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IF...THEN, etc.). If the line number reference extracted is less than the line number of the current line being scanned, it searches forward from the beginning of the program; otherwise, it begins its search from the current line.

While performing its search, it also keeps track of the future line number for each line encountered. When it finds a match, it replaces the line number reference by the future line number of the matching line. After it has resolved all such line number references, it starts over from the top; this time, it steps through all the lines of the program, a line at a time, and actually renumbers them. That's all there is to it.

Let me advise you at this point that the remainder of the article will discuss some internal mechanisms of the BASIC interpreter and will be more technical. If you are satisfied with the utility of RENUM, skip the rest of the article. But, if you're a system programmer, read on!

How does RENUM know where to start? The address of the first line in a program is always pointed to by a two-byte register at locations 136 and 137. (The value of a two-byte register is always computed as the left byte + 256 * right byte.) Before we discuss how RENUM steps through the program, resolves line number references and renumbers lines, we need some background information on how BASIC works.

BASIC Tokens

As everyone probably knows by now, a BASIC program is always stored in RAM in a "tokenized" format. Keywords (PRINT, LET, GOTO, etc.) are replaced by single bytes whose values identify the keyword. Variables are also stored as single bytes whose value is 128 + N, where N is the position of the variable in the variable table (the first variable occupying position zero).

Numeric literals (like those found in expressions or in statements like A = 123 or GOTO 32700) are replaced by seven bytes. The first byte is always 14, which stands for "numeric literal follows," and the last six bytes make up the BCD (Binary Coded Decimal) representation of the literal. Line numbers are encoded into a two-byte representation so that the right byte multiplied by 256 plus the left byte equals the value of the line number.

Each BASIC line (except REM and DATA), whether it is made up of one statement or multiple statements, is always stored as a string of one-byte tokens in this format:

N1, N2, PL, (LL, TK, ... other tokens..., DM)...

where the portion enclosed in parentheses may occur one or more times. N1 and N2 make up the line number so that LN = N1 + 256 * N2. PL is the length of the whole tokenized string, including N1 and N2. If PL is added to the address of N1, we get the address of the next line. LL is the offset, relative to the address of N1, of the next statement within the string.

The value of LL is never greater than PL, but it is equal to PL at the last or only statement within the line. TK is the token representing the keyword, and it may be followed by other tokens. Finally, DM is an end-of-statement delimiter. It contains a value of 22 if the statement is the last or only statement in the line; otherwise, it contains a value of 20.

For example, consider this line in BASIC:

356 ?A:GOTO 12345

The resulting token string that represents it is fully annotated below:

Relative Address	Token Value	Description
0	100	356 MOD 256
1	1	INT(356/256)
2	17	offset to next line
3	7	offset to next statement
4	40	token for ?
5	128	variable number + 128
6	20	end of first statement
7	17	offset to next line
8	10	token for GOTO
9	14	"number follows"
10	66	exponent byte of literal
11	1	1, of 12345 (0 * 16 + 1)
12	35	23, of 12345 (2 * 16 + 3)
13	69	45, of 12345 (4 * 16 + 5)
14	0	other digits, if any
15	0	same as above
16	22	end of statement and line
17		(start of next line)

A tokenized statement is not necessarily compressed, as you can see above. Compression is more readily apparent in a program where long, meaningful variable names are used generously, and literals sparingly.

The syntax for GOTO, "GO TO", GOSUB, TRAP, and RESTORE (tokens 10, 11, 12, 13, and 35, respectively) requires a line reference immediately following the keyword. (RESTORE sometimes requires none.) For these statement types, RENUM immediately resolves the line number references, if any. Both ON...GOTO (tokenized format 30,...,23) and ON...GOSUB (format 30,...,24) are followed by a list of line number references which are separated internally by the token 18. You may say that token 18 stands for the commas separating the numbers.

Finally, IF...THEN is recognized as the token string (7,...,27). When a line number reference immediately follows THEN, that number becomes a part of the IF...THEN token string. In all other cases (as in IF...THEN A = 0, or IF...THEN GOTO

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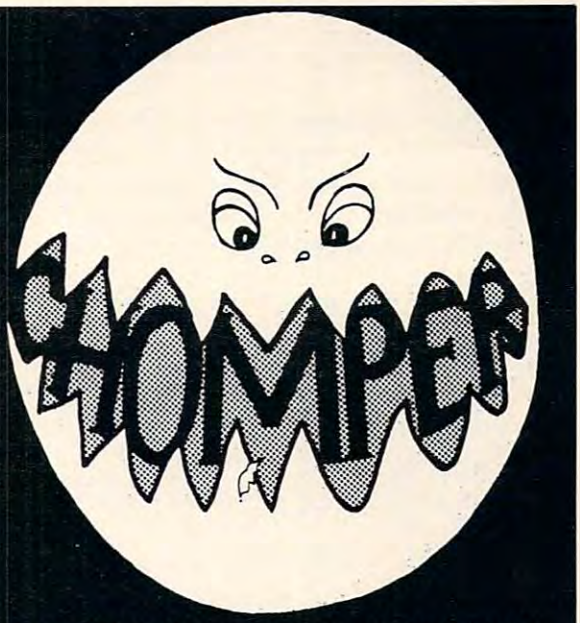

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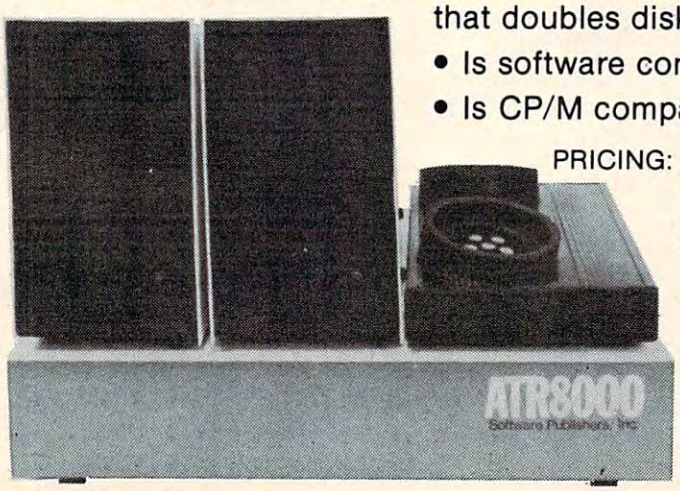

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100), the whole statement is broken into two token strings so that it now reads (internally) as "IF...THEN <null statement>: next statement." I urge you to investigate these statement types, and others, by RUNning the short program below:

```
10 DIM A$(1)
20 X=PEEK(136)+PEEK(137)*256
30 LN=PEEK(X)+PEEK(X+1)*256:PL=PEEK(X
   +2)
40 IF LN=32768 THEN STOP
50 IF LN<=90 THEN 90
60 LIST LN:? "ADDR=";X
70 FOR I=1 TO PL
80 ? PEEK(X+I+1);",";:NEXT I:? :INPUT
    A$
90 X=X+PL:GOTO 30
```

Just add the BASIC statements you want to examine after line 90 and type RUN. Line 40 checks for end of program. A "phantom" line (numbered 32768) is always present as the last statement of any program to tell the BASIC interpreter where the program ends. It cannot be listed, deleted, or referenced. But it *is* there.

If you also want to see all the valid keywords in BASIC, and their tokenized values as well, type this program in.

```
5 DIM A$(10)
10 I=42161:K=0:? CHR$(125)
20 A$="":J=0
30 C=PEEK(I):IF C>128 THEN 100
40 J=J+1:A$(J)=CHR$(C)
50 I=I+1:GOTO 30
100 C=C-128:J=J+1:A$(J)=CHR$(C)
110 PRINT K,A$
120 K=K+1:IF K>53 THEN STOP
130 I=I+3:GOTO 20
```

You will notice that there are 54 (0 through 53) keywords. BASIC looks up this table when translating a statement into a token string. If it finds no match, BASIC assumes that the statement has an implied LET keyword, and it assigns a token value of 54 for the keyword portion of the resulting token string.

BCD To Decimal, And Back

As I said earlier, all numeric literals used in BASIC statements (including line number references) are expressed in BCD (Binary Coded Decimal) format internally. When I discovered this, while I was investigating tokens, I realized that I needed the capability of converting a line number reference from BCD to decimal, and back, in order to make RENUM work.

The process takes many steps, including normalization of a number to even powers, "chunking" of digits by two's, and merging nybbles [*a piece of information that's four bits long*] to bytes [*one that's eight bits*]. In fact, a whole article could be devoted to BCD to decimal conversion. Suffice it to say that I did not have to write a lengthy routine to do the conversion – I simply took advantage of BASIC's built-in conversion routines.

BASIC Variable Table

BASIC maintains a variable table (addressed by locations 134 and 135) where all variables are stored. Each entry in the table is eight bytes long; the first byte specifies the variable type, and the second byte identifies the variable number, which starts with zero. For scalar variables (not DIMensioned), the first byte is always zero, and the segment defined by bytes three through eight contains the BCD representation of the variable's value.

Let's define a variable, say WM, to be our work area for doing the conversion. To convert a BCD number to decimal, we just POKE the six bytes representing the number into the BCD segment of the entry corresponding to WM. *Voilà*! WM now contains the decimal value of the number (as would be proved by PRINTing it).

To convert the other way (as when we are replacing a line number reference by a future line number), we simply equate WM to the desired decimal value, extract the last six bytes of WM's entry in the variable table, and POKE them into the token string to replace the old BCD number.

BASIC Symbol Table

But how do we know where WM resides in the variable table? When RENUM is first loaded (or ENTERed from cassette), dozens of variables would have already been added to the variable table. All variables defined and used in the program (or even in direct mode) get stored in the table. But before each one is added, the variable's NAME is first added to the end of another table – the symbol table. (It starts at location 2048 on a cassette-based system, and it seems to start at 7676 when DOS II is present.)

This table is actually a character string which is a concatenation of all variable names – in the sequence they are first defined. And this sequence is followed by the variable table. The last character of each name is flagged (bit seven turned on) to serve as a terminator. Type in this short program to see what the symbol table looks like:

```
10 X=2048
20 I=0
30 C=PEEK(X+I)
40 IF C=0 THEN STOP
50 PRINT CHR$(C);
60 I=I+1
70 GOTO 30
```

Before RUNning it, enter a few variables with long names (RUMPLESTILTSKIN=0, etc.) in direct mode so you can recognize them. The characters appearing in reverse video mark the ends of

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the variable names.

With this information, it is possible to resolve the question posed above by extracting the variable name string segments, one at a time, until one of them matches "WM," at which point the variable number for WM would be obtained. However, this method requires a slow and lengthy routine to perform string extraction and matching. There has to be a better way.

Current Line Pointer

A new register comes into play. Locations 138 and 139, I discovered, always point to the current line being executed. With this new knowledge, I was able to define WM and pinpoint its location in the variable table in a single line of BASIC! I refer you now to line 32120 in the listing. The first statement defines the variable WM. Keep in mind that when this whole statement was tokenized, an entry for WM was added to the variable table, and its variable number now appears in the tokenized string.

The second statement determines the address of this very same line as it is being executed. At this point, X points to the beginning of the line. Let us dissect the third statement. The expression "(X+5)" positions us to the token for WM in the statement "WM=0". "PEEK(X+5)-128" looks at that byte and converts it to the true variable number assigned to WM. Multiplying it by eight computes the offset from the beginning of the variable table (defined by the first two terms of the statement). Finally, adding two to the result positions us to the BCD segment of WM's entry in the variable table. With this address saved in Y, BCD to decimal conversion (and back) becomes a breeze (as shown respectively by the one-liners 32470 and 32530).

RENUM, Line By Line

With all that background information out of the way, we can now talk about the other significant lines in RENUM. Lines 32100 through 32210 are the main loop of the program, which positions the variable C to the keyword token of every statement encountered before it enters the "analyze-keyword" subroutine at line 32280. The next loop, 32220 through 32270, performs the actual renumbering of the lines.

Line 32290 checks for GOTO,GO TO, GOSUB, TRAP, and RESTORE. Lines 32300 through 32370 check for the statements ON...GOTO and ON...GOSUB. Line 32330 skips numeric literals that the program might come across following the keyword ON, but before the words GOSUB (token 24) or GOTO (token 23). Lines 32380 through 32440 handle the IF statement, and line 32410 similarly skips insignificant numbers until it encounters the word THEN (token 27). The reason for skipping over these numeric literals is to preclude RENUM from misinterpreting BCD segments as valid tokens. Line 32430 handles the case where IF...THEN is immediately followed by a line number.

The subroutine starting at 32450 performs the search and replace operation. Line 32450 itself checks for end of statement (as when RESTORE is not followed by a number). When a line number reference is found, line 32470 converts it (now expressed as six bytes in BCD format) into decimal for comparison with the current line, which is performed at 32480.

At this point, it is determined whether searching is to start from the top or from the current position. Lines 32500 and 32510 search for a matching line number. When a match is found, line 32530 converts the future line number of that matching line to BCD as described previously and replaces the original reference. Finally, control is transferred to 32550 when the actual renumbering process is completed.

