   *+1     ;BUFFER LENGTH LSB
0349 0240 ICBLH *=   *+1     ;BUFFER LENGTH MSB
034A 0250 ICAX1 *=   *+1     ;AUX CONTROL BYTE 1
034B 0260 ICAX2 *=   *+1     ;AUX CONTROL BYTE 2
0008 0270 OPNOT =   $08     ;OPEN FOR OUTPUT
0003 0280 OPEN  =   $03     ;COMMAND CODE - OPEN
000C 0290 CLOSE =   $0C     ;COMMAND CODE - CLOSE
0009 0300 PUTREC =   $09     ;PUT RECORD
009B 0310 EOL   =   $9B     ;END OF LINE (CR)
001B 0320 ESC   =   $1B     ;ESC CONTROL CODE
0014 0330 COND  =   $14     ;CONDENSED C.C.
0000 0340 NULL  =   $00     ;NULL CHARACTER
0060 0350 IOCB6 =   $60     ;IOCB #6 INDEX
0028 0360 BUFSZ =   40     ;MAX RECORD SIZE
E456 0370 CIOV  =   $E456   ;CIO ENTRY VECTOR
034C 0380      *=   $0600   ;PROGRAM ORIGIN
0600 A2FF 0390 LDX   #$FF
0602 9A   0400 TXS
0603 A260 0410 LDX   #IOCB6 ;INIT THE STACK POINTER
0605 A903 0420 LDA   #OPEN  ;OPEN P: USING #6
0607 9D4203 0430 STA  ICCOM,X ;SETUP OPEN COMMAND
060A A948 0440 LDA   #PNAME&$FF ;POINT TO THE NAME
060C 9D4403 0450 STA  ICBAL,X
060F A906 0460 LDA   #PNAME/256
0611 9D4503 0470 STA  ICBAH,X
0614 A908 0480 LDA   #OPNOT  ;OPEN FOR OUTPUT

```

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```

0616 9D4A03 0490      STA  ICAX1,X
0619 A900 0500      LDA  #$00          ;CLEAR AUX2
061E 9D4E03 0510      STA  ICAX2,X
061E 2056E4 0520      JSR  CIOV          ;DO THE OPEN
0621 3024 0530      BMI  RETURN        ;EXIT IF NO GOOD
0623 A94E 0540      LDA  #PCODE&$FF   ;SETUP THE...
0625 9D4403 0550      STA  ICBAL,X
0628 A906 0560      LDA  #PCODE/256   ;...BUFFER ADDRESS
062A 9D4503 0570      STA  ICBAL,X
062D A928 0580      LDA  #BUFSZ&$FF   ;SETUP MAX...
062F 9D4803 0590      STA  ICBLL,X
0632 A900 0600      LDA  #BUFSZ/256   ;...BUFFER SIZE
0634 9D4903 0610      STA  ICBLL,X
0637 A909 0620      LDA  #PUTREC       ;SETUP THE PUT...
0639 9D4203 0630      STA  ICCOM,X      ;...COMMAND CODE
063C 2056E4 0640      JSR  CIOV
063F A90C 0650      LDA  #CLOSE        ;CLOSE THE FILE
0641 9D4203 0660      STA  ICCOM,X
0644 2056E4 0670      JSR  CIOV
0647          0680 RETURN = *          ;RETURN TO DEBUGGER
0647 00          0690 BRK
          0700 ;
0648 50          0710 PNAME .BYTE "P:",EOL
0649 3A
064A 9B
064B 1B          0720 PCODE .BYTE ESC,COND,NULL,EOL
064C 14
064D 00
064E 9B
064F          0730 .END

```

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Using The Color And Locate Instruction To Program Pong Type Games

Michael A. Greenspan

New Atari Owners may be confused (as I was) about the COLOR and SETCOLOR instructions. These two commands, and the LOCATE instruction, form the basis of the following PONG type game.

In Graphics 3, there are four color registers labeled 0, 1, 2, and 3, which are accessed by the instruction COLOR X, where X is the number of the register desired. (COLOR 4 is the same as COLOR 0; COLOR 5 is the same as COLOR 1, etc.) While COLOR determines the register used, SETCOLOR enables you to determine which of the 128 colors are used by your chosen register to draw points on the screen. Thus, since the SETCOLOR instructions are identical, the following commands will each put a dark gold on the screen at location 1,1:

```
10 GR 3: COLOR 1: SETCOLOR 0, 1, 2* : PLOT 1,1
10 GR 3: COLOR 2: SETCOLOR 0, 1, 2* : PLOT 1,1
```

Each color register has a different default color that determines the color of the points plotted in that register if no SETCOLOR 0, X, X instruction is given. Therefore plotting points in different color registers will produce different colors in the absence of SETCOLOR instructions, and identical colors if identical SETCOLOR instructions are used.

In the program below, a ball will move from left to right and a joystick is used to maneuver a paddle on the far right to intercept the ball. The paddle is plotted in color register 1, and the ball in color register 2. In order to move the ball, it is replotted in color register 4, whose default color is the same as the background color (and thus is invisible), and then replotted on the adjacent square in color register 2.

The LOCATE instruction determines if there is a hit. X and Y are the X and Y coordinates of the ball. LOCATE X+1, Y, X tells the computer to LOCATE the point to the right of the ball and to

store the *color register* of that point in Z. Since the paddle is plotted in color register 1, Z=1 means that the ball hit the paddle.

Once you understand the use of COLOR and LOCATE to move the ball and effect a hit, it is a relatively simple matter to add boundaries, 2 or more paddles, sound, etc., etc., etc.. (Of course the same result can be accomplished by Player Missile Graphics, but that's the subject of another article.)

In the program below, A and B are the X and Y coordinates of the paddle. X and Y are the X and Y coordinates of the ball. C relates to random changes in the color of the paddle. S relates to the speed with which the ball moves.

*The SETCOLOR command instructs the computer to set the color of the points on the screen (that's the function of the 0) to color 1 (that's gold) brightness 2. A two for the first number will change the Text Window to that color. A four will change the background.

```
1 REM BY MIKE GREENSPAN
2 REM 15604 SYCAMORE LANE
3 REM ROCKVILLE, MD 20853
4 REM QUESTIONS CALL 0-202 857 0350
5 REM OR H-301 924 2210
10 S=51: GRAPHICS 3
20 A=35: B=10: X=0: Y=INT(RND(0)*19)+1: C=INT(RND(0)*15)+1
25 REM PLOT THE PADDLE
30 COLOR 1: SETCOLOR 0, C, 8: PLOT A, B: PLOT A, B+1
35 REM MOVE THE PADDLE UP?
40 IF STICK(0)=14 THEN COLOR 4: PLOT A, B: PLOT A, B+1: B=B-1: IF B<0 THEN B=0
50 IF STICK(0)=14 THEN GOTO 30
55 REM MOVE THE PADDLE DOWN?
60 IF STICK(0)=13 THEN COLOR 4: PLOT A, B: PLOT A, B+1: B=B+1: IF B>19 THEN B=19
70 IF STICK(0)=13 THEN GOTO 30
75 REM PLOT THE BALL AND HOLD IT AT TH AT LOCATION WHILE THE COMPUTER COUNTS FROM 1 TO S
80 COLOR 2: PLOT X, Y: FOR D=1 TO S: NEXT D
85 REM CHECK IF THE BALL HIT THE PADDLE
90 LOCATE X+1, Y, Z
95 REM MOVE BALL TO THE RIGHT IF IT HAS NOT REACHED THE END OF THE ROW
100 IF Z<>1 THEN IF X<=35 THEN COLOR 4: PLOT X, Y: X=X+1: GOTO 30
105 REM IT'S A MISS
110 IF Z<>1 THEN IF X>35 THEN MISS=MISS+1: ? "HITS-"; HIT; " MISSES-"; MISS: COLOR 4: FOR B=0 TO 19: PLOT 35, B: PLOT 36, B
120 IF Z<>1 THEN NEXT B: S=S+10: GOTO 20
125 REM IT'S A HIT
130 HIT=HIT+1: ? "HITS-"; HIT; " MISSES-"; MISS: S=S-10: COLOR 4: FOR B=0 TO 19: PLOT 35, B: PLOT 34, B: NEXT B: GOTO 20
```

Atari BASIC String Sort

Jerry White

Putting data in alphabetical order makes finding things much easier. Having numbered items in numeric order is often essential.

This Atari BASIC adaptation of the Shell-Metzner sort algorithm does both. Numbered items will be placed before alphabetic data if both are used.

This demo program can easily be modified to suit your needs. For demonstration purposes, I set up this program to handle up to 100 records. Each record or item may contain up to 30 characters.

Suppose 30 characters is just short of your requirements. Let's assume you need a 35 character record. All you would have to do is change all references of the number 30 to 35, and change all 29's to 34. You would also have to change both places where you find A\$(3000) in line 130 to A\$(3500). This figure is the record size multiplied by 100. If you have more than 100 records, just multiply your record size by the maximum number of records you may possibly need.

You do not have to enter all your records at one time. You also do not have to type the entire

length of the dimensioned record size. Just to get a feel for the program, type in a few names or numbers. As you enter each item, REC will store the current record number. To end your data entry, just enter a null record which means just press the return key.

The data will be sorted then displayed on the screen. You can pause the display by holding the CTRL key and typing I. Repeat this procedure to continue.

After the sorted data is displayed, you may continue by pressing the OPTION button. Again, a null entry will begin the sort phase.

Add some options of your own, such as saving the file (A\$) on cassette or diskette, and you've got yourself a mini-database. You can find endless uses for manipulating data. Sorting is one of the most effective ways of making data easier to read and handle. Remember, your Atari computer can do a great deal more than entertain you.

```

100 REM ATARI BASIC STRING SORT
110 REM TUTORIAL BY JERRY WHITE
120 REM *** SETUP ***
130 DIM A$(3000), B$(30), C$(30): A$(1)=""
:A$(3000)="" : A$(2)=A$: B$="": C$=""
140 GRAPHICS 0: SETCOLOR 2, 0, 0: POKE 82, 2:
GOTO 320
150 REM *** SORT A$ ***
160 T=INT(T/3)+1: FOR L1=1 TO REC-T: FOR L
2=L1 TO 1 STEP -T
170 IF A$(L2*30-29, L2*30)<=A$( (L2+T)*30-
29, (L2+T)*30) THEN 210
180 C$=A$(L2*30-29, L2*30): A$(L2*30-29, L2
*30)=A$( (L2+T)*30-29, (L2+T)*30)
190 A$( (L2+T)*30-29, (L2+T)*30)=C$
200 NEXT L2
210 SOUND 0, REC+10-L1, 10, 2: NEXT L1
220 IF T>1 THEN 160
230 REM *** DISPLAY SORTED DATA ***
240 SOUND 0, 0, 0, 0: ? CHR$(125): ? , " *** SO
RTED DATA *** "
250 FOR ME=1 TO REC: ? A$(ME*30-29, ME*30)
:NEXT ME
260 REM *** CONTINUE OPTION ***
270 ? : ? "        PRESS OPTION TO ADD DAT
A": ? "        PRESS SELECT TO END DEMO";
280 IF PEEK(53279)=3 THEN 330
290 IF PEEK(53279)=5 THEN GRAPHICS 0: END

300 GOTO 280
310 REM *** DATA ENTRY ***
320 ? : ? "ENTER UP TO 100 RECORDS TO BE
SORTED: "
330 REC=REC+1: ? : ? "ENTER RECORD "; REC: B
$="": INPUT B$: LB=LEN(B$)
340 IF LB=0 THEN REC=REC-1: T=REC: ? , " ***
S O R T I N G *** ": GOTO 160
350 A$(REC*30-29, REC*30-29+LB)=B$
360 GOTO 330

```

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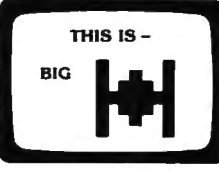
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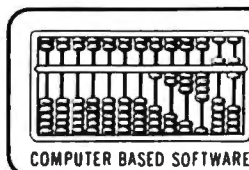
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Dynamic Player Animation With Atari

Alan Watson

This article describes a simple technique to create dynamic players with ATARI's Player/Missile Graphics. Articles have appeared here in **COMPUTE!**, as well as *ATARI CONNECTION*, which describe how to set up P/M Graphics, bit-map players, and move them using joysticks. If you would like your airplane to face in the direction it is moving, or your players to shake their heads or move their feet, this article may help you.

The central idea is to use a string or substring to hold the bit-map description for each view or position you want your player to assume. Then, using the VAL function, poke different strings or substrings to make your player change.

As an example program, we will create a figure who "marches" raising first one foot, then the other. First, we draw and bit-map the different positions involved in marching. See Figure 1.

We will put our bit-map descriptions in DATA statements to make them easy to find should we want to make changes in any of the player positions later. It is important to use three digits for each row in each bit-map. For example, in our DATA statements, 7 will be entered 007, 66 will be entered 066, and so on. This makes it easy to find each element of the string or substring when we get ready to poke the description into memory.

Now let's get to the program itself:

LINES 100 – 150. Here strings are dimensioned. Our data is read (in groups of three digits) and put into the string P\$. P\$ now contains the descriptions for all three positions.

LINES 200 – 290. These lines set up P/M Graphics.

LINE 220 is our player's starting position.

LINE 230 enables double line resolution.

LINES 240 and 250 set player/missile address.

LINE 260 enables P/M Graphics.

LINE 270 clears out player memory area.

LINE 280 sets our player color to gold.

LINE 290 sets player's horizontal position.

LINES 300 – 390. These lines establish a view or position pointer to indicate which position is to be drawn. Since all our descriptions are in the string P\$, we use a substring V\$ to extract the position description of each "march" step as needed. Sound is added in line 385 so we can hear the steps as they are made.

LINES 400 – 470. This is the motion routine.

LINE 410 reads the joystick.

LINES 420, 430, 440, 450, and 460 check for no joystick movement or movement left, right, down, or up respectively.

LINE 470 sends the program back to the pointer to begin again with the next player position.

LINES 500 – 530. These DATA statements hold the bit-map information. Each of lines 510, 520, 530 contains a different position.

After making your way through this example, you will no doubt have ideas for expanding it or for figures of your own design. You may want to add positions which have our marching figure actually turn and march facing left or right. To do this, set up a pointer which is changed as the joystick position is read. Another idea is to use separate strings or substrings for the head and body. By concatenating the strings, you can make the player shake his head while marching or while not moving his feet at all.

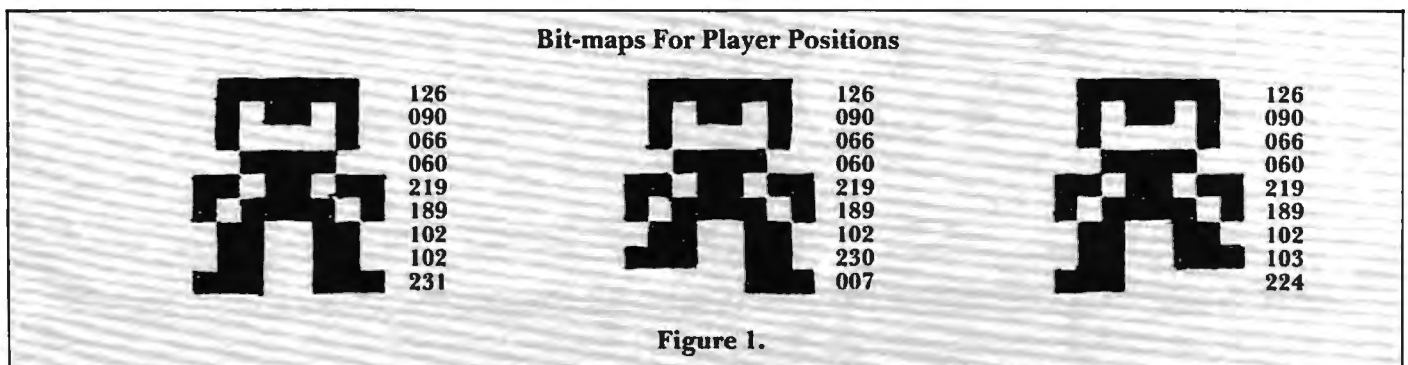
If, like me, you have grown tired of moving static figures around the screen, these ideas will help you. Now your spaceships can explode in a cloud when they are hit, your figures can dance and change expressions, and your animation efforts can be more rewarding.

References:

Crawford, Chris, "Player-Missile Graphics with the Atari Personal Computer System", p. 66, **COMPUTE!**, Issue 8, January 1981.

"Player-Missile Graphics", p. 10, *The Atari Connection*, Vol. 1, No. 1, Spring 1981.

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HOME MANAGER

Part I

Cash Flow

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Program 1.

```

10 REM *** DYNAMIC PLAYER ANIMATION
    WITH ATARI ***
20 REM BY Alan Watson
30 REM June 25, 1981
100 REM *** DIMENSION STRINGS & READ
    PLAYER DATA ***
110 DIM P$(81),U$(27),D$(3)
120 FOR I=1 TO 27
130 READ D$
140 P$(3*I-2,3*I)=D$
150 NEXT I
200 REM *** SET P/M GRAPHICS ***
210 GRAPHICS 2+16:SETCOLOR 4,7,2
220 X=127:Y=63
230 POKE 559,46
240 I=PEEK(106)-8:POKE 54279,I
250 PMBASE=I*256
260 POKE 53277,3
270 FOR I=PMBASE+512 TO PMBASE+640:POKE
    I,0:NEXT I
280 POKE 704,22
290 POKE 53248,X
300 REM *** VIEW POINTER & STRING ***
310 C=C+1
320 IF C>4 THEN C=1
330 ON C GOTO 340,350,340,360
340 U$=P$(1,27):GOTO 370
350 U$=P$(28,54):GOTO 370
360 U$=P$(55,81)
370 FOR I=1 TO 9
380 POKE PMBASE+512+Y+I,UAL(U$(3*I-2,3*I
    ))
385 IF C=2 OR C=4 THEN SOUND 0,28*I,6,9-
    I
390 NEXT I
400 REM *** MOTION ROUTINE ***
410 A=STICK(0)
420 IF A=15 THEN 310
430 IF A=11 THEN X=X-1:POKE 53248,X
440 IF A=7 THEN X=X+1:POKE 53248,X
450 IF A=13 THEN FOR J=11 TO 0 STEP -1:P
    OKE PMBASE+512+Y+J,PEEK(PMBASE+511+Y+J):
    NEXT J:Y=Y+1
460 IF A=14 THEN FOR J=1 TO 11:POKE PMBA
    SE+511+Y+J,PEEK(PMBASE+512+Y+J):NEXT J:Y
    =Y-1
470 GOTO 310
500 REM *** BIT-MAP DATA FOR EACH
    VIEW ***
510 DATA 126,090,066,060,219,189,102,102
    ,231
520 DATA 126,090,066,060,219,189,102,230
    ,007
530 DATA 126,090,066,060,219,189,102,103
    ,224

```

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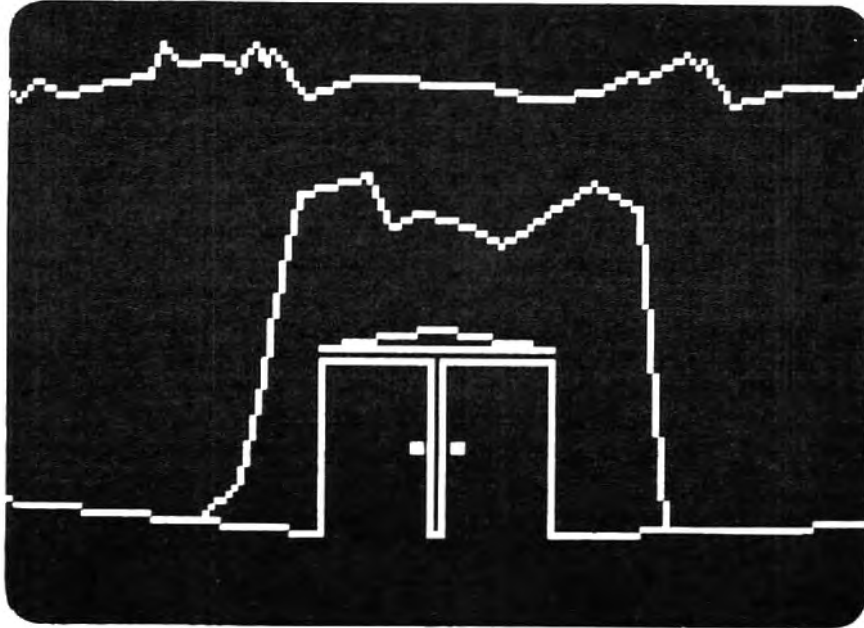
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SWEDE 1 is a package of four programs (3-D, LUNAR LANDER, ALIEN ATTACK, and SPACE BATTLE) which is meant to be studied as well as enjoyed. It covers mainly the mysterious world of Player/Missile Graphics. By studying the programs you will learn how to smoothly move an object, such as a space capsule, horizontally, vertically, and diagonally. You will also learn how to make the player fire and rotate 360 degrees. Also included are sections on the Cursor, the ESCape key and conversions of other BASICs into Atari BASIC.

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Editor's Note: We present in the following article, the most comprehensive Atari memory information ever published in a magazine. Because of its length, we had to make a tradeoff between source code size and magazine fit. Though small, it's quite readable and is arranged for your ease of use. Enjoy it. — RCL.

Shoot

John H. Palevich
Bethesda, MD

Editor's Note: This article provides a good game, a way to create cassette Boot tapes, and extensive material for study on the Atari's machine language techniques. RM

Shoot is a machine language arcade style game that must be initialized on a 16K or greater Atari with or without DOS, but will run on ANY Atari, even an Atari 400 with 8K of RAM!

O.K. Before I tell you everything you ever wanted to know about how you too can write machine language video games for your Atari, I'm going to let you see just such a game. Stop reading this paragraph for a moment, and go and look at program 1. Program 1 is a Basic program that takes about 6K to run. It will take the machine language program that I've encoded in the data statements and write it out onto a cassette tape. But this cassette tape is no ordinary cassette tape — it's a *Boot Tape*.

What, you may ask, is a Boot Tape? It is the name of a tape that has a machine language program on it, along with information to tell the Atari how to load it into memory and where to jump to begin execution. Space Invaders is an example of a program that Atari offers in boot tape form. You can think of a boot tape as a do-it-yourself ROM Pac, since you need not have Basic (or any other cartridge) installed in your Atari at the time you 'boot' (short for boot-strap as in "to pull oneself up by one's boot-straps") the boot tape.

So what I want you to do now is warm up the Atari, type in the program in program 1, and run it. To those of you with only 8K: sorry, you'll have to type this in on a friend's machine. Be careful with those DATA statements! When you run the program, one of four things will happen:

1. It prints the line numbers of the data statements on the screen, Beeps the bell twice, and saves a perfect copy of the Boot Tape on the cassette, and stops.
2. It prints some of the line numbers, but stops with the message "Error in line #1040"
3. It prints some of the line numbers, but stops with the message "Too many/few lines"
4. It does something else (like crash).

In case 1, you can smile and move on to the next paragraph. In case two, check the line number mentioned in the error statement against the same

line in program 1. They won't be identical, so fix your mistake. In case 3, make sure that line 200 is entered correctly and also check that you've not forgotten to type in any of the data statements. In case 4, make sure that the string on line 300 is: 'hhh', reverse-video-asterisk, 'LV', reverse-video-d. If it is, then that's not the problem which means you've come up with a totally new error, so congratulate yourself and try again.

Now, take the boot tape you just wrote and go over to ANY Atari computer. Open the lid and remove the ROM pack. Turn off all the peripherals (especially all 815's, 810's, and 850's) except for the cassette recorder. Put the boot tape in the cassette recorder, rewind it, and press 'Play'. Turn off the Atari 400/800, press down on the START button, and turn the 400/800 back on. It should beep once, which is your signal to press the return key and wait. The boot tape will load into the RAM of your Atari. Once there, the cassette will stop and the game will begin!

First you will see a copyright message — must to make sure everybody knows that I wrote it — which will last for about 8 to 12 seconds. Then the message will disappear and three zeros will appear. The left (green) one is your score. The middle (red) one is your high score. The right (yellow) one is time remaining. Plug a joystick into controller jack 1 (far left) and press the start button.

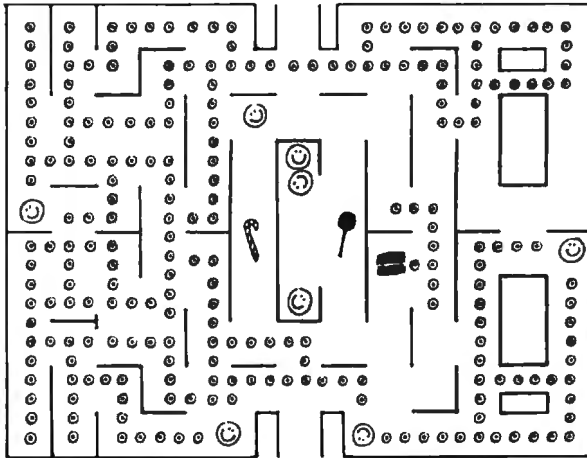
Shazam! Eight rows of assorted sizes and colors of airplaned, helicopters and saucers will start flying hither and yon across the screen. Push the joystick left and right to aim the gun, press the button to fire the missile, then use the joystick to guide the missile into one of the planes. If you miss, try again. If you hit the plane it will explode and you will score some points: Helicopter — 5 points, Plane — 10 points, Saucer — 25 points. Clearing a rack of planes within 30 seconds gives you a bonus of 50 points. If you take more than 30 seconds to clear a rack of planes, the game will give you another full rack of planes immediately. For every 15 points you score you get an additional second of play time. When the timer goes to zero, your game ends, the high score is adjusted, and the program waits for you to press on the console buttons: Press START to restart the game. Press OPTION and SELECT down simultaneously to have the program make a copy of itself. If you do this, it will beep twice, wait until you've pressed return, and write a copy of itself to the cassette recorder. (THIS type of copying can be done on ANY size Atari, but first you have to have a working Boot Tape ... which is why you've spent so much time typing in those data statements!).

Well, if you are afraid of machine language, or don't want to program, you can stop reading this article at this point and go back to playing my game. But if you want to know how it works, read on ...

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I've included a listing of the "source code" [assembler input, usually documented, as here — Ed.] for SHOOT, but I bet that there won't be enough free room to print it in its entirety. It IS commented very well, and all you assembly language freaks can take it and modify it as much as you like.... You might run into some size problems, since I wrote it on a much larger computer and just transferred the assembled object code over to the Atari, but with a bit of luck, you should be able to cut it down to size. One hint, most of the Atari equates aren't used, so you needn't bother to type them.... I'd bet that you'd need a disk and at least 32K to be able to start changing the code.

In general (and here I start using slang that no one who hasn't read the Atari OS manuals will understand) there are three parts to a video game on the Atari — the setup, the main loop, and the end. In addition to these three parts are two other parts — the Vertical Blank Interrupt (VBI) and the Display List Interrupt (DLI).

The VBI occurs every sixtieth of a second and is used by the Atari to keep the realtime clock, do attract mode, update all sorts of counters, and so forth. The video game maker uses this time to move the players, update the scores, fire the shots, decrement the time left, and do sound effects.

The DLI occurs whenever the ANTIC chip reads a display list instruction that has the high bit set. The Atari OS doesn't use the DLI, but the video game maker can use it to change character sets, playfield colors, and player positioning/width on the fly. In the Super Breakout cartridge, for example, all of the bricks are 'really' the same color, but carefully placed DLI's in the display list change the hue of that color between rows of bricks. The octave bands in the Music Composer cartridge are also DLI generated.

In any event, here's the poop on SHOOT: All the flying objects, AND the gun, are the same player, Player 0. Eleven display list interrupts are used to change the color of the sky/ground, the position of the planes/gun, the color of the planes/gun, and to check if the missile hit the previous plane. Since the sky/ground has no information in it, it need not take up any memory space, so the playfield display uses only the 20 characters in the score line at the top of the screen.

The vertical blank interrupt updates the score, awards bonus time, moves the gun, and fires and moves the missile. When the user runs out of time, a flag called STOP is set to tell the main program that the game is over. If a missile is in flight or the player is scoring points, this routine will also generate the appropriate sound effects.

The main body of the program actually has very little to do. First it draws the playfield, sets up the player missile graphics, knits the VBI and DLI handlers into the operating system, displays the

copyright message and zeroes the scores. Then it waits for the user to press some console buttons. START starts the game and OPTION and SELECT save a copy to tape.

When the game is started, the main loop draws a set of planes, sets Count Down Timer #3 for thirty seconds, and waits for either the user to shoot down all the planes in the current rack, or the count down timer to expire, or the game to end. If the user shoots down all the planes within thirty seconds, 50 points are added to the value of the last plane shot down. When either 30 seconds are up, or all the planes are shot down, the main loop draws a whole new set of planes. This goes on until the user runs out of time.

When the user runs out of time (and, if he can shoot a whole rack off the screen in less than ten seconds, he, or she can play forever) the final score is compared with the high score. If the final score is higher than the high score it becomes the new high score. In either event, the program loops to the wait for user input section and the user may play another game.

Well, that's SHOOT in a nutshell. I've hidden most of the gritty details in the comments to the code. Feel free to use any part of my code for a game of your own, with the provision that you don't try to sell it! I'd bet that the VBI and the DLI handlers could be used in conjunction with Basic programs that take care of the slower details. For example, you might want to use the VBI to move a Pong ball and Paddle set while the Basic program took care of the scoring, playfield generation, instructions, and so forth. Best of Luck!

Program 1: The Boot Tape Maker

```

0 DIM HS(1),BS(2),ADS(4),AS(60),BUFS(1148)
1 POKOFF=4*1024-1
2 GOTO 100
10 IF HS>="0" AND HS<="9" THEN D=ASC(HS)-48:RETURN
12 D=ASC(HS)-65:RETURN
20 HS=BS(1,1):GOSUB 10:B=D:HS=BS(2,2):GOSUB 10:B=B*16+D:
   CHECK=CHECK+B:RETURN
30 BS=ADS(1,2):GOSUB 20:AD=B:BS=ADS(3,4):GOSUB 20:AD=AD*256+B:RETURN
100 GRAPHICS 0
110 TRAP 900:LINE=1000:LSUM=0
120 READ AS:IF AS="END" THEN 200
130 ? LINE:CHECK=0:BS=AS(1,2):GOSUB 20:NOB=B
140 ADS=AS(3,6):GOSUB 30:FAD=AD
150 FOR I=1 TO NOB:BS=AS(6+2*I,6+2*I):GOSUB 20
160 M=FAD+I-1-POKOFF:BUFS(M,M)=CHR$(B):NEXT I
165 SUM=CHECK-65536*INT(CHECK/65536)
170 ADS=AS(LEN(AS)-3,LEN(AS)):GOSUB 30
180 IF SUM<>AD THEN 900
185 LSUM=LSUM+SUM:LINE=LINE+10:GOTO 120
200 IF LSUM<>125120 THEN ? "Too many/few lines":END
205 CLOSE #1
210 OPEN #1,8,128,"C:"
220 IOCB=832+16
230 POKE IOCB+2,11
240 BUF=ADR(BUFS)
250 POKE IOCB+4,BUF-(INT(BUF/256)*256)
260 POKE IOCB+5,INT(BUF/256)
270 BUFLN=LEN(BUFS)
280 POKE IOCB+8,BUFLN-(INT(BUFLN/256)*256)

```

```

290 POKE IOCB+9, INT(BUFLEN/256)
300 DUMMY=USR(ADR("hhhLVd"), 16)
310 CLOSE #1
320 END
900 ? "ERROR IN#";LINE:END
1000 DATA 1810000009001008101860A93C8D02D3A916850AA910850B004C4E08A9
1010 DATA 18101812707070460018G070F070F070F070F070F070F070F070F070F00DF0
1020 DATA 18103070F070F07041191028432931393831204A20482050414C45076D
1030 DATA 181048564943480908292849486968898C0818283840586878800A5A
1040 DATA 18106038380001020304050607087C7C9102030201FFFEFD00000816
1050 DATA 1810780102030405060708090A0B0001000100010001000101000100E9
1060 DATA 181090FF000003060C1C3C7E7F00C06030383C7E7F00181818183C077E
1070 DATA 1810A87EFFF0000F820F29E90F000001F044F79090F0000010D3F7F0844
1080 DATA 1810C0180000080B0FCFE18000018247E817E000001050008FF06070D
1090 DATA 1810D80000020A0118FE0A011003190020FD190020488A48A6B0E80708
1100 DATA 1810F0BD4C108D0AD48D1AD0A6B0AD08D02901F013A9009D62109D0870
1110 DATA 1811086D10BD78101865B185B18D1ED0E886B0BD6210187D6D109D0ACE
1120 DATA 18112062108D00D08D57108D12D0BD83108D08D068AA6840A5B1D00B40
1130 DATA 18113808A9808D03D24C901138E90185B1A98A8D03D2A205BD00180A4A
1140 DATA 18115018690109109D0018C91AD009A9109D0018CA4C4D11A5B7D00893
1160 DATA 18116827A6B5E88B5E00FD01EA20086B5A205BD0E1818690109900A96
1160 DATA 1811809D0E18C99A9009A9909D0E18CA4C7811A6B6E886B6E03CD00C8F
1170 DATA 18119822A20086B6A5B7D02EA205BD0E1838E90109909D0E18C99F0A8B
1180 DATA 1811B0D009A9999D0E18CA4CA311A900A2061D0D18CAD0FA290FC90AA9
1190 DATA 1811C800D004A90185B7A900854DAD78024A4AAABD8E1085B3CABA0B72
1200 DATA 1811E00A0A0AAA0008D921099601AC899601AE8C8C010D0FA05B20C56
1210 DATA 1811F81865B385B28D04D0A5B4F026AAA9009D8019CAF011A5B1D00DD2
1220 DATA 1812101286B4A9FF9D80198E00D24C2A12B6B44C2A12A2008E00D20A10
1230 DATA 18122866B4A5B7D016AD8402D011A5B4D00DA96285B4A5B30A0A180B0E
1240 DATA 181240698485B2A9FF85B08D1ED04CD1E7A9A88D01D2A9808D03D20E26
1260 DATA 181258A9008D00D2A9308D02D2A280A9009DFF199D7F19CAD0F7A90C83
1260 DATA 18127000A2089DFFCFCAD0FAA92E8D2F02A9188D07D4A9038D1DD00C27
1270 DATA 181288A9100DF028D6F028D1BD0A90085B4A90185B7A9A08D0ED40A7F
1280 DATA 1812A0A9108D3102A9198D3002A9108D0102A9A8D0002A211A03508B7
1290 DATA 1812B8A906205CE4A9C08D0ED4A9C68DC402A9368DC502A9188DC60CD2
1300 DATA 1812D002A90A8DC702A214BD3710200E1409C09DFF17CAD0F2A5130AC1
1310 DATA 1812E8186903C513D0FCA214A9009DFF17CAD0FAA9108D0518A9500C3C
1320 DATA 1813008D0C18A9908D1318A90185B7A9088D1FD0AD1FD0C901D0060A1C
1330 DATA 181318202A144C4E12C906D0EFA900A2069D0D189DFF17CAD0F7A90ADB
1340 DATA 181330918D1118A9928D1218A9908D1318A9108D0518A90085B7850962
1360 DATA 181348B185B685B6A218A00020C613C8C008D0F8A207A0D0A9038D0C96
1360 DATA 1813602A02205CE4A9C08D0ED4AD2A02D0034C4D13A008A900196C091D
1370 DATA 1813781088D0FAC90D00AA9321865B186B14C4D13A5B7F0DCA6130C73
1380 DATA 181390186902C513D0FCA200BD0718291FDD0018F00580084CB0130969
1390 DATA 1813A8E0E006D0EC4C0813A206D0FF17291F09409D0618CAD0F34C08B4
1400 DATA 1813C008130000008EC2138CC313AD0AD22907C90680F70A0AAABD0975
1410 DATA 1813D8D210996D108DD3109978108DD410998310A9009962108DD508CF
1420 DATA 1813F010AAACC213A9088DC413BDAA1099001AE8C8CEC413D0F3990D46
1430 DATA 181408AAACC31360008C0D14A8BA48982A2A2A2903AA98299F1D087A
1440 DATA 181420F6FEA868AA9BAC0D1460A220A90C9D42032056E4A9149D450B11
1450 DATA 18143803A9759D4403A9039D4203A9080D4A03A9809D4B032056E40900
1460 DATA 181450A9009D4403A9109D4603A9789D4803A9049D4903A9089D4208D9
1470 DATA 101468032056E4A90C9D42032056E460433A9B0652
1480 DATA END

```

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```

1      ;--MIDAS--
2      : ENABLE LC
      .MLIST SEQ
      .TITLE SHOOT
      SBTTL by John H. Palevich
      :
      : "Shoot" -- Inspired by the Atari VCS "Air Sea Battle" cartridge.
      :
      : Feel free to modify & give away. Don't even think of selling this.
      : D.K. If you want to assemble this on your Atari, you'll have to
      : change some things around. Most changes can be inferred from looking
      : at the code that this assembler produced and figuring out what you'd
      : have to type to get the Atari to do the same thing.
      :
      : Some hints, though:
      :   . means /256
      :   .+ means +
      :   .ASCII means .BYTE
      :   . (in expressions) means the value of the program counter
      :
      : Labels shouldn't have "-".
      :
      : Colleen Operating System Equate File
      :
      0000 WARMST = $0008 :WARM START FLAG
      0009 BOOT0 = $0009 :SUCCESSFUL BOOT FLAG (<WAS BOOT?>)
      000A DOSVEC = $000A :DISK SOFTWARE START FLAG
      000C DOSINH = $000C :DISK SOFTWARE INH1 ADDRESS
      000E APPMH1 = $000E :APPLICATIONS MEMORY HI LIMIT
      :
      : CLEARED ON A COLD OR WARM START
      0010 INITBS = $0010 :INITERRUPT HANDLER
      0011 POWMSK = $0011 :SYSTEM MASK FOR PUCKEY IRQ HANDLER
      0012 BRKKEY = $0012 :BREAK KEY FLAG
      0013 RTLOCK = $0012 :REAL TIME CLOCK (IN 16 MSEC UNITS)
      :
      0015 BUFADR = $0015 :INDIRECT BUFFER ADDRESS REGISTER
      :
      0017 ICCOMT = $0017 :COMMAND FOR VECTOR
      :
      0018 DSKFMS = $0018 :DISK FILE MANAGER POINTER
      :
      001A DSKUTL = $001A :DISK UTILITIES POINTER
      :
      001C PTIMOT = $001C :PRINTER TIME OUT REGISTER
      001D PRPNT = $001D :PRINTER BUFFER POINTER
      001E PRUFSS = $001E :PRINT BUFFER SIZE
      001F PTMP = $001F :TEMPORARY REGISTER
      :
      0020 ZIOCB = $0020 :ZERO PAGE I/O CONTROL BLOCK
      0010 ICHBSZ = 16 :NUMBER OF BYTES PER IOCB
      0010 MARIOC = $10C852 :LENGTH OF THE IOCB AREA
      0020 IOCBAS = $0020
      0020 ICHIDZ = $0020 :HANDLER INDEX NUMBER (FF = IOCB FREE)
      0021 ICONDZ = $0021 :DEVICE NUMBER (DRIVE NUMBER)
      0022 ICCOMZ = $0022 :COMMAND CODE
      0023 ICSTAZ = $0023 :STATUS OF LAST IOCB ACTION
      0024 ICBALZ = $0024 :BUFFER ADDRESS LOW BYTE
      0025 ICBHIZ = $0025 :BUFFER ADDRESS HIGH BYTE
      0026 ICPITZ = $0026 :PUT BYTE ROUTINE ADDRESS - 1
      0027 ICPITZ = $0027
      0028 ICBLLZ = $0028 :BUFFER LENGTH LOW BYTE
      0029 ICBLLZ = $0029
      002A ICAXIZ = $002A :AUXILIARY INFORMATION FIRST BYTE
      002B ICAXIZ = $002B
      002C ICSPRZ = $002C :TWO SPARE BYTES (CIO LOCAL USE)
      002E ICIDNO = $002E :IOCB NUMBER X 16
      002F CIOCHR = $002F :CHARACTER BYTE FOR CURRENT OPERATION
      :
      0030 STATUS = $0030 :INTERNAL STATUS STORAGE
      0031 CHKSUM = $0031 :CHECKSUM (SINGLE BYTE SUM WITH CARRY)
      0032 BUFRLO = $0032 :POINTER TO DATA BUFFER (LO BYTE)
      0033 BUFRHI = $0033 :POINTER TO DATA BUFFER (HI BYTE)
      0034 BUFRLO = $0034 :NEXT BYTE PAST END OF DATA BUFFER (LO BYTE)
      0035 BUFRHI = $0035 :NEXT BYTE PAST END OF DATA BUFFER (HI BYTE)
      0036 CHETRY = $0036 :NUMBER OF COMMAND FRAME RETRIES
      0037 DRETRY = $0037 :NUMBER OF DEVICE RETRIES
      0038 BUFRFL = $0038 :DATA BUFFER FULL FLAG
      0039 RECVDN = $0039 :RECEIVE DONE FLAG
      003A INTDOK = $003A :TRANSMISSION DONE FLAG
      003B CHKSNT = $003B :CHECKSUM SENT FLAG
      003C MCKSMZ = $003C :NO CHECKSUM FOLLOWS DATA FLAG
      :
      003D BPTR = $003D
      003E FTYPE = $003E
      003F FEDF = $003F
      0040 FREQ = $0040
      0041 SOUNDR = $0041
      0042 CRITIC = $0042 :NOISY I/O FLAG (ZERO IS QUIET)
      :
      0043 FMSZPG = $0043 :TOTAL OF 7 BYTES FOR DISK FILE MANAGER ZERO PAGE
      :
      004A CKEY = $004A :FLAG SET WHEN GAME START PRESSED
      004B CASSBT = $004B :CASSETTE BOOT FLAG
      004C DSTAT = $004C :DISPLAY STATUS
      :
      004D ATTRCT = $004D :ATTRACT FLAG
      004E DRMSK = $004E :DARK ATTRACT FLAG
      004F COLRSH = $004F :ATTRACT COLOR SHIFTER (EOR'D WITH PLAYFIELD COLORS)
      :
      0050 LEDGE = 2 :LMARGIN'S VALUE AT COLD START
      0051 REDGE = 39
      :
      0050 IMPCHR = $0050
      0051 HOLD1 = $0051
      0052 LMARGIN = $0052 :LEFT MARGIN (SET TO ONE AT POWER ON)
      0053 RMARGIN = $0053 :RIGHT MARGIN (SET TO ONE AT POWER ON)
      0054 ROWCRS = $0054 :CURSOR COUNTERS
      0055 COLCRS = $0055
      0056 DINDEX = $0056
      0058 SAVMSC = $0058
      005A OLDROW = $005A
      005B OLDCOL = $005B
      :
      005D OLDCHR = $005D :DATA UNDER CURSOR
      005E OLDADR = $005E
      0060 NEWROW = $0060 :POINT DRAW GOES TO
      0061 NEWCOL = $0061
      0063 LOGCOL = $0063 :POINTS AT COLUMN IN LOGICAL LINE
      0064 ADRSS = $0064
      0066 MLTTPM = $0066
      0068 SAVADR = $0068
      006A RAMTOP = $006A :RAM SIZE DEFINED BY POWER ON LOGIC
      :
      0290 TXTRGW = $0290 :Text rows
      0291 TXTCOL = $0291 :Text colors
      0293 TXINDEX = $0293 :Text index
      0294 TXTMSK = $0294 :Font's convert into new msc
      0296 TXTOLD = $0296 :oldrow and oldcol for text (etc.)
      02A2 ESCFLG = $02A2 :Escape flag
      02B2 LOGMAP = $02B2 :Logical line start bit map
      02B6 INVFLAG = $02B6 :Inverse video flag (logged by Atari key)
      02B7 FILFLG = $02B7 :Fill flag for draw
      02B8 SCRFLG = $02B8 :Set if scroll occurs
      02BE SHFLCK = $02BE :Shift Lock
      02BF BOTSCR = $02BF :Bottom of screen: 24 Norm, 4 Split.
      :
      : COLORS
      :
      02C0 PCOLOR = $02C0 :P0 COLOR
      02C1 PCOLR1 = $02C1 :P1 COLOR
      02C2 PCOLR2 = $02C2 :P2 COLOR
      02C3 PCOLR3 = $02C3 :P3 COLOR
      02C4 COLOR0 = $02C4 :COLOR 0
      02C5 COLOR1 = $02C5 :COLOR 1
      02C6 COLOR2 = $02C6 :COLOR 2
      02C7 COLOR3 = $02C7 :COLOR 3
      02C8 COLOR4 = $02C8 :COLOR 4
      :
      : GLOBAL VARIABLES
      :
      02E4 RAMSIZ = $02E4 :RAM SIZE (HI BYTE ONLY)
      02E5 MEMTOP = $02E5 :TOP OF AVAILABLE USER MEMORY
      02E7 MEMLO = $02E7 :BOTTOM OF AVAILABLE USER MEMORY
      02EA OVSTAT = $02EA :STATUS BUFFER
      :
      02F0 CRSHW = $02F0 :CURSOR INHIBIT (00 = CURSOR ON)
      02F1 KEYDEL = $02F1 :Key delay
      02F3 CHACT = $02F3 :CHARACT REGISTER RAM
      02F4 CHBAS = $02F4 :CHBAS REGISTER RAM
      02F5 FILEDA = $02F5 :RIGHT FILL DATA (DRAM)
      02F6 ATACHR = $02F6 :Atascii character
      02FC CH = $02FC :Global variable for keyboard
      02FE DSPFLA = $02FE :DISPLAY FLAG: DISPLAYS CNTLS IF NON ZERO;
      02FF SSFLAG = $02FF :Start/stop flag for paging (CNTL 1). Cleared by Bra
      :
      : Page three RAM assignments
      :
      : Device control blocks
      : ($10)
      :
      0300 DCB = $0300 :Device control block
      0300 ODEVIC = $0300 :Peripheral Unit 1 bus I.O. number
      0301 DUNIT = $0301 :Unit number
      0302 DCOMND = $0302 :Bus command
      0303 OSTATS = $0303 :Command type/status return
      0304 DBUFL0 = $0304 :Data buffer pointer low
      0305 DBUFL1 = $0305 :Data buffer pointer high
      0306 OTIMLO = $0306 :Device time out in 1/2 second units
      0308 OBYTLO = $0308 :Number of bytes to be transferred low byte
      0309 OBYTHI = $0309
      030A DAUX1 = $030A :Command Aux byte 1
      030B DAUX2 = $030B
      :
      0340 IOCB = $0340 :Handler index number (FF = IOCB free)
      0341 ICDNO = $0341 :Device number (drive number)
      0342 ICCOM = $0342 :Command code
      0343 ICSTA = $0343 :Status of last IOCB action
      0344 ICBAL = $0344 :Buffer address low byte
      0345 ICBHIZ = $0345 :Buffer address high byte
      0346 ICPIT = $0346 :Put byte routine address - 1
      0347 ICPHT = $0347
      0348 ICBLL = $0348 :Buffer length low byte
      0349 ICBLLH = $0349
      034A ICAXI = $034A :Auxiliary information (first byte)
      034B ICAXZ = $034B
      034C ICSPR = $034C :Four spare bytes
      :
      03C0 PRNBUF = $03C0 :Printer buffer (40 bytes)
      :
      : Page Four RAM Assignments
      :
      03FD CASBUF = $03FD :Cassette Buffer (131 bytes)
      :
      0480 USAREA = $0480 : (0480 thru 05FF for the user)
      : (except for floating point...)
      :
      : FLOATING POINT ROM ROUTINES
      :
      : IF CARRY IS USED THEN CARRY CLEAR => NO ERROR, CARRY SET => ERROR
      :
      AFP = $0800 :ASCII -> FLOATING POINT [FP]
      INBUF + CIX -> FRO, CIX, CARRY
      FASC = $08E6 :FP -> ASCII FRO -> FOR.FOO+1, CARRY
      IFP = $09AA :INTEGER -> FP

```

```

E468 SENDV = SE468 :SEND ENABLE ROUTINE 006B
E469 INTINV = SE468 :INTERRUPT HANDLER INITIALIZATION 006C
E46E CIOINV = SE40E :CENTRAL INPUT OUTPUT INITIALIZATION 008E
E471 BLKBOV = SE471 :BLACKBOARD MODE
E474 WARMVS = SE474 :WARM START ENTRY POINT 007B
E477 COLDVS = SE477 :COLD START ENTRY POINT 007C
E47A RBLQV = SE47A :CASSETTE READ BLOCK ENTRY POINT VECTOR
E47D CSOPIV = SE47D :CASSETTE OPEN FOR INPUT VECTOR
:VCTABL = SE48D
:
:
: OPERATING SYSTEM EQUATES
:
:
: COMMAND CODES FOR IOCBS
0003 OPEN = J :OPEN FOR INPUT/OUTPUT
0005 GETREC = B :GET RECORD (TEXT)
0007 GETCHR = 7 :GET CHARACTER(S)
0009 PUTREC = B :PUT RECORD (TEXT) 0200
000B PUTCHR = B :PUT CHARACTER(S) 0200
000C CLOSE = C :CLOSE DEVICE 0202
000D STATUS = D :STATUS REQUEST 0204
000E SPECIL = E :BEGINNING OF SPECIAL ENTRY COMMANDS 020B
:
: SPECIAL ENTRY COMMANDS
0011 DRAWLN = $11 :DRAW LINE
0012 FILIN = $12 :DRAW LINE WITH RIGHT FILL
0020 RENAME = $20 :RENAME DISK FILE 020E
0021 DELETE = $21 :DELETE DISK FILE 0210
0022 FORMAT = $22 :FORMAT 0212
0023 LOCKFL = $23 :LOCK FILE TO READ ONLY 0214
0024 UNLOCK = $24 :UNLOCK LOCKED FILE 0218
0026 POINT = $26 :POINT SECTOR 021A
0028 NOTE = $28 :NOTE SECTOR 021C
00FF IOCFRE = $FF :IOCB "FREE" 021E
:
: AUXILIARIES
:
: ( ) INDICATES WHICH DEVICES USE BIT
0001 APPEND = $1 :OPEN FOR WRITE APPEND (D), OR SCREEN READ (E) 0224
0002 DIRECT = $2 :OPEN FOR DIRECTORY ACCESS (D) 0226
0004 OPNIN = $4 :OPEN FOR INPUT (ALL DEVICES) 022A
0006 OPNOUT = $6 :OPEN FOR OUTPUT (ALL DEVICES) 022B
0008 OPNIN-OPNOUT = $8 :OPEN FOR INPUT AND OUTPUT (ALL DEVICES) 022C
000A MCHMOD = $10 :OPEN FOR MIXED MODE (E,S) 022E
0020 INSCLR = $20 :OPEN WITHOUT CLEARING SCREEN (E,S) 022F
:
: DEVICE NAMES
0046 SCREDIT = 'E :SCREEN EDITOR (R/W) 0284
0048 KBD = 'K :KEYBOARD (R ONLY) 0284
0053 DISPLAY = 'S :SCREEN DISPLAY (R/W) 0284
0050 PRINTR = 'P :PRINTER (R ONLY) 0284
0043 CASSET = 'C :CASSETTE 0284
0044 MODEM = 'M :MODEM 0284
0044 DISK = 'D :DISK 0284
:
:
: OPERATING SYSTEM STATUS CODES
0001 SUCCES = $01 :SUCCESSFUL OPERATION 0270
0080 BRKABT = $80 :BREAK KEY ABORT 0274
0081 PRVOPN = $81 :IOCB ALREADY OPEN 0276
0082 NONDEV = $82 :NON-EXISTANT DEVICE 0276
0083 WRONLY = $83 :IOCB OPENED FOR WRITE ONLY 0277
0084 NVALID = $84 :INVALID COMMAND
0085 NOTOPN = $85 :DEVICE OR FILE NOT OPEN
0086 BADIOC = $86 :INVALID IOCB NUMBER
0087 ROONLY = $87 :IOCB OPENED FOR READ ONLY
0088 EOFERR = $88 :END OF FILE
0089 TRMCRD = $89 :TRUNCATED RECORD 0278
008A TIMEOUT = $8A :PERIPHERAL TIME OUT 0279
008B DMACK = $8B :DEVICE DOES NOT ACKNOWLEDGE COMMAND 027A
008C FRMERR = $8C :SERIAL BUS FRAMING ERROR 027B
008D CSROR = $8D :CURSOR OVERRANGE
008E OVRRUN = $8E :SERIAL BUS DATA OVERRUN
008F CHKERR = $8F :SERIAL BUS CHECKSUM ERROR
:
:
: OPERATING SYSTEM STATUS CODES
0090 DERERR = $90 :PERIPHERAL DEVICE ERROR (OPERATION NOT COMPLETED)
0091 BADMOD = $91 :BAD SCREEN MODE NUMBER 027C
0092 FNCNOT = $92 :FUNCTION NOT IMPLEMENTED IN HANDLER 027D
0093 INSMEM = $93 :INSUFFICIENT MEMORY FOR SCREEN MODE 027E
:
:
: PAGE ZERO RAM ASSIGNMENTS
0000 LINZ05 = $0000 :LINBUS RAM (WILL BE REPLACED BY MONITOR RAM)
:
: THESE LOCATIONS ARE NOT CLEARED
0002 CASINI = $0002 :CASSETTE INIT LOCATION 0284
0004 RAMLO = $0004 :RAM POINTER FOR MEMORY TEST 0285
0006 TRMSZ = $0006 :TEMPORARY REGISTER FOR RAM SIZE 0286
0007 TSDAT = $0007 :RAM TEST DATA REGISTER 0287
:
: CLEARED ON COLD START ONLY
:
:
: Many random OS variables, the following were commented

```