The program itself can be further reduced in size by merging statements into single lines, but that is up to you. The most obvious features missing from the program are sound and graphics, and that can be easily remedied.

```
32100 REM RENUMBER BY MANNY JUAN
32110 T8=256:I=1:Z=32100
32120 WM=0:X=PEEK(138)+PEEK(139)*T8:Y
      =PEEK(134)+PEEK(135)*T8+8*(PEEK
      (X+5)-128)+2
32130 ? "FROM,BY":INPUT FR,BY:? CHR$(
      125)
32140 B=PEEK(136)+PEEK(137)*T8:X=B:M=
      FR
32150 LN=PEEK(X)+PEEK(X+I)*T8:SOUND 0
      ,LN,10,8
32160 IF LN=Z THEN 32220
32170 PL=PEEK(X+2):C=X+3
32180 LL=PEEK(C):C=C+I
32190 GOSUB 32280
32200 IF LL<PL THEN C=X+LL:GOTO 32180
32210 X=X+PL:M=M+BY:GOTO 32150
32220 M=FR:X=B:SOUND 1,0,0,0
32230 LN=PEEK(X)+PEEK(X+I)*T8:SOUND 0
      ,32768-LN,10,8
32240 IF LN=Z THEN 32550
32250 MH=INT(M/T8):ML=M-MH*T8
32260 POKE X,ML:POKE X+I,MH
32270 M=M+BY:X=X+PEEK(X+2):GOTO 32230
32280 TK=PEEK(C)
32290 IF TK=10 OR TK=11 OR TK=12 OR T
      K=13 OR TK=35 THEN C=C+I:GOSUB
      32450:RETURN
32300 IF TK<>30 THEN 32380
32310 C=C+I:D=PEEK(C)
32320 IF D=23 OR D=24 THEN 32350
32330 IF D=14 THEN C=C+6
32340 GOTO 32310
32350 C=C+I:GOSUB 32450:D=PEEK(C)
32360 IF D<>20 AND D<>22 THEN 32350
32370 RETURN
```

(continued on p. 206)

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```
32380 IF TK<>7 THEN RETURN
32390 C=C+I:D=PEEK(C)
32400 IF D=27 THEN 32430
32410 IF D=14 THEN C=C+6
32420 GOTO 32390
32430 C=C+I:IF C<(X+LL) THEN GOSUB 32
      450
32440 RETURN
32450 D=PEEK(C):IF D=20 OR D=22 THEN
      C=C+I:RETURN
32460 IF D<>14 THEN ? M;" SR,";:C=C+I
      :RETURN
32470 C=C+I:FOR J=0 TO 3:POKE Y+J,PEE
      K(C+J):NEXT J
32480 IF WM<LN THEN WX=B:RN=FR:GOTO 3
      2500
32490 WX=X:RN=M
32500 WN=PEEK(WX)+PEEK(WX+I)*T8:SOUND
       1,WN,10,8
32510 IF WN<Z AND WN<WM THEN RN=RN+BY
      :WX=WX+PEEK(WX+2):GOTO 32500
32520 IF WN<>WM THEN ? M;" NF,";:GOTO
       32540
32530 WM=RN:FOR J=0 TO 3:POKE C+J,PEE
      K(Y+J):NEXT J
32540 C=C+6:RETURN
32550 ? :? (M-FR)/BY;" LINES"
32560 ? "LIST";CHR$(34);"C:";CHR$(34)
      ;",";FR;",";M-BY
32570 END                                    ©
```

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If you've ever used the VIC's data file functions to do tape saves and loads of machine code, hex tables, or graphics, you'll appreciate the speed, ease, and flexibility with which this program, Dump/Recover, accomplishes those tasks. You'll also learn a bit about using BASIC's internal machine language routines.

VIC Block SAVE And LOAD

Sheila Thornton
New York, NY

This program is built around four of the kernal routines, the self-contained machine language software modules in VIC's operating system which can be accessed through a group of JMP instructions located at the top of memory.

These routines – SETLFS, SETNAM, SAVE, and LOAD – are subroutines of the SAVE and LOAD functions in BASIC, but can be used individually to save any size memory block up to location 32766 ($7FFE) and to load the saved matter into its original position or a new one.

To discourage casual copying of their proprietary software, Commodore has inserted code in the SAVE routine which aborts attempted tape saves above 32766 ($7FFE hex). However, a VIC owner who boasts a 1540 disk has informed me that, curiously, this prohibition doesn't extend to disk saves.

Dump/Recover (Program 1) combines 43 bytes of machine code and ten lines of BASIC to connect you to the kernal routines and to allow specification of start and end address and name via an INPUT statement.

Understanding The Method

Program 2 is a commented disassembly of the machine code that Dump/Recover must POKE into memory. In the first four instructions, the logical file number, device, and secondary address are selected, and then the SETLFS routine which makes it all happen is called. The second four instructions specify the length of the file name and its location in memory, and then jump to SETNAM, which will expect to find the file name immediately above the end of the array variables (as pointed to by zero page locations 49 and 50) and the name length at address 0.

At this point, the SAVE or LOAD routines can be called, but the usual tape messages (other than the PRESS... instructions) will not be displayed. Some sleuthing inside VIC's Operating System disclosed that SAVE and LOAD require that bit seven at address 157 ($9D) be set for the messages to be printed. The two instructions following the jump to SETNAM accomplish this.

While these messages are not required for a successful save or load, I find it comforting to see that VIC is indeed SAVING/SEARCHING FOR/LOADING the file I've specified. This feedback also serves as a check for typing errors, and helps to spare VIC from doggedly searching through an entire cassette for, say, "OPCODE TABEL" while I've excused myself to make tea. Unfortunately, I wasn't able to find how to turn on the "?LOAD ERROR" message, so this is handled in BASIC.

After completing these preparatory routines, the program returns to BASIC, which checks whether a save or load has been chosen and jumps to the appropriate machine code. LOAD will look at addresses 251 and 252 ($FB, $FC) to find the start address, and SAVE will additionally use 253 and 254 for the end address.

Since Dump/Recover's purpose is to save and load any permitted section of memory, I decided that the "safest" place to put the machine code was in the BASIC input buffer (512 to 600 – $0200-$0258), making it necessary to re-POKE the code every time the program is run. While this doubles the permanent program length (to 487 bytes), it does add flexibility.

Returning to Program 1, you can see that Dump/Recover's first job is to accept the start and end addresses (in decimal) and the file name, so the input buffer can be freed up for the machine code. The end address entered for a save must be one higher than that of the last byte to be saved. For a load, a "0" must be entered as the end address.

Line 1003 places the name length in location 0 and turns the end-of-arrays pointer, plus the name length, into a decimal number. Because all of the program's variables must be set up before the latter step is taken, "U" is first set equal to "1." In line 1004, the program puts the file name above the BASIC variables, jumps to the SETLFS and SETNAM routines, POKEs the start address pointer, and tests whether a dump or recovery has been selected. If a dump, line 1005 places the end address in memory, jumps to the appropriate machine code, and ends the program.

Since a side effect of the LOAD routine is that the numeric and array variable pointers are set to the end address of the loaded material, line 1006 saves the pointers in the input buffer before LOAD is called, and restores them afterward. Line 1007 checks the I/O STATUS word, and prints a load error message if STATUS reports either an unrecoverable load error or any mismatch.

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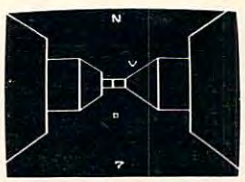

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If the END statements in lines 1005 and 1008 are changed to RETURNs, Dump/Recover can be used as a subroutine; but don't forget that, while RUN restores the DATA pointer, GOSUB does not. I have fashioned short, unique versions of Dump/Recover to include in programs which need to load in binary data and to preface frequently used machine code tapes so they will load in without making BASIC forget where it's put its variables.

Material saved with Dump/Recover can be verified from BASIC using the format, VERIFY "FILENAME",1,1. BASIC will also load these tapes, but the adjustment made to the variable pointers may make it necessary to execute a NEW after the load. You'll often find it necessary to protect the loaded file from BASIC by lowering the string and end-of-memory pointers.

The kernal routines are pretty thoroughly documented in the *Programmer's Reference Guide* (pp. 182-211), but I'd like to share with you some omissions and errors I discovered there while writing this program. First, the *Guide* neglects to say what the valid secondary addresses are for the SAVE function. I wasn't surprised to discover that they are the same as used in BASIC:

0 = Relocatable save
1 = Non-relocatable save
2 = Relocatable save with end-of-tape marker
3 = Non-relocatable save with E-O-T marker

The discussion of the SETLFS routine indicates that 255 ($FF) should be used if *no* secondary address is desired. While this may be true for other I/O operations, a 255 functions exactly like a 3 for a tape save. The *Guide* also gives incorrect secondary addresses for a load. In fact, a "0" will permit a relocating load, and a "1" will inescapably send the file back to its origin.

With just a few bytes of simple "straightline" code, even inexperienced machine language programmers can tap significant programming power and speed from the 36 kernal routines. I've found other documentation errors in the *Guide*, though, so I suggest you thoroughly test out a routine before incorporating it in a program.

Program 1: BASIC Version

```
999 REM "DUMP/RECOVER" FOR VIC-20
1000 PRINT"START,END,NAME":INPUTV,W,V$:R=540:FO
    RJ=1TO43:READT:POKER+J+5,T:NEXT:GOTO1
    003
1001 DATA169,1,162,1,160,0,32,186,255,165,0,166
    ,49,164,50,32,189,255,169,128,133,157
    ,96
1002 DATA169,0,166,251,164,252,32,213,255,96,16
    9,251,166,253,164,254,32,216,255,96
1003 T=LEN(V$):POKE0,T:U=1:S=256*PEEK(50)+PEEK(
    49)+T
1004 FORJ=1TOT:POKES-J,ASC(RIGHT$(V$,J)):NEXT:S
    YS546:U=V:T=252:GOSUB1009:IFW=0THEN1006
1005 U=W:T=254:GOSUB1009:SYS579:END
1006 FORJ=0TO5:POKER+J,PEEK(45+J):NEXT:SYS569:F
    ORJ=0TO5:POKE45+J,PEEK(R+J):NEXT
1007 IFSTATUSAND48THENPRINT:PRINT"?LOAD":PRINT"
    ERROR";
1008 END
1009 POKET,INT(U/256):POKET-1,U-256*PEEK(T):RET
    URN
```

Program 2: Machine language subroutines

```
0222 A9 LDA #01      ;SET FILE NO.
0224 A2 LDX #01      ;SET DEVICE NO. (TAPE)
0226 A0 LDY #00      ;SET SEC. ADDR.
                     ; (RELOCATABLE)
0228 20 JSR FFBA     ;CALL SETLFS
022B A5 LDA 00       ;GET NAME LENGTH
022D A6 LDX 31       ;GET NAME START ADDR. LO
022F A4 LDY 32       ;GET NAME START ADDR. HI
0231 20 JSR FFBD     ;CALL SETNAM
0234 A9 LDA #80      ;
0236 85 STA 9D       ;TURN ON TAPE MESSAGES
0238 60 RTS          ;
0239 A9 LDA #00      ;SET LOAD FUNCTION
023B A6 LDX FB       ;GET LOAD START PNT. LO
023D A4 LDY FC       ;GET LOAD START PNT. HI
023F 20 JSR FFD5     ;CALL LOAD
0242 60 RTS          ;
0243 A9 LDA #FB      ;SET SAVE START PNT.
                     ;OFFSET
0245 A6 LDX FD       ;GET SAVE END PNT. LO
0247 A4 LDY FE       ;GET SAVE END PNT. HI
0249 20 JSR FFD8     ;CALL SAVE
024C 60 RTS          ;
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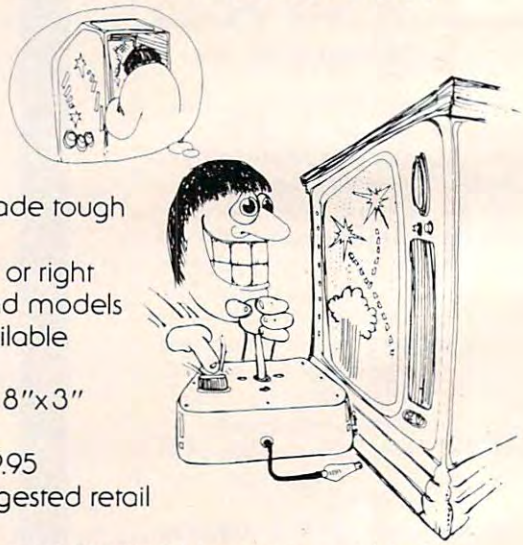

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TextPlot II

Mark Grebe
York, NE

When "TextPlot" (**COMPUTE!**, November 1981, #18) was published, I thought that it would probably be limited to such uses as labeling graphs. At the time, I was busy writing games for the Atari, so I overlooked this valuable routine. However, when David Plotkin's article, "Using TextPlot for Animated Games" (**COMPUTE!**, April 1982, #23), appeared, it caught my eye immediately. I had been toying with the idea of writing a machine language routine similar to Apple's shape tables, so I decided to see if TextPlot would work.

I soon found that TextPlot had a limitation. It can place the character only at horizontal positions that are divisible by four. In the four color modes, the Atari stores information for four pixels in one byte. When you attempt to move the object horizontally, it jumps four pixels instead of moving smoothly.

After many hours of writing, I finished a revision. The command to invoke TextPlot II is almost identical to the one used in TextPlot:

```
A=USR(ADR(A$),chr,color,horiz,vert)
```

There must be four parameters in the command. Unlike TextPlot, if you don't have four, the program returns an ERROR -22. TextPlot merely used the system bell. (I would like to suggest that machine language programmers use this error number as a standard for the wrong number of parameters in a USR statement.) The meanings of the parameters are:

chr - ASCII value of the character you wish to plot.

color - The color of the character (1-3).

horiz & vert - these are the same as the X and Y values used for PLOT and DRAWTO in the graphics mode you are in.