```

0040 D040 = $40 ; Tells Antic chip to start retrieving 102F F0 70 .BYTE D1BL8-DLINT,DLBL8 ;17,18
data from memory referenced by the next L 1031 F0 70 .BYTE DLBL8-DLINT,DLBL8 ;19,20
0020 DLVSCR = $20 ; (sort of) enables vertical scroll 1033 F0 70 .BYTE DLBL8-DLINT,DLBL8 ;21,22
0010 DLHSCR = $10 ; enable horizontal scroll 1035 41 .BYTE DLJVB
; .ADDR MDLIST
;
; Playfield Instructions
;
000F DLPF15 = 15 ; 320 dots 2 colors 1 scan line
000E DLPF14 = 14 ; 160 4 1
000D DLPF13 = 13 ; 160 4 2 1038 28 43 29 TMSG: .ASCII"(C)1981 J H PALEVICH";Horrible bugs will infest the code
000C DLPF12 = 12 ; 160 2 1 103B 31 39 38
000B DLPF11 = 11 ; 160 2 2 103E 31 20 4A
000A DLPF10 = 10 ; 80 4 4 1041 20 48 20
0009 DLPF9 = 9 ; 80 2 4 1044 50 41 4C
0008 DLPF8 = 8 ; 40 4 8 1047 45 50 49
104A 43 48
;
; Character PF types
0007 DLPF7 = 7 ; 20 chars 5 colors 16 scan lines
0006 DLPF6 = 6 ; 20 5 8
0005 DLPF5 = 5 ; 40 8 16 (hairy 4 color characters)
0004 DLPF4 = 4 ; 40 5 8
0003 DLPF3 = 3 ; 40 2 10 (Text processing)
0002 DLPF2 = 2 ; 40 2 8 (Normal text mode)
;
; PF1 & PF0 are special. . . .
;
; Player & Missile Offsets
; Denoted by PH prefix
0024 PMLF = $24 ;Left side of screen 104C 80 90 82
0020 PMR1 = $00 ;Right side of screen 104F 92 84 94
0180 PMDM = $180 ;Missile offset for double line resolution 1052 86 98 88
0200 PMPD0 = $200 ;Player 0 1055 98 C8
0280 PMPD1 = $280 ;Player 1
0300 PMPD2 = $300 ;Player 2
0380 PMPD3 = $380 ;Player 3
0300 PMSM = 2*PMDM ;Missile offset for single line resolution
0400 PMSPD = 2*PMPD0 ;Player 0
0500 PMSP1 = 2*PMPD1 ; 1
0600 PMSP2 = 2*PMPD2 ; 2
0700 PMSP3 = 2*PMPD3 ; 3
;
; Colors, denoted by CL
0000 CLGREY = 0 ;grey
0010 CLGOLD = 1 ;gold
0020 CLORNG = 2 ;orange
0030 CLRED = 3 ;red-orange
0040 CLPINK = 4 ;pink
0050 CLPURP = 5 ;purple
0060 CLPURB = 6 ;purple blue
0070 CLPLU = 7 ;blue 1
0080 CLBLUE = 8 ;blue 2
0090 CLLBLU = 9 ;light blue
00A0 CLTRQ = $A0 ;Turquoise
00B0 CLGBLU = $B0 ;green blue
00C0 CLGREN = $C0 ;green
00D0 CLYGRN = $D0 ;yellow green
00E0 CLOGRN = $E0 ;orange green
00F0 CLTOR = $F0 ;light orange
;
; Bit Masks for console switches
0001 SWSTAT = $1 ;Start 1060 01 02 03
0002 SWSEL = $2 ;Select 1070 02 01 FF
0004 SWOPT = $4 ;Option 1073 FE FD
;
; Joystick bit masks
000B JVR = 8 ;Right
000A JVL = 4 ;Left
0002 JVB = 2 ;Back
0001 JVF = 1 ;Forward
;
RS D300 PIA = $D300
D300 PORTA = PIA+0 ;PORTA-->STICK0,1 X-Y CONTROLLE
D301 PORTB = PIA+1 ;PORTB-->STICK2,3
D302 PACTL = PIA+2 ;NONE PACTL<--3C [1
D303 PBCTL = PIA+3 ;NONE PBCTL<--3C [1
;
D300 ASCZER = '0 ;Ascii zero
D301 COLON = $3A ;Ascii Colon
D302 EDL = $9B ;End of Record
;
; The following are subroutines
F385 PUTLIN = $F385 ;X -- Lo byte
; Y -- Hi byte
; of line
1083 00 01 00
1086 01 00 01
1089 00 01 00
108C 01 01
;
E7D1 XVB = 2E7D1 ;System VBLANK exit routine
;
;
; That's the end of the tables used by the OLIN
; routine.
1115 E8
1116 86 80
1118 8D 62 10
;
; Message table
10C2 00 00 80
10C5 80 FC FE
10C8 18 00
;
; TMSG: .ASCII"(C)1981 J H PALEVICH";Horrible bugs will infest the code
;
; saucer flying left, right, hovering, etc.
;
;
; if who-so-ever changes this copyright
; message to something else!
10CA 00 18 24
10CD 7E 81 7E
10DD 00 00
;
; The next many tables are for the display list interrupt handler.
; They are all 11 bytes long, so that there is one byte in each
; table for each display list interrupt. The first DLI uses the
; first byte in the table, and so forth, so in the TCOLB table,
; for instance, the top of the sky is black, then the first DLI
; makes it turn CLBLUE, the second CLBLU, and so on.
;
; TCOLB - table of colors for background
; The sky starts out black and turns light blue, then
; the background turns green for the "ground" under the gun.
;
; TCOLP - COLOR PLAYER ZERO
; Player zero is the planes in the sky and the gun on the ground
;
; TCOLM - COLOR MISSILE
;
; TDX -- Player's position
; The gun is always stuck at 124.
; DPLANE takes care of the planes' X position,
; DLIN sets the X position to zero to kill the
; plane and get it off the screen.
;
; TDX -- Player's velocity.
; The gun is always zero, so it will not drift off
; to either side.
;
; TVAL -- PLAYER'S POINT-VALUE
;
; Set by DPLANE
; Used by DLIN
;
; TWID -- width of the player
;
; 0 -- normal (two GR, 0 characters) wide
; 1 -- double (four GR, 0 characters) wide
; The gun is double width
;
; TWID: .BYTE 0,1,0,1,0,1,0,1,0,1,1
1083 00 01 00
1086 01 00 01
1089 00 01 00
108C 01 01
;
; TPLANE: .BYTE 1,5,0,8 ;Helicopter, left
;
; .BYTE $FF,5,0,0 ; " " , right
;
; .BYTE 2,10,1,24 ;Airplane, left
;
; .BYTE $FE,10,1,10 ; " " , right
;
; .BYTE 3,25,0,32 ;Saucer, left
;
; .BYTE $FD,25,0,32 ;Saucer, right
;
; Player missile table equates
;
; MPMBAS = ORG-$800 ;Player missile base --
; Leave 2K for the main program
;
; $CORLM = MPMBAS ;Score line (uses 20 bytes)
;
; GUNOFF = 98 ;Gun offset -- Y position of top
; of gun.
;
; GUNPOS = $A0 ;GUNOFF ;Memory location of
; top of gun in player memory.
;
; SCORE = $C000 ;Address of Score (six digits)
; HISCOR = $C004 ;Address of High score (six digits)
; TIME = $C008 ;Address of Time remaining (six digits)
;
; This is the DLI handler --
; it is called every time the Antic chip fetches a display
; list byte with the high bit set. It saves the A and X registers,
; changes the sky & color & width & position of the next plane,
; and checks to see if the previous plane has been hit. If so, it
; moves that plane off the screen and adds the point value of that
; plane to the DSCOR variable. Then it restores X & A and returns.
;
; DLIN: PHA ;Save A
; TXA ;Save X
; LDY #0 ;Change the sky's color as fast as
; we can.
; LDA TCOLB,X ;but,
; STA WSYHC ;wait until we can do it without
; COLBK ;the user noticing it.
;
; LDY DLIC ;Save A
; LDA MDPL ;Did missile 0 hit anything?
; AND #1 ;like POT
; BEQ DLH2 ;No.
; LDA #0 ;Yes:
; STA TPX,X ;So zero x position,
; and x velocity.
; STA TDY,X ;and add the value of
; that player to DSCOR
; LDA DSCOR
; ADC DSCOR
; STA DSCOR
; LDA DSCOR
; STA HITCLR ;And clear the hit registers.
;
; DLIN2: INX ;In any event, update:
; STX DLIC
; LDA TPX,X ;plane's X position.

```

```

111B 18          CLC
111C 7D 6D 10    ADC TOX,X
111F 9D 62 10    STA TFX,X
; Main program starts here!!!
;
1122 8D 00 00    STA HPOSP0
1126 8D 57 10    LDA TCOLP,X ;plane's color
1128 8D 12 00    LDA COLPM0
112B 8D 83 10    LDA TWID,X  ;plane's width
112E 8D 08 00    STA SIZEP0
1131 68          PLA
1132 6A          TAX
1133 68          PLA
1134 40          RTI ;and return.
;
124E A9 A8      BEGIN: LDA #SA8 ;Missile sound is pure at volume 8
1250 8D 01 D2   STA AUOC1
1253 A9 63      LDA #SB0 ;Score sound is a silent fuzz.
1256 8D 03 D2   STA AUOC2
;
1258 A9 00      LDA #0 ;missile frequency is ultrasonic
126A 8D 00 D2   STA AUOF1
;
126D A9 30      LDA #S30 ;score frequency is a high fuzz.
126F 8D 02 D2   STA AUOF2
;
1382 18          CLC
1383 65 B1      ADC DSCOR
1385 85 B1      STA DSCOR
1387 4C 8D 13   JMP REDRAW ;and a new round.
;
138A A5 07      MAIN4: LDA STOP ;Check if player is stopped.
138C F0 BC      BEQ MAIN ;Nope.
;
; Player died, so update high score
; and restart.
;
138E A5 13      LDA RTCLOC+1 ;Wait 4 to 5 seconds
1390 18          CLC
1391 69 02      ADC #2
1393 C6 13      HIW: CMP RTCLOC+1 ;for points to drain.
1395 00 FC      BNE HIW
;
1262 A2 80      LDX #120
1264 A9 00      LDA #0
1266 9D FF 19   CLOOP: STA MPMBAS+PHDP0-1,X ;We only use Player zero
1269 9D 7F 19   STA MPMBAS+PHDM-1,X ;and the missiles.
126C CA        DEX
126D 9D F7      BNE CLOOP
;
126F A9 00      LDA #0 ;Move all the players and missiles
1271 A2 08      LDX #8 ;off the screen.
1273 9D FF CF   FLOOP: STA HPOSP0-1,X
1276 CA        DEX
1277 00 FA      BNE FLOOP
;
1279 A9 2E      LDA #S2E ;Enable PM DMA and a normal playfield.
127B 8D 2F 02   SDACT: STA
127E A9 18      LDA #18
1280 8D 07 04   CLOOP: STA MPMBAS ;Missile defues.
1283 A9 03      LDA #3 ;Tell the CIA to expect PM DMA
1285 8D 10 00   STA GRACTL
;
1288 A9 10      LDA #S10 ;Enable T10 player so the
128A 8D 0F 02   ORA GPRIOR ;missiles will be COL03
128D 8D 0F 02   STA GPRIOR
128F 8D 16 00   STA PRIOR
;
1293 A9 00      LDA #0 ;Zero the missile
1295 8D B4 04   STA NY
;
1297 A9 01      LDA #1 ;Stop the player from firing.
1299 85 B7      STA STOP
;
129B A9 4D      LDA #4D ;Disable DLI's
129D 8D 0E 04   STA DLI ;DLI handler
12A0 A9 10      LDA #10 ;Set up the vector to our
12A2 A9 10      LDA #10 ;display list.
12A4 8D 31 02   STA #DLIST+8
12A5 A9 19      LDA #DLIST+8FF
12A7 8D 30 02   STA SDSLFL
12A9 A9 10      LDA #10 ;Set up the vector to our
12AB A9 10      LDA #10 ;DLI handler
12AD 8D 01 02   STA VDLST+1
12AF A9 EA      LDA #EA ;DLI handler
12B1 8D 00 02   STA VDLST+7
12B4 A2 11      LDX #VBLK+7 ;Load the address of our
12B6 A9 35      LDA #35 ;vehicle blank interrupt
12B8 A9 06      LDA #SETIMM ;handler into X & Y and call
12BA 20 5C E4   JSR SETVBV ;SETVBV to set up the VBL vector.
;
12BC A9 00      LDA #0
12BE A9 00      LDA #0
12BF 8D 0E 04   STA #SCO ;Enable DLI's
12C0 8D 0E 04   STA #MIEN
;
12C2 A9 C6      LDA #CLGREEN+8 ;Color 0 (score) is green
12C4 8D C4 02   STA COLOR0
;
12C7 A9 C6      LDA #CLRED+8 ;Color 1 (high score) is red.
12C9 8D C6 02   STA COLOR1
;
12CC A9 18      LDA #CLGOLD+8 ;Color 2 (time) is gold.
12CE 8D C6 02   STA COLOR2
;
12D0 A9 0A      LDA #CLGREY+10 ;Color 3 (missiles) is white.
12D2 8D 0A 02   STA COLOR3
;
12D3 8D 0A 02   STA
;
12D6 A2 14      LDX #20 ;for the twenty characters in the message,
12D8 8D 37 10   COPYR1: LDA TMSG-1,X ;load a character,
12DB 20 DE 14   JSR ASTOIN ;Call ASTOIN to get it to internal
12DE 09 C0      ORA #SC0 ;form, change it to color 3, and
12E0 9D FF 17   STA SCGRM-1,X ;store it on the play field.
12E3 CA        DEX
12E4 00 F2      BNE COPYR1
12E6 8D 05 13   RTCLOC+1 ;get the real time (4 second ticks)
12E8 18          CLC
12E9 69 03      ADC #3 ;8 to 12 seconds of glory
;
12EB C6 13      COPYW: CMP RTCLOC+1 ;Wait a while 'till user's read it.
12ED 00 FC      BNE COPYW
;
1302 00          XTEMP: BYTE 0 ;Temporary variables
1303 00          YTEMP: BYTE 0 ;Used to save state of
1304 00          ZTEMP: BYTE 0 ;the processor.
;
1305 8E C2 13   DPLAN1: STX XTEMP ;Save X
1308 6C C3 13   STY YTEMP ;Save Y
130B AD 0A D2   DPLAN1: LDA RANDOM ;Get a random number
130E 29 07      AND #7 ;reduce it to 0-7
1310 C9 06      CMP #8 ;is it > 8 ?
1312 00 F7      BCS DPLAN1 ;Yes. Pick another one.
1313 00 00      A #0 ;No. Multiply by 4
;
1314 00          TAX
1315 00          TAX
1316 00          TAX
1317 8D 02 10   DPLAN2: LDA TPLANE,X ;And use it to index into
131A 8D 0D 10   STA TOX,Y ;the TPLANE table for
131C 8D 03 10   LDA TPLANE+1,X ;the velocity, the value,
131E 8D 7B 10   STA TVAL,Y ;the width, and the
1320 8D 04 10   LDA TPLANE+2,X ;index into the plane
1322 8D 83 10   STA TWID,Y ;picture table.
1323 00 00      A #0
1324 00          TAX
1325 00          TAX
1326 00          TAX
1327 8D 00 10   DPLAN3: LDA #PTOL,X ;Copy eight bytes from
132A 8D 0A 1A   STA MPMBAS+PHDP0,Y ;the picture table to
132C 8D E8 1A   INX ;the player's defun space.
132E 8D 00 1A   INY
132F 8D C8 13   DEC TEMPA
1330 00 F3      BNE DPLAN3
1331 9D 98      LDA #1 ;Restore the processor
1332 AA          TAX ;state, and return
1333 8D C3 13   LDY YTEMP ;(X has had 8 added to it
1334 8D 00 13   RTS ;so that the next plane
; drawn will be one position
; lower in the player's defun).
;
1335 A5 B1      VBLH: LDA DSCOR ;Check if there are any unscored
1337 00 08      BNE VBL6 ;points left. Yes.
1339 A9 80      LDA #S80 ;No.
133B 8D 03 D2   STA AUOC2 ;Turn off point sound
133E 4C 90 11   JMP VBL7
;
1341 38          VBL6: SEC ;Subtract one from the unscored
1342 E9 01      SBC #1 ;points counter.
1344 85 B1      STA DSCOR
;
1349 A9 8A      LDA #S8A ;Turn on the point sound.
134B 8D 03 D2   STA AUOC2
;
134E A2 05      LDX #8 ;Add one to the SCORE counter.
1350 8D 05 10   VBL6: LDA SCORE,X ;Which by an amazing coincidence
1352 18          CLC ;is in a human readable form.
1353 69 01      ADC #10
1355 9D 0A 18   STA SCORE,X ;If it was a space make it a '1'.
1358 C9 1A      CMP #S1A ;Greater than a '9'?
135A 00 09      BNE VBL6 ;No.
135C A9 10      LDA #S10 ;Yes. Set to '0' and add one to
135E 9D 00 10   STA SCORE,X ;the next most significant digit.
1361 CA        DEX
1362 4C 40 11   JMP VBL6
;
1365 A5 87      VBLH5: LDA STOP ;No Free time if
1367 00 27      BNE VBL7 ;we're STOPed.
;
1369 A9 85      DNE DSEC ;Has he scored 15 points in a row
136B 8D 85 05   INX ;yet?
136C 88 85      STX DSEC
136E 8D 0E 0F   CPX #16
1370 00 1E      BNE VBL7 ;Nope.
1372 A2 00      LDX #0 ;Yes. Reset this counter, then, and
1374 88 85      STX DSEC
;
1376 A2 05      LDX #5 ;give this man a second of free time.
1378 8D 0E 18   VBL6: LDA TIME,X ;{this routine is just like the VBL6
137A 18          CLC ;one, only it fiddles with numbers that
137C 69 01      ADC #1 ;are a different color. . . .}
137E 09 90      ORA #S90
1380 9D 0E 18   STA TIME,X
1383 C9 9A      CMP #S9A
1385 9D 09 0A   BCC VBL7
1387 A9 90      LDA #S90
1389 9D 0E 18   STA TIME,X
138B CA        DEX
138D 4C 78 11   JMP VBL6
;
1390 A6 86      VBL7: LDX JIFF ;Have 60 jiffies (a jiffy is used
1392 E8          INX ;by Pet owners and other people
1393 86 86      STX JIFF ;to denote a 60th of a second) elapsed?
1395 10 3C      CPX #60
1397 00 22      BNE VBL9 ;No!
1399 A2 00      LDX #0 ;Yes. Reset jiffy counter
139B 86 86      STX JIFF
;
; Write out the copyright message.
;
1400 A5 87      LDA STOP ;Has time stopped?
1402 00 2E      BNE VBL12 ;Yes.
;
1406 A2 05      LDX #5 ;No, so we shall take away a second from
1408 8D 0E 18   VBL12: LDA TIME,X ;the user's time (har har har)
140A 38          SEC ;in just the same way as we added one,
140B E9 01      SBC #1 ;except for a few changes.
140D 09 90      ORA #S90
140F 9D 0E 18   STA TIME,X
;
141A C9 09      CMP #S9F ;Like this check for borrow in place
141B 00 9F      BNE VBL9 ;of a check for carry.
141D A9 99      LDA #S90
141B 9D 0E 18   STA TIME,X
;
1400 80          ASTEMP: BYTE 0 ;Used to save the state of Y
;
1401 80          ASTOIN: STY ASTEMP ;Save Y.
1402 80          TAX ;Copy A into Y
1403 80          TXA
1404 80          PHA
1405 80          TYA
;
1406 80          ASTOIN: STY ASTEMP ;Save Y.
1407 80          TAX ;Copy A into Y
1408 80          TXA
1409 80          PHA
1410 80          TYA
;
1406 80          ASTOIN: STY ASTEMP ;Save Y.
1407 80          TAX ;Copy A into Y
1408 80          TXA
1409 80          PHA
1410 80          TYA

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1187 CA          DEX
1188 4C A3 11    JMP          VBL10
;
; Erase & initialize score line
;
1189 A9 08      VBL9: LDA #0          ;Was the user run out of time??
118D A2 08      LOD          ;If so, OR-ing together all of his
118F 1D 9D 18  VBL11: ORA TIME-1,X ;time-left digits should give a zero
11C2 CA 0E      OEX
11C3 D0 FA      BNE VBL11
11C5 29 0F      AND          ;Does it?
11C7 C9 0D      CMP          ;No.
11C9 00 04      RNF VBL12
11CB A9 01      LDA #1          ;Yes. Stop time!!!
11CD 85 07      STA STOP

11CF A9 00      VBL12: LDA #0          ;Store a zero into the ATRACT flag
11D1 85 4D      STA ATRACT ;to keep the Atari from futzing with
;our screen colors. . . Of course
;this means that the user might end
;up with the game field permanently
;embossed on his TV screen. . . .

11D3 AD 78 02    LDA STICK0 ;Take STICK0
11D6 4A          LSR A
11D7 4A          LSR A ;Divide it by 4
11D8 AA          TAI ;Use that number to look up the
11D9 8D 0E 10    LDA JTAB,X ;direction the missile should
11DE 85 B3 03    STA MDX ;travel in.
11DE CA 0E      DER ;If than subtract one from that
11DF 8A          TRX ; (if better not be 0. . .)
11E0 0A          ASL A ;And multiply by eight
11E1 0A          ASL A ;to get an index into the
11E2 0A          ASL A ;table of the gun pictures
11E3 AA          TAI
11E4 AD 00      LDY #0
11E6 8D 92 10    GUNDIR: LDA GUNTAB,X ;Copy the picture of the gun
11E9 9D 8D 1A    STA GUNPOS,Y ;into player zero. Use two
11EC C8 09 1A    INY ;bytes for each byte in the
11ED 99 8D 1A    STA GUNPOS,Y ;picture table so the gun is
11F0 EB          INX ;18 dots (32 scan lines) high.
11F1 C8          INY
11F2 C0 10      CPY #10
11F4 0D F8      BNE #GUNDIR

11F8 A5 82      LDA MX ;Now update missile's X position.
11FB 18          BIC #0
11F9 65 83      ADC #1
11FB 65 82      STA MX
11FD 8D 04 00    STA #PNDSHD

1200 A5 84      LDA MY ;Missile Y
1202 F0 26      BEQ VCONT ;No missile.
1204 AA          TAI
1205 A9 00      LDA #0
1207 9D 8D 19    STA #MPHBAS+PNHM,X

120A CA          DER ;Hit top of screen?
120B F0 11      BEQ #DIE
;No.
;No.
120D A5 81      LDA DSCOR ;Hit in a plane with the missile?
120F 0D 12      BNE VMHIT ;No.
1211 86 84      STX MY
1213 A9 FF      LDA #FFF ;Draw new missile
1215 9D 8D 19    STA #MPHBAS+PNHM,X

;
; Set up the PM graphics.
;
1218 8E 00 02    STX AUDF1 ;fweep sound effect
1218 4C 2A 12    JMP VCONT

121E 86 84      VMHIT: STX MY ;Zero the missile's Y coordinate
1220 4C 2A 12    JMP VCONT ;to kill the missile.

1223 A2 00      VMHIT: LDY #0 ;Since we hit something we should
1225 8E 00 02    STX AUDF1 ;silence the sound register
1228 86 84      STX MY ;and zero the missile.

122A A5 87      VCONT: LDA STOP ;Stopped?
122C 0D 16      BNE VCONT2 ;Yes.

122E A0 84 02    LDA STRIG0 ;Check if human wants to fire
1231 0D 11      BNE VCONT2 ;No.

1233 A5 84      LDA MY ;Check if he CAN fire.
1236 0D 0D      BNE VCONT2 ;Can't

1237 A9 82      LDA #GUNOFF*2 ;Set the Y coordinate to just
1239 85 84      STA MY ;above the muzzle of the gun.
123B A5 83      LDA MDX ;To get the X coordinate.
123D 0A          ASL A ;multiply MDX (the direction the
123E 0A          ASL A ;gun is pointing) by 4
123F 18          CLC ;and add to 132 (which is the
1240 69 84      ADC #132 ;CENTER of the Gun)
1242 85 82      STA MX

1244 A9 FF      VCONT2: LDA #FFF ;Reset DLI counter
1246 85 80      STA DLIC
1248 8D 1E 00    STA HIICLR ;Zero hits.
1248 4C 01 E7    JMP XVB ;Jump to the OS's exit vblank routine.

1249 A2 14      LOX #20 ;Fill score line with spaces.
12F1 A9 08      LDA #0
12F3 9D FF 17  ERASES: STA SCORLN-1,X
12F6 CA 0E      DER
12F7 D0 FA      BNE ERASES

12F9 A9 10      LDA #S10 ;Make score ' D'
12FB 8D 05 18  STA SCORE+6

12FE A9 8D 08  LDA #S80 ;Make high score ' D'
1300 8D 0C 18  STA MISCOR+6

1303 A9 08      LDA #S90 ;Make time ' 0'
1305 8D 13 18  STA TIME+6

1308 A9 01      REPEAT: LDA #1 ;Stop the player (just to make
130A 85 87      STA STOP ;sure!)
130C A9 08      LDA #S08 ;Set up to read the consol
130E 8D 1F 00  STA CONSOL ;switches

1311 A9 1F 00  WAIT: LDA CONSOL ;The other two switches -- Select
1314 C9 01      CMP #SWSTR1 ;and option, are not pressed down.
1316 D0 08      BNE WAIT

1318 20 2A 14   JSR MAKETP ;If they are pressed down, make a
;copy of this whole program
;And reset since the sound registers
;will be massed up. . . .

131B 4C 4E 12   JMP BEGIN

131E C9 08      WAIT1: CMP #6 ;Is the start switch pressed?
1320 D0 EF      BNE WAIT ;Nope. . . .

1322 A9 0D      LDA #0 ;Yes. Start game (!)
1324 A2 06      LOX #6 ;Erase line and score, but not
1326 9D 0D 18  RESTR2: STA TIME-1,X ;high score.
1328 9D FF 17  STA SCORE-1,X
132A CA 0E      DER
132B D0 F7      BNE RESTR2

132F A9 91      LDA #S1 ;Set the time left to ' 120'
1331 8D 85 18  STA TIME+3
1333 A9 82      LDA #S2
1335 8D 1E 18  STA TIME+4
1337 A9 80      LDA #S0
1339 8D 13 18  STA TIME+5

133E A9 10      LDA #S10 ;Set the score to ' 0'
1340 8D 05 18  STA SCORE+5

1343 A9 00      LDA #0 ;Let the player shoot.
1345 85 87      STA STOP
1347 85 0E      STA OSCOR ;Clear out the vblank
1349 85 8B      STA DFF ;counters.
134B 85 88      STA DSEG

134E A9 0C      LDA #C ;Name of cassette device.
1350 85 56      STA ICCOM,X
1352 8D 3A      JSR RTS
1354 8D 3A      JSR CAS: .ASCII 'C:'
1356 8D 3A      JSR .BYTE EDL

1357 8D 80      JSR PND # ;Used by MAKETP to figure
;out what to save. Must
;point to just after last
;byte of program.

1422 A8          TAY ;Restore X & Y registers.
1423 08          PLA
1424 AA          TAX
1425 98          TYA
1426 AC 0D 14   LDY ASTEMP
1428 8D 00      RTS

;
; Boot tape writer. Writes out a Boot tape and returns.
;
142A A2 20      MAKETP: LDY #C1W0 ;Choose IOCB two
142C A9 DC      LDA #CLOSE ;Close it.
142E 9D 42 03   STA ICCOM,X
1431 20 56 E4   JSR CIOV

1434 A9 14      LDA #CAS- ;Open the C: device.
1436 9D 45 03   STA ICBAH,X
1438 A9 75      LDA #CAS+SFF
143B 9D 44 03   STA ICBAL,X
143E A9 03      LDA #OPEN
1440 9D 42 03   STA ICCOM,X
1443 A9 08      LDA #OPHOT ;for output
1445 9D 4A 03   STA ICAX1,X
1448 A9 80      LDA #S80 ;short IRQ
144A 9D 48 03   STA ICAX2,X
144D 20 56 E4   JSR CIOV

1456 A9 00      LDA #PST+SFF ;Write out the program in
1458 9D 44 03   STA ICBAL,X ;one fell swoop (using a
145A A9 10      LDA #PST- ;block putchar)
145C 9D 40 03   STA ICBAH,X
145E A9 78      LDA #PND-PST+SFF
1460 9D 48 03   STA ICBL1,X
1462 A9 04      LDA #PND-PST-
1464 9D 49 03   STA ICBLN,X
1466 A9 08      LDA #PUTCHR
1468 9D 42 03   STA ICCOM,X
146B 9D 06 E4   JSR CIOV

146C A9 0C      LDA #CLOSE ;Close cassette buffer
146E 9D 42 03   STA ICCOM,X
1470 8D 56 E4   JSR CIOV

1474 8D 3A      CAS: .ASCII 'C:' ;Name of cassette device.
1477 8D 80      .BYTE EDL

147B PND # ;Used by MAKETP to figure
;out what to save. Must
;point to just after last
;byte of program.

0000 .END

```

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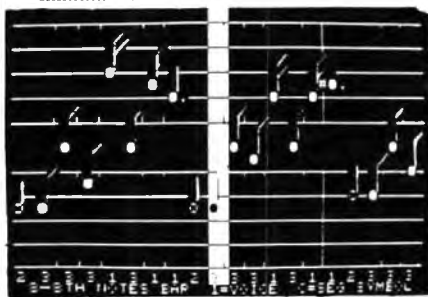
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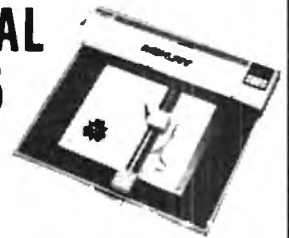
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The SOUND commands allow you to initiate a note or series of notes (or even several songs) from BASIC, and then play them in the background mode without interfering with your BASIC program. This allows your program to run at full speed with simultaneous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

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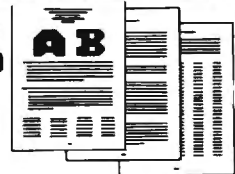
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Paper-Mate text editing includes floating cursor, scroll up or down, page forward or back, and repeating insert and delete keys. Text Block handling includes transfer, delete, append, save, load, and insert.

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Unlike most word processors, PET graphics as well as text can be used. Paper-Mate can send any ASCII code over any secondary address to any printer.

Paper-Mate works on 16K or 32K PETs with any ROM, cassette or disk, and CBM or non-CBM printers. An 8K version is in the planning.

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Flex File was developed by Michael Riley.

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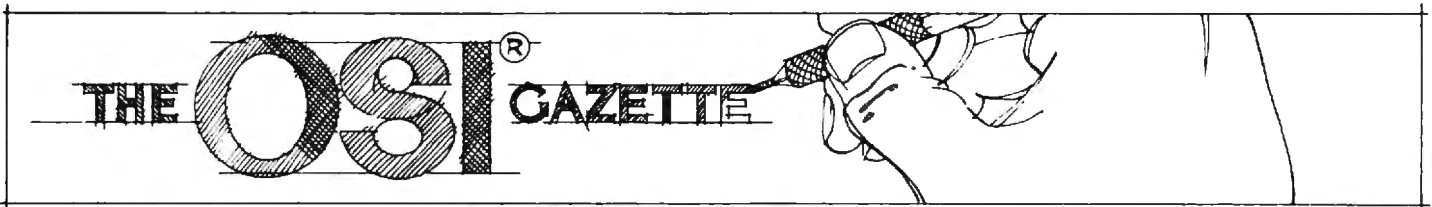
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Exploring OSI's Video Routine

Kerry Lourash
Decatur, IL

Welcome to the BASIC-in-ROM Explorers' Club! On our journey through the Fill-the-Buffer routine, we had to bypass a tour of the Video routine at \$BF2D. Now we are ready to unravel the mysteries of the routine that makes objects appear and disappear on the screen.

The Video routine (VR) is a section of machine language code located in BASIC-in-ROM at \$BF2D-BFFC. Input from the keyboard and the LOAD routine and output from the SAVE, PRINT, LIST, etc. routines are fed to the VR, which displays the information on the screen.

This is what the VR does:

1. Prints text on the screen.
2. Does automatic carriage return (CR) and line feed (LF) when the end of the video line is reached.
3. Scrolls the screen.
4. Slows printing rate, if necessary, for compatibility with printers or other slow peripherals.

Preparing For Our Journey

The format of our map (see Fig. 1) is the same as that of our first trip (**COMPUTE!** #12, p. 90). I've shown subroutines immediately after the point where they are called, instead of in numerical order. Addresses at the left are part of the main routine and indented addresses are subroutines.

The result approximates an outline of the VR. Machine language addresses have been retained so ML readers can pinpoint and disassemble any part of the routine for more information. BASIC-oriented readers should consider the addresses as line numbers. Most assembly language mnemonics have been replaced by explanations of what is happening. The few mnemonics that are used have their BASIC equivalents listed in the heading of the chart.

All numbers are hexadecimal unless specified otherwise.

The VR uses several locations in RAM and ROM:

- 0200** - Holds address of the video memory location where current character will be printed.
- 0201** - Temporary storage for character to be printed.
- 0202** - Storage for A register while A, X, and Y are pushed on the stack. Also holds the number of bytes to be scrolled in the last page of video memory.
- 0206** - TV delay loop value.
- 0207** - 020E Scroll-one-byte subroutine.
- BFFB** - Holds number of last page of video memory for C1P(D3).
- BFFC** - Holds number of last page of video memory for C2P(D7).
- FFE0** - Cursor "home" position; C1P = 65, C2P = 3F.
- FFE1** - Characters/line-1; C1P = 17, C2P = 3F.
- FFE2** - Video memory size; 0 = 1K, 1 = 2K.
- D000** - D3FF C1P video memory.
- D000** - D7FF C2P video memory.

Both the Fill-the-Buffer routine and the video routine generate an automatic CR/LF, but the two functions shouldn't be confused. Unlike the FTB, whose "terminal width" counter is in RAM, (loc. 0F), the VR has its character/line permanently set in the monitor (loc. FFE1). If you set the terminal width at less than the char./line value, the FTB will tell the VR to do a CR/LF before the VR does one automatically. However, if you set the terminal width greater than the video line length, the VR will still be triggered at 24 or 64 (decimal) characters, and the video line length will not be longer. You may see a CR/LF at seemingly random intervals. The intervals are not random; both FTB and VR are doing CR/LFs independently of each other. Another difference is that the VR doesn't generate nulls after its CR/LF, as the FTB can. A third difference is that the actual CR/LF subroutines are located in the VR. When you hit the RETURN key or the FTB does a CR/LF, the FTB is sending a CR and a LF character to the VR.

I'd also like to clear up the definition of a few terms, such as "high" and "low" bytes and "pages." The address D365 is a two-byte address. D3 is the high byte and 65 is the low byte. A page contains 256 (dec.) or 0100 (hex) bytes. Notice that the high byte is also the page number (0000-00FF is zero

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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.

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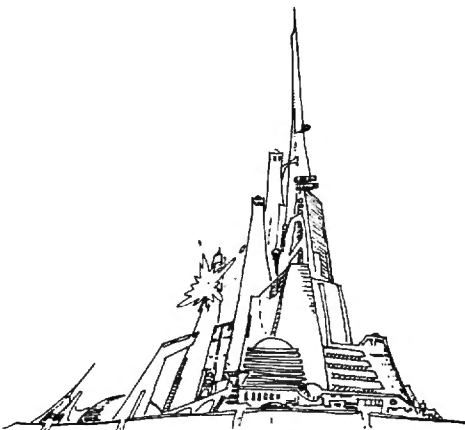
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This disk contains a new BEXEC* that boots up with a numbered directory and which allows creation, deletion and renaming of files without calling other programs. It also contains a slight modification to BASIC to allow 14 character file names.

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 1/4") \$34.95 (8").

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OSI



OSI

page). The C1P video memory has 4 pages (D000-D3FF) and the C2P has 8 (D000-D7FF).

The cursor stays on the "home" line; its address varies by only 24 or 64 (dec.). Because we know it will always be on the same page, the cursor's location can be specified by only one byte (loc. 0200). I call this byte the cursor offset. The location of the cursor is found by adding the cursor offset to D300 (C1P) or D700 (C2P).

For those not familiar with machine language, I suggest you think of the A, X, and Y registers as variables. When a value is loaded into the X register, think $x = \text{value}$.

On Our Way At Last!

We start with the character to be displayed in the A register. This character may come from any one of several routines such as LOAD, LIST, or FTB. At BF2D, the A register is loaded into location 0202. The A, X, and Y registers are saved on the stack. At BF35, the contents of 0202 are put back into the A register. This seemingly meaningless back-and-forth shift is done because the X and Y registers must be transferred to the A register so that they can be pushed onto the stack. At BF38, the character is checked to see if it is a null (00). If so, the routine branches to BF6D where the Y, X, and A registers are pulled from the stack and restored. Then, at BF72, the VR returns to the routine that called it.

If the character is not a null, location 0206 is examined to see if it is greater than zero. If it is greater than zero, the contents of 0206 are used as a counter for the TV delay loop. This timing loop slows the VR to keep it from printing too fast for slower peripherals. If 0206 contains zero, the timing loop is bypassed.

At BF47, the character is checked to see if it is an LF(0A). If the character is other than an LF, it falls through to BF48. If the character is an LF, we go to BF76. For the time being, let's bypass BF76 and see what happens if the character is not an LF.

At BF48, the character is tested to see if it's a CR(0D). If the character is a CR, the routine falls through to BF4F. Again, let's defer exploration of this route and branch to BF55. This is the route all non-control characters travel.

Stalking The Non-Control Character

At BF55, the character is stored in location 0201. We JSR (jump to subroutine) to BFC2, where the contents of 0201 are printed D300 (C1P) or D700 (C2P) plus the cursor offset. The cursor offset is stored in 0200, which was initialized with the contents of FFE0 when the BREAK key was pressed at system start-up. The contents of FFE0 are 65 (C1P) or 40 (C2P). This means "home" position in the C1P is D365 and D740 in the C2P. After the character is printed, we RTS to BF5B and increment the cursor offset (loc. 0200).

At BF65, the current cursor offset is compared to the maximum cursor offset. If the end of the

video line has been reached, an automatic CR/LF is done (JMP BF73). Otherwise, the routine JSRs to BFDE. At BFDE the character at D300 (C1P) or D700 (C2P), plus the cursor offset, is stored in 0201. Remember that location 0200 was incremented at BF5B, so the character stored is the one in front of the current character. As far as I can tell, this character is never reused, except when a CR is done. At BFEF, the cursor character (5F) is printed and an RTS to BF6D is done.

At BF6D, the A, X, and Y registers are pulled from the stack and restored. Then BF72 does an RTS back to the routine that called the VR.

Let's go back and see the path a CR character follows. The CR starts at BF4F with a JSR to BFD5. BFD5 does a JSR to BFC2, which prints the character in 0201, the character "underneath" the cursor. This character is invariably a "space" (20). At BFD4 we RTS to BFD8, where the character in the "home" position is stored in 0201. At BFEF, the cursor character (5F) is printed at the "home" position. Now we RTS to BF52, which JMPs to BF6D. The A, X, and Y registers are restored and we RTS to the VR calling routine.

Spoor Of The Wily LF

Let's review the status of the TV display at the end of the CR. The cursor character has moved from its former position at the end of the home line to the home position. The character that formerly occupied this position is now stored in 0201.

With this in mind, we track the line feed character through the VR. The LF is usually done immediately after a CR. We left the LF at BF76, which JSRs to BFC2 and prints the contents of 0201 at the home position. This restores the first character of the line and erases the cursor. At BFD4, we RTS to BF79, where the cursor offset is ANDed with the hex number E0. This has the effect of rounding the offset to the start of the video line.

The rounded-off number is stored in 0202. Next, a scroll-one-byte routine is copied from BASIC ROM to RAM at 0207-020E. At BF8C, the X register is loaded with D3(C1P) or D7(C2P). The X register will be used later to determine whether or not the routine is scrolling the last page of video memory. Hex 20 is stored in the A register and the line width is put into the Y register. If the line width is greater than 20, which indicates a 2K memory, the A register is doubled (40). At BF99, the A register is used to set the 0207-E subroutine for a 20 (32 dec.) or a 40 (64 dec.) character line length. The Y register is zeroed in preparation for use as an offset counter for the 0207 subroutine.

At BF9E, the actual scroll is started with a JSR to 0207, which gets one byte from video memory and stores it in the next line above. The Y register is incremented and we RTS to BFA1 and check to see if the current page has been completely scrolled.

If the page is not done, we branch to BF9E to scroll another byte. When the page is done, the 0207 subroutine is set to scroll the next page. A check is made to see if the 0207 subroutine is set to the last page of video memory. If the sub is not set to the last page, we go back to BF9E to scroll another page. If we are on the last page, we scroll down to the home line, using the Y register and location 0202 to tell when to stop scrolling. At BFB6, the home line is cleared by storing "space" characters in its memory locations. We JSR to BFDE, which prints the cursor in the home position. Finally, we RTS to BF6D, pull the A, X, and Y registers from the stack and, at BF72, the VR returns to the routine that called it. Our journey is finally over, and I hope it has been an informative one.

Video Routine (BF2D)

Figure 1.

```

JSR      - GOSUB
RTS      - RETURN
BRANCH, JUMP - GOTO
INCREMENT - Add one
/0200/   - Contents of loc. 0200
AND      - Logical function

```

All numbers are in hexadecimal.

```

BF2D Put /A reg./ (char.) in 0202
BF30 Save A,X,Y registers on stack
BF35 Put /0202/ (char.) in A reg.
BF38 If char. is null, branch to BF6D.
BF3A Load Y reg. with /0206/ (TV delay)
BF3D If Y is zero, branch to BF47.
BF3F TV delay loop
BF47 If char. is a LF, branch to BF76.
BF4B If char is not CR, branch to BF55.
BF4F JSR to BFD5.

```

BFD5 JSR BFC2

BFC2 Load X with /0200/
(cursor offset)

BFC5 Load A with /0201/
(char to print)

BFC8 Load Y with /FFE2/
(video mem size)

BFCB If Y is not zero, go to BFD1.

BFGD Store A is D300+/X/ (C1P)

BFD0 RTS

BFD1 Store a in D700+/X/ (C2P)

BFD4 RTS

BFD8 Load A with /FFED/
(cursor "home" offset)

BFDB Put /A/in 0200 (cursor offset)

BFDE Put /0200/ is X.

BFE1 Put char at D300-/X/ in A.

BFE4 Put /FFE2/ (video mem size) in Y.

BFE7 If Y is equal to zero, (1K video mem.) goto BFEC.

BFE9 Load A with char. at D700+/X/.

BFEC Put A in 0201
(temporary char. storage)

BFEE Put cursor char. (5F) in A.

BFF1 Branch always to BFC8.

BFC8 Load Y with /FFE2/
(video mem size)

BFCB If Y is not zero, go to BFD1.

BFGD Store A is D300+/X/ (C1P)

BFD0 RTS

BFD1 Store a in D700+/X/ (C2P)

BFD4 RTS

BF52 JMP BF6D

BF55 Put char. in 0201
(temporary char. storage)

BF58 JSR BFC2

BFC2 (See BFC2 subroutine above)

BFD4 RTS

BF5B Increment /0200/ (cursor offset).

BF5E Put /FFE1/ (chars/line-1) in A.

BF62 Add /FFE0/ (cursor "home" offset)
to A.

BF65 If A is greater than /0200/
(cursor offset) JMP BF73.

BF73 JSR BFD8

BFD8 (See BFD8 subroutine above)

Put char. in "home" position into
0201 and print cursor in
its place.

BFD4 RTS

BF76 JSR BFC2

BFC2 (See BFC2 above)/

Print char. from 0201 at home
position.

BFD4 RTS

BF79 Put /FFE0/ (cursor "home" offset)
in A.

BF7C AND A with number E0 and put
result in 0202.

BF81 Transfer scroll subroutine from
BFF3-A to RAM. (0207-B)

BF8C Load X with /BFFE/ (D3) or
/BFFC/ (D7).

BF8F Put 20 (line length) in A.

BF91 Put /FFE1/ (chars.line-1) in Y.

BF94 If Y greater than 20, then /A/.

BF99 Use A to set line length in
scroll subroutine (0207-E).

BF9C Zero Y register (byte counter).

BF9E JSR 0207

0207 Load one byte from video memory

020A Store byte one line above
previous location

020D Increment Y.

020E RTS

BFA1 If page is not done, loop to BF9E.

BFA3 Increment high byte of video
addresses in scroll subroutine.

BFA9 If high byte not equal to D3 (C1P)
or D7 (C2P) then branch to BF9E.

BFB1 Scroll last page down to
cursor line.

BFB6 Put "spaces" in home line
(erase line).

BFC0 Branch always to BF6A.

BF6A JSR BFDE (See BFDE sub above.)
print cursor at home position,
store char. in 0201.

BF6D Pull A,X,Y from stack.

BF72 RTS (Return from calling routine.) ©

Odds And Ends

String Array Bug

J. Horemans

If you use string arrays for example A\$(N), then be aware of OSI's program bug that can wipe out your program if the FRE function is called by the machine when leftover strings fill your RAM. Avoiding the problem is simple. Merely choose the DIMensions of the string array with the formula $N = 3 * I + 3$. For example DIMA\$(44) is O.K., but DIMA\$(45) can cause a program to crash. Also call the FRE function after doing a string array manipulation. Write yourself a program to find (and then make a permanent list of) the values that circumvent this problem. Here is a suitable example.

```
10 for I=1 to 20 (or any other values e.g. 21 to 40)
20 N=3*I+2
30?N
40 next I
```

You should get a list like:

```
2, 5, 8, 11,14, ... 44, 47, 50, ...
```

The values of N printed on the screen are the ones to use. Choose the one closest to the size array you need. It is also necessary to put a line like this after string array manipulations:

```
100 X= FRE(0)
```

For Those Inclined To Experiment

Here is a program to demonstrate the string array bug in OSI.

```
5 A$="B"
10 FOR I=1 TO 100
20 B$(1)=B$(1)+A$
30 next
40 B$(1)=" "
50 X= FRE(0)
60 A=A+1:"DONE" A;X
70 GOTO 10
```

Run the program as is. Nothing happens for a few moments, then the screen starts to flicker. This is the external symptom of the string bug. Recover by pressing the break key and doing a warm start by pressing W. Now add line one:

```
1 DIMB$(2) (or use any number generated by  $3 * N + 2$ )
```

The computer should now hum through this little program, telling you it is happily doing its job and, in the process, cleaning up the leftover string in line 50. Remember, it is necessary to have a line like line 50 to call this function. Try running the program without line 50. If the DIM statement is o.k. the screen won't flicker, but my 8K machine never gets past DONE 1.

If you are making a graphic display, and the o.k. message keeps coming up to mess it up, here are two ways to defeat it.

1. In immediate mode (no line number):

```
POKE 3,96
```

This will turn off the message altogether, but you have to press RETURN to get the cursor back to the left of the screen.

2. Just before your subroutines, put this line:

```
3990 FOR I=1 to 10000: NEXT:END
```

Your program will now wait for the time specified by counting from 1 to 10000 (or whatever number you put in) before flashing the o.k. message and ruining your display. If your subroutines aren't at the end or you haven't any yet, just use any convenient high number for the line.

Those fast screen clears are great, but those pokes to locations 11 and 12 can be hard to keep in order if several ML calls are needed. Here is a fast full screen clear that does NOT use the ML call via USR(X). The method is described in *The First Book of OSI* by Williams and Dorner. I have adapted it to the C1P/Superboard screen. It does take more memory than some machine screen clears, but many of them need DATA lines to POKE in too, and that can cause confusion with your DATA statements.

```
5000 A=PEEK(129): B=PEEK(130):POKE129,0:
POKE130,212
```

```
5010 S$=" " rem 31 BLANK SPACES
```

```
5020 FOR I=1 to 32:S$=S$+" ":NEXT:POKE 129,A:
POKE 130,B:RETURN
```

To call this screen clear insert a line like this:

```
100 GOSUB 5000
```

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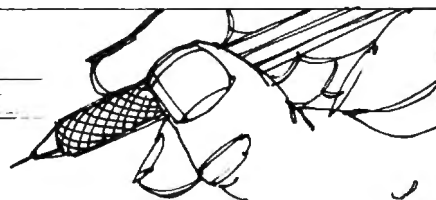
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THE PET GAZETTE



The Unwedge – Tape Append And Renumber

David A. Hook
Ontario, Canada

Lately in **COMPUTE!** there has been a great emphasis on the subject of appending. Both Harvey Herman (#8 pg. 96, #10 pg. 164) and Roy Busdiecker (#10 pg. 132) have presented their techniques.

These examples all require the use of a Basic program, which must be deleted later. Reference is made to the need to correctly arrange the line numbers. However, the programmer is required to find his own solution to this particular obstacle.

Wouldn't a utility combining Append with Renumber be helpful? The UNWEDGE attempts to satisfy these needs:

1. Written in machine language for speed of operation.
2. Self-relocating. The Basic program loads the code into high memory and protects itself from intrusion by Basic.
3. Works with Basic 2.0 (upgrade ROM) or Basic 4.0. The Basic loader automatically takes the proper code for the machine in use.
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6. Compatible with the popular DOS support programs. While the Append function only works for tape append, the UNWEDGE doesn't interfere with the Wedge's function.
7. The same 'SYS' command is used to activate and to cancel the routines.
8. Consumes only 771 bytes of user memory.

Bill Seiler deserves the credit for nearly all the coding. 'PET Renumber 3.0' for original ROM (1.0) appeared in Pet User Notes (Vol I, #7 Nov./Dec. 1978). I have upgraded this for 2.0 and 4.0 ROM and provided for user input of line numbers.

Seiler was also responsible for the 'Append Wedge' for original ROM, which was printed in Commodore Canada's Transactor (Vol. 2, #3 July 1979).

The above PET User Notes issue included "M7171" by Jim Russo and Henry Chow. This is a high-monitor with merge capability for original ROM.

Features of both of these were cannibalized and converted for use with the recent ROM releases. Additions were made to provide messages and to allow loading of tape recorded on older machines.

To Use The Program (First Time):

1. Copy the Basic program listing. Watch for the "L", "H" and "-" in the DATA statements.
2. Save the Basic Program. If you try to run it first, an error may require a reset of the PET. You know what that means!
3. RUN the program. In about 20 seconds the screen will clear and give you the important information. Copy down the SYS number shown — you'll need it to activate/cancel UNWEDGE.
4. (OPTIONAL)

(If you're not familiar with the machine language monitor, the next set of "funny numbers" might confuse you. Don't let it, they are there to ease the next step.)

Prepare a tape to save the machine language code by itself. Move the cursor up to the line that begins:

```
.S "AP/REN...(etc.)
```

Hit the return key, and follow instructions (PRESS PLAY...). When the cursor returns, type

```
X RETURN
```

which gets you back to Basic.

You will note that the file name contains both the version (2 or 4) saved as well as the correct SYS number to use. This will be helpful when you come to use the machine code again.

This copy will load faster than the Basic program and doesn't require RUN after loading. SYS number will activate/cancel. The restriction is that it always sits in the same spot, and could overwrite something already in that spot in high-memory. Use the relocating Basic version if you're not sure.

For Tape #2 or Disk:

Change the "01" to "02" if you're saving to Tape #2. Insert "0:" or "1:" (Drive #) after the quote and ahead of the "AP/REN", and change

"01" to "08" if you're saving the object code on disk.

5. Activate the routine with the given SYS number. Since this is reversible, you may cancel UNWEDGE using the same number. (Don't try to save the machine language as in step 4 above, when the UNWEDGE is active).

To Use The Program (Subsequently):

Either: Load the Basic program, then Steps 3 and 5.

Or: Load the machine code, then Step 5.

To Renumber A Basic Program In Memory

The Append routine requires each segment (on tape) to have higher line numbers than the previous one (in memory). Thus, Renumber will often be called upon to prepare the various segments — the benefit of combining these utilities.

1. Clear the screen and move the cursor about 3/4 of the way down the screen.
2. Type the '`<`' (less-than key) in the first column of a line.

Examples of options available:

```
·R          'RETURN'
·R 1000    'RETURN'
·R 250,5   'RETURN'
```

The first example will renumber with starting line of 100 and step size of 10, which are the default settings.

The second one selects a starting line of 1000, and increment 10.

The final selection results in a starting line of 250, with a step size of 5.

The maximum step size allowed is 255. Be sure that the last line number (after Renumbering) will not exceed 63999.

3. When 'RETURN' is pressed, the upper part of the screen will show a variety of characters. (It is being used to store the line numbers). The message 'RENUMBERING' will be displayed.

4. When the cursor returns (1-10 seconds) the process is complete. All 'GOTO', 'THEN', 'GOSUB' and 'RUN' destinations have been updated. Any references to non-existent lines will be numbered '65535' (illegal line number) to flag the error. You'll have to correct these before proceeding.

5. Renumber will handle up to 500 lines, which should cover most programs.

To Append One Basic Program To Another

1. Place the program to be appended in Tape #1. Its first line number must be higher than the last line of the program in memory. Use the Renumber feature to prepare this segment beforehand.
2. Type the '`<`' (less-than key) in the first column of a screen line.

Examples:

```
·APPEND    'RETURN'
·A         'RETURN'
·A "PROG"  'RETURN'
```

The first two examples will Append the next program found on tape to the program in memory. Note that only the first letter "A" is necessary, though the whole word may be entered.

By specifying a file name (in quotes), the program 'PROG' will be Appended. Others found on the tape will be bypassed.

3. Only Basic programs may be Appended and Appended-to. If the in-memory program is not all Basic, the routine aborts giving 'NOT ALL BASIC PROGRAM' message.

4. If the specified program is not all Basic, a simple LOAD, not Append is executed. The same message is printed, but without the error condition. Be careful here, since the memory pointers may have been changed.

5. If the combined program will not fit into memory, an 'OUT OF MEMORY ERROR' will be shown. The Append will not take place.

6. The routine handles one of the differences in SAVE locations between Basic 1.0 and 2.0/4.0.

The other difference may be handles in one of two ways: Since Renumber (with subsequent SAVE) will often precede Append of a routine, the other discrepancy will be covered. As an extra precaution, simply reSAVE any segment before attempting to append it.

7. The message 'APPENDING' will be displayed as the proper file is found and loaded. When the cursor returns, the job is complete.

8. Repeat step 2 for further Appends, using Renumber as necessary.

I hope that this utility will find a home in your machine. Loading UNWEDGE into memory after power-up will keep it available for use.

As with most of my work, little would be possible without the published references by Jim Butterfield. Additionally, my thanks to Jim for the advice and suggestions on many subjects.

```
0 REM APPEND & RENUMBER BASIC PROGRAMS
1 REM      SELF-RELOCATING
2 REM FOR BASIC 2.0 AND BASIC 4.0
3 REM
4 REM DAVID A. HOOK, 58 STEEL STREET
5 REM      BARRIE, ONTARIO, CANADA
6 REM      L4M 2E9      (705) 726-8126
```

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```

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9 REM PERMISSION TO COPY FOR NON-COMMERCIAL PURPOSES
10 QV=PEEK(50003):IF QV=1 OR QV=160 THEN12
11 PRINT"ITWON'T WORK WITH YOUR ROM":END
12 EA=PEEK(52)+256*PEEK(53)-1:B=770:SA=EA-B:J%=SA/256:J=SA-256*J%
13 POKE EA-1,J%:POKE 53,J%:POKE 49,J%
14 POKE EA-2,J:POKE 52,J:POKE 48,J
15 J%=(SA+31)/256:J=SA+31-256*J%
16 POKE EA-3,J%:POKE EA-4,J
17 PRINT"ITWORKING...(20 SECONDS)
18 FOR I=SA TO EA-5:READ A#:A=VAL(A#)
19 IFASC(A#)=72 THEN J=I+VAL(MID$(A#,2)):A=J/256:GOTO21
20 IFASC(A#)=76 THEN J=I+VAL(MID$(A#,2)):A=J-256*INT(J/256)
21 POKE I,A:NEXT
22 IFQV=1THEN25
23 PRINT"ITCORRECTING FOR BASIC 4.0..."
24 FORI=1TO28:READA,D:POKESA+A,D:NEXT
25 PRINT"ITACTIVATE OR CANCEL ITAPPEND/RENUM"
26 A#=MID$(STR$(SA),2):QV%=MID$(STR$(4+2*(QV=1)),2)
27 PRINTTAB(18)"IT--WITH: IT'SYS("A#)"
28 PRINT"ITSAVE NOW (WITH MONITOR) ON TAPE#1:
29 A#="AP/REN"+QV%+"-"+A#
30 PRINT"IT.S "CHR$(34)A#CHR$(34)",01";
31 X=SA/4096:GOSUB33:X=EA/4096:GOSUB33:PRINT:PRINT
32 SYS1024
33 PRINT", ";FORJ=1TO4:X%=X:X=(X-X%)*16:IFX%>9THENX%=X%+7
34 PRINTCHR$(X%+48);:NEXTJ:RETURN
35 DATA 173, L767, H766, 133, 52, 173
36 DATA L763, H762, 133, 53, 162, 3
37 DATA 181, 120, 72, 189, L748, H747
38 DATA 149, 120, 104, 157, L742, H741
39 DATA 202, 208, 241, 76, 121, 197
40 DATA 96, 201, 60, 208, 8, 72
41 DATA 165, 119, 201, 0, 240, 8
42 DATA 104, 201, 58, 176, 239, 76
43 DATA 125, 0, 32, 112, 0, 201
44 DATA 65, 240, 7, 201, 82, 208
45 DATA 237, 76, L282, H281, 162, 1
46 DATA 134, 212, 202, 134, 209, 134
47 DATA 157, 169, 2, 133, 219, 32
48 DATA 112, 0, 170, 240, 23, 201
49 DATA 34, 208, 246, 166, 119, 232
50 DATA 134, 218, 32, 112, 0, 170
51 DATA 240, 8, 201, 34, 240, 4
52 DATA 230, 209, 208, 242, 32, 86
53 DATA 246, 32, 18, 248, 32, 10
54 DATA 244, 165, 209, 240, 8, 32
55 DATA 148, 244, 208, 8, 76, 110
56 DATA 245, 32, 166, 245, 240, 248
57 DATA 224, 1, 208, 235, 165, 150
58 DATA 41, 16, 208, 127, 162, 24
59 DATA 173, 124, 2, 201, 4, 240
60 DATA 7, 162, 0, 32, L128, H127
61 DATA 240, 108, 32, L123, H122, 56
62 DATA 165, 42, 233, 2, 133, 42
63 DATA 165, 43, 233, 0, 133, 43
64 DATA 160, 0, 177, 42, 240, 24
65 DATA 32, L91, H90, 32, 110, 242
66 DATA 169, 13, 32, 210, 255, 169
67 DATA 63, 32, 210, 255, 162, 1
68 DATA 32, L83, H82, 76, 119, 195
69 DATA 32, L70, H69, 177, 42, 208
70 DATA 3, 32, L63, H62, 173, 125
71 DATA 2, 56, 237, 123, 2, 170
72 DATA 173, 126, 2, 237, 124, 2
73 DATA 168, 165, 42, 56, 233, 2
74 DATA 141, 123, 2, 165, 43, 233
75 DATA 0, 141, 124, 2, 138, 24
76 DATA 109, 123, 2, 141, 125, 2
77 DATA 152, 109, 124, 2, 141, 126
78 DATA 2, 197, 53, 144, 3, 76
79 DATA 85, 195, 32, 185, 243, 76
80 DATA 221, 243, 32, L2, H1, 230
81 DATA 42, 208, 2, 230, 43, 96
82 DATA 189, L11, H10, 240, 6, 32
83 DATA 210, 255, 232, 208, 245, 96
84 DATA 13, 78, 79, 84, 32, 65
85 DATA 76, 76, 32, 66, 65, 83
86 DATA 73, 67, 32, 80, 82, 79
87 DATA 71, 82, 65, 77, 32, 0
88 DATA 13, 65, 80, 80, 69, 78
89 DATA 68, 73, 78, 71, 32, 0
90 DATA 13, 82, 69, 78, 85, 77
91 DATA 66, 69, 82, 73, 78, 71
92 DATA 13, 0, 32, 112, 0, 240
93 DATA 33, 176, 249, 32, 115, 200
94 DATA 72, 166, 17, 164, 18, 134
95 DATA 62, 132, 63, 104, 240, 24
96 DATA 32, 112, 0, 240, 19, 176
97 DATA 249, 32, 115, 200, 166, 17