TextPlot II is a BASIC loader program. Since the program is too large to fit in page six, it is broken into two parts. The portion in the variable A$ is completely relocatable, as the only call used is JSR $0600. This is a call to the other portion of the program.

Well, that's it, short and simple. If you come up with any amazing games using TextPlot II, please let me know. If you don't want to type in all those data statements, I'll be happy to make you a copy. Just send a cassette or diskette, an SASE mailer, and $3 to:

Mark Grebe
36 Edison Avenue
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```
30000 DIM A$(354):FOR I=1 TO 354:READ
       X:A$(I,I)=CHR$(X):NEXT I:FOR I
      =0 TO 21:READ X:POKE 1536+I,X:N
      EXT I
30010 DATA 104,240,10,201,4,240,13,17
      0,104,104,202,208,251,169,22,13
      3,185,76,64,185,104,133,195,104
30020 DATA 201,128,144,4,41,127,198,1
      95,170,141,22,6,224,96,176,15,1
      69,64,224,32,144,2,169,224
30030 DATA 24,109,22,6,141,22,6,104,1
      04,141,23,6,104,104,141,24,6,20
      1,4,144,5,56,233,4
30040 DATA 176,247,133,214,201,0,240,
      7,169,4,56,229,214,133,214,78,2
      4,6,78,24,6,6,214,24
30050 DATA 104,104,141,25,6,133,186,1
      66,87,169,10,224,3,240,8,169,20
      ,224,5,240,2,169,40,133
30060 DATA 207,133,187,165,88,133,203
      ,165,89,133,204,32,0,6,24,173,2
      4,6,101,203,133,203,144,2
30070 DATA 230,204,24,165,203,101,212
      ,133,203,165,204,101,213,133,20
      4,173,22,6,133,187,169,8,133,18
      6
30080 DATA 32,0,6,165,212,133,205,173
      ,244,2,101,213,133,206,160,0,16
      2,8,169,0,133,209,133,208
30090 DATA 177,205,69,195,72,104,10,7
      2,144,8,24,173,23,6,5,208,133,2
      08,224,1,240,8,6,208
30100 DATA 38,209,6,208,38,209,202,20
      8,228,104,152,72,160,0,132,215,
      132,212,166,214,240,88,56,38
30110 DATA 215,202,208,250,177,203,5,
      215,69,215,145,203,165,215,73,2
      55,133,215,200,200,177,203,5,21
      5
30120 DATA 69,215,145,203,166,214,6,2
      09,38,212,202,208,249,160,0,24,
      177,203,101,212,145,203,169,8
30130 DATA 56,229,214,170,132,212,70,
      208,102,212,202,208,249,240,2,2
      08,135,160,2,24,177,203,101,212
30140 DATA 145,203,24,165,208,101,209
      ,160,1,145,203,24,144,9,165,209
      ,145,203,200,165,208,145,203,10
      4
30150 DATA 168,24,165,203,101,207,133
      ,203,144,2,230,204,200,192,8,20
      8,206,96
30160 DATA 169,0,133,212,162,8,70,186
      ,144,3,24,101,187,106,102,212,2
      02,208,243,133,213,96
```

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The new Commodore 64 computer has one of the best, if not the best, graphics capabilities of any home computers.

Graphics Potential

The 64 has text graphics with a 40 x 25 character format, just like the PET. Plus, it has *Sprites* to use with the text graphics. These tools allow you to design your own pictures in four different colors (the manual shows how to use only one color), just like arcade video games. Sprites can be one of 16 colors in the single-color mode, and four of eight colors in the multicolor mode.

Eight sprites are available for screen display in a 24 horizontal by 21 vertical pixel format. Each sprite has a different "display hierarchy" when crossing over another sprite. Sprite 0 would move in front of Sprite 1; Sprite 1 and Sprite 0 would move in front of Sprite 2, and so on up to Sprite 7. All other sprites would move in front of Sprite 7. Also, you can tell each sprite whether it moves in front of or behind the normal text graphics.

Each sprite can be expanded to twice its size, horizontally, vertically, or both. Automatic collision detection tells you when sprites have hit each other or when a sprite has hit the background text graphics.

Commodore's manual gives the register number in the graphics IC chip which gives access to the collision information. First of all, the sprite-to-sprite collision is register 30 decimal. When sprites collide, the graphics chip sets their bits in this register. Second, the sprite to background graphics collision is register 31 decimal. When a sprite collides with the background, its bit is set.

Creating a Sprite

To make a sprite, you must first draw it on a 24x21 grid. Then you convert the set dots in each row into three separate bytes of data, using binary code. For each byte, add up the number according to its bit. The numbers for each bit in a byte are 128, 64, 32, 16, 8, 4, 2, 1.

Example of converting the grid:

```
Row 1  +.......+.......++++++++
Row 2  +..+...+.......++++++++
Row 3  ...+...+.......+++...+++

101 DATA 129,1,255:REM DATA FOR ROW1
102 DATA 145,1,255:REM DATA FOR ROW2
103 DATA 17,1,199 :REM DATA FOR ROW3
104 DATA
```

Next, POKE into memory the 63 bytes of data to describe the sprite to the computer. The conversion of the grid into 63 bytes is not hard, but it is very time consuming. This is the reason for the Sprite Editor.

The Easy Way

The sprite editor gives many easy single-key commands to edit the sprite, display it, and save it. When the program is executed, commands are printed along the left side of the screen. On the right side of the screen is a 24x21 grid which is used to edit a sprite. To move the cursor, use the cursor keys. If you want a pixel set on the sprite, push the 1, 2, or 3 keys. If you want the pixel erased, push the "←" key. Any time you want to see the actual sprite, push the "=" key and it will compute the grid into the byte form and display the sprite in the lower left corner of the screen.

If you make any updates on the grid, they will not be displayed in the corner until the "=" key is pushed again. Once the sprite has been displayed, it can be enlarged horizontally or vertically by pressing "X" or "Y". Also, you can display the data for using this sprite in a program by pushing "B".

On all four of the following commands, the computer will ask if it is the correct command to be executed. The four commands are "N" for erasing the grid and the sprite to edit a new sprite; "S" for saving sprite data to cassette; "L" for loading a sprite from cassette; and "Q" for quitting the program.

To change colors while creating a sprite, use the "F1," "F3," "F5," and "F7" keys.

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```
10 POKE53281,6:DIM A(21,24),B(63),A$(15):X=0:
   Y=0:R=0:C=0:S=1039:S1=55311
11 V=53248:POKEV+21,0:POKEV+23,0:POKEV+29,0:R
   ESTORE:FORX=0TO15:READA$(X):NEXT
12 PRINT"{CLEAR}":FORR=1TO21:FORC=1TO24:A(R,C
   )=46:NEXT:NEXT:FORX=1TO63:B(X)=0:NEXT
14 POKEV+4,60:POKEV+5,200:POKE2042,13:POKEV+3
   7,0:POKEV+41,14:POKEV+38,1
16 FORX=1TO63:POKE831+X,B(X):NEXT:POKEV+21,4:
   POKEV+28,4
20 PRINT"{CLEAR}{DOWN}MC SPRITE EDITOR{DOWN}"
22 PRINT"_ ERASE"
23 PRINT"1 MC 0-BLACK"
24 PRINT"2 SC  -LT BLUE"
25 PRINT"3 MC 1-WHITE"
32 PRINT"= COMPUTE SPRITE"
33 PRINT"X SCALE 'X'"
34 PRINT"Y SCALE 'Y'"
35 PRINT"B BASIC DATA"
36 PRINT"N NEW SCREEN"
37 PRINT"S SAVE SPRITE"
38 PRINT"L LOAD SPRITE"
39 PRINT"Q QUIT"
50 Y=0:FORR=1TO21:FORC=1TO24:Y=Y+1:POKES+Y,A(
   R,C):POKES1+Y,14:NEXT:Y=Y+16:NEXT
55 X=1:Y=1:GOTO79
60 GETA$:IFA$=""THEN60
61 R=S+X+(Y-1)*40:C=A(Y,X):POKER,C:POKER+1,C
62 IFA$="{DOWN}"THENY=Y+1:IFY>21THENY=1
63 IFA$="{UP}"THENY=Y-1:IFY<1THENY=21
64 IFA$="{RIGHT}"THENX=X+2:IFX>24THENX=1
65 IFA$="{LEFT}"THENX=X-2:IFX<1THENX=23
66 IFA$="_"THENA(Y,X)=46:A(Y,X+1)=46
67 IFA$>"0"ANDA$<"4"THENR=48+VAL(A$):A(Y,X)=R
   :A(Y,X+1)=R
68 IFA$="="THEN100
69 IFA$="X"THENPOKEV+29,ABS(PEEK(V+29)-4)
70 IFA$="Y"THENPOKEV+23,ABS(PEEK(V+23)-4)
71 IFA$="B"THEN120
72 IFA$="L"ORA$="S"ORA$="N"ORA$="Q"THEN190
73 IFA$="{F1}"THENR=33:GOSUB130
74 IFA$="{F2}"THENR=37:GOSUB130
75 IFA$="{F3}"THENR=41:GOSUB130
76 IFA$="{F4}"THENR=38:GOSUB130
79 R=S+X+(Y-1)*40:C=A(Y,X)+128:POKER,C:POKER+
   1,C:GOTO60
100 Y=0:FORR=1TO21:FORX=0TO2:Y=Y+1:B(Y)=0:FORC
   =1TO7STEP2:Q=A(R,X*8+C)-48
102 IFQ<0ORQ>3THENQ=0
104 B(Y)=B(Y)+2^(7-C)*Q:NEXT:NEXT:NEXT:FORX=1T
   O63:POKE831+X,B(X):NEXT:GOTO55
110 PRINT"{REV}"A$": YES OR NO"
111 FORX=1TO10:GETN$:NEXT
112 GETN$:IFN$=""THEN112
114 PRINT"{UP}                {UP}":RETURN
115 PRINT"{REV}CONTINUE":GOTO111
119 REM
120 PRINT"{CLEAR}":FORX=1TO7:PRINT"DATA";:FORY
   =1TO9:PRINTB((X-1)*9+Y)"{LEFT},";:NEXT
122 PRINT"{LEFT} ":NEXT:PRINT:GOSUB115:GOTO20
130 C=PEEK(V+R)AND15:C=C+1:IFC>15THENC=0
132 POKEV+R,C:PRINT"{HOME}{03 DOWN}";:IFR=33TH
   EN136
133 PRINT"{DOWN}";:IFR=37THEN136
134 PRINT"{DOWN}";:IFR=41THEN136
135 PRINT"{DOWN}";
136 PRINT"{07 RIGHT}"A$(C)"  ":RETURN
190 GOSUB110:IFN$<>"Y"THEN79
191 GETN$:GETN$:IFA$="N"THEN11
192 IFA$="Q"THENPOKEV+21,0:POKEV+28,0:PRINT"{0
   4 DOWN}":END
194 PRINT"{CLEAR}":POKEV+21,0:INPUT"NAME OF SP
   RITE";N$:PRINT
196 IFA$="L"THENOPEN1,1,0,N$:GOTO300
200 OPEN1,1,1,N$:FORX=1TO63:PRINT#1,B(X):NEXT:
   CLOSE1:GOTO16
300 FORX=1TO63:INPUT#1,B(X):NEXT:CLOSE1:PRINT"
   {DOWN}COMPUTING SPRITE MATRIX"
310 Y=0:FORR=1TO21:FORX=0TO2:Y=Y+1:FORC=2TO8ST
   EP2:Q=X*8+C:P=2^(8-C)
312 S=B(Y)AND(P*3):A(R,Q)=46:A(R,Q-1)=46
314 IFS>0THENA(R,Q)=S/P+48:A(R,Q-1)=S/P+48
330 NEXT:NEXT:NEXT:S=1039:GOTO16
500 DATA BLACK,WHITE,RED,CYAN,PURPLE,GREEN,BLU
   E,YELLOW
510 DATA ORANGE,BROWN,LT RED,GRAY1,GRAY2,LT GR
   N,LT BLUE,GRAY3
```


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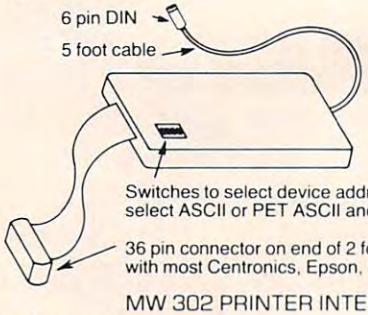

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Add five invaluable commands to VIC BASIC: renumber, delete, find, change, and kill. This enhancement to BASIC automatically locates itself, protects itself, and becomes "part of the computer." It requires 1200 bytes of RAM, a little more than 1K. The article describes the step-by-step process of entering this program (it's machine language, but you can enter and use it without knowing machine language). Alternatively, the author offers to make tape copies – see instructions below.

Tiny Aid For VIC-20

David A. Hook
Barrie, Ontario

Since the early days of the PET, various enhancements for BASIC have been available. Bill Seiler, then of Commodore, produced the first public-domain version, called "BASIC-Aid."

Many updates and improvements have been made over the past couple of years. The PET/CBM program has ballooned to a 4K package for almost every possible PET/CBM equipment configuration.

As has been customary in the Commodore community, Jim Butterfield developed a version of the BASIC-Aid. He called this Tinyaid2 (or Tinyaid4, for BASIC 4.0). This offered the six most useful commands from the full-fledged program.