```

98 DATA 134, 66, 208, 12, 169, 100
 99 DATA 133, 62, 169, 0, 133, 63
 100 DATA 169, 10, 133, 66, 162, 36
 101 DATA 32, L-115, H-116, 169, 254, 133
 102 DATA 33, 169, 127, 133, 34, 165
 103 DATA 40, 133, 31, 165, 41, 133
 104 DATA 32, 32, L292, H291, 160, 3
 105 DATA 177, 31, 145, 33, 185, 92
 106 DATA 0, 145, 31, 136, 192, 1
 107 DATA 208, 242, 177, 31, 240, 16
 108 DATA 32, L301, H300, 170, 136, 177
 109 DATA 31, 133, 31, 134, 32, 32
 110 DATA L267, H266, 208, 220, 169, 255
 111 DATA 200, 145, 33, 200, 145, 33
 112 DATA 165, 40, 133, 119, 165, 41
 113 DATA 133, 120, 208, 3, 32, L277
 114 DATA H276, 32, L274, H273, 208, 3
 115 DATA 76, 57, 196, 32, L266, H265
 116 DATA 32, L263, H262, 32, L260, H25
 117 DATA 170, 240, 233, 162, 4, 221
 118 DATA L262, H261, 240, 5, 202, 208
 119 DATA 248, 240, 238, 165, 119, 72
 120 DATA 165, 120, 72, 32, 112, 0
 121 DATA 176, 230, 32, 115, 200, 32
 122 DATA L51, H50, 104, 133, 120, 104
 123 DATA 133, 119, 160, 0, 162, 0
 124 DATA 189, 1, 1, 240, 15, 72
 125 DATA 32, 112, 0, 144, 3, 32
 126 DATA L82, H81, 104, 145, 119, 232
 127 DATA 208, 236, 32, 112, 0, 176
 128 DATA 8, 32, L102, H101, 32, 118
 129 DATA 0, 144, 248, 201, 44, 240
 130 DATA 192, 208, 175, 32, L134, H133
 131 DATA 169, 0, 133, 33, 169, 128
 132 DATA 133, 34, 160, 1, 177, 33
 133 DATA 197, 18, 240, 21, 201, 255
 134 DATA 208, 24, 133, 95, 133, 94
 135 DATA 165, 94, 133, 96, 162, 144
 136 DATA 56, 32, 85, 219, 76, 233
 137 DATA 220, 136, 177, 33, 197, 17
 138 DATA 240, 236, 32, L96, H95, 32
 139 DATA L116, H115, 208, 212, 32, L62
 140 DATA H61, 160, 0, 177, 31, 200
 141 DATA 145, 31, 32, L90, H89, 208
 142 DATA 8, 230, 42, 208, 2, 230
 143 DATA 43, 136, 96, 164, 31, 208
 144 DATA 2, 198, 32, 198, 31, 76
 145 DATA L-29, H-30, 32, L28, H27, 160
 146 DATA 1, 177, 33, 136, 145, 33
 147 DATA 32, L56, H55, 240, 5, 32
 148 DATA L65, H64, 208, 239, 164, 42
 149 DATA 208, 2, 198, 43, 198, 42

163 DATA 28, 240, 29, 181, 107, 149, 110, 87, 113, 73, 120, 211, 125, 173
 164 DATA 128, 229, 184, 162, 202, 237, 203, 179, 264, 205, 265, 179, 267, 248
 165 DATA 270, 28, 271, 244, 352, 246, 353, 184, 374, 246, 375, 184, 481, 173
 166 DATA 482, 180, 519, 246, 520, 184, 608, 127, 609, 205, 611, 147, 612, 207
 READY.

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150 DATA 96, 165, 42, 133, 31, 165
 151 DATA 43, 133, 32, 165, 119, 133
 152 DATA 33, 165, 120, 133, 34, 96
 153 DATA 165, 62, 133, 94, 165, 63
 154 DATA 133, 95, 96, 165, 94, 24
 155 DATA 101, 66, 133, 94, 144, 2
 156 DATA 230, 95, 96, 165, 31, 197
 157 DATA 33, 208, 4, 165, 32, 197
 158 DATA 34, 96, 32, L2, H1, 230
 159 DATA 33, 208, 2, 230, 34, 96
 160 DATA 160, 0, 230, 119, 208, 2
 161 DATA 230, 120, 177, 119, 96, 137
 162 DATA 138, 141, 167, 76

STP-488 A Smart Terminal Program For An IEEE-488 Modem

Earl Wuchter
N. Catasauqua, PA

When the time comes that you decide to hook up to a commercial sharing network, or take advantage of some of the hundreds of free systems in operation across the country, you will have to make a hardware/software selection. The options facing you are as confusing as they are numerous. The program given here may help you decide.

The most straightforward way to go is with an IEEE modem, either the Commodore 8010 or the STAR 488. My personal choice was the STAR, but I think that the 8010 is identical. The STAR 488 has all the features a modem should have. It has both originate and answer modes and a half/full duplex switch. There is also a test (analog echo) mode. In addition, there are LEDs to indicate carrier detect, xmit, rcv, and test.

You must select a terminal program that is compatible with the hardware. The PET does not use true ASCII, so the program must do some conversions if you want to send or receive lower case. Some IEEE to RS-232 interface devices do this conversion for you. STP-488 will probably not work with that type of interface.

It is possible to communicate with an IEEE modem in BASIC, but if you try to write a terminal program, you will most likely be disappointed with the results. The simplest BASIC "dumb" terminal program will be hard

```

1      ; SMART TERMINAL FOR PET AND IEEE MODEM
2      ;
3      ; EARL WUCHTER
4      ; 1610 WASHINGTON ST.
5      ; CATASAUQUA, PA 18032
6      ; JUNE 81
7      ;
8      ;-- ROM ROUTINES USED (VER 3.0 & 4.0)
9      ; $FFC6 SET INPUT DEVICE. X=FILE NO.
10     ; $FFC9 SET OUTPUT DEVICE. X=FILE NO.
11     ; $FFCC RESTORE DEFAULT I/O DEVICES.
12     ; $FFD2 PRINT (A) ASCII
13     ; $FFE4 GET ONE FROM KYBD BUFF
14     ; $F2E2 CLOSE FILE A (4.0)
15     ; $F2AE CLOSE FILE A (3.0)
16     ; $BB1D PRINT A STRING (4.0)
17     ; $CA1C PRINT A STRING (3.0)
18     ;-- SYSTEM VARIABLES (VER 3.0 & 4.0)
19     ; $35 PTR (HI) TO TOP OF MEMORY
20     ; $96 ST (I/O STATUS)
21     ; $9B STOP AND RVS FLAG
22     ; $9E KEYBOARD BUFFER CHAR COUNT
23     ; $A7 ENABLE CURSOR FLASH
24     ; $C4 ADDR OF CURRENT SCREEN LINE
25     ; $C6 CURSOR POSITION ON LINE
26     ; $CD QUOTE FLAG
27     ; $D1 FILENAME LENGTH FOR OPEN FILE
28     ; $D2 FILE NO. FOR OPEN
29     ; $D3 SECONDARY ADDR FOR OPEN
30     ; $D4 DEVICE NO. FOR OPEN
31     ;-- ZERO PAGE USED FOR PROGRAM WORK SPACE
32     BPT = $11 BUFFER POINTER
33     CTRL = $40 CTRL FLAG
34     CCNT = $41 CHARACTER COUNT
35     LCNT = $42 LINE COUNT
36     ASAVE = $43 RAW CHARACTER
37     VER = $44 ROM VERSION INDICATOR
38     MODE = $45 SAVES ORIGINAL UC/LC STATUS
39     ;-- CBM/ASCII STUFF
40     RVS = $12 RVS USED IN PLACE OF CTRL KEY
41     OFF = $92
42     CR = $0D
43     ;
44     ; NOTE: ASSEMBLER QUIRK:
45     ; > RETURNS LOW BYTE OF ARGUMENT
46     ; < RETURNS HIGH BYTE
47     ;
48     ;
49     * = $0400
50     BYT $00,$0B,$04 BASIC LINE 1 SYS1037
51     BYT $1,$00,$9E,'1037',00
52
53     BYT $0,$00
54
55     ;
56     LDA 59468 SAVE ORIGINAL MODE
57     STA MODE
58     LDA #14 SELECT LOWER CASE MODE
59     STA 59468 POKE 59468,14
60     LDA #05 SET UP TO OPEN A FILE
61     STA $D2 FILENO=5
62     STA $D4 DEVICE=5 (MODEM)
63     LDA #00
64     STA $D1 NO FILE NAME
65     STA $D3 SECONDARY ADDR
66     STA $9E CLEAR KYBD BUFFER COUNT
67     JSR RESET SET BUFFER POINTER
68     STA (BPT),Y INSERT INITIAL EOF
69     LDA $FFE5 TEST FOR 3.0 OR 4.0 ROM
70     AND #04
71     STA VER 0=3.0 4=4.0

```

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pressed to keep up with a steady stream of incoming characters without losing some. It may have to ignore the keyboard as long as characters are coming in, which means you can't interrupt the other system. BASIC is certainly not fast enough to do the communication and also store text in memory.

On the other hand, a machine language program can be made as elaborate as you like. The biggest problem with a machine language program is writing it. PET I/O routines are very good, but not easy to trace. STP-488 does the equivalent of BASIC file handling commands by calling the appropriate routines in ROM. This technique was described by Raymond Diedrichs in the April 81 issue of **COMPUTE!**.

STP-488 begins with the familiar SYS 1037. If you are not up on this trick, there are two things to know: You may not change the BASIC line, and you cannot copy the program without using the (machine language) monitor. You can list it, but you won't see much.

The program was designed to be as powerful and easy to use as possible without becoming too large to be keyed in manually. In order to achieve this goal, some frills such as a help option had to be omitted.

I have tested the program on a variety of PETs. It works with Upgrade and 4.0 ROM, with graphic and business keyboards, in 40 and 80 column machines. The function of the shift keys varies slightly depending on the type of keyboard used.

Program Features

1. STP-488 Loads and runs like BASIC.
2. It works with Upgrade and 4.0 ROMS.
3. Monitor style operation.
4. Upper/lower case sent and received.
5. CAPS LOCK (modified).
6. CTRL characters may be sent.
7. Automatic storage of received text.

71	0431	F0 06	BEQ	INIT2	
72	0433	20 63 F5	JSR	0F563	4.0 OPEN 5,5,0
73	0436	4C 3C 04	JMP	QUERY	
74	0439	20 24 F5	INIT2	JSR	0F524 3.0 OPEN
75			;		
76	043C	A9 14	QUERY	LDA	N>PROMPT
77	043E	A0 06		LDY	N<PROMPT
78	0440	20 09 05		JSR	PRMSG PRINT PROMPT LINE
79	0443	20 E4 FF	GETANS	JSR	0FFE4 GET ONE CHAR
80	0446	29 7F		AND	007F ACCEPT UC OR LC
81	0448	C9 41		CMP	0'A' WAIT FOR AN
82	044A	90 F7		BCC	GETANS - ALPHA CHAR
83	044C	A2 06		LDX	006 2*(N.COMMANDS-1)
84	044E	DD 15 06	CHECK	CMP	CMDS,X CMDS EMBEDDED IN PROMPT STRING
85	0451	F0 07		BEQ	OKCMD FOUND A MATCH
86	0453	CA		DEX	TO SLASH DELIMITER
87	0454	CA		DEX	TO NEXT CMD CHAR
88	0455	10 F7		BPL	CHECK TRY AGAIN
89	0457	4C 43 04		JMP	GETANS WAIT FOR A VALID REPLY
90	045A	A9 04	OKCMD	LDA	N<(QUERY-1) PUSH ADDR
91	045C	48		PHA	- FOR EASY
92	045D	A9 3B		LDA	N>(QUERY-1) - RTS TO
93	045F	48		PHA	- MONITOR
94	0460	BD 21 06		LDA	PGMA+1,X PUSH ADDR OF
95	0463	48		PHA	- ROUTINE FOR
96	0464	BD 20 06		LDA	PGMA,X - JUMP VIA RTS
97	0467	48		PHA	
98	0468	60		RTS	JUMP TO ROUTINE
99			;		
100	0469	68	EXIT	PLA	PULL RETURN ADDR
101	046A	68		PLA	- TO MONITOR
102	046B	A5 45		LDA	MODE RETURN SCREEN TO
103	046D	8D 4C E8		STA	59468 - ORIGINAL MODE
104	0470	A9 05		LDA	005 CLOSE 5
105	0472	A6 44		LDX	VER
106	0474	F0 06		BEQ	EXIT3
107	0476	20 E2 F2		JSR	0F2E2 4.0 CLOSE
108	0479	4C CC FF		JMP	0FFCC RESTORE DEFAULT I/O
109	047C	20 AE F2	EXIT3	JSR	0F2AE 3.0 CLOSE
110	047F	4C CC FF		JMP	0FFCC RESTORE DEFAULT I/O
111			;		
112	0482	A9 2A	ONLINE	LDA	N>MSG1 PRINT ONLINE
113	0484	A0 06		LDY	N<MSG1
114	0486	20 09 05		JSR	PRMSG
115	0489	A9 00		LDA	000
116	048B	85 40		STA	CTRL RESET CTRL FLAG
117	048D	20 7C 05	MAIN	JSR	RECV RECIEVE AND ECHO
118	0490	F0 03		BEQ	INKEY WHEN NOTHING
119	0492	20 49 05		JSR	STORE CHAR TO BUFFER
120	0495	20 13 05	INKEY	JSR	TSTOP CHANCE TO EXIT
121	0498	20 C6 05		JSR	KYBD TRY THE KEYBOARD
122	049B	F0 F0		BEQ	MAIN WHEN NOTHING
123	049D	20 B8 05		JSR	XMIT SEND IT OUT
124	04A0	4C 8D 04		JMP	MAIN LOOP
125			;		
126	04A3	A9 0D	FORWRD	LDA	NCR NO MSG NECESSARY
127	04A5	20 D2 FF		JSR	0FFD2 PRINT CR
128	04A8	A2 13	PAGE	LDX	019 20 LINES PER 'PAGE'
129	04AA	86 42		STX	LCNT SET THE COUNTER
130	04AC	A2 27	LOOP1	LDX	0027 SET CHAR COUNTER
131	04AE	86 41		STX	CCNT - FOR LONG LINES
132	04B0	20 24 05	LOOP	JSR	TSTOP2 STOP KEY TEST
133	04B3	20 4F 05		JSR	FETCH RETRIEVE NEXT CHAR
134	04B6	F0 39		BEQ	EOFMSG END OF TEXT
135	04B8	20 6C 05		JSR	PRINT DISPLAY IT
136	04BB	C9 0D		CMP	NCR END OF LINE ?
137	04BD	F0 04		BEQ	EOL YES
138	04BF	C6 41		DEC	CCNT COUNT CHARACTER
139	04C1	10 ED		BPL	LOOP NOT END OF LINE
140	04C3	C6 42	EOL	DEC	LCNT COUNT THE LINE
141	04C5	10 E5		BPL	LOOP1 WHEN NOT END OF PAGE

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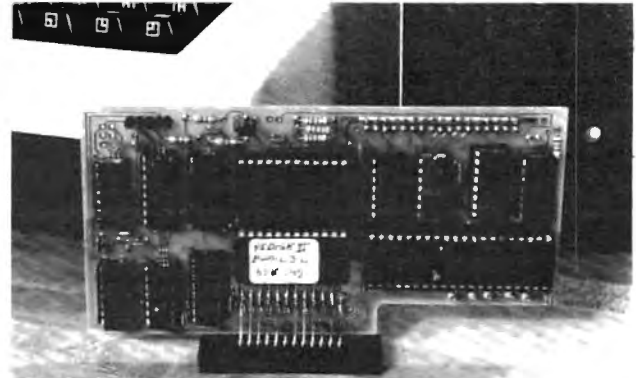
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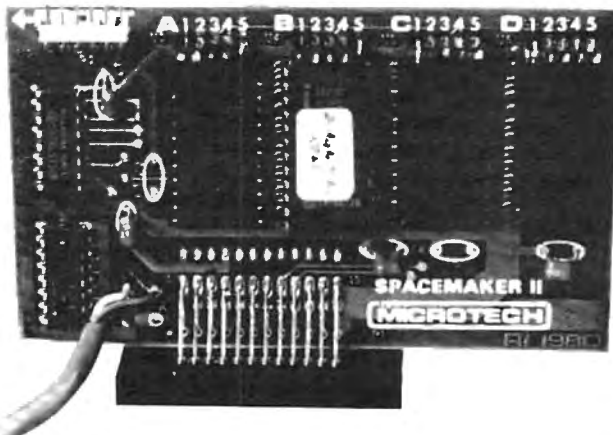
The PDOS II software links BASIC by adding a new repertoire of disk commands. IOPEN, ICLOSE, IINPUT, and IPRINT provide the basis of the powerful file handling package. ILOAD, ISAVE and IRUN allow complete disk control. PDOS II also offers a full DOS-mode of operation for all disk diagnostic and utility functions. Diskette format, backup, diagnostic, and reorganization capabilities are provided.



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In general, the program operates as follows: A prompt line "o/r/f/x/?" is displayed and you make your selection by touching the proper key. You may use upper or lower case commands. There will not be a flashing cursor at this point. The options are Online, Rewind, Forward, and Exit. The STOP key gets you out of the online and forward modes and returns you to the prompt line. Exit takes you back to the PET READY mode, so there are really only three program functions.

In the online mode, a flashing cursor will appear. All characters received (including the echoes of those sent) will be stored in a buffer. This buffer is circular, and extends from address \$0700 to the upper limit of memory. During program initialization an EOF (end-of-file) mark is put into the first buffer location. When the STOP key is used to go offline, another EOF is inserted and its address is printed for reference.

The Rewind function moves the buffer pointer backwards to the previous EOF and again prints the address.

The Forward function reprints the stored information from the current location up to the next EOF. Forward will print twenty screen lines and pause until you hit any key. The STOP key can be used to get back to the prompt mode. It will not insert an EOF when used in Forward, but will leave the pointer at the current location.

There is no fast forward function that will jump you to the next EOF without printing, but if you know the address of the EOF you want to reach, you can get there quickly with one or more rewind commands.

File Control

Going in and out of the online mode does not break the line. You stop sending and receiving,

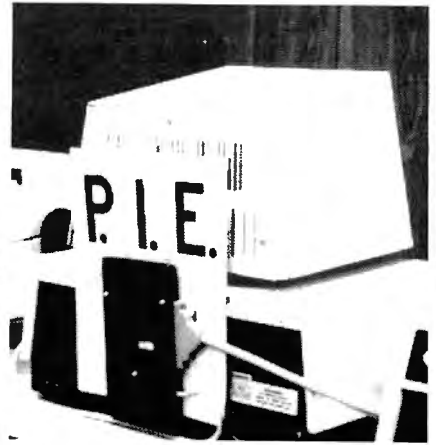
```

142 04C7 20 E4 FF   KWAIT JSR 0FFE4 WAIT FOR A KEY
143 04CA F0 FB     BEQ KWAIT - BEFORE DOING
144 04CC D0 DA     BNE PAGE - NEXT PAGE
145
;
146 04CE A9 34     ;REWIND LDA #>MSG2 PRINT REWIND
147 04D0 A0 06     LDY #<MSG2
148 04D2 20 09 05 JSR PRMSG
149 04D5 A2 00     LDX #00 FOR INDEXED INDIRECT
150 04D7 A0 06     LDY #<TOP HIGH PAGE OF THIS PGM
151 04D9 C6 11     REW2 DEC BPT DECREMENT POINTER LO
152 04DB A5 11     LDA BPT TEST FOR PAGE CHANGE
153 04DD C9 FF     CMP #0FF
154 04DF D0 0C     BNE REW3 OK, NO PAGE CHANGE
155 04E1 C6 12     DEC BPT+1 DECREMENT PAGE
156 04E3 C4 12     CPY BPT+1 LOWER THAN LIMIT ?
157 04E5 D0 06     BNE REW3 NO, NO WRAP
158 04E7 A5 35     LDA $35 HIMEM PAGE
159 04E9 85 12     STA BPT+1
160 04EB C6 12     DEC BPT+1 PTR= HIMEM-1
161 04ED A1 11     REW3 LDA (BPT,X) LOOK FOR EOF
162 04EF D0 E8     BNE REW2 NO, KEEP TRYING
163 04F1 A9 3E     EOFMSG LDA #>MSG5 PRINT EOF
164 04F3 A0 06     LDY #<MSG5
165 04F5 20 09 05 JSR PRMSG
166 04F8 A5 12     LDA BPT+1 PRINT EOF ADDR
167 04FA 20 33 05 JSR WROB
168 04FD A5 11     LDA BPT
169 04FF 20 33 05 JSR WROB
170 0502 A9 44     LDA #>MSG5B PRINT OFF,CRLF,
171 0504 A0 06     LDY #<MSG5B
172 0506 4C 09 05 JMP PRMSG
173
;
174 0509 A6 44     PRMSG LDX VER
175 050B F0 03     BEQ PRN3
176 050D 4C 1D BB JMP $BB1D 4.0 PRINT STRING
177 0510 4C 1C CA PRM3 JMP $CA1C 3.0
178
;
179 0513 A6 9B     TSTOP LDX $9B FROM ONLINE
180 0515 E0 EF     CPX #0EF 9B IS STOP/RVS FLAG
181 0517 D0 19     BNE STOP4 WHEN NOT STOP
182 0519 A9 00     LDA #00 INSERT EOF
183 051B 20 49 05 JSR STORE - THEN PRINT
184 051E 20 F1 04 JSR EOFMSG - EOF ADDR
185 0521 4C 2A 05 JMP STOP3
186 0524 A2 EF     TSTOP2 LDX #0EF FROM REPLAY
187 0526 E4 9B     CPX $9B
188 0528 D0 08     BNE STOP4
189 052A A9 00     STOP3 LDA #00
190 052C 85 9E     STA $9E CLEAR KYBD BUFFER
191 052E E6 A7     INC $A7 DISABLE CURSOR FLASH
192 0530 68     PLA RETURN TO MONITOR
193 0531 68     PLA
194 0532 60     STOP4 RTS
195
;
196 0533 4B     WR0B PHA CONVERT HEX TO ASCII
197 0534 4A     LSRA SHIFT HIGH
198 0535 4A     LSRA - NYBBLE TO
199 0536 4A     LSRA - LOW END
200 0537 4A     LSRA
201 0538 20 3E 05 JSR HEXASC - THEN CONVERT AND PRINT
202 053B 68     PLA - ONE HEX DIGIT
203 053C 29 0F     AND #0F DO THE LOW NYBBLE
204 053E 09 30     HEXASC ORA #030 ADD THE ASCII BITS
205 0540 C9 3A     CMP #03A GREATER THAN ?
206 0542 90 02     BCC HEXASC2 NO
207 0544 69 86     ADC #086 YES, ADD 7 & UC
208 0546 4C D2 FF HEXASC2 JMP $FFD2 PRINT ONE HEX DIGIT
209
;
210 0549 20 55 05 STORE JSR PTRUP PUT CHAR INTO
211 054C 91 11     STA (BPT),Y BUFFER
212 054E 60     RTS

```

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but this is transparent to the remote system. Because of this, and the fact that the STOP key inserts an EOF, it is possible to isolate particular sections of text for use later.

For example, suppose you want to send the command "TYPE GOOD.NEWS" and isolate the returned file. Type the command, but do not send the RETURN that ends it. Next, hit STOP to insert an EOF and give you the prompt line. You could now rewind if desired, but it is not necessary. Next, go online again and send the RETURN. When the entire file has been received and the other system has sent its ready prompt, hit STOP and immediately go online again. Your file is now bracketed by EOF marks and can be rewound and replayed at will.

Isolated files can be saved on tape by using the monitor. This program, or a similar one, will be needed to read them.

The Keyboard

The program will put your PET into the lower case mode. On exit, the original mode will be restored.

The function of the shift keys will be modified. They will function more like the CAPS LOCK key found on some terminals. On graphic keyboards, they will affect only the alpha characters and the "high specials" (left bracket, backslash, right bracket, up arrow, and left arrow). These last characters, when shifted, represent respectively those characters having ASCII codes 7B through 7F. Because the PET does not have symbols corresponding to these codes, they will be displayed as PET graphics. If a shifted left arrow (ASCII del) is sent, the echo will be ignored.

With a business keyboard, the action of the shift keys is slightly different. For keys with one symbol, the action will be as described above. For keys with two symbols, shift will behave normally.

```

213 ;
214 #54F 20 55 05 ; FETCH JSR PTRUP FETCH NEXT CHAR
215 #552 B1 11 LDA (#BPT),Y - FROM BUFFER
216 #554 60 RTS
217 ;
218 #555 E6 11 PTRUP INC BPT INCREMENT PTR
219 #557 D0 10 BNE RET2 WHEN NO PAGE CHANGE
220 #559 E6 12 INC BPT+1 INCR PAGE
221 #55B A4 12 LBY BPT+1 TEST PAGE VS
222 #55D C4 35 CPY #35 - HIMEM (HIGH)
223 #55F D0 08 BNE RET2 NO WRAP
224 #561 A0 07 RESET LDY #(<TOP+1) RESET BUFFER PTR TO
225 #563 04 12 STY BPT+1 - START OF BUFFER
226 #565 A0 00 LDY #00 - WHICH BEGINS ON PAGE
227 #567 04 11 STY BPT - FOLLOWING THIS PGM
228 #569 A0 00 RET2 LDY #00 FOR STORE & FETCH
229 #56B 60 RTS
230 ;
231 #56C 4B ; PRINT PHA BEFORE PRINTING, ERASE
232 #56D A9 20 LDA #120 - FLASHING CURSOR
233 #56F A4 C6 LBY #C6 CURSOR COLUMN
234 #571 91 C4 STA (#C4),Y C4 IS ADDR OF LINE START
235 #573 60 PLA RESTORE ORIGINAL CHAR
236 #574 20 D2 FF JSR $FFD2 PRINT IT
237 #577 A2 00 LDX #00 RESET THE
238 #579 06 CD STX #CD - QUOTE FLAG
239 #57B 60 RTS
240 ;
241 ;
242 #57C A2 05 ; RECV LDX #05 INPUT FROM FILE 5
243 #57E 20 C6 FF JSR $FFC6 DEVICE = MODEM
244 #581 20 E4 FF JSR $FFE4 GET#5
245 #584 A6 96 LDX #96 TEST ST (STATUS)
246 #586 D0 2F BNE NULL NOT OK
247 #588 29 7F AND #7F MASK PARITY BIT
248 #58A C9 0D CMP #CR CR IS THE ONLY
249 #58C F0 1E BEQ ECHO - SPECIAL CHARACTER
250 #58E C9 20 CMP #20 - ACCEPTED. REJECT
251 #590 90 25 BCC NULL - CONTROL CHARS
252 #592 C9 7F CMP #7F REJECT DEL
253 #594 B0 21 BCS NULL IF SENT, NO ECHO
254 #596 C9 60 CMP #60 IS IT LOWERCASE ?
255 #598 90 08 BCC UCIN NO, GOTO UC CONVERSION
256 #59A 29 DF AND #DF MASK ASCII LC BIT
257 #59C C9 5B CMP #'Z'+1 LEFT BRACKET
258 #59E B0 0A BCS ORB7 SHIFT HIGH SPECIAL
259 #5A0 90 0A BCC ECHO LC BECOMES SHIFTED
260 #5A2 C9 41 UCIN CMP #'A' IS IT LESS THAN 'A'
261 #5A4 90 06 BCC ECHO YES, NO CHANGE
262 #5A6 C9 5B CMP #'Z'+1
263 #5A8 B0 02 BCS ECHO YES, DON'T SHIFT IT
264 #5AA 09 00 ORB7 ORA #80 UC ALPHA BECOMES SHIFTED
265 #5AC 20 6C 05 ECHO JSR PRINT DISPLAY INCOMING CHAR
266 #5AE 4B FIX PHA
267 #5B0 20 CC FF JSR $FFCC RESTORE DEFAULT I/O
268 #5B3 60 PLA
269 #5B4 09 00 ORA #00 TO SET FLAGS
270 #5B6 60 RTS RETURN CHAR IN (A)
271 #5B7 A9 00 NULL LDA #00 FOR TESTS
272 #5B9 F0 F4 BEQ FIX
273 ;
274 #5BB A2 05 ; XMIT LDX #05 FILENO.
275 #5BD 20 C9 FF JSR $FFC9 SET OUTPUT DEV =MODEM
276 #5C0 20 D2 FF JSR $FFD2 PRINT#5
277 #5C3 4C CC FF JMP $FFCC RESTORE I/O AND RTS
278 ;
279 #5C6 46 A7 ; KYBD LSR #A7 ENABLE CURSOR FOR GET
280 #5C8 20 E4 FF JSR $FFE4 FROM KYBD BUFFER
281 #5CB F0 3E BEQ RETRN2 NOTHING THERE
282 #5CD 85 43 STA ASAVE RAW CHARACTER

```

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Control Characters

Control (CTRL) characters can be sent, but will be ignored when they are received. CTRL characters serve no purpose on the PET system except to make the cursor do funny things. The only exception is carriage return. Line feed (CTRL J) may be sent. It is not needed for CRT printing.