Following is my modification of that work, designed to provide VIC users with the same benefits. After using this for a while, I think you will find the added commands nearly indispensable.

Features

VIC Tiny Aid is a machine language program which consumes about 1200 bytes of your RAM memory. After you have loaded the program, type "RUN" and hit "RETURN". The program repacks itself into high memory. The appropriate pointers are set so that BASIC will not clobber it. VIC Tiny Aid is now alive.

Once activated, five commands become attached to BASIC. They will function only in "direct" mode; i.e., don't include them in a program.

```
(1) NUMBER 1000,5        'RETURN'
    NUMBER 100,10
```

Renumbers a BASIC program with a given starting line number and given increment between line numbers. The maximum increment is 255.

All references after GOTO, THEN, GOSUB, and RUN are automatically corrected. A display of these lines is presented on the screen as it works. If a GOTO refers to a non-existent line number, then it is changed to 65535. This is an illegal line number, and must be corrected before the BASIC program is used.

```
(2) DELETE 100-200       'RETURN'
    DELETE - 1500
    DELETE 5199 -
```

Deletes a range of lines from a BASIC program. Uses the same syntax as the LIST command, so any line range may be specified for removal. DELETE with no range will perform like a NEW command, so be careful.

```
(3) FIND /PRINT/         'RETURN'
    FIND /A$/, 150-670
    FIND "PRINT", 2000-
```

Will locate any occurrences of the characters between the "/ " marks. Almost any character may mark the start/end of the string to be found, so long as both are the same. The first example will find all the PRINT instructions in the program.

If you are looking for a string of text which contains a BASIC keyword, you must use the quote characters as markers. This will prevent the search string from being "tokenized."

If a limited line-range is desired, use the same syntax as for LIST. Note that a comma (",") must separate the line-range from the end marker.

All lines containing the string are printed to the screen. If a line has more than one of them, each occurrence will cause a repetition of that line.

```
(4) CHANGE -PRINT-PRINT#4,-      'RETURN'
    CHANGE /ABC/XYZ/, 6000-
    CHANGE /DS$/D1$/, -5000
```

Using the same syntax as FIND, you may change any string to any other string in a BASIC program. This command is very powerful and was

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not part of the early versions of BASIC-Aid or Toolkit.

As before, you may indicate a line-range. As the changes are made, the revised lines are displayed on the screen.

Watch out for the difference between BASIC keywords and strings of text within quotes. You may use the quote characters to differentiate, as with FIND.

(5) KILL 'RETURN'

This command disables VIC Tiny Aid and its associated commands. A syntax error will be the result if any of the above commands are now tried.

Since the routine is safe from interference from BASIC, you may leave it active for as long as your machine stays on. It is possible that VIC Tiny Aid may interfere with other programs that modify BASIC's internal "CHRGOT" routine. The KILL command allows you to avoid this conflict.

Procedure

The VIC contains no internal machine language monitor, which is really the only practical way to enter this program. So follow one of the three methods below to perform the task.

(1) Borrow an Upgrade or BASIC 4.0 PET/CBM, with its internal ML monitor. This will be the easiest method to enter the program.

(2) Use your VIC-20, but you must have a machine language monitor:

— Jim Butterfield's Tinymon For VIC (**COMPUTE!**, January 1982, #20).

— my adaptation of Supermon For VIC (*The Transactor*, Volume 3, Issue #5).

— VICMON cartridge from Commodore.

(3) The easy way:

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If you are using a VIC, and have a 3K RAM or SUPEREXPANDER cartridge, plug this in. It will be somewhat easier to follow, since programs are then "PET-compatible" without further juggling. However, don't use the 8K or 16K expansion for this job.

If you are familiar with the operation of the ML monitor, please skip ahead to the specifics below.

You are about to type in almost 2500 characters worth of hexadecimal numbers. In addition to the digits from zero to nine, the alphabetic characters from A-F represent numbers from ten to fifteen. These characters, and three instructions, will be all that are used to enter our program. You don't have to understand the process – just type in the characters exactly. It's not very exciting, but don't be too intimidated by the "funny" display.

Believe it or not, this is the most efficient way to enter the information. The program will use only 1200 characters of memory. Using a "BASIC loader" (with DATA statements), the program wouldn't fit in a 5K VIC!

Enter the machine language monitor program using a:

TINYMON/SUPERMON FOR VIC – LOAD and RUN the program.

PET/CBM – Type "SYS1024" and hit "RETURN".

VICMON Cartridge – "SYS 6*4096" or "SYS 10*4096" (this depends on the version you have), then type "RETURN".

Note: If you are working on the unexpanded VIC, you will need to follow the alternate instructions in parentheses below.

The cursor will be flashing next to a period character ("."). Type the entry starting at the current cursor position:

.M 0580 05C0 'RETURN' (.M 1180 11C0)

Several lines should appear on the screen, much like the "memory-dump" which accompanies this article. A four-digit quantity called an "address" leads off a line, and either eight or five columns of two-digit values appear alongside.

Look at the tables of values in the article. They show eight rows of these addresses. Note that the first "block" has the address "0580," which matches the first address just above. The first row of the next table shows "05C0," which is the second (or ending) address just above.

Your mission is to type in the matching values from the article, in place of the two-digit values you see on the screen. If you're using your VIC for this job, you will have to be on your toes. The tables show eight bytes per row, whereas the various VIC monitors present only five bytes at a time. You could mark off the values in groups of five before you start.

Remember to hit "RETURN" at the end of each screen line, or the changes won't be made.

Double check the values you've typed. It's not easy to find an error later on.

Look at the next block of values. Type in the

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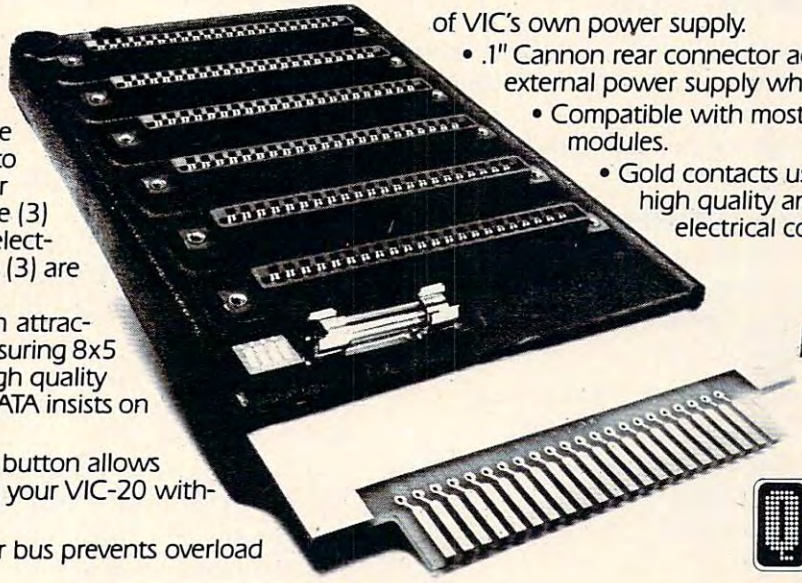

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start/end addresses to display:

```
.M 05C0 0600    'RETURN'    (.M 11C0 1200)
```

Type in the values required and go on with the rest of the blocks.

You will use addresses ranging from:

```
05xx-06xx-07xx-08xx-09xx-0Axx
```

as shown in the tables. The "x" characters stand for the other two digits of the address in the leftmost column.

If you are working on the unexpanded VIC, the sequence of addresses is:

```
11xx-12xx-13xx-14xx-15xx-16xx
```

You will have to type these pairs of characters in place of the leading two shown just above.

With that task complete, we are ready to preserve this work on tape. So type:

```
.S "VIC AID.ML",01,0580,0AB6   'RETURN'
(or: .S "VIC AID.ML",01,1180,16B6   'RETURN')
```

Mount a blank tape, and follow the instructions. Save a second copy, for safety.

Exit the ML monitor, with:

```
.X    'RETURN'
```

VERIFY the program normally before going any further.

Now comes the easy part. Type "NEW", then the BASIC listing. Enter this exactly, without including any extra text. Save this as "VIC AID.BAS" and VERIFY it.

Leave this program in memory for the next stage.

Finally, LOAD the "VIC AID.ML" and SAVE "VIC AID.REL" on another blank tape. Both the BASIC part and the machine language part have been SAVEd together.

Check-Out

We are going to check out the machine language using a "checksum" method. Type in "NEW" before proceeding. Now enter the following program:

```
10 I=0 (or: 10 I=3072 for unexpanded VIC)
20 T=0:FOR J=1408+I TO 2741+I
30 T=T+PEEK(J)
40 NEXT J
50 PRINT T
```

After a few seconds, if the value 161705 appears, you've likely got it perfectly. Go to the next section.

If not, there's at least one incorrect entry. Change the two values in line 20, using the table below. Re-RUN the program and compare against the value in the third column.

Repeat the process for each row, noting any that don't match. Each row corresponds to two "blocks" from the last section. You will have to re-enter the ML monitor to re-check those sections that differ. Re-SAVE the ML part!

Block #	Value 1	Value 2	Checksum
1- 2	1408	1535	15201
3- 4	1536	1663	17221
5- 6	1664	1791	15925
7- 8	1792	1919	15117
9-10	1920	2047	15565
11-12	2048	2175	14141
13-14	2176	2303	15840
15-16	2304	2431	16276
17-18	2432	2559	15152
19-20	2560	2687	15194
21	2688	2741	6073

Operation

The final acid test. RELOAD the program from tape and RUN it. The screen will clear and a brief summary of the added commands will be displayed. The cursor should return almost instantly, under the "READY." message.

If the cursor does not come back, there is something still amiss. All the numbers appearing in the listing in this article were produced from a working copy of the program (Honest!). You still have option (3) from the procedure section available. If you do send a tape/disk at this point, include your non-functioning version. I can then do a compare, to see where the error(s) were.

This has been a massive exercise, and mistakes can easily creep in. Your comments are welcome.

Program 1: Memory Dump of Tiny Aid

```
0580 A5 2D 85 22 A5 2E 85 23
0588 A5 37 85 24 A5 38 85 25
0590 A0 00 A5 22 D0 02 C6 23
0598 C6 22 B1 22 D0 3C A5 22
05A0 D0 02 C6 23 C6 22 B1 22
05A8 F0 21 85 26 A5 22 D0 02
05B0 C6 23 C6 22 B1 22 18 65
05B8 24 AA A5 26 65 25 48 A5

05C0 37 D0 02 C6 38 C6 37 68
05C8 91 37 8A 48 A5 37 D0 02
05D0 C6 38 C6 37 68 91 37 18
05D8 90 B6 C9 DF D0 ED A5 37
05E0 85 33 A5 38 85 34 6C 37
05E8 00 AA AA AA AA AA AA AA
05F0 AA AA AA AA AA AA AA AA
05F8 AA AA AA AA AA AA AA AA

0600 DF AD FE FF 00 85 37 AD
0608 FF FF 00 85 38 A9 4C 85
0610 7C AD D9 FB 00 85 7D AD
0618 DA FB 00 85 7E 4C 8F FC
0620 00 F0 03 4C 08 CF A9 C9
0628 85 7C A9 3A 85 7D A9 B0
0630 85 7E 60 DB FB 00 85 8B
```

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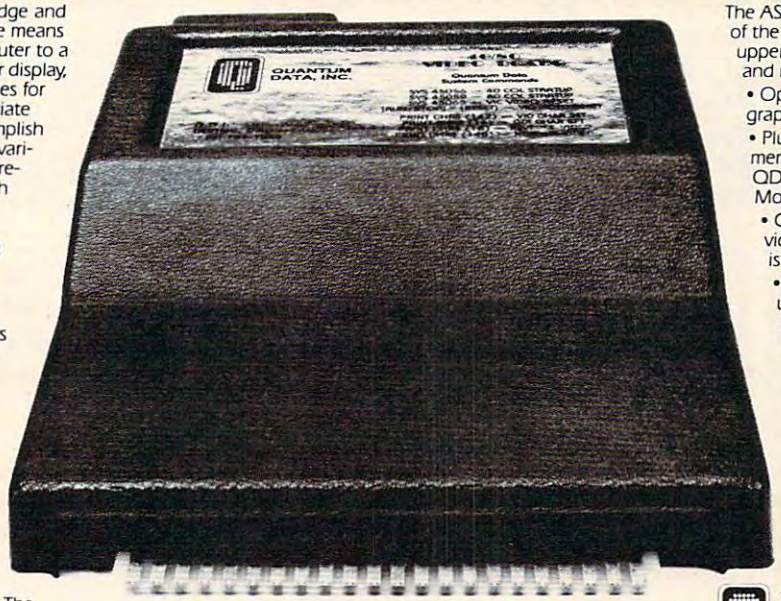

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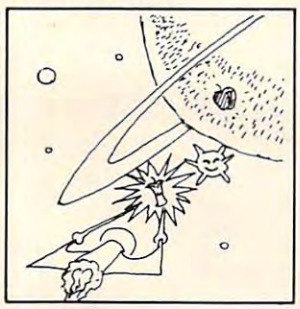

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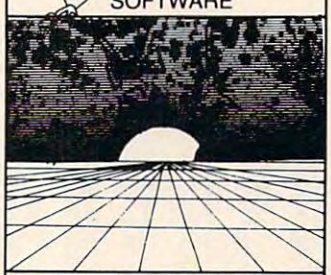

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```
0638 86 97 BA BD 01 01 C9 8C

0640 F0 10 D0 02 A4 8C A6 97
0648 A5 8B C9 3A B0 03 4C 80
0650 00 00 60 BD 02 01 C9 C4
0658 D0 ED A5 8B 10 02 E6 7A
0660 84 8C A2 00 00 86 A5 CA
0668 E8 A4 7A B9 00 00 02 38
0670 FD D9 FF 00 F0 13 C9 80
0678 F0 13 E6 A5 E8 BD D8 FF

0680 00 10 FA BD D9 FF 00 D0
0688 E4 F0 BF E8 C8 D0 E0 84
0690 7A A5 A5 0A AA BD F5 FF
0698 00 48 BD F4 FF 00 48 20
06A0 E9 FB 00 4C 73 00 00 20
06A8 B2 FD 00 A5 5F A6 60 85
06B0 24 86 25 20 13 C6 A5 5F
06B8 A6 60 90 0A A0 01 B1 5F

06C0 F0 04 AA 88 B1 5F 85 7A
06C8 86 7B A5 24 38 E5 7A AA
06D0 A5 25 E5 7B A8 B0 1E 8A
06D8 18 65 2D 85 2D 98 65 2E
06E0 85 2E A0 00 00 B1 7A 91
06E8 24 C8 D0 F9 E6 7B E6 25
06F0 A5 2E C5 25 B0 EF 20 33
06F8 C5 A5 22 A6 23 18 69 02

0700 85 2D 90 01 E8 86 2E 20
0708 59 C6 4C 67 E4 20 7C C5
0710 20 73 00 00 85 8B A2 00
0718 00 86 49 20 8C FD 00 A5
0720 A5 C9 00 00 D0 07 A2 02
0728 86 49 20 8C FD 00 20 73
0730 00 00 F0 03 20 FD CE 20
0738 B2 FD 00 A5 5F A6 60 85

0740 7A 86 7B 20 D7 CA D0 0B
0748 C8 98 18 65 7A 85 7A 90
0750 02 E6 7B 20 CA FF 00 F0
0758 05 20 DC FD 00 B0 03 4C
0760 8F FC 00 84 55 E6 55 A4
0768 55 A6 31 A5 32 85 8B B1
0770 7A F0 D8 DD 00 00 02 D0
0778 ED E8 C8 C6 8B D0 F1 88

0780 84 0B 84 97 A5 49 F0 5B
0788 20 F0 FD 00 A5 34 38 E5
0790 32 85 A7 F0 28 C8 F0 CA
0798 B1 7A D0 F9 18 98 65 A7
07A0 C9 02 90 40 C9 4B B0 3C
07A8 A5 A7 10 02 C6 8B 18 65
07B0 0B 85 97 B0 05 20 24 FE
07B8 00 F0 03 20 0C FE 00 A5

07C0 97 38 E5 34 A8 C8 A5 34
07C8 F0 0F 85 8C A6 33 BD 00
07D0 00 02 91 7A E8 C8 C6 8C
07D8 D0 F5 18 A5 2D 65 A7 85
07E0 2D A5 2E 65 8B 85 2E A5
07E8 7A A6 7B 85 5F 86 60 A6
07F0 43 A5 44 20 3D FE 00 20
07F8 E1 FF A9 00 00 85 C6 A4

0800 97 4C F2 FC 00 A4 7A C8
0808 94 31 A9 00 00 95 32 B9
0810 00 00 02 F0 15 C5 8B F0
0818 05 F6 32 C8 D0 F2 84 7A
0820 60 C9 AB F0 04 C9 2D D0
0828 01 60 4C 08 CF 90 05 F0
0830 03 20 A6 FD 00 20 6B C9
0838 20 13 C6 20 79 00 00 F0

0840 0B 20 A6 FD 00 20 73 00
0848 00 20 6B C9 D0 E0 A5 14
0850 05 15 D0 06 A9 FF 85 14
0858 85 15 60 20 CA FF 00 85
0860 43 20 CA FF 00 85 44 38
0868 A5 14 E5 43 A5 15 E5 44
0870 60 A5 7A 85 22 A5 7B 85
0878 23 A5 2D 85 24 A5 2E 85

0880 25 60 A5 22 C5 24 D0 04
0888 A5 23 C5 25 60 A4 0B C8
0890 B1 22 A4 97 C8 91 22 20
0898 01 FE 00 D0 01 60 E6 22
08A0 D0 EC E6 23 D0 E8 A4 0B
08A8 B1 24 A4 97 91 24 20 01
08B0 FE 00 D0 01 60 A5 24 D0
08B8 02 C6 25 C6 24 4C 24 FE

08C0 00 A0 00 00 84 A5 84 0F
08C8 20 CD DD A9 20 A4 A5 29
08D0 7F 20 D2 FF C9 22 D0 06
08D8 A5 0F 49 FF 85 0F C8 B1
08E0 5F F0 19 10 EC C9 FF F0
08E8 E8 24 0F 30 E4 84 A5 20
08F0 7C FE 00 C8 B1 AE 30 D6
08F8 20 D2 FF D0 F6 20 D7 CA

0900 38 60 A0 9D 84 AE A0 C0
0908 84 AF 38 E9 7F AA A0 00
0910 00 CA F0 EE E6 AE D0 02
0918 E6 AF B1 AE 10 F6 30 F1
0920 20 6B C9 A5 14 85 35 A5
0928 15 85 36 20 FD CE 20 6B
0930 C9 A5 14 85 33 A5 15 85
0938 34 20 8E C6 20 CA FF 00

0940 20 CA FF 00 D0 21 20 AC
0948 FF 00 20 CA FF 00 20 CA
```

(continued on p. 222)

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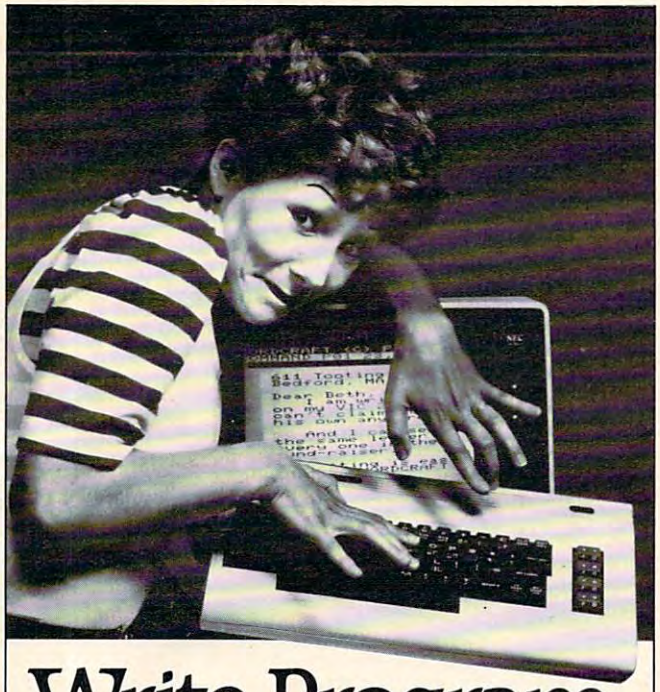

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```
0950 FF 00 D0 03 4C 8F FC 00
0958 20 CA FF 00 A5 63 91 7A
0960 20 CA FF 00 A5 62 91 7A
0968 20 B7 FF 00 F0 E2 20 CA
0970 FF 00 20 CA FF 00 20 CA
0978 FF 00 C9 22 D0 0B 20 CA

0980 FF 00 F0 C5 C9 22 D0 F7
0988 F0 EE AA F0 BC 10 E9 A2
0990 04 DD D4 FF 00 F0 05 CA
0998 D0 F8 F0 DD A5 7A 85 3B
09A0 A5 7B 85 3C 20 73 00 00
09A8 B0 D3 20 6B C9 20 51 FF
09B0 00 A5 3C 85 7B A5 3B 85
09B8 7A A0 00 00 A2 00 00 BD

09C0 00 00 01 C9 30 90 11 48
09C8 20 73 00 00 90 03 20 82
09D0 FF 00 68 A0 00 00 91 7A
09D8 E8 D0 E8 20 73 00 00 B0
09E0 08 20 91 FF 00 20 79 00
09E8 00 90 F8 C9 2C F0 B8 D0
09F0 96 20 AC FF 00 20 CA FF
09F8 00 20 CA FF 00 D0 08 A9

0A00 FF 85 63 85 62 30 0E 20
0A08 CA FF 00 C5 14 D0 0F 20
0A10 CA FF 00 C5 15 D0 0B 20
0A18 D1 DD A9 20 4C D2 FF 20
0A20 CA FF 00 20 B7 FF 00 F0
0A28 D2 20 A2 FF 00 E6 97 20
0A30 24 FE 00 E6 2D D0 02 E6
0A38 2E 60 20 A2 FF 00 C6 97

0A40 20 0C FE 00 A5 2D D0 02
0A48 C6 2E C6 2D 60 20 F0 FD
0A50 00 A0 00 00 84 0B 84 97
0A58 60 A5 35 85 63 A5 36 85
0A60 62 4C 8E C6 A5 63 18 65
0A68 33 85 63 A5 62 65 34 85
0A70 62 20 CA FF 00 D0 FB 60
0A78 A0 00 00 E6 7A D0 02 E6

0A80 7B B1 7A 60 89 8A 8D A7
0A88 43 48 41 4E 47 C5 44 45
0A90 4C 45 54 C5 46 49 4E C4
0A98 4B 49 4C CC 4E 55 4D 42
0AA0 45 D2 00 00 A5 FC 00 41
0AA8 FC 00 A5 FC 00 C6 FB 00
0AB0 98 FE 00 AC FB 00 03 AA
0AB8 AA AA AA AA AA AA AA AA
```

Program 2: BASIC section of Tiny Aid

```
1 PRINT"{CLEAR}    {REV} VIC TINY AID "
2 PRINT"{DOWN}  ADAPTED FOR VIC BY:
3 PRINT"     DAVID A. HOOK
4 PRINT"{DOWN}  FROM 'TINY AID' BY:
5 PRINT"    JIM BUTTERFIELD
6 PRINT"{DOWN}  AND 'BASIC AID' BY:
7 PRINT"      BILL SEILER
8 PRINT"{DOWN}{REV}SAMPLE  COMMANDS:
9 PRINT"{DOWN}CHANGE /?/PRINT#4,/
10 PRINT"FIND .GOSUB., 200-
11 PRINT"DELETE 130-625
12 PRINT"NUMBER 100,5
13 PRINT"KILL        (VIC AID)
14 SYS(PEEK(43)+PEEK(44)*256+383)
```

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This tutorial shows a quick and easy way to select random numbers using PEEK and POKE to increase speed. The technique is also demonstrated as an alternative to the SOUND command.

Atari PEEK And POKE Alternatives

Jerry White
Levittown, NY

When writing a BASIC program, it is often necessary to find the fastest possible method to achieve a desired result. When speed is important, an assembler subroutine is usually the best alternative. In many cases, however, using PEEK and POKE instructions instead of conventional routines can significantly increase the speed.

In each of the four example routines below, RAM location 540 is used as a timer. The term "jiffy" is used to denote 1/60 of a second. Location 540 counts backwards until it reaches zero. When the number 255 is POKEd into this location, it will take four and one quarter seconds to count back to zero.

Each routine begins with a Graphics 0 command to clear the screen. You might want to try Mode 2 later on to see how the elapsed time of each routine is affected. Standard text mode was chosen so the routines could be listed on the screen and the elapsed time displayed.

Time tests 1 and 2 show two ways to select a random number between zero and 255. The first method is the conventional way. For demonstration purposes, the random number was selected ten times.

The second listing provides an alternative method which is four times faster. Our number is selected with a PEEK at location 20. This is also a jiffy counter, but unlike location 540, this one counts forward until it reaches 255. It is then reset to zero and continues counting normally. This method of selection is only useful when a single random number is required. For example, to return a decision on a 50 percent probability, check location 20 for less than, or for equal to, 127. This method would not be effective if more than one number is needed within a short period of time. It is, however, an excellent alternative in most cases, and is much faster than the conventional method because the multiplication is eliminated.

Time test routines 3 and 4 loop through the 256 pitches of Atari's undistorted sound. Test 3 uses the conventional SOUND command. The execution time was 123 jiffies, or just over two seconds. Test 4 uses the POKE command. The difference was 17/60ths of a second.

There are many situations where the PEEK and POKE commands can be used to speed up your BASIC programs. There are also things that could not be done at all in Atari BASIC were it not for PEEK and POKE. I will continue to explore this subject in future **COMPUTE!** tutorials.

Atari BASIC Time Test 1

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=1 TO 10:X=RND
   (0)*256:NEXT TEST:TIME=PEEK(540)
20 ? :? "TIME=";255-TIME;" 60ths of a
   second."

TIME=16 60ths of a second.
```

Atari BASIC Time Test 2

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=1 TO 10:X=PEE
   K(20):NEXT TEST:TIME=PEEK(540)
20 ? :? "TIME=";255-TIME;" 60ths of a
   second."

TIME=4 60ths of a second
```

Atari BASIC Time Test 3

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=0 TO 255:SO.0
   ,TEST,10,2:NEXT TEST:TIME=PEEK(540)
20 ? :? "TIME=";255-TIME;" 60ths of a
   second."