To send a CTRL character, first key RVS (shifted or unshifted). It will print on the screen as an inverse check mark, but will not be sent. The next key, however, will be sent as the CTRL equivalent. This is much simpler than it sounds. To send CTRL C, key RVS followed by C. Once RVS has been keyed, it cannot be cancelled. If you hit it accidentally, follow it with an @. This will send a null (00).

Echoes

Some host computers, upon receiving a character, immediately send it back to the terminal. A system that does this is called a "full duplex" system. Those that do not echo each character are called "half duplex" systems.

Hardware terminals normally have a half/full duplex switch. When this switch is set to the half duplex mode, the terminal itself will echo each character keyed back to its printer or CRT. Terminal programs often have a program option to simulate the function of the half/full switch. This option will cause the program to print each character that it sends out.

Many modems have a similar switch. When this switch is in the half duplex position, the modem will echo each character from the terminal back to the terminal.

When you are communicating with a full duplex system you must set all of your switches to full duplex, or you will receive more than one echo for each keyed character. For a half duplex system, one switch must be set to half duplex.

Because the IEEE modem has such a switch, this program does not need one. If you are

283	05CF	29	7F		AND	#07F	MASK CBM SHIFT BIT
284	05D1	C9	12		CMP	#RVS	CTRL KEY ?
285	05D3	D0	11		BNE	KYDD4	WHEN NOT
286	05D5	85	40		STA	CTRL	SET CTRL FLAG =012
287	05D7	20	D2	FF	JSR	0FFD2	PRINT RVS
288	05DA	A9	8A		LBA	#0BA	CHECK MARK
289	05DC	20	D2	FF	JSR	0FFD2	
290	05DF	A9	92		LDA	#OFF	TURN RVS OFF
291	05E1	20	D2	FF	JSR	0FFD2	- FOR ECHO
292	05E4	D0	14		BNE	NULL2	BRANCH ALWAYS
293	05E6	A4	40	KYDD4	LDY	CTRL	CTRL FLAG SET ?
294	05E8	C0	12		CPY	#RVS	
295	05EA	D0	06		BNE	TSTCR	NO,
296	05EC	C6	40		DEC	CTRL	YES, UNSET IT
297	05EE	29	1F		AND	#01F	PREPARE CTRL CHAR
298	05F0	D0	19		BNE	RETRN2	AND SEND IT BACK
299	05F2	C9	0D	TSTCR	CMP	#CR	
300	05F4	F0	15		BEQ	RETRN2	
301	05F6	C9	20		CMP	#020	LESS THAN SPACE ? (CURSOR CTRL)
302	05F8	80	03		BCS	TESTA	NO,
303	05FA	A9	00	NULL2	LDA	#00	YES, IGNORE IT
304	05FC	60			RTS		
305	05FD	C9	41	TESTA	CMP	#'A'	SPECIAL OR NUMERIC ?
306	05FF	90	0A		BCC	RETRN2	YES, RETURN UNSHIFTED
307	0601	A6	43		LDX	ASAVE	
308	0603	30	09		BMI	SHFTD	FOR UC ALPHA AND HIGH SPEC.
309	0605	C9	5B		CMP	#'Z'+1	LEFT BRACKET
310	0607	B0	02		BCS	RETRN2	YES, DONT SHIFT HIGH SPECIALS
311	0609	09	20	ORB5	ORA	#020	INSERT LC BIT FOR UNSHIFTED
312	060B	09	00	RETRN2	ORA	#00	RETURN WITH CHAR IN (A)
313	060D	60			RTS		AND FLAGS SET
314	060E	C9	5B	SHFTD	CMP	#'Z'+1	IF HIGH SPECIAL,
315	0610	B0	F7		BCS	ORB5	SEND SHIFTED
316	0612	90	F7		BCC	RETRN2	SEND UC ALPHA WITHOUT SHIFT
317					;		
318	0614	0D		PROMPT	BYT	CR	
319	0615	4F	2F	52	CMDS	BYT	'0/R/F/X/? ',00
320	0618	2F	46	2F			
321	061B	50	2F	3F			
322	061E	20	00				
323					;		
324	0620	01	04	PGMA		WORD	ONLINE-1
325	0622	CD	04			WORD	REWIND-1
326	0624	A2	04			WORD	FORWARD-1
327	0626	68	04			WORD	EXIT-1
328	0628	46	06			WORD	TOP-1 FOR A PATCH
329					;		
330	062A	12	4F	4E	MSG1	BYT	RVS,'ONLINE',OFF,CR,00
331	062D	4C	49	4E			
332	0630	45	92	0D			
333	0633	00					
334	0634	12	52	45	MSG2	BYT	RVS,'REWIND',OFF,' ',00
335	0637	57	49	4E			
336	063A	44	92	20			
337	063D	00					
338	063E	12	45	4F	MSG5	BYT	RVS,'EOF ',00
339	0641	46	20	00			
340	0644	92	0D	00	MSG5B	BYT	OFF,CR,00
341					;		
342	0647	EA			TOP	NOP	COMPUTED PGM END ADDR
343	0648					END	
TOTAL ASSEMBLER ERRORS =							0
TOTAL WARNINGS =							0

connecting to a remote system for the first time, and you are not sure what type of system it is, set the modem switch to full duplex. If each character you send appears twice, flip the modem switch to

half duplex.

Test the program thoroughly before attempting to go online with any system. Then, before using a commercial network, get some experience by calling a

CBBS (Computer Bulletin Board System). These free systems are set up by clubs (or by very special individuals). Check with your local computer club for details. You may have so much fun that you will forget about the commercial networks.

For Hackers And Bit Twiddlers

Being one of you myself, I have provided the means to add another program function. The ? in the prompt can be changed to any character you want. The search count byte at 044D can be increased to 8. The address table for the routines contains a dummy entry. What more do you need? Don't forget to change the value of TOP in the Rewind and Reset routines.

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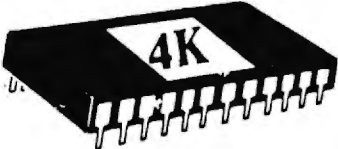
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4.0 Garbage Collection: A Small Bug

Jim Butterfield
Toronto, Canada

One of the nicest things about 4.0 Basic is that garbage collection problems are completely eliminated. Well, not quite ...

The following problem is a rare bug. A number of things must come together within your processor before it has a chance of happening:

— You must be almost completely out of memory space. By this, I don't mean that the processor has gotten to the point where it needs to do a garbage collection; rather, the processor must have very little space left even after the collection. The processor must be on the edge of saying OUT OF MEMORY.

— You must be in the process of concatenating at least three strings. "Concatenating" is a good word to use when you want to impress your friends (pronounce it with emphasis on the cat). It means: joining together. A three-way concatenation might be coded as: M\$ = A\$ = B\$ = C\$ or PRINT J\$ = "" = M\$. The = sign does the concatenation; it joins the strings together.

Seeing The Bug

Now we know the rules, let's inspect the bug. Remember, it only happens on 4.0 Basic machines, so users with earlier ROMs won't be able to join in the fun.

Try the following program:

```
100 X = FRE(0)/5-10
110 DIM A(X)
120 Z$ = Z$ + "X" + "="
130 PRINT Z$:GOTO 120
```

The first two lines guarantee that we will have very little working memory, and that the program will very quickly stop with an OUT OF MEMORY message. The calculation of line 100 is a great leveller: whether you have 8, 16 or 32K, you'll run out of memory very promptly.

The last two lines build a string which continually increases in size. Z\$ progressively becomes: X = , then X = X = , then X = X = X = and so on. But as you will see when you run the program, something goes badly amiss just before the OUT OF MEMORY halt. Variable Z\$ starts to pick up completely wrong values.

Why It Happens

If the computer was performing a two-way concatenation (e.g. Z\$ = Z\$ + "X"), it would join the

two strings together and store the result. No problem. But with three or more strings to put together, PET must save an intermediate result — and that's where it gets into trouble.

The intermediate result is held in memory, of course. But since it's not permanent, the garbage collection procedure pays no attention to it. Most strings are moved, but not the intermediate one. To make the situation even more complex: the computer, ignoring the temporary string, loses track of how much space is really available in which to stage the concatenation. If it had all the facts, it would decide that it didn't have enough space for the job, and would report OUT OF MEMORY immediately. Instead, it tries the job — even though there isn't enough memory — and ends up botching it.

What To Do About It

There are several easy ways out of this problem.

It's likely that Commodore will make a corrected ROM available in the near future to clean up the problem permanently. In the meantime; however, you can get around the potential dangers with a little coding.

One way is to make sure that you'll never run the processor out of memory. If there's any doubt, you could sprinkle a few memory tests of your own into your program. For example, a line like IF FRE(0) < 768 THEN PRINT "OUT OF MEMORY" : STOP would guarantee that you would always have space for three jumbo-sized strings in memory — or would stop if you didn't.

Another way is to avoid multi-way concatenations. So long as you join only two strings together at a time, you'll be safe. For example, try changing line 120 in the test program above to: Z\$ = Z\$ + "X" : Z\$ = Z\$ + "+". The problem will go away. ©

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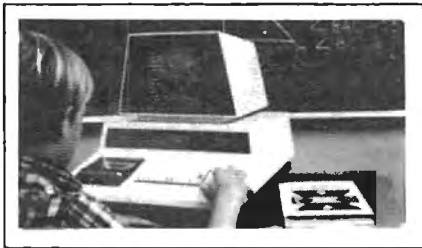
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Q. What is the Regent?

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printers can interface with the Regent, and do all those good things we promised. It's designed to operate with 8K, 16K, 32K PET/CBM models and with the Commodore disk drives and new DOS.

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Q. SUB-it? Proctor? What are they?

A. The SUB-it is a single ROM chip (on an interface board in the case of the original 2001-8 models) that allows up to 15 PETs to be connected to a common disk via the standard PET-IEEE cables. The Commodore 2040, 2050 or 8050 dual disks and a printer may be used.

(The SUB-it has no system software or hardware to supervise access to the IEEE bus. The system is thus unprotected from user-created problems. Any user—even a rank novice—has full access to all commands

and to the disk and bus. This situation can, of course be corrected partially by the Proctor, completely by the Regent.)

The SUB-it prevents inadvertant disruption when one unit in a system is loading and another is being used.

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Q. How expensive are these classroom miracles?

A. We think the word is **inexpensive**. The Regent system is \$250 for the first PET; \$150 for each additional PET in the system. The SUB-it is \$40. (Add an interface board at \$22.50 if the PET is an original 2001-8.) And the Proctor is \$95.

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Using The Monitor On The Pet

Eric Brandon

Supposedly, everyone knows how to use the monitor in the PET computer, right? A lot of people seem confused to me, however, and many authors of articles seem to feel they have to explain how to SAVE their programs using the monitor, how to enter their programs using the monitor, and so on.

There are basically two versions of the monitor, one is for the Original ROM PET, and must be LOADED from tape. The monitors in the upgrade ROM and BASIC 4.0 ROM are identical to the user, and can be entered with an SYS 4 or SYS 1024 from BASIC. Where there are differences in usage, I will point them out.

One difference I should point out right here, however, is that, with the Original ROM monitor, it is difficult to program in BASIC and use the monitor at the same time, since BASIC programs reside in the same area of memory as the monitor. One way to overcome this problem is presented in **COMPUTE!** #4 ("Relocate PET Monitor Almost Anywhere") and **COMPUTE!** #5 ("After the Monitor's Moved"), both by Roy Busdiecker.

When you first enter the monitor, what you see is a letter (either "B" or "C"), followed by an asterisk. A "B" indicates you have entered it via a machine language BRK instruction such as when you use SYS 1024. A "C" indicates you have Called the monitor directly. The only time you really need to Call the monitor is when you want to enter it on the BASIC 4.0 ROM without canceling a CMD instruction. This is done with a SYS 54386. A further explanation of this can be found in **COMPUTE!** #11 ("Working With BASIC 4.0") by Jim Butterfield.

The next thing you see is a list of the 6502's registers. This list can also be called up by the "R" command, and looks like this:

```
PC  IRQ  SR  AC  XR  YR  SP
.;  0401 E62E 32  04  5E  00  FE
```

The hexadecimal numbers are in left to right order: the Program Counter, the Interrupt ReQuest vector, the Status Register, the ACcumulator, the X Register, the Y Register, and the Stack Pointer. You can move the cursor over any of these values, and change them to whatever you wish by simply overstriking the old numbers. The Original ROM monitor does not supply you with the value of the IRQ vector; this can be found at \$0219 and \$021A.

One of the commands available to you at this point is "M". This command allows you to see the value of memory locations in hexadecimal format. For example, to view the bytes from \$033A to \$0400, you would type:

```
M 033A 0400
```

You can stop such a listing by hitting the STOP key. You may also use the cursor to overstrike the hex numbers with any values you wish. You must hit RETURN over each line, however, to enter the changes into memory.

Another command available is "G". This means Go, and is used to execute machine language programs. If you wished to execute a program beginning at \$033A, for example, you would type in:

```
G 033A
```

This is equivalent to SYS 826. If you enter just "G", you will execute instructions beginning where the Program Counter is pointing.

The "L" command will LOAD bytes from tape or disk. The format is:

```
L "NAMEPROG",DN
```

where DN is the device number (01 for tape, 08 for disk) in hex. For the original ROM, the format is:

```
L DN,NAMEPROG
```

Note that no quotation marks are necessary. An advantage of LOADING from the monitor is that certain pointers are conserved. If, for instance, you LOADED (from BASIC) a machine language program into the second cassette buffer, and then typed in a line of BASIC, your machine would hang up since your variable pointer would be below \$0400, the beginning of your BASIC program! Using the monitor, however, you would not have any of these problems. If you must LOAD machine language from BASIC, type "NEW:CLR" after LOADING.

The "S" command is used to SAVE memory to tape or disk. The format is:

```
S "NAMEPROG",DN,BADD,EADD
```

where DN is the device number, BADD is the beginning address in hex, and EADD is the ending address *plus one* in hex. For instance, to SAVE a program called TEST that resides from \$033A to \$03C0 onto drive 0 of the disk, you would type in:

```
S "0:TEST",08,033A,03C1
```

The format for the Original ROM monitor is different. To SAVE the same program to tape you would type in:

```
S 01,TEST,033A,03C1
```

As with LOAD, no quotation marks are necessary.

The last command is "X" which means eXit. It takes you out of the monitor and returns you to BASIC. This command should be taught to every computer science student, since they somehow manage to end up in the monitor despite the fact

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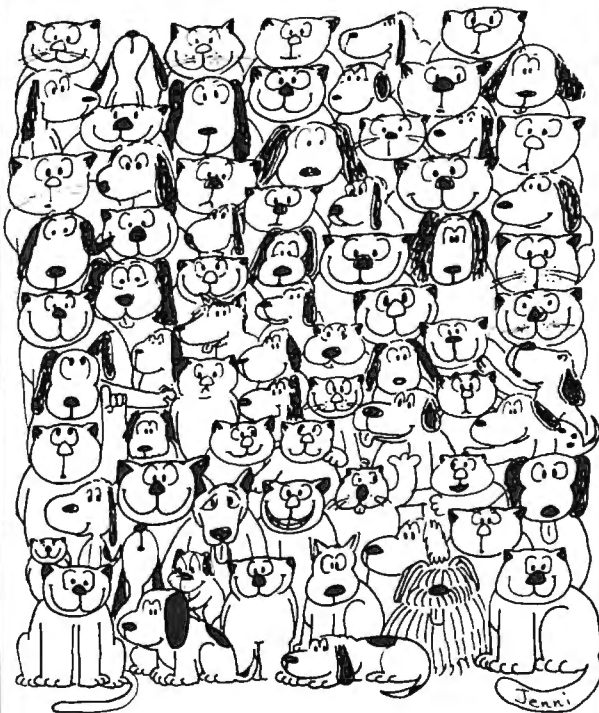
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that they don't know how to leave BASIC.

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Odds And Ends

Louis C. Ray
Los Angeles, CA

In issue 6 of **COMPUTE!** Jim Butterfield described the various ROM sets that are available for the CBM/PET computers and the Commodore disk systems. On the strength of that article I proceeded to acquire the BASIC 3.0 ROMs for my model 2001-8 PET and a 2040 disk with DOS 2.1.

I wanted to use the "relative file mode" of the DOS 2.1 program in the 2040 disk drive. However, the manuals from Commodore do not indicate how the relative positioning feature can be called from a computer without BASIC 4.0. Unfortunately, my Commodore computer is an old model with static RAMs that cannot be easily upgraded to use the BASIC 4.0 ROMs. Phone calls to several Commodore district offices yielded no help, although most of Commodore folks were friendly and sympathetic.

After some experimentation, I have discovered the syntax necessary for the RECORD command of BASIC 4.0 to be simulated by BASIC 3.0. It is as follows:

PRINT#15,"P"ch/rc1/rch/b

- where **ch** is the channel open to the relative file (in binary)
- rc1** is the low order half of the record number (in binary)
- rch** is the high order half of the record number (in binary)
- b** is the byte pointer (in binary)
- If not given, a 1 is assumed for the byte pointer.

The following short program shows how I get the "relative files" with my PET.

```

10 OPEN15,8,15:LF=10
20 OPENLF,8,LF,"0:TEST,L80,W"
22 INPUT"RECORD NUMBER":RN%
23 IFRN%>254ORRN%<0THEN22
24 PRINT#15,"P";CHR$(LF);CHR$(RN%);CHR$(0)
25 GOSUB3400:IFEN=50THEN600
26 INPUT"READ OR WRITE W":C#
27 IFLEFT$(C#,1)="R"GOTO500
28 IFLEFT$(C#,1)="A"THEN50
29 GOTO600
50 CLOSE3
60 STOP
400 INPUT#15,EN,EM$,ET,ES
405 IFEN=0THENRETURN
410 PRINTEN;EM$;ET;ES;RETURN
420 CLOSE3:CLOSE15:STOP
500 INPUT#LF,A$
510 PRINTA$;GOTO22
600 PRINT"TYPE LINE":INPUT"":A$
610 PRINT#LF,A$;CHR$(13);
620 GOTO22
    
```

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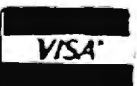
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2040 Disk Program Listing

David M. Conley
Santee, CA

This is a program for the PET and the 2040 disk drive, that will list, in alphabetical order, every file and program on all your disks. This is done in a two-step process.

The first step is to read the directory off of each disk, one by one, and put this data onto a disk, as a sequential file. The disk being read goes in drive 0, and the file is put on the disk in drive 1. The PET checks the name you give each disk against a list of legal names, and will refuse a bad name. When it writes a file, the PET first scratches any *old* file with the same name. This makes updates automatic.

When you are done inputting/updating the disk directory files, Input an up arrow for the disk name, and the PET will start sorting the names.

This sorting routine and a print-out routine are in the second part of the program. It reads each file in drive 1, using the list of names in the DATA statements, and, on the first pass, gets all the programs that start with any non-alphabetical character. It then sorts these programs, and prints them out in order. Then it goes through the files again, this time getting all the ones that start with "A", sorts and prints them. It does this all the way to "Z", and then stops. The end result of all this is a listing of ALL the programs and files you have on ALL your disks.

In this format, this program will show Program Name, Type, Disk name, and Size, and is set up to use the 2022 printer.

For large disk libraries, this program is SLOW! To speed it up, you can have the PET look for several letters at once, which will require fewer passes through the files to get all the data. This uses up lots of memory though, so don't try to do too much at once, or you'll run out of memory. Putting too many names into the PET will also

```

- ONE AT A TIME      + THREE AT A TIME
-----
- 720 REM ** THIS SORTS FOR 1 LETTER AT A TIME
+ 720 REM ** THIS SORTS FOR 3 LETTERS AT A TIME

- 840 PRINT"J":FOR I=1 TO 27:E$=MID$(A$,I,1)
+ 840 PRINT"J":FOR I=1 TO 27 STEP 3:E$=MID$(A$,I,1)

+ 842 G$=MID$(A$,(I+1),1)

+ 844 H$=MID$(A$,(I+2),1)

- 850 PRINT"LOOKING FOR "E$"'S
+ 850 PRINT"LOOKING FOR "E$", "G$" & "H$"'S

- 980 IF E$<>"*" THEN 1000
+ 980 IF E$="*" THEN 990

+ 982 IF G$="*" THEN 990

+ 984 IF H$="*" THEN 990

+ 986 GOTO 1000

- 1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:J=J+1:PRINT"*";
+ 1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:J=J+1:PRINT"*";:GOTO 1010

+ 1002 IF MID$(F$,2,1)=G$ THEN C$(J)=F$:J=J+1:PRINT"*";:GOTO 1010

+ 1004 IF MID$(F$,2,1)=H$ THEN C$(J)=F$:J=J+1:PRINT"*";:GOTO 1010
-----
- ONE AT A TIME      + THREE AT A TIME

```

drastically increase the time required to sort these names.

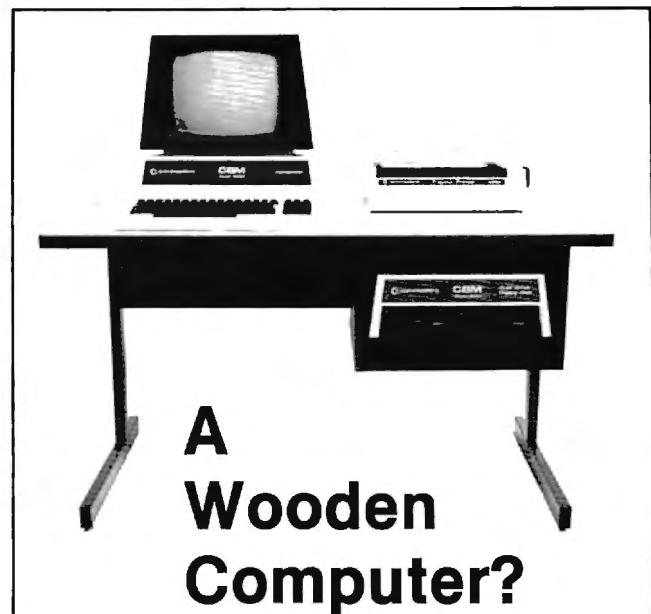
Shown below are the changes necessary to look for three letters at a time.