TIME=123 60ths of a second
```

Atari BASIC Time Test 4

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=0 TO 255:POKE
   53760,TEST:NEXT TEST:TIME=PEEK(540)
20 ? :? "TIME=";255-TIME;" 60ths of a
  second."

TIME=106 60ths of a second
```

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For Commodore 2022 and 2024 printers, add an automatic shut-off to stop the machine when the paper has run out.

Paper Monitor Switch For 2022 Printer

Rev. Jack Weaver
Homestead, FL

Dire warnings are always posted for the users of dot-matrix printers. The warning DO NOT OPERATE UNLESS PAPER IS IN THE MACHINE is justified!

It is somewhat surprising, then, that Commodore did not see fit to include a Paper Monitor Switch in its 2022 and 2024 printers.

We use large amounts of fan-fold paper and have found, to our dismay, that not every stack of fan-fold paper is truly a continuous stack. For some reason, the stack may be separated, and this might not be obvious until it is too late. The paper runs out, the tractor runs on, and the printer continues to print – all without paper. This prompts visions of those tiny wires that make up the print head beating themselves flat against the platen and then ruining the guides through which they run.

The solution offered here works perfectly and has saved our print head more than once when we have had to leave the room during a printing run.

Our solution is twofold. First, the hardware fix.

The principle used is very simple. We discovered that if we grounded the PA-2 pin (Pin ID character E) on the Parallel User Port, a value of 251 is produced when location 59471 is PEEKed.

(This method naturally assumes that the PA-2 pin is not being used for any other peripheral.) If the PA-2 is *not* grounded, when we PEEK location 59471, the value is 255. Our method grounds PA-2 when the paper runs out and isolates PA-2 when paper is in the printer.

We used the tractor feed carriage (which is isolated from ground) as the bracket to which we attached a three-inch long, stainless steel fishing leader, properly bent to touch the paper entry guide when no paper is in the machine.

This stainless steel "whisker" is attached to the PA-2 pin by a 28-gauge stranded wire which we coiled for flexibility. (The wire is soldered to an appropriate edge card connector which matches the Parallel Port.) When the paper is properly in the machine, the steel "whisker" is isolated from the paper guide by the paper itself. This gives us the two circumstances needed for our PEEKing program. The attached drawings should be self-explanatory.

The Software Fix

You may call the subroutine with a GOSUB before and just after paging – or preferably just before every PRINT # command to the printer. After the bottom edge of the last sheet of paper has passed the "whisker," the program will stop until the up-arrow key (↑) is pressed (which should be done only *after* new paper has been introduced).

The Subroutine

Line 4000 returns you to the program if the value of PEEK(59471) is equal to anything other than 251. This means that there is still paper in the printer.

If PEEK(59471) is equal to 251, then the paper is out, and line 4010 fills the screen with the warning that the paper has run out.

Line 4015 clears the keyboard buffer in the event that the up-arrow has been pressed during the run.

Lines 4016-4027 give an audible signal if you have installed a CB-2 line amplifier for sound.

Line 4029 goes back for more sound continuously until the up-arrow is pressed.

Line 4030 turns off sound after up-arrow is pressed and returns from the subroutine to the main program.

Included is a short program for testing the proper grounding of the PA-2 line. After the line is properly connected, run this short program and manually ground and un-ground the "whisker"; you will see the value of PEEK(59471) change as you do it. If it does not change back and forth from 251 to 255 as you manually operate the "whisker," then there is some error in your construction. Use extreme care that only the PA-2 pin is selected for grounding. Consult your PET manual or see attached diagram of the Parallel User Port.

This arrangement has no effect on any of our peripheral operations (such as our 2040 disk or the 2040 printer).

Program 1: Monitor/Indicator For 2022 Printer

```
4000 IF PEEK(59471)<>251 THEN RETURN
4010 FOR J=1 TO 10:PRINT "ŗPAPER IS OUT ¬
     ¬XXX PUT IN NEW PAPER":PRINT:NEXT J
4012 PRINT "ŧŧŧTYPE '^' WHEN READY TO ¬
     ¬CONTINUE"
4015 GET WQ$:IF WQ$<>"" THEN 4015
4016 POKE 59467,16:POKE 59466,15:J=1
```

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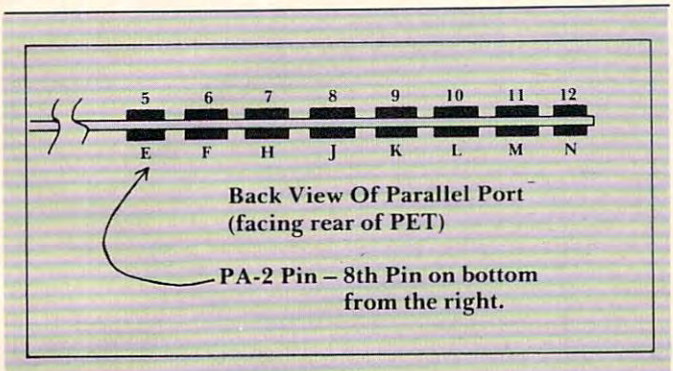
```
4020 GET WQ$:FOR X=255 TO 1 STEP -J:
     ¬POKE 59464,X
4025 IF PEEK(151)=59 THEN 4030
4027 NEXT X:J=J+1:IF J=10 THEN J=1
4029 IF WQ$<>"^" THEN 4020
4030 GET WQ$:POKE 59467,0:RETURN
READY.
```

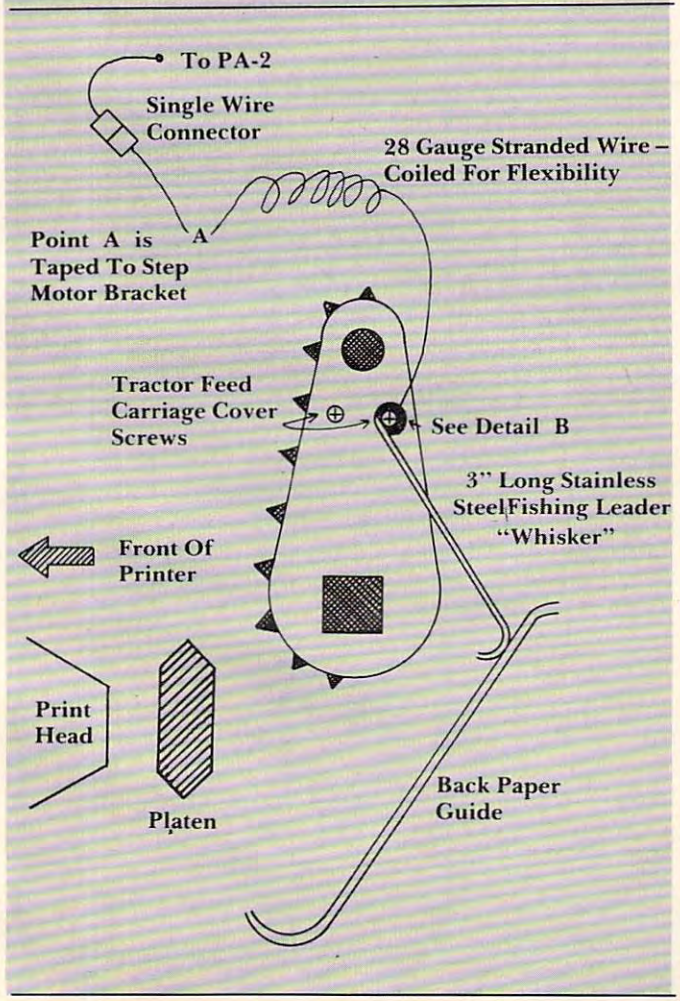
Test Program: Grounding

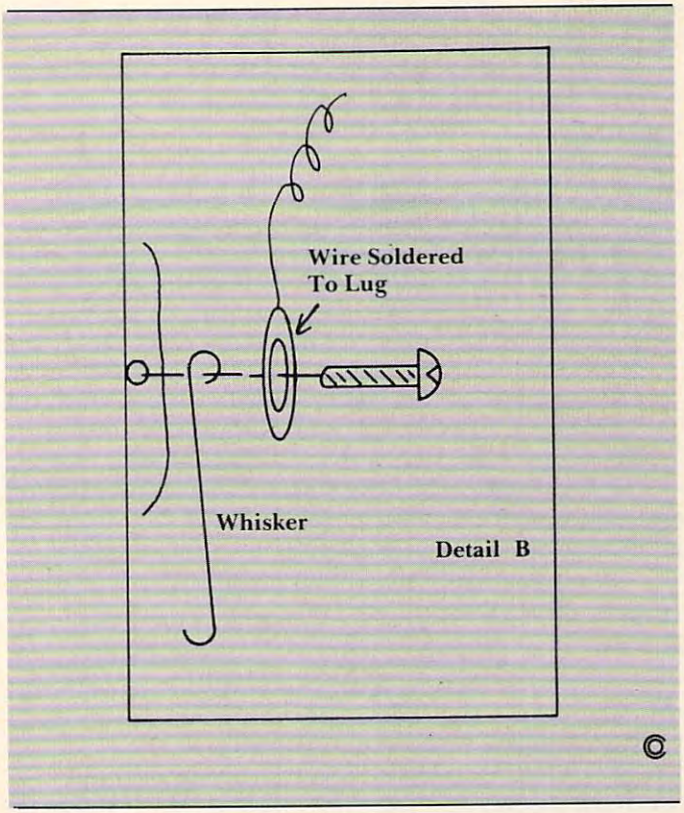
```
10 PRINT PEEK(59471)

20 GOTO 10

READY.
```







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"Change Disk" changes the device number of any Commodore disk: 2040, 4040, 8050 or 2031. It is an adaptation of a Commodore utility program.

A Floppy With A Strange Device

Jim Butterfield, Associate Editor

Why would you want to change a device number logically? You can dig into the innards and restrap the disk to a new device number if you wish. "Logical" changes are temporary and vanish when power is removed from the unit.

The most usual reason is a temporary hookup. In order to make copies or do some similar job, you want to hook together two or more units. Maybe you've borrowed an 8050 from a friend for the afternoon; he wouldn't be pleased to find the unit restrapped when you return it.

The trick is to have the program search out the right place to do the disk unit change. There are three different sets of locations which are used on various disks: 12/13 on the early 2040 and 3040 units; 119/120 on 2031 units; and 50/51 on 4040s and 8050s. We find out which one is correct by PEEKing the innards of the disk and seeing which set of locations contains the correct (old) numbers. When we find the right one, we make the change.

For those users interested in "innards": the disk units check the device strapping once only at power up. It stores the computed "listen" and "talk" addresses in RAM memory, and from then on will use only the computed values. So we can change RAM, and the device number will be operational until we cut the power.

```
99 DATA 12,50,119,0
100 INPUT"OLD DEVICE NUMBER";DO
110 IFDO<8 OR DO>15 THEN100
150 INPUT"NEW DEVICE NUMBER";DN
160 IFDN<8 OR DN>15 THEN150
200 OPEN15,DO,15:REM COMMAND CHANNEL
210 A$=CHR$(DO+32):B$=CHR$(DO+64)
220 READA:IFA=0THENPRINT"DISK NOT R
    ECOGNIZED!";GOTO310
230 PRINT#15,"M-R"CHR$(A)CHR$(0):GE
    T#15,X$:IFX$<>A$GOTO220
240 PRINT#15,"M-R"CHR$(A+1)CHR$(0):
    GET#15,X$:IFX$<>B$GOTO220
300 PRINT#15,"M-W"CHR$(A)CHR$(0)CHR
    $(2)CHR$(DN+32)CHR$(DN+64)
310 CLOSE15
```

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This may be the next best thing if you don't have a disk drive for your VIC. You can store and quickly locate up to 60 pages of information on one cassette tape.

VIC File Clerk

Dennis Surek
Welland, Ontario

This program is designed to save you some space around the house – space perhaps presently occupied by large filing cabinets or old cardboard storage boxes. You will be able to file and at any time read back quickly 60 pages of information stored on one side of a 60-minute cassette.

Whether it is recipes, or budgets, or utility bills, the computer stores them efficiently and accurately. This program should be SAVEd at the beginning of every tape that is to be converted into a filing cabinet.

The program first displays the file numbers and names and then asks which one you wish to access, and whether you wish to read or write to that file. If you are writing, the instructions will appear. Whether you are writing or reading, you will "Fast Find" to the proper file. [*See* Home and Educational Computing!, *Fall 1981, p. 15.*]

If you are writing, you can write as many pages as the file maximum allows. If you are reading, you can switch to writing subsequent pages, or you can continue reading through following pages and files.

Line 10 sets the number of files (NF) at 15 and the number of pages per file (NP) at 4. Changing either or both of these to lower values is easily done and requires no further changes to the program. The product NF x NP should be kept to 60 or less. With this in mind, it is just as easy to decrease NF and increase NP. But note that the program only fast finds to each file, and that increasing the number of pages per file defeats this fast find feature.

Increasing NF to more than 15 creates some minor problems. You will have to put additional data statements for file names between lines 100 and 240. Secondly, to keep the menu from scrolling up when the program is run, insert the following four lines:

```
81 IF I<>INT(NF/2)THEN90
82 PRINT"PRESS ANY KEY TO":PRINT
   "CONTINUE"
83 GETB$:IFB$=" "THEN83
84 PRINT"(CLEAR)"
```

These lines allow you to see half of the file names first and then to call for the rest when you are ready.

Three Naming Choices

Lines 100 to 240 are reserved for file names. There are three methods for dealing with file names. If you know all of the file names ahead of time, you could enter them when you key in this program. Conversely, you might not bother with file names at all, but use only the file numbers, writing descriptions of the files on the cassette box.

The system that I use is to save the program at the exact beginning of the magnetic portion of each tape. I then simply edit any of these lines to the title I want and reSAVE the program starting at the same position on the tape. The new program has not changed in length and therefore will still fast find to the proper file headers.

Lines 250 to 290 determine which file you want and whether you wish to read or write. If you are reading file #1, then line 300 branches to the read file routine beginning on line 660. This is possible because the PLAY key is already down from loading the program and no fast forward is required. In all other cases, some cassette key instructions will be needed. Line 310 determines if any keys are down and instructs you to press STOP in order to bring all keys up. Line 320 temporarily halts the program until this is done. If you are writing file #1, then line 330 branches to the write routine on line 420. Again, no fast forward is required for this file.

For all other files the cassette must be put into fast forward. Line 340 gives this instruction, and line 350 halts the program until the fast forward key is depressed. Line 360 begins the timer, and line 370 halts the program until an elapsed time of 90 jiffies per page per file is reached. At that instant, line 380 stops the cassette motor. Lines 390 and 400 get all keys up in a manner described previously. Line 410 branches to the read routine, and lines 420 to 500 are the instructions for writing a file.

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Line 510 opens the file for writing and increments the page count. In the command OPEN1,1,1 the first "1" is the logical file number or reference number for our data file. The second specifies cassette drive #1, and the third indicates that the file is being opened for writing with no end of tape marker. It is the absence of this marker that allows the reading of consecutive pages later. For convenience, all files are assigned logical file #1. The program keeps track of the actual file number with the variable F.

Lines 520 to 590 input from the keyboard up to 20 message lines that make up one page. If a message line containing more than 22 characters is entered, it is edited to that length by line 540. Line 550 displays the last five characters of the message line as accepted so that you know how to begin your next message line.

If you are writing fewer than 20 message lines and have signaled this with the input message STOP, then line 580 will fill the rest of the page with blank message lines. This keeps all the pages the same length and therefore at a specific location on the tape. This enables you to later change any page simply by writing over the old one without having to rewrite the following pages in that file. Lines 600 to 650 determine if you wish to write the next page. If the answer is no, the program terminates.

Lines 660 to 740 are the read file routine. The zero in the command OPEN1,1,0 indicates a read operation. Line 720 moves the cursor up one line if the message line is 22 characters so that no blank lines will be displayed between message lines.

Lines 750 to 780 are for inputting and branching on commands to read or write subsequent pages. Lines 790 to 810 are the usual instructions to get all cassette keys up when changing from reading one page to writing the next page.

This program has been kept reasonably short so that load time is at a minimum. For that reason, there is no programming of special color or sound commands.

```
10 NF=15:NP=4:DIMA$(NF),O$(20)
20 PRINT"{CLEAR} ***VIC FILE CLERK***"
30 REMBY DENNIS SUREK
40 REM   555 LLOYD AVE
50 REM   WELLAND,ONT
60 PRINT"THIS PROGRAM WILL"
70 PRINT"READ OR WRITE TO FILE:"
80 FORI=1TONF
90 READ A$(I):PRINTI;TAB(5);A$(I):NEXTI
100 DATA UNNAMED
110 DATA UNNAMED
120 DATA UNNAMED
130 DATA UNNAMED
140 DATA UNNAMED
150 DATA UNNAMED
160 DATA UNNAMED
170 DATA UNNAMED
180 DATA UNNAMED
190 DATA UNNAMED
200 DATA UNNAMED
210 DATA UNNAMED
220 DATA UNNAMED
230 DATA UNNAMED
240 DATA UNNAMED
250 INPUT"FILE SELECTED";F
260 IFF<1ORF>NFTHEN250
270 INPUT"R-READ/W-WRITE";C$
280 IFC$="W"ORC$="R"THEN300
290 GOTO270
300 IFF=1ANDC$="R"THEN660
310 PRINT"{CLEAR}";:IF(PEEK(37151)AND64)=0THEN
    PRINT"PRESS STOP ON TAPE"
320 IF(PEEK(37151)AND64)=0THEN320
330 IFF=1THEN420
340 PRINT"PRESS FAST FORWARD"
350 IF(PEEK(37151)AND64)=64THEN350
360 PRINT"OK":A=TI
370 IFABS(TI-A)<(F-1)*NP*90THEN370
380 POKE37148,PEEK(37148)AND247
390 PRINT"PRESS STOP ON TAPE"
400 IF(PEEK(37151)AND64)=0THEN400
410 IFC$="R"THEN660
420 PRINT"{CLEAR}";
430 PRINT"INSTRUCTIONS TO"
440 PRINT"{REV}WRITE FILE"
450 PRINT"{02 DOWN}MAXIMUMS:"
460 PRINT"========"
470 PRINT"{DOWN}-20 LINES PER PAGE"
480 PRINT" (TYPE STOP IF LESS)"
490 PRINT"-";NP;"PAGES PER FILE"
500 PRINT"{02 DOWN}{REV}WAIT{OFF} FOR PROMPT.F
    IRST"
510 OPEN1,1,1:PC=PC+1
520 PRINT"{CLEAR}{REV}WRITE FILE";F;"PAGE";PC
530 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
    560
540 O$(K)=LEFT$(O$(K),22)
550 PRINT"*LINE EDITED TO*";RIGHT$(O$(K),5)
560 IFO$(K)="STOP"THEN580
570 PRINT#1,O$(K):NEXTK
580 FORI=KTO20:PRINT#1," ":NEXTI
590 CLOSE1
600 PRINT"WRITE NEXT PAGE?":INPUT"Y/N";W$
610 IFW$="N"THEN820
620 IFW$="Y"ANDR$="N"THEN790
630 IFW$="Y"ANDPC<NPTHEN510
640 IFPC>=NPTHENPRINT"MAX";NP;"PAGES REACHED":
    GOTO820
650 GOTO600
660 OPEN1,1,0:PC=PC+1
670 IFPC>NPTHENPC=1:F=F+1
680 PRINT"{CLEAR}";
690 PRINT"{REV}READ FILE";F;"PAGE";PC
700 FORK=1TO20
710 INPUT#1,O$(K)
720 PRINTO$(K):IFLEN(O$(K))=22THENPRINT"{UP}";

730 NEXTK
740 CLOSE1
750 PRINT"READ NEXT PAGE?":INPUT"Y/N";R$
760 IFR$="Y"THEN660
770 IFR$="N"THEN600
780 GOTO750
790 PRINT"PRESS STOP ON TAPE":R$="Y"
800 IF(PEEK(37151)AND64)=0THEN800
810 GOTO510
820 END
```

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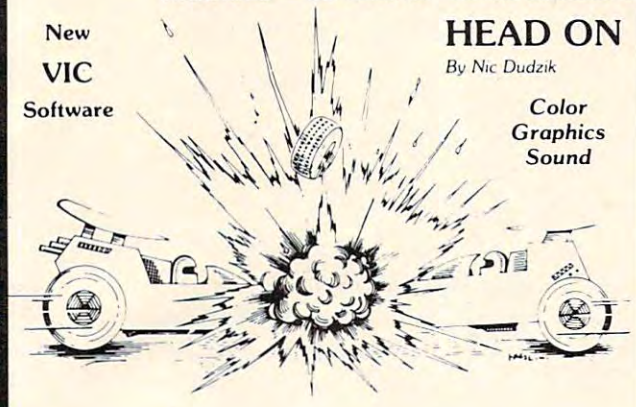

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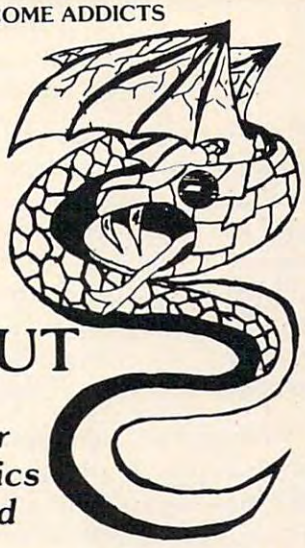

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These three short Applesoft programs show you how to change line numbers in order to delete and create undeletable lines.

Undeletable Lines, Revisited

P. Kenneth Morse
Augusta, GA

Michael P. Antonovich described (**COMPUTE!**, October 1981, #17) a method of using the Apple's monitor to enter Applesoft program statements that could not be easily deleted using the Applesoft DEL command. He indicated that a way to get rid of such lines was to change the end-of-program pointer in $69-6A (115-116, decimal).

There are, however, at least two other general approaches to deleting "undeletable" lines:

(1) Change the line number back to a deletable number. This may be done by using the monitor (or POKE statements) to modify the number of a specific line, or by simply running Apple's Renumber program. Once a deletable line number has been achieved, DEL will complete the job. Readers may find the program text file Deletable (see Program 1) helpful in quickly gaining control of undeletable lines.

(2) LIST the deletable portion of the program to a new text file, clear memory with a NEW command, and then EXEC the text file. The undeletable lines will have vanished!

Mr. Antonovich's approach (changing the end-of-program pointer) and the text file approach (#2 above) will work only when the undeletable lines are at the end of the program. However, undeletable lines may also be placed at the beginning of the program (where they inhibit LISTings beginning at specific line numbers) or in mid-program. For example:

```
10 PRINT "THIS IS ";
20 PRINT "A TEST"
```

may be converted to

```
65535 PRINT "THIS IS ";
20 PRINT "A TEST"
```

by entering

```
POKE 2051,255:POKE 2052,255
```

in immediate execution mode, and the program will RUN and LIST, but you cannot RUN, LIST or GOTO either 20 or 65535 as specific line numbers. However, it is not practical to make the opening lines undeletable, since the program would then work only for the trivial case of a program with no GOTOs or GOSUBs! To test this, enter:

```
NEW
10 PRINT "THIS IS ";
20 PRINT "A TEST "
30 GOTO 50
40 STOP
50 PRINT "IT WAS A SUCCESS"
```

and change line 10 to line 65535 as above. The program will not be able to find line 50!

Secondly, it is not necessary to key in an entire line through the monitor to achieve an undeletable line number. Programs 2 and 3 below provide Applesoft and Integer BASIC programs that will change specified line numbers to the undeletable value of 65535.

Deletable (Lines 1-8 In Program 1)

RUNning Program 1 creates a program text file, Deletable, which may be EXECed to convert undeletable Applesoft lines to a deletable range (63000-63999). Deletable will renumber up to 1000 undeletable lines per run. Once the line numbers are in the deletable range, DEL will finish the job.

Line 0 is a temporary line, used to create the text file Deletable by LISTing to the file lines 1-8. When Deletable is RUN, line 2 sets the value of the high and low bytes to be POKEd as the new deletable line number. Line 3 initializes L1, the line address, as the start-of-program address stored in bytes 103-104 (decimal). Line 4 calculates CL, the line number being tested, and determines if it is undeletable (i.e., at least 64000). If the value of CL (line 4) is undeletable, deletable values are POKEd (line 5), the POKE values are incremented, and control is passed to line 6. When all line numbers have been tested (or 1000 lines have been made deletable), Deletable deletes itself!

Deletable may also come in handy in case of a bombed Applesoft program caused by an inadvertent POKE which created an illegal line number. However, if the pointer to the next line was bombed, Deletable will not be able to help.

To use Deletable:

— Key in (and SAVE) Program 1
— RUN (this will create Deletable)
— LOAD the program containing the undeletable lines
— EXEC Deletable
— RUN

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Applesoft (Lines 61800-61970 In Program 2)

The program will renumber as 65535 all lines between 62000-63999 and then delete itself. Here's how it works.

Beginning with the first line currently in memory, the program calculates CL, the current line number (line 61920). If CL is less than 62000, then the address (L1) of the next line number is calculated in line 61940, and the program recycles to 61920. If the number is at least 62000, the address of the line number is saved in the L() array, and a test is made to determine if the end of the lines to be renumbered has been reached.

If not, the program returns to 61920 to test the next line number. If it is the final line, it then renumbers each line referenced in the L() array to 65535, and DELetes Applesoft Permanent Notice. If you expect to renumber more than ten lines, you will need to DIM L(), either as a direct command or by inserting a DIM statement in the program.

To use Applesoft Permanent Notice:

— Key in and SAVE Program 2
— RUN (this creates Applesoft Permanent Notice)
— NEW or LOAD a program
— Enter lines numbered 62000-63999 which you want to be made permanent
— EXEC Applesoft Permanent Notice
— RUN 61800

Integer (Lines 31000-31170 in Program 3)

Integer Permanent Notice operates in somewhat similar fashion, but the lines to be renumbered should be in the range 32000-32767 (remember: Integer BASIC doesn't like numbers greater than 32767). Lines 31070-31090 determine L1, the address of the line number to be tested. CL, the line number itself, is calculated in 31100 and tested in 31110. If CL is 32000 or greater (line 31120), then L1 is tested (line 31130) to see if the final line has been tested. If not, the address L1 is stored in the array ADD(L), L is incremented, and control shifts to line 31120. When all line numbers have been tested, the value 255 (line 31160) is POKEd into both bytes of each address stored in ADD(). ADD() is currently DIMensioned at 10; this may be changed to renumber more than ten lines to undeletable status.