If you have a different printer, insert its routine in the appropriate spot. Do the same thing for the sort routine, if you have a better one. It's probably better to have a disk reserved for this program and data files only. It'll save the 2040 a little time when it looks for a file.

```

100 REM ** BY D. M. CONLEY 3/81
110   -
120 REM * THIS PROGRAM READS AND STORES -
    -THE DIRECTORY FROM A DISK AS A SEQ
130 REM * FILE ON THE DISK IN DRIVE #1. -
    - THE DISK BEING READ GOES IN -
    -DRIVE #0.
140   -
150 N=152: DIM D$(N): OPEN 15, 8, 15
160 PRINT "hvvvvv TO START PRINT OUT,
    - INPUT '^'
170 INPUT "vvvvv DISK NO. 2<<<<"; B$
180 IF B$="2" THEN PRINT "↑↑↑↑↑↑↑↑":
    -GOTO 170
190 IF B$="^" THEN CLR: GOTO 740
200 READ E$
210 IF E$="END" THEN PRINT "vvvv THAT'S -
    -NOT A GOOD DISK NAME: TRY AGAIN!
220 IF E$="END" THEN RESTORE: GOTO 170
230 IF E$<>B$ THEN 200
240 RESTORE
250   -
260 REM ** READ DIRECTORY
270   -
280 PRINT #15, "I0": REM ** INITIALIZE -
    -DRIVE 0
290 PRINT #15, "M-E" CHR$(212) CHR$(237):
    -REM ** DIRECTORY LOAD PATCH
300 PRINT "h v  r DIRECTORY FROM DRIVE -
    -0 f v"
310 B=30: C$="S0:*": OPEN 2, 8, 0, C$
320 GOSUB 1410: GET#2, A$: GET#2, A$: I$=""
330 IF ST<>0 GOTO 520
340 FOR A=1 TO B: GET#2, A$: IF A$="" -
    -THEN A$=CHR$(0)
350 I$=I$+A$: NEXT A$: G=ASC(MID$(I$, 3, 1)):
    -G=G+ASC(MID$(I$, 4, 1))*256
360 IF B=30 THEN 510
370 FOR I=6 TO 27: IF MID$(I$, I, 1)<>CHR$(
    -34) THEN NEXT: GOTO 510
380 D$=MID$(I$, 5, 27)
390 IF LEFT$(D$, 1)=" " THEN J=LEN(D$):
    -D$=RIGHT$(D$, (J-1)): GOTO 390
400 D$=D$+B$+STR$(G): K=K+1
410 FA=0: F=0: FOR X=1 TO LEN(D$):
    -X$=MID$(D$, X, 1)
420 IF X$=CHR$(34) AND F=0 THEN F=1:
    -GOTO 480
430 IF X$=CHR$(34) THEN F=0: GOTO 480
440 IF F THEN 480
450 IF X$<>" " THEN FA=0: GOTO 480
460 IF X$=" " AND FA=0 THEN X$="*": FA=1
470 IF X$=" " THEN NEXT X
480 X1$=X1$+X$: NEXT X
490 D$=X1$: X1$=""
500 D$(K)=D$: PRINT D$
510 D$="": I$="": B=32: IF A$<>"S" THEN 330
520 PRINT: C$="READ DIRECTORY": GOSUB 1410

```



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```

530 C$="CLOSE 2": CLOSE 2:GOSUB 1410:
    -PRINT"↓↓"
540 REM ** PRINT#15,"I1":GOSUB 1420 -
    - (THIS IS NOT NORMALLY NEEDED"
550 OPEN 1,8,15
560 E$="S1: "+B$+" ":REM ** SCRATCH OLD -
    -FILE
570 PRINT#1,E$
580 CLOSE 1
590 -
600 E$="@1: "+B$+" ",S,W"
610 OPEN 2,8,2,E$
620 FOR X=1 TO K
630 PRINT#2,D$(X)CHR$(13);:REM *** PUT -
    -FILE ON DISK
640 NEXT X
650 PRINT#2,"*CHR$(13);
660 CLOSE 2:GOSUB 1410:K=0:GOTO 160
670 -
680 -
690 -
700 REM *** THIS HALF OF THE PROGRAM -
    -PRINTS OUT THE DIRECTORYS
710 -
720 REM ** THIS SORTS FOR 1 LETTER AT A -
    -TIME
730 -
740 A$="*ABCDEFGHIJKLMNPOQRSTUVWXYZ":
    -N=1000:DIM C$(N)
750 -
760 REM 'N' IS THE MAX NO. OF PROGRAMS -
    -THAT START WITH THE SAME LETTER -
    -IN YOUR
770 REM DISKS. BE SURE 'N' IS LARGE -
    -ENOUGH....BETTER TOO BIG THAN TOO -
    -SMALL!
780 -
790 OPEN 15,8,15:PRINT#15,"I1"
800 GOSUB 1410:J=1
810 OPEN4,4:PRINT#4,"h"
820 PRINT#4,"          PROGRAM NAME -
    - TYPE          DISK SIZE
830 PRINT#4,"          CCCCCCCCCCCCCCCCCC
    -CCCCCCCCCCCCCCCCCCCC":CLOSE4
840 PRINT#4:"h":FOR I=1 TO 27:E$=MID$(A$,I,
    -1)
850 PRINT"↓↓↓LOOKING FOR "E$"'S
860 PRINT"          ('*' = -
    -FILE FOUND)
870 READ B$
880 PRINT:PRINT"SEARCHING DISK #"B$;
890 IF B$="END" THEN RESTORE:GOTO 1030
900 D$="1: "+B$+" ",S,R"
910 OPEN 2,8,2,D$:GOSUB 1410
920 GET#2,F1$:IF F1$=CHR$(13) THEN 940
930 F$=F$+F1$:GOTO 920
940 IF ST THEN CLOSE 2:GOTO 870
950 T=LEN(F$):IF LEFT$(F$,1)="*" THEN -
    -F$=RIGHT$(F$, (T-1)):GOTO 950
960 REM ** THE ABOVE LINE ELEMINTATES -
    -A OBSCURE PROBLEM THAT CAUSES A -
    -"*"
970 REM ** TO BE THE 1ST CHARACTER IN -
    -F$. I DON'T KNOW WHY IT DOES IT!
980 IF E$<"*" THEN 1000
990 T=ASC(MID$(F$,2,1)):IF T<65 OR T>90 -
    -THEN C$(J)=F$:J=J+1:PRINT"*";:
    -GOTO 1010
1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:
    -J=J+1:PRINT"*";
1010 F$="":GOTO 920
1020 -
1030 REM ** START SORT
1040 TP=1:LOWER(1)=1:UPPER(1)=J
1050 IF TP<=0 THEN 1240
1060 LB=LOWER(TP):UB=UPPER(TP):TP=TP-1
1070 IF UB<=LB THEN 1050
1080 L=LB:K=UB:TEMP$=C$(L)
1090 IF K<1 THEN 1120
1100 IF TEMP$>=C$(K) THEN 1120
1110 K=K-1:GOTO 1090
1120 IF K<=L THEN C$(L)=TEMP$:GOTO 1190
1130 C$(L)=C$(K):L=L+1
1140 IF L>K THEN 1170
1150 IF C$(L)>=TEMP$ THEN 1170
1160 L=L+1:GOTO 1140
1170 IF K>L THEN C$(K)=C$(L):K=K-1:
    -GOTO 1100
1180 C$(K)=TEMP$:L=K
1190 TP=TP+1
1200 IF L-LB<UB-L THEN LOWER(TP)=L+1:
    -UPPER(TP)=UB:UB=L-1:GOTO 1070
1210 LOWER(TP)=LB:UPPER(TP)=L-1:LB=L+1
1220 GOTO 1070
1230 -
1240 L=0:OPEN4,4:FOR K=1 TO J
1250 X1$=C$(K):IF X1$="" THEN 1310
1260 D$="":F=0:FOR X=1 TO LEN(X1$)
1270 X$=MID$(X1$,X,1):IF X$="*" THEN -
    -F=F+1:GOTO 1340
1280 D$=D$+X$
1290 NEXT X
1300 IF C$(K)<>"*" THEN PRINT#4," -
    - ";D$:C$(K)="":L=L+1
1310 NEXT K:PRINT:PRINT"FOUND"L"ITEMS":
    -CLOSE4
1320 J=1:NEXT I
1330 END
1340 IF F=1 AND LEN(D$)<20 THEN D$=D$+ -
    -":GOTO 1340
1350 IF F=2 AND LEN(D$)<32 THEN D$=D$+ -
    -":GOTO 1350
1360 IF F=3 AND LEN(D$)<38 THEN D$=D$+ -
    -":GOTO 1360
1370 GOTO 1290
1380 -
1390 REM ** INPUT FROM ERROR CHANNEL
1400 -
1410 INPUT#15,EN,EM$,ET$,ES$:IF EN=0 -
    -THEN RETURN
1420 IFEN=1THEN RETURN
1430 PRINT"¿ ERROR #"EN"EM$;:IF EN<30 -
    -THEN PRINT" ON "ET$"."ES$;
1440 PRINT"↓":END
1450 -
1460 -
    BELOW IS THE LIST OF ACCEPTABL
    -E NAMES FOR DISKS. THESE ARE -
    -MINE.
1470 -
    PUT YOUR OWN IN PLACE OF -
    -THESE.
1480 -
    "END" MUST ALWAYS BE THE LAST -
    -NAME.
1490 -
1500 DATA 00,1A,1B,2A,2B,3A,3B,4A,4B,5A,
    -5B,6A,6B,7A,7B,8A,8B,9A,9B
1510 DATA 10A,10B,11A,11B,12A,12B,13A,
    -13B,14A,14B,15A,15B,16A,16B,17A,
    -17B
1520 DATA 18A,18B,19A,19B,20A,20B,21A,
    -21B,22A,22B,23A,23B,24A,24B,25A,
    -25B
1530 DATA 26A,26B,27A,27B,28A,28B,29A,
    -29B,30A,30B
1540 DATA END

```


If you can't get the complete print-out in one sitting, you can easily continue later from where you had to stop. Say, for example, you just got the print-out for the "E" 's, and you had to stop. To start up again from where you stopped, change the FOR... TO... statement in line 840 to read FOR I = 7 TO 27. This will cause the PET to start looking for the 7th letter in A\$, which is an "F".

The Data is stored as C\$(1) to C\$(K) in the sort and print routine. After it prints, a letter sort could be saved as a tape or disk file if you wanted, using a routine similar to the one in lines 610 to 660.

Beware of the dreaded Garbage Collection Routine! Because of all the string manipulation, after this program runs for a while, Garbage Collection can eat up a LOT of time. If you have a solution to this problem (No, I don't want to buy a set of 4.0 ROMs), let me know.

This should make keeping track of all those hundreds of programs a little easier, and make it easy to spot unnecessary duplicates that use up valuable disk space. ©

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All About LOADing Pet Cassettes

Louis F Sander
Pittsburgh, PA

This article, based on long experience and on material from many sources, summarizes the major points about PET's LOAD command as it applies to cassette tapes. Disk LOADing is rather different and is not covered here. If you don't yet have a disk drive, or if you have any questions about LOADing from tape, read on.

The Pet Cassette

To understand LOADing, it's helpful to understand what is recorded on the tape itself. It's extremely useful for you to *hear* the recorded material, and you can easily do so by connecting an audio amplifier between the tape drive connector's READ and GND pins. Your CB2 amplifier will do nicely, if you have one. Here is what you'll find on every PET tape:

1. Ten seconds of high-pitched leader tone. This tone prepares PET for LOADing the program, but mainly it was put there to insure that the tape's non-magnetic leader passed by before anything important was recorded. Only a second or so of the tone is required to initiate a LOAD, so you can often save some time by winding your tape past most of it before LOADing. Your audio amplifier or an external recorder will make this step a cinch.
2. A three-second, 192-byte tape header, consisting of one byte to differentiate program and data tapes, four bytes telling PET the starting and ending addresses of the LOAD, and 187 bytes containing the program name plus trailing spaces as needed. (Although the program name can be up to 187 bytes long, most are much shorter because only the first 16 characters print on the screen when FOUND, and because 77 characters at most can be entered as a name in immediate mode.) All this data is recorded twice in the header and if you listen carefully you can hear the tiny gap between the two copies.
3. Two more seconds of leader tone, followed by ...
4. The program itself, repeated twice, with an audible gap between the copies. If the program is in BASIC, each keyword is recorded as a one-byte abbreviation, or "token," to save

space in memory and on the tape. On this part of the tape, each 1K of program takes about 18 seconds of playing time, so a 1K program takes about 33 seconds to LOAD, including leader, header, etc.

Many Pet owners like to use C-10 cassettes, recording only one or two programs per side, to save unproductive SEARCHING time. But longer cassettes can hold any number of programs, and PET's ability to LOAD them selectively by name, in immediate or program mode, allows very large and complex programs to be cut into pieces which even the smallest PET can digest.

The LOAD Command

When executed, LOAD transfers a program from tape to PET's memory. A LOAD command can be executed in immediate mode by typing it in on the keyboard or by pressing the shifted RUN/STOP key. LOADing can be done in program mode by executing a line containing a LOAD command, or by POKing the keyboard buffer. There are important differences in the way PET handles these four methods of execution, and they will be described in detail later. Whatever method is used to execute the LOAD, if the tape is not positioned at the start of a program when the LOAD is attempted, PET will ignore what it reads until it finds the next program header on the tape.

The format for LOAD is:

LOAD ("program name") (,device number)

The items in parentheses are optional. The device number can be either 1 or 2, indicating a LOAD from TAPE #1 or TAPE #2. It can also be a numeric variable or expression whose value, after going through the INT function, is either of those numbers. If it is omitted, TAPE #1 is automatically selected. If used, the program name can be enclosed in quotes, or can be specified as a string variable. If no program name is specified, PET will LOAD the next program it finds on the selected tape.

If a program name *has* been specified, PET will search for that name before LOADing. The search is on a character-by-character basis, and a match is made whenever each character in "program name" is found in the corresponding position in the name of the FOUND program. This means that LOAD "CAT" will load CAT, CATNIP, CATAPULT, or any other program whose name begins with CAT. Programs such as TOMCAT will *not* cause a match, because the letters in CAT will not be found in the right positions. Programs like CA won't match either, because there is nothing to match with the T.

This method of searching can be useful when you enter

LOAD "STAR"

because you're not sure if your program is called STARWARS or STARFIGHTER, but it can some-

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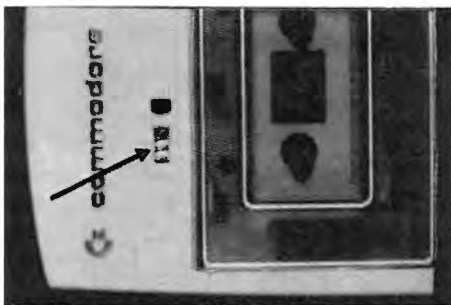
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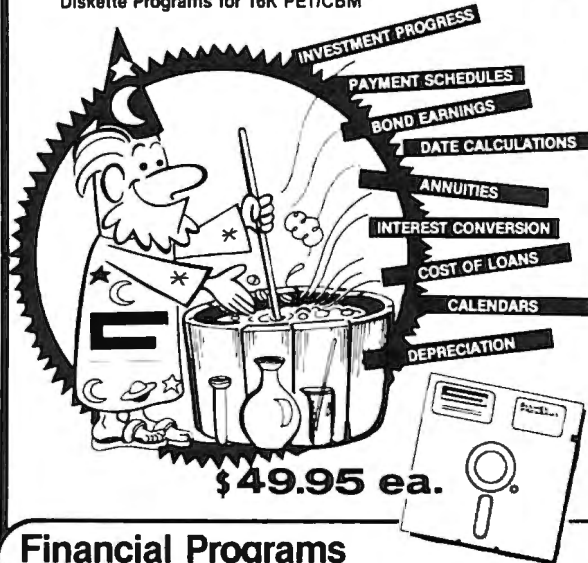


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times cause PET to load an unwanted program, such a STARVATION.

The following examples show LOAD's valid formats and the resulting screen dialogue:

PET LOAD Command Formats

To LOAD From TAPE #1	To LOAD From TAPE #2*	Action
LOAD	LOAD "",2	LOAD the next program found on the tape.
LOAD "WIMP"	LOAD "WIMP",2	Search for the program names WIMP, and LOAD it when found.
LOAD A\$	LOAD A\$,2	Search for the program with the same name as A\$, and LOAD it when found.
LOAD A\$,J-3	LOAD A\$,J-3	Search for A\$ on TAPE #(J-3) and LOAD it when found. 1<(J-3)<3

*An alternate way of specifying TAPE #1 is to use this format with a 1 rep

LOAD Command Screen Dialogue

LOAD "WIMP"	This is your command. All else is PET's response.
PRESS PLAY ON TAPE #1	Shown only if no tape controls are down when LOAD is executed.
OK	Shown when you press a tape control.
SEARCHING FOR WIMP FOUNDSPACEWARS	The tape has started to move. PET has read the header of a program named SPACEWARS.
FOUND WIM	Not a match with "WIMP," since fourth character is missing.
FOUND	Found an unnamed program. No match.
FOUNDSPACEWIMP	Not a match, since first character doesn't match.
FOUND WIMPOLESTREET	A match, since all letters searched for are in the right place.
LOADING	WIMPOLESTREET is being loaded into memory.
READY.	The LOAD is complete.

LOADing In Immediate Mode

Pressing the shifted RUN/STOP key in immediate mode LOADs and automatically RUNs the next program on TAPE #1; this is probably the most common method of LOADing PET programs.

LOAD can also be executed in immediate mode by typing the command onto the screen and pressing RETURN. Any of the previously illustrated command formats can be used in this way. In every case, the word LOAD can be abbreviated by typing an L and a shifted O, (even if the shifted O puts a graphics character on the screen). Try this trick if you haven't used it already — it's a good one. Programs loaded by typing in LOAD or 'L shifted O' do *not* automatically begin executing when the LOAD is complete. You must type in RUN (or 'R shifted U'), then press RETURN to start them.

You can find the names of all programs on a tape by entering LOAD "XYZ", where XYZ is any combination of letters *not* starting the name of a program on the tape. If you do this, PET will search

the tape from beginning to end, showing you the first 16 characters of the name of each program it finds along the way.

When a program is LOADED in immediate mode, all the appropriate prompts and messages appear on the screen, and the new program completely replaces the old one in memory. On completion of the LOAD, PET performs a CLR, which initializes all variables except TI and TI\$, destroys all arrays previously set up, and closes all logical files.

LOADing Under Program Control

There are two ways of having one PET program LOAD another. The first is to have the original program POKE a 131 into the keyboard buffer, then terminate. This is the equivalent of stopping the first program and pressing shifted RUN/STOP in immediate mode. In an Original ROM PET this might be done by:

```
9150 POKE 527,131 : POKE 525,1 : END
```

The Upgrade ROM version of this would be:

```
9150 POKE 623,131 : POKE 158,1 : END
```

When either of these lines es executed, PET will immediately LOAD and RUN the next program it finds on TAPE #1. All the appropriate screen messages will appear, the new program will completely replace the old one in memory, and a CLR will be performed at the end of the LOAD, just as though shifted RUN/STOP had been pressed.

The second method of LOADing under program control is to use the LOAD command, in any of its previously mentioned formats, in a program line. For example:

```
140 LOAD "WIMP" —or— 150 LOAD A$,2
```

This method has some properties which are at once useful and troublesome:

1. LOAD in a program line stops execution of the current program, LOADs the specified program from wherever it is found on the tape, and begins executing it at once.
2. If PLAY is already pressed, no messages appear on the screen to disturb its appearance. If PLAY has *not* been pressed, the PRESS PLAY message, but no others, will appear on the screen.
3. No CLR is performed after the LOAD, and the start of variables pointer is not reset, so the values of all numeric variables in the new program will be the same as those in the old one. This process is sometimes called "passing parameters" from one program to another. As an example of how it works, if variable KM had a value of 4986 in the old program, and the first line of the new one is 10 PRINT KM, the number 4986 will be printed on the screen. Without the passing parameter feature, of course, KM would have an initial value of 0 in

the new program, and the 0 would be printed on the screen.

4. String variables will be passed to the new program, but only if they have been "operated on" in the old one. The line:

```
150 A$="KATHLEEN"
```

will *not* get KATHLEEN into the new program unless it has been followed by something like:

```
155 A$=A$+" "
```

5. User-defined functions will not be reliably passed from the old program to the new one.

6. One program or a whole series of programs can be loaded in this way, but none of them can be longer than the program most recently loaded by one of the other methods, (that is from immediate mode or by POKEing the keyboard buffer). This is an absolute requirement, caused by the fact that the start of variables pointer is not reset by the program mode LOAD. Programs violating this restriction may LOAD all right, but they will not RUN properly, if they RUN at all. You can set the pointer yourself to get around the restriction, if that's your cup of tea.


The above set of properties allows the creative programmer to write very large programs of appreciable complexity, and to break them into sub-programs, each of which will fit into PET's memory. The first program can fill the screen with graphics or whatever, make some calculations and, based on their result, ask PET to LOAD any one of many other programs from either tape drive. Because the screen messages are suppressed, the PET operator will not see the LOAD taking place. Nor will he have to take action to RUN the new program. And, because numeric and string parameters can be passed from one program to the next, the second program can work on input, or results, from the first, and on ad infinitum. The only price for this flexibility is the length restriction mentioned above, and the fact that strings need to be operated on in order to be passed from program to program.

Machine Language

The material in this article applies in full only when you are LOADING programs written in BASIC. PET handles machine language programs (MLP) somewhat differently, and a discussion of the differences is beyond our scope at this time. Suffice it to say that the LOAD formats and LOAD execution methods we've described here will load MLPs into PET's memory, but afterwards things begin to differ. MLPs are never automatically RUN by a LOAD command. And the status of memory pointers and other programs afterwards is likely to be quite different from what is seen with BASIC.

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equipped to delve into these matters on his own and, if he pays careful attention to PET's memory pointers, he's likely to be able to get LOAD to do anything he wants.

LOAD Errors And Other Problems

During a LOAD, PET compares the two copies of the program on the tape. If, for some reason, it finds them different, it tries to decide which copy is correct, and it is often able to do so. But sometimes PET can't correct the errors, and in these cases you'll get a ?LOAD ERROR message. Other times, PET will find and print the program name, but will not LOAD the program. Or it may miss the program name altogether and merrily keep SEARCHING to the end of the tape.

When any of these things happen, you should rewind your tape and try again. If things don't work properly the second time, you should take corrective action. Clean and demagnetize your tape head, as described in **COMPUTE! #10** ("Getting the Most From Your PET Cassette Deck," page 42) and elsewhere in the PET literature. If this doesn't correct the problem, try LOADING the program several times. If you are at last successful, make sure the program runs properly, SAVE it on a fresh tape, and consider discarding the first copy. Usually the combination of cleaning/demagnetizing/new program copy will cure any persistent LOADING difficulties. If not, you, and perhaps your service dealer, will have to look further.

Along these lines, it's impossible to over emphasize the value of *listening* to your LOADs, since most error situations can be easily heard on the tape. Without trying, I have developed the ability to *hear* most bad loads, and you can do it, too. The ear is an amazingly sensitive organ, even to digital input. Advanced PET troubleshooters can also make use of the STATUS word, and of PEEKing tape error locations.

A word on head alignment is in order here. If you consistently have trouble LOADING tapes created on other PETs, it is likely that your tape deck's read/write head, or the one on the other PET, is out of alignment. **COMPUTE! #8**, contains some good instructions on correcting this problem. ("Detecting Loading Problems and Correcting Alignment on your PET," page 114). Incidentally, head misalignment is *very* easy to detect by ear. ©

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LINE NUMBERING the SM-KIT automatically numbers BASIC statements until you turn the function off.

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.

DISK COMMANDS as in DOS Support (Universal Wedge), the "shorthand" versions of disk commands may be used for displaying disk directory, initializing, copying, scratching files, load and run, etc.

LOAD SM-KIT can load all or part of BASIC or machine language programs. It can append to a program in memory, overwrite any part of a program, load starting with any absolute memory location, and load without changing variable pointers.

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Linelist

G. H. Watson
Physics Department
University of Delaware
Newark, DE

When examining a PET BASIC program for the first time it is certainly convenient to have a listing produced by a printer. No printer means that you must list the program on the screen. When the screen is full, each new line which is listed will scroll an earlier line off the top of the screen. At most, you may view 24 lines of your program. This would be acceptable if only you could stop the listing, examine the contents, and then continue. The listing process may be slowed by depressing the OFF/RVS key and stopped by hitting the RUN/STOP key, but unfortunately no provision was made for an indefinite pause and then continue.

If you have suffered from typing LIST line#-line# over and over or you have tired of trying to strike the STOP key at just the right instant, then LINELIST may be the answer to your problems. LINELIST is a BASIC "loader" for a fairly short machine language program (140 bytes). By loading and running LINELIST, a program will be created at the top of memory — usually just below screen memory and where ASCII strings are stored. With an appropriate SYS command, a listing will be created just as though LIST were entered. The important distinction is that the listing may be halted by holding down the SHIFT key. When the shift key is released, the listing continues. Depressing SHIFT/LOCK frees both hands to copy the program onto paper. Further, one additional line is listed each time another key is struck; I use INST/DEL to avoid having some of the keystrokes displayed when the listing is completed.

How does this program work? Most of the LINELIST machine code is identical to the LIST routine stored in ROM. "Why not just use a JSR instruction to connect to the BASIC LIST routine?" you may ask. This indeed was my original intention; unfortunately no corresponding RTS exists to facilitate return from the subroutine call. Luckily, the part of the LIST routine we are interested in is relocatable — the absolute address of the code is not referenced. So the routine can be "downloaded" into RAM where the necessary changes may be made.

First the loader program reads the top of memory pointer at \$34, \$35 and moves the pointer down to make room for 140 bytes. Then eight bytes are loaded which are responsible for setting up the pointer which starts the listing process at the start of BASIC. The pointer at \$28, \$29 (start

of BASIC) is transferred to \$5C, \$5D (block transfer pointer #2):

```
A5 28 LDA *TXTTAB
85 5C STA *LOWTR
A5 29 LDA *TXTTAB+1
85 5D STA *LOWTR+1
```

```
/TXTTAB=0028 /LOWT=005C
```

Through PEEK and POKE statements, the required part of the LIST routine is downloaded — \$C5DC-\$C657 for BASIC 2.0 (upgrade ROM) and \$B657-\$B6DD for BASIC 4.0.

In order to provide the pause feature, the listing routine must be diverted after each line is printed. The patch is made by replacing the stop key test (JSR ISCNTC - 20 E1 FF) present in the transplanted ROM routine with a JSR to the pause subroutine. The loader program keeps track of where the new subroutine resides and replaces \$FFE1 with the correct address (which depends on the top of memory pointer). The PAUSE subroutine is short:

```
20 E1 FF PAUSE JSR ISCNTC
A5 98 WAIT LDA *SHFKEY
D0 FC BNE WAIT
60 RTS
```

```
/ISCNTC=FFE1 /SHFKEY=98
```

If SHFKEY contains a one, the SHIFT key is depressed; not depressed if zero. Finally, the loader program displays the SYS command which will produce the listing.

With just four bytes (A5 98 D0 FC) any machine language program may have a pause feature. This may also be added to a BASIC program with the following statement: WAIT 152,1,1. As an example, the previous statement placed as line 505 in DISK DISASSEMBLER will allow you to control the output with the SHIFT key.

I hope you will find this program useful. With a small amount of programming (16 bytes along with changing 2 bytes), it is possible to get a dramatic effect. Perhaps you will find a different application which requires moving a ROM routine into RAM. Please share it with us if you do.

```
100 REM LINELIST/2.0 G.H.WATSON 4/81
110 :
120 REM READ TOP OF MEMORY
130 M=PEEK(52)+256*PEEK(53)
140 :
150 REM SFT NEW TOP OF MEMORY
160 M=M-140:X=M:GOSUB400
170 POKE 52,L:POKE 53,H
180 :
190 REM BEGIN AT START OF BASIC
200 FOR J=0TO7:READ A:POKE M+J,A:NEXT
210 :
220 REM DOWNLOAD ROM ROUTINE FOR LIST
230 FOR J=0TO123:A=PEEK(50652+J)
```

W
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```
240 POKE M+J+8,A:NEXT
250 :
260 REM PATCH LINELIST TO ROUTINE
270 X=M+J+8:GOSUB400
280 POKE M+23,L:POKE M+24,H
290 FOR J=0TO7:READ A:POKE X+J,A:NEXT
300 :
310 PRINT"LINELIST: SYS";M:END
320 :
400 H=INT(X/256):L=X-H*256:RETURN
410 :
500 DATA 165,40,133,92,165,41,133,93
510 DATA 32,225,255,165,152,208,252,96
```

For BASIC 4.0 change the following lines to:

```
160 M=M-151:X=M:GOSUB400
```

```
230 FOR J=0TO134:A=PEEK(46679+J)
```

©

Power On/Error Indicator For CBM Disks

Jim Butterfield
Toronto, Canada

This is a simple, inexpensive little board that you mount in your Commodore 2040 or 4040 disk unit. It does two things:

- The red error light on the disk unit becomes two-colour: red for error, green for power on;
- When an error occurs, the light turns to a flickering red, and there is a low-level audible alarm.

The first effect — the red/green light — is similar to that of the 8050 disk unit. It's very handy for reminding you that the power is on.

The second item — flickering light and audible alarm — is very useful, particularly to beginning disk users. Instead of having to remember to look at the disk unit to see if everything is going well, the unit will let you know that there's a problem.

The disk will continue to sound the alarm until the error condition is cleared, either by doing another operation or by interrogating the error status. I know one user who can't stand to have his disk yipping at him, and has disabled the sounder unit. He's an exception: the sound is quite low level, and most of us find that it's useful to have problems called to our attention.

Installation

Putting the Indicator into your 2040 is not difficult,

and requires no permanent changes to your disk unit. You can always put everything back exactly the way it was. The board mounts onto one of the disk boards by means of a screw which replaces an existing screw. You'll need to remove the old I.E.D light — a matter of loosening the locking ring — and replace it with the new two-colour unit.

It can be done without technical expertise, but it's probably better to have someone on hand with a little experience. My disk is quite an early unit, and I found two small problems: the mounting screw wouldn't fit into its matching nut until I loosened the whole disk circuit board and positioned the nut properly; and the mounting screw didn't get a satisfactory ground from the board it was mounted on ... I had to run in a separate ground wire. Neither of these are serious problems, and I understand that they are unlikely to occur on more recent models of 2040 and 4040.

I had a little trouble with the locking ring, but that was my usual clumsiness. I dropped it on the floor and spent half an hour finding it in my shag carpet.

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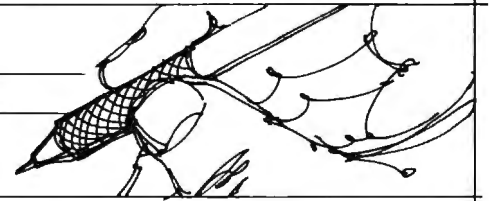
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An Efficient A/D Interface

Richard Olivo

We use AIM-65's for the acquisition and storage of transient analog data. Once digitized and stored, the data are played back to oscilloscopes or to chart recorders for permanent copies. The interface requirements are fairly demanding in terms of speed (a sample is taken every 100 microseconds) and sensitivity (the input signal is a bipolar voltage of about 50 millivolts). I have designed an efficient, general purpose analog/digital interface which connects to the user 6522 versatile interface adapter on the AIM, and could be used without modification with other 6522-based parallel ports.

It is designed around two relatively inexpensive, high-performance integrated circuits from Analog Devices, Inc. (Box 280, Norwood, MA 02062). I chose these devices for their ease of use (they require no external parts), their speed, and their moderate cost. Analog-to-digital conversion is performed by the AD570 (\$29), an 8-bit device with an input range of +5 to -5 volts and a 25-microsecond conversion time. Digital-to-analog output is provided by the 8-bit AD558 (\$11), which has an output range of 0 to 10 volts and which requires about 2 microseconds to produce a full-scale change in the output voltage. The data lines of these two devices are connected to the 6522's ports A and B, with control lines CA1 and CA2 also used. Control lines CB1 and CB2 are free; we use them to receive trigger pulses (CB1) and to output sync pulses (CB2). I added circuitry to protect CB1 and CB2 against inadvertent application of non-TTL voltages, but this protection could be omitted. The interface also provides preamplification of the input with variable gain from 1 to 1000 (in 1,2,5 steps), a zero-offset adjustment, and a choice between direct- or capacitor-coupling for the input. The output connector is switchable between the preamplifier's output and the output of the digital-to-analog converter. The full interface circuitry is shown in Figure 1.

Although programs for data collection can become lengthy, the actual routines for analog input and output are brief. Output through the digital-to-analog converter is extremely simple, since the device is connected in its transparent (unlatched) mode. In this mode, a byte written to Port B appears immediately as a steady analog voltage at the converter. The AD570 input conver-

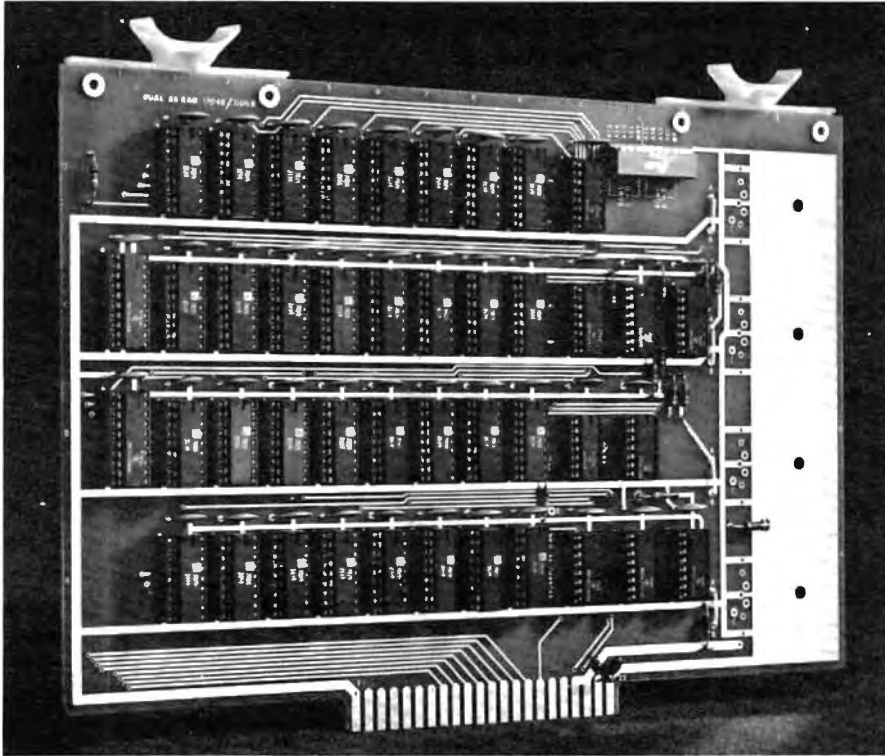
ter, on the other hand, requires control lines to start conversion and to detect that data are ready. In my circuit, control line CA2 initiates conversion by supplying a TTL pulse, which must last at least two microseconds. Conversion begins on the falling phase of the pulse, which also blanks the AD570's data lines. After 25 microseconds, the end of conversion and the appearance of new data are signalled by the \overline{DR} line (pin 17 of the AD570, connected to control line CA1); this line goes low and remains low until the next conversion is initiated. Thus, a routine to acquire a byte of analog data must accomplish four tasks: it must initiate conversion by making CA2 go high and then low, it must update a storage vector to be used to place the new data in memory, it must examine CA1 to check if the new data are ready, and finally it must read Port A and store the data in memory. If the storage buffer is more than one page of memory (as in my system), the minimum practical sampling interval approaches 100 microseconds, even though the converter itself requires only 25 microseconds. The remainder of the time is taken up by the software.

In my program, data sampling is interrupt driven. Timer T1 on the AIM's 6522 versatile interface adapter is set to generate interrupts at 100-microsecond intervals and, at each interrupt, an interrupt service routine is executed to acquire one byte of data. Prior to enabling interrupts, however, a series of initialization steps must be carried out. The data-direction registers are set to make Port A an input and Port B an output; the auxiliary control register is set to place timer T1 in free-running mode with the output to PB7 disabled; the peripheral control register makes CA1 interrupt on a negative transition (used to indicate that data are ready); T1 is loaded with the two-byte value of the sampling interval, expressed in microseconds; the address of the interrupt service routine is placed in the AIM's IRQV2 (or whichever address the 6502 jumps through when an interrupt occurs); and the interrupt enable register is set up to allow timer T1 to interrupt. Details of how to use interrupts may be found in the AIM User's Guide, the 6500 Programming Manual, or in Leventhal's *6502 Assembly Language Programming* (Osborne/McGraw-Hill). In addition, if data are to be saved in memory, a storage index and a storage vector on page zero must be given their initial values prior to the first interrupt.

Once initialization is finished and the interrupt has been enabled, the microprocessor will jump to

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The VAK-2, 8K Ram Board, is identical to the VAK-4 with sockets for all 16K of Ram, but it has only one of the 8K blocks populated with IC's. Therefore, the VAK-2 is user expandable to a full 16K with the purchase of the VAK-3 Expansion Kit.

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THE BANKER MEMORY contains 32K of RAM, 4 PROM sockets for 2716/2732/2332, a PROM programmer, 40 bits of parallel I/O, and 4 timers from two 6522 I/O chips. Addressing is extremely flexible with the RAM independently addressable in 4K blocks, PROM's independently addressable, and I/O addressable anywhere on a 64 byte boundary (even in AIM's I/O area at AXXX by adding a single jumper to the AIM).

This may sound familiar, but read on! Unlike other AIM compatible memory boards, THE BANKER MEMORY has on-board bank-switching logic! The four 8K blocks of RAM plus the 4 PROM sockets make up 8 resources, each associated with a bit in an Enable Register. Through this Enable Register resources may be turned on and off under software control. When a resource is off, its address space is freed for other uses. You can even put BANKER resources at the same address and switch among them for virtually unlimited RAM and PROM expansion! You can even have multiple page zero's and stacks! Do you need 160K byte of memory? It only takes 5 of THE BANKER MEMORY boards and you end up with 5 page zeros and stacks to boot!

There's more! The BANKER MEMORY also incorporates 18 bit addressing which allows for the 256K address spaces of the future. RAM, PROM, and I/O each has its own full 18 bit address decoder which allows these resources to be in different 64K banks. This board and other MTU products, such as our 320 by 200 dot VISIBLE MEMORY and Floppy Disk Controller with 16K DMA RAM, can turn your AIM into a truly powerful 6502 computer that far surpasses the packaged systems in functional performance.

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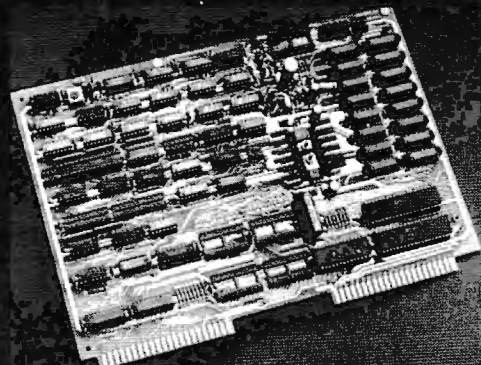


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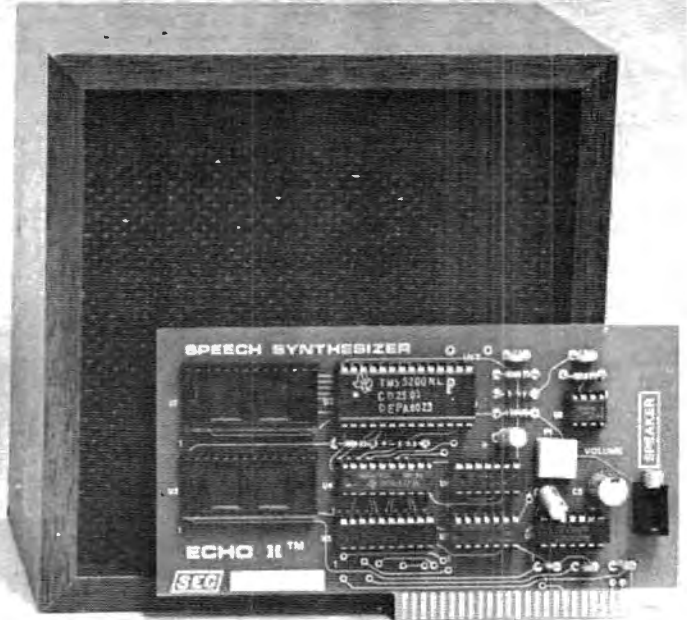
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The ECHO][™ comes complete with speaker, instruction manual, and a disk containing a speech editor, sample programs, and a sample vocabulary. Suggested list price is \$225.

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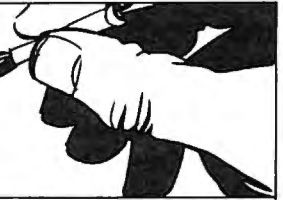
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New Products



Commodore Business Machines To Sponsor National Careers For The Disabled Symposium

King of Prussia, PA, Aug. 6, 1981 — The first National Careers for the Disabled Symposium, offering first-hand information to career-oriented disabled persons, will be sponsored by Commodore Business Machines, Inc., in association with Careers for Disabled, Inc., and be held at the Convention Center in Baltimore, Md., December 4-6, 1981.

The symposium will reach out to the many thousands of people who, because of their disabilities, and in some cases lack of skills, have been kept out of the mainstream of the work force and society.

Each workshop will include a special lecture on "how to" obtain training and then market new or existing skills in areas such as computer technology, starting your own business, continuing your education, sales, government and unions, finance, printing and the graphic arts, clerical, travel

and leisure, food services, communications, and repair trades.

In announcing that Commodore has agreed to sponsor the symposium, James Finke, president and chief operating officer of the company, said, "Today, business leaders must assume leadership rolls in helping assimilate millions of handicapped people into the work force. It is our belief that their symposium will be an important first step in bringing about this reality.

Additional information on and reservation forms for the first National Careers for the Disabled Symposium are available by contacting Careers for the Disabled, 261 Madison Avenue, Suite 1102, New York, NY 10016.

Atari Video Computer System™ Service Network Formed

Sunnyvale, CA — Atari, Inc., announced the formation of a nationwide independent service network to provide convenient warranty service for the Atari Video Computer System (VCS™). The network, which will include 500 service locations by the end of 1981, will be composed of inde-

pendent electronics retail and repair centers, trained and authorized by Atari to service the Atari VCS. In addition, the centers will become retail outlets for Atari VCS hand controllers: joysticks, paddles and keyboards.

"With the number of Atari VCS owners growing daily, we need more service centers in more places across the U.S.," said Michael J. Moone, president of Atari's Consumer Electronics Division. "By recruiting and training independent shops to service our product, Atari can better serve the more than 2.5 million Atari VCS owners in this country."

Previously, all VCS service had been performed by Atari's own regional service centers located in Somerset, New Jersey and Sunnyvale, California. These centers will continue to operate as support for the independent service network. They will be joined by two more Atari regional Centers in Chicago and Dallas later this year.

The Atari Video Computer System is a programmable home video entertainment unit that utilizes over 40 interchangeable game and educational cartridges. The VCS can be played on any home TV set.

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Atari Memory Price Drop

Mosaic has announced that they are reducing the prices on two major memory products for the ATARI Computers.

The 8K to 16K RAM Expansion Kit will retail for \$49.95, down from \$79.00. The Mosaic 32K RAM will retail for \$179.95, down from \$219.95.

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Family Oriented Software Developed

New York, NY — Apple Computer Inc. and the Children's Television Workshop, creators of "Sesame Street," have combined talents to design, develop and distribute 20 software programs for use on Apple personal

computers.

The programs are an outgrowth of 50 educational games developed by the Children's Television Workshop (CTW), and were tested over the past year at the Sesame Place Computer Gallery, a component of the newly created "playground of the future" in Langhorne, Penn.

The Children's Computer workshop, a division of CTW and directed by Joyce Hakansson, decided to adapt the 50 games used at Sesame Place into 20 marketable programs to allow public access to these informal educational programs. Apple will publish the programs, then distribute them through its more than 1,000 U.S. computer retail dealers under the Special Delivery Software label.

"CTW used Apple computers at Sesame Place because of their 16-color graphics and sound capabilities. The new programs rely on these capabilities," said

Hakansson.

"Developing the software programs is a natural extension of our interest in blending entertainment and education on television. This is our first step into electronic publishing, a field which we believe will make a significant impact on informal education," said CTW President Joan Ganz Cooney.

The games, entertaining in their use of sound, color and animation, are primarily aimed at the three-to-13-year-old age group. They are designed to acquaint children with computers.

Program concepts include tests of motor skills, reading, vocabulary, math, logic and problem solving and creative and artistic challenges.

"The programs have been thoroughly researched and their appeal has been proven through regular use by visitors at Sesame Place," said Mike Kane, marketing

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EPROM type is selected by a personality module which plugs into the front of the programmer. Power requirements are 115 VAC 50/60 Hz. at 15 watts. It is supplied with a 36-inch ribbon cable for connecting to microcomputer. Requires 1½ I/O ports. Priced at \$169.00 with one set of software. (Additional software on disk and cassette for various systems.) Personality modules are shown below.

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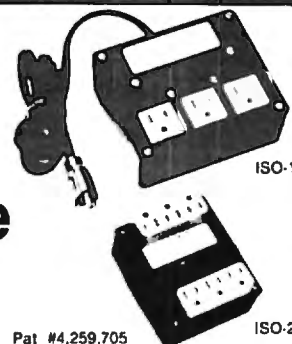
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manager for Apple's Personal Computer Division.

"Apple is deeply involved in the education market and we insist that educational software for the home be of the same high quality as programs designed for classrooms," Kane added.

CompuMart Announces New Summer/Fall Catalog

CompuMart Corp. has just published its new summer/fall micro-computer catalog.

The 48-page catalog features pricing and technical information for microcomputers and micro-computer systems from Apple, Commodore, Hewlett-Packard, Rockwell International, Texas Instruments, and other manufacturers. Books, accessories, and peripherals (including 13 printers from 5 manufacturers) are listed.

To obtain your free copy of

this catalog, write to CompuMart Corp., P.O. Box 568, Dept. 004, Cambridge, MA 02139.

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BRAIN BOX — The Computer Tutor announces the release of 200 educational programs on 30 titles. These are available on floppy disks and cassettes for Apple and PET microcomputers.

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A demonstration disk with a variety of lessons from the BRAIN BOX catalog is available for \$30, which will be credited against the purchase price of any 2 or more titles.

For your free catalog, write BRAIN BOX, 601 West 26 Street, New York, NY 10001 or call 212/989-3573.

New Axlon* Memory System For Atari* 800 Announced

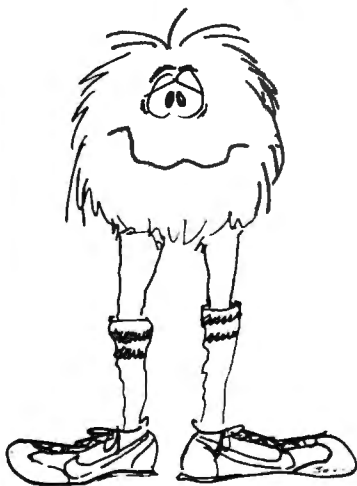
Sunnyvale, CA — Axlon Incorporated of Sunnyvale announced the release of its 128K memory system for the Atari 800, making it a powerful personal computer.

According to John Vurich, Axlon's president, the system, called the RAMDISK™ Memory System, comes with software that makes the new system function like a disk device. The system can also be programmed as bank selectable RAM memory.

The RAMDISK Memory System, when utilized as an additional disk device in conjunction with an Atari 810* Disk Drive, is compatible with existing software written for the Atari 800 system. Function for function, the RAMDISK system is up to 20 times faster than the Atari 810.

The RAMDISK Memory System can also be utilized as bank selectable RAM memory. The system is organized into

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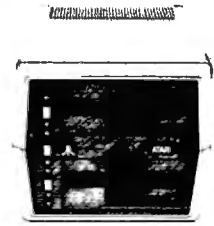
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The RAMDISK Memory System is the first memory product for the personal computer market using 64K RAM chips. Until now a product such as RAMDISK was not feasible because of the high cost of the new 64K RAM chips.

The RAMDISK module is installed in the second RAM slot in the Atari 800 with 16K RAM modules in the first and third RAM slots providing 160K bytes of RAM memory. Installation is accomplished in a matter of minutes and requires no modifications to the Atari 800 computer.

The RAMDISK Memory System includes the 128K RAMDISK module, operating manual, DOS Memory Management Software and utility software. The RAMDISK Memory System is available at Atari dealerships

nationwide. The suggested retail price of the system is \$699.00.

* Indicates Trademark of Atari Incorporated
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Market Information Now Provided To CompuServe

Columbus, Ohio — Archer Commodities, Inc. is now a provider of commodity market information on the CompuServe Information Service.

Archer Commodities is a commodity futures brokerage firm located in Chicago. A wholly owned subsidiary of Heinold Commodities, Archer Commodities provides its customers with market information, experience and needed personal attention in helping them trade commodities successfully.

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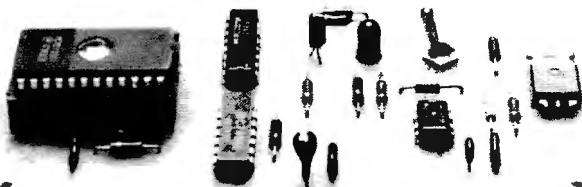
current market reports and commentary, educational and informational material on futures trading and special announcements from Archer Commodities. Subscriber requests for charts, market newsletters and quotation equipment are handled by Archer on an individual basis through an interactive feedback procedure.

CompuServe subscribers can access information from Archer Commodities for the standard fee of \$5 per hour weekday evenings, all day weekends and holidays. Weekday daytime access is also available. The equipment needed would be a personal computer or computer terminal, a telephone and a modem.

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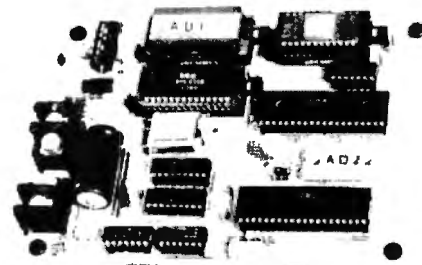
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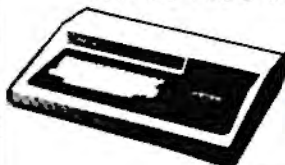
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Another program plots the user's functions or data sets, with axis labels, automatic or selected scaling and range, optional grids, with either data points or connecting lines or both plotted. Plot is on screen or printer. Data sets may be saved on cassette or disk, and/or generated by user's own program with subroutine provided.

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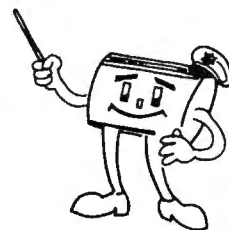
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A great learning experience for those new to machine language programming but who want to master it easily. Twelve-page manual included but we also recommend the book, "6502 Assembler Language Programming," by Lance A. Leventhal at \$17.00 direct from Skyles.

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32K Byte RAM/ROM Expansion

PROTRONICS has announced a new 32K Dynamic Random Access Memory (DRAM) board for the PET/SYM/KIM/AIM-65.

The 32K DRAM board contains sixteen RAM chips and five 24-Pin PROM sockets. The PROM sockets are for 2716/2516 2K type PROMs or 2732/2532 4K type PROMs (PROMS not included). This enables a total on-board memory expansion of 52K Bytes possible.

The Board also uses a new type of 16K DRAM chip which is pin compatible with the new 64K DRAM chips. This enables future on-board expansion to 128K of RAM (bank selectable, of course).

This Board has direct compatibility with the KIM-4 Buss which is used on most expansion chassis, such as those made by HDE, SEAWELL and other manufacturers.

It can connect directly to your computer with an adaptor cable which is available from PROTRONICS.

Addressing circuitry on board allows RAM to be configured in a contiguous 32K block placed above or below 8000 HEX. 4K blocks of RAM can be disabled using a Dip shunt (supplied) or a Dip switch. ROM configuration circuitry allows five 2K or 4K type PROMs to be located anywhere in the memory map. All configuration is done with short jumper plug wires (supplied) or with wire wrapping techniques.

Both the RAM & ROM are fully buffered to the data buss.

On-board circuitry synchronizes to the processor's clock to enable the refresh period to occur during cycles that are unused by the processor.

The Board requires only +5 Volts at 550 mA typical (without PROMs), which is supplied from the host computer through the expansion connector. There are

no on-board voltage generators to go bad.

It all fits on a 6x4.5" board, allowing construction of a two board computer system. (Board 1: CPU, I/O. Board 2: RAM, ROM).

PROTRONICS recommends that if you already have 4K or 8K of static RAM and wish to keep it in your system, reconfigure the static RAM above 8000 HEX. (Most computers have this capability. Refer to your computer's reference manual.)

The 32K DRAM Board documentation includes a section for constructing your own power supply. This optional project will supply +12, +5, -5 or -12 volts for under \$30 (including cabinet). (The 32K DRAM Board requires only +5 Volts to operate.)

Suggested retail price is \$289.88 (U.S. Prices), for more information write or call: PROTRONICS, 1516 E. Tropicana STE 7A, Las Vegas, NV 89109, (702) 361-6331.

Expanded Game Line

Sunnyvale, CA —

"Monty Plays the Scrabble Brand Crossword Game" is a new member of the Personal Software Strategy Game line of programs for personal computers. The new program joins the "Monty Plays Monopoly" program. Both Monty programs were written by Ritam corporation and are computerized opponents, rather than computer reproductions of the games themselves.

"Monty Plays the Scrabble Brand Crossword Game" plays the Selchow and Righter board game with up to three human opponents. A Scrabble game set is required.

In operation, the Monty program turns a personal computer into a skilled game player with a vocabulary of over 54,000 words on diskette.

Graphic presentation of the Monty character, board positions

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and scores, plus sound effects, heighten involvement with the program. For example, the four levels of difficulty which the program allows the user to choose are illustrated by Monty's increasingly academic garb, from a simple sport shirt to collegiate cap-and-gown.

Monty is available for use in 48K byte Apple II and II Plus computers with Applesoft Basic and one disk drive. Suggested retail price for the Monty game is \$34.95.

Note: Scrabble is a registered trademark of Selchow & Righter; Monopoly is a registered trademark of Parker Bros.; Apple II, II Plus and Applesoft are trademarks of Apple Computer Inc.; Monty is a trademark of Ritam Corporation. Personal Software and Strategy Game are trademarks of Personal Software Inc. Monty is not sponsored or endorsed by Parker Bros. or Selchow and Righter.

Spelling For Very Young Learners

In July Edu-Ware Services, Inc. releases a new product under the EDU-WARE label, SPELLING

BEE. Designed for children in kindergarten through third grade, SPELLING BEE meets three objectives: 1) develop computer literacy, that is, allow new learners to interact comfortably with the computer; 2) link the abstract verbal symbol (word) to the concrete (picture); 3) build basic spelling skills while identifying specific groupings (i.e. consonants, vowels, two- and three-letter words).

SPELLING BEE's high resolution graphics and musical sound effects appeal to capture a child's interest. Documentation speaks directly to parents and teachers, while EDU-Ware's Illustrated Children's Guide introduces youngsters to computer operation.

A System Generator allows the parent or teacher to tailor this system's length and emphasis to the individual child's needs. SPELLING BEE's demonstration mode allows the parent to review all spelling words before the child begins. As the child works within

the tutorial, the system ignores incorrect responses. Only correct responses are reinforced. Then a drill mode tests the learner's performance, recording this information for the parent or teacher.

The system requires Applesoft, 48K, and DOS 3.3. It retails for \$29.95.

For further information contact EDU-WARE Services, Inc., 22222 Sherman Way, Suite 203, Canoga Park, CA 91303 (213) 346-6783.

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

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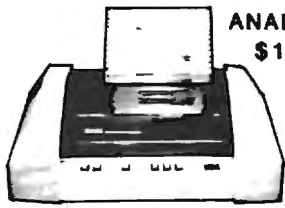
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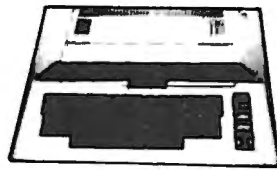
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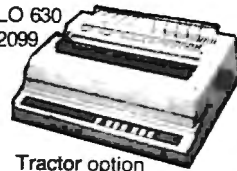


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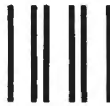
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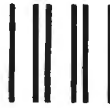
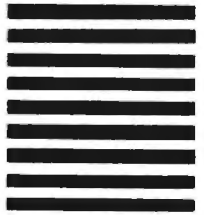
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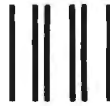
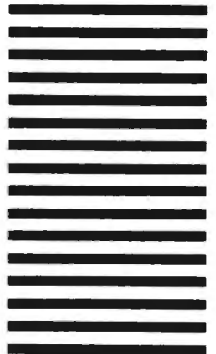
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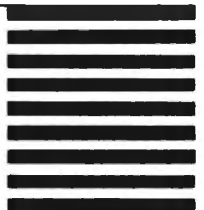
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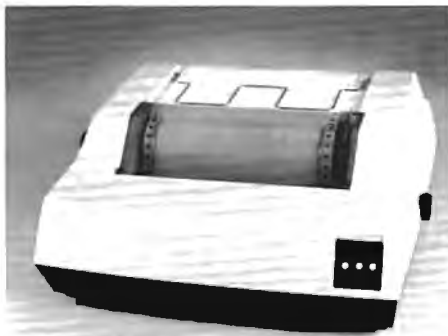
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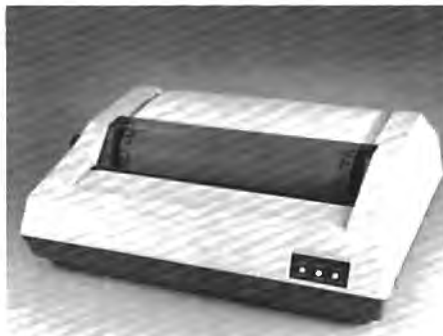
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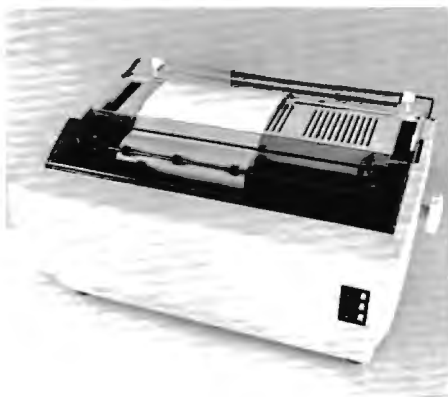
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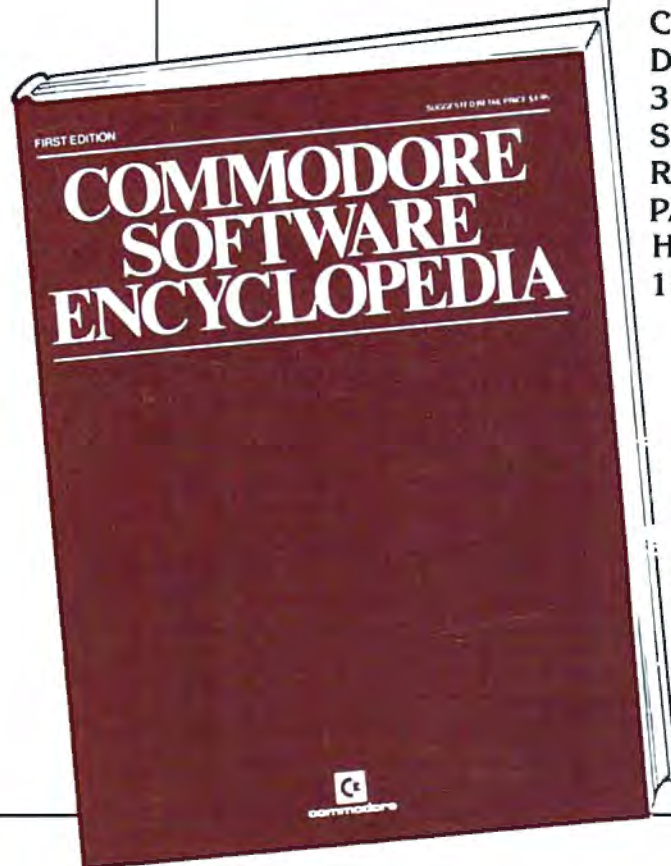
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