To use Integer Permanent Notice:

— Key in and SAVE Program 3
— RUN
— NEW or LOAD a program file
— Enter lines to be made permanent. Number them between 32000 and 32767
— EXEC Integer Permanent Notice
— RUN 31000

Program 1: Deletable

```
0 D$ = CHR$ (4): PRINT D$"OPEN DELETABLE": PRINT D$"WRITE
   DELETABLE": LIST 1 - 8: PRINT D$"CLOSE DELETABLE": END
1 REM

      SAVE 'DELETABLE' BEFORE RUNNING!


2 HI = 246:LO = 24: REM  VALUE IS 63000
3 L1 = PEEK (103) + 256 * PEEK (104):L = 0
4 CL = PEEK (L1 + 2) + 256 * PEEK (L1 + 3): IF CL < 64000
   THEN 6
5 POKE L1 + 2,LO: POKE L1 + 3,HI:LO = LO + 1: IF LO > 255
   THEN LO = 0:HI = HI + 1
6 L1 = PEEK (L1) + 256 * PEEK (L1 + 1): IF L1 = 0 THEN 8
7 IF 256 * HI + LO < 64000 THEN 4
8 DEL 1,8
```

Program 2: Applesoft Undeletable

```
1 D$ = CHR$ (4):F$ = "APPLESOFT PERMANENT NOTICE": PRINT
   D$"OPEN"F$: PRINT D$"WRITE"F$: LIST 61800,61970: PRINT
   D$"CLOSE": END
61800 REM ----------
61810 REM  'PERMANENT NOTICE'
61820 REM    BY KEN MORSE
61870 REM ----------
61875 TEXT : HOME : PRINT "'REM' LINES FOR PERMANENT
   NOTICES SHOULDBE NUMBERED 62000 OR HIGHER, AND SHOULD
   BE THE HIGHEST NUMBERED LINES IN THE  PROGRAM"
61880 PRINT : INPUT "MAKE PROGRAM LINES PERMANENT
   BEGINNING AT 62000 THROUGH ";LL
61890 IF LL < 62000 THEN 61880
61900 FL = 62000
61910 L1 = PEEK (103) + 256 * PEEK (104):L = 0
61920 CL = PEEK (L1 + 2) + 256 * PEEK (L1 + 3): IF CL =
   > FL THEN 61950
61940 L1 = PEEK (L1) + 256 * PEEK (L1 + 1): GOTO 61920
61950 L(L) = L1 + 2:L1 = PEEK (L1) + 256 * PEEK (L1 +
   1):CL = PEEK (L1 + 2) + 256 * PEEK (L1 + 3): IF L1 >
   0 THEN L = L + 1: GOTO 61950
61960 FOR J = L TO 0 STEP - 1: POKE L(J),255: POKE L(J) +
   1,255: NEXT J
61970 DEL 61800,61970: END
```

Program 3: Integer BASIC Undeletable

```
1 D$ = "": REM   CTRL-D
2 PRINT D$;"OPEN INTEGER PERMANENT NOTICE": PRINT
   D$;"WRITE INTEGER PERMANENT NOTICE": LIST 31000,31170:
   PRINT D$;"CLOSE"
31000 REM   ----------
31010 REM    'PERMANENT NOTICE'
31020 REM    FOR INTEGER BASIC
31030 REM      BY KEN MORSE
31040 REM   ----------
31050 DIM ADD(10)
31060 FL = 31999:L = 0
31070 L1 = PEEK (202):L2 = PEEK (203)
31080 IF L2 > 127 THEN L2 = L2 - 256
31090 L1 = L1 + 256 * L2
31100 CL = ( PEEK (L1 + 1)) + 256 * ( PEEK (L1 + 2))
31110 IF CL > FL THEN 31130
31120 L1 = L1 + PEEK (L1): IF CL < = FL THEN 31100
31130 IF L1 > PEEK (76) + 256 * ( PEEK (77) - 256) THEN
   31160
31140 ADD(L) = L1
31150 L = L + 1: GOTO 31120
31160 FOR J = L TO 0 STEP - 1: POKE ADD(J) + 1,255: POKE
   ADD(J) + 2,255: NEXT J
31170 END
```

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Atari Moving Message Utility

Michael A. Ivins
Cheyenne, WY

"Ticker Tape Atari Messages," **COMPUTE!**, February 1981, struck me as being an excellent way for dealers and others to present promotional and other kinds of messages. However, the message I tried to type in was one of several hundred characters and occupied many lines of text on the screen.

When I tried to run the message, I found that nothing was being displayed beyond the third screen line of my original text. This coincides with the limit placed on a logical line of program code.

I then set out to expand the program. The program which accompanies this article is the result. It is a menu-driven program with four options. The first option is the entering of a long message in shorter segments (I call them "phrases") and concatenating these into the main message string. The load and save routines allow choice of disk or tape and include error traps in case you forgot to turn on your tape recorder. These two options eliminate the need to type a new message every time the program is run. For an explanation of the actual message movement, I refer you to the original article.

In the preparation of this program, I ran into something which I have not seen documented anywhere. When you want to change the DIM of a variable, you will encounter an ERROR 9 unless you use the CLR command, as I did in lines 100 and 200. The *BASIC Reference* states, "This command clears the memory of all previously dimensioned strings, arrays, and matrices so the memory and variable names can be used for other purposes. It also clears the values stored in undimensioned variables."

It also does something not mentioned in the manual. When I first attempted to use the command, I wanted to put it in a subroutine. However, every time I did this I was presented with an "ERROR 16", which means a RETURN was encountered without a matching GOSUB. It is now apparent to me that the CLR command not only clears variables, but also clears the "stack" similar to the way the "POP" command does. This means that a CLR command must never be used as part of a subroutine or in a FOR-NEXT loop.

Some Few Hints

The way the program is written, you can enter a message of up to 2000 characters. This is a pretty long message, but if you should like an even longer one it is only necessary to change the DIM statements in the enter and load routines. If you would like your message to be more colorful, mix upper- and lowercase letters and inverse. They will still be displayed as uppercase letters, but in as many as four different colors (a similar trick gives us the colored stars in the message border).

A control comma (graphics heart) will show as a blank space, and it is sometimes wise to add it at the end of a phrase to insure separation from the start of the next one. Finally, although this program will accept phrases up to three lines long, I advise entering shorter phrases to avoid any chance of losing something.

Ticker Tape Update

```
1 REM MOVING MESSAGE UTILITY
10 OPEN #1,4,0,"K:":GOTO 20
15 ? CHR$(125);"YOU MUST ENTER OR LOA
   D A MESSAGE FIRST":GOTO 25
20 ? CHR$(125)
25 ? "■MOVING MESSAGE UTILITY■"
30 ? :? "■ENTER NEW MESSAGE":? :? "■LOA
   D AN OLD MESSAGE":? :? "■AVE CURRE
   NT MESSAGE":? :? "■UN CURRENT MESS
   AGE"
35 GET #1,A:IF A<>69 AND A<>76 AND A<
```

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COMPUTE MAGAZINE GAME REVIEW. . . (Sept. 1982) says. . .

"Space Ace. . . requires the reaction instincts of a pro-hockey goalie. It's suitable for all but very young children and is aimed at the video game addicts among us. . . fans of arcade-style games should find Space Ace both well executed and challenging."

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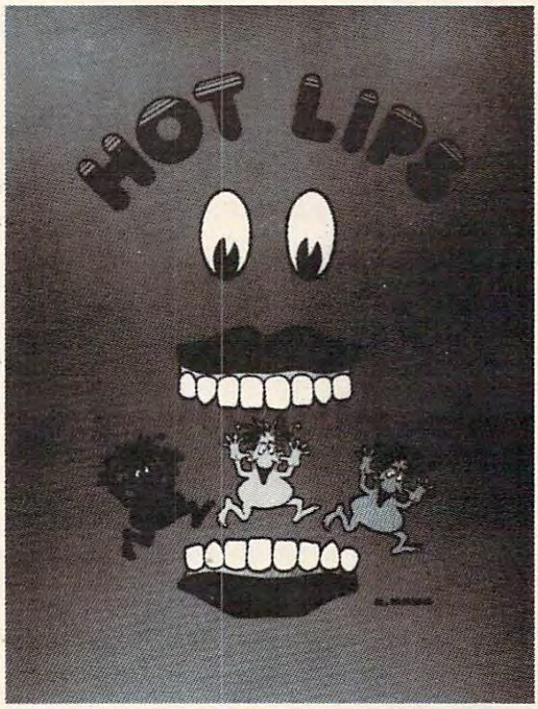

CHOMP! CHOMP! CHOMP! Sounds and sights of giant gnashing teeth, marching critters and musical notes of delight greet you from the screen as you are tracked by an army of hungry little critters. To escape and score you must entice these critters into the crunching jaws of HOT LIPS. This megamouth eats anything, (including you!) and you must be quick to avoid its teeth. Various pitfalls and bonus scoring opportunities visually surprise and excite you as you become immersed in the strategy of this action-packed game. The "critters" are outstanding graphically and provide a challenge for every game player. Full hi-res graphics and exceptionally smooth continuous action make this a truly fun game.

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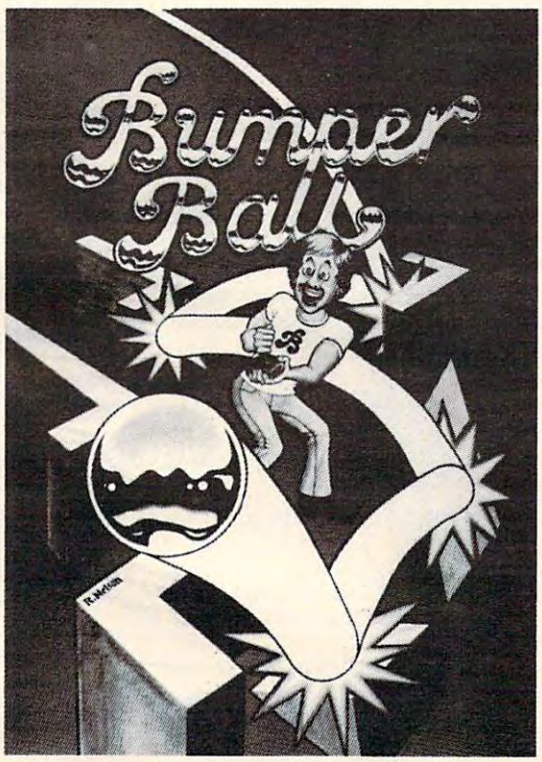

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```
   >82 AND A<>83 THEN 35
40 IF A=69 THEN 100
41 IF A=76 THEN 200
42 IF A=83 THEN 300
43 GOTO 400
100 CLR :DIM X$(2000),B$(1),W$(20),P$
    (20),Y$(20),Z$(20),M$(115),Q$(15)
101 W$="* ■ {J} {■ J} * ■ {J} {■ J} * ■ "
    :Y$=W$
102 ? CHR$(125);"ENTER YOUR MESSAGE O
    NE SENTENCE OR":? "PHRASE AT A TI
    ME, HITTING RETURN"
103 ? "AFTER EACH ONE.":? "NO INDIVID
    UAL SENTENCE OR PHRASE"
105 ? "MAY BE LONGER THAN 110 CHARACT
    ERS.":? "WHEN THE LAST PHRASE IS
    ENTERED, HIT"
108 ? "RETURN AGAIN FOR THE MENU"
110 INPUT M$:IF M$="" THEN 125
115 X$(LEN(X$)+1)=M$:IF LEN(X$)<1900
    THEN 110
125 IF LEN(X$)<20 THEN FOR C=1 TO 20-
    LEN(X$):X$(LEN(X$)+1)=B$:NEXT C:X
    $(LEN(X$)+1)=B$
130 DIM A$(LEN(X$)),C$(LEN(X$)):A$=X$
135 GOTO 20
200 CLR :DIM X$(2000),B$(1),W$(20),P$
    (20),Y$(20),Z$(20),M$(115),Q$(15)
201 ? "{CLEAR}LOAD FROM CASSETTE OR D
    ISK";:INPUT Q$
202 W$="* ■ {J} {■ J} * ■ {J} {■ J} * ■ "
205 IF Q$(1,1)<>"C" AND Q$(1,1)<>"D"
    THEN 200
210 IF Q$(1,1)="D" THEN 220
215 Q$(2)=":":? "INSERT CASSETTE WITH
     MESSAGE INTO":? "TAPE RECORDER.
    PRESS RETURN WHEN READY":GOTO 230
220 ? "ENTER FULL FILENAME":? "EXAMPL
    E-'D:PROMO1.MSG'"
225 INPUT Q$
228 TRAP 280
230 OPEN #3,4,0,Q$
231 X=1
235 INPUT #3,X:FOR I=1 TO X:GET #3,A:
    X$(I,I)=CHR$(A):NEXT I
240 X$(X,X)=CHR$(A)
245 CLOSE #3
250 ? "LOAD COMPLETE":? "PRESS ANY KE
    Y FOR MENU."
260 GET #1,A
265 DIM A$(LEN(X$)),C$(LEN(X$)):A$=X$
270 GOTO 25
280 ? "DEVICE DOES NOT RESPOND.":? "C
    HECK TO SEE THAT IT IS CONNECTED"
285 ? "TO THE COMPUTER AND IS TURNED
    ON.":? "NOW ENTER THE DEVICE CODE
     AND FILE-"
290 ? "NAME (IF ANY) TO TRY AGAIN.":I
    NPUT Q$:CLOSE #3:GOTO 230
300 TRAP 15:IF X$="" THEN 15
305 ? CHR$(125);"SAVE TO CASSETTE OR
    DISK";:INPUT Q$
310 IF Q$(1,1)<>"C" AND Q$(1,1)<>"D"
    THEN 305
315 IF Q$(1,1)="D" THEN 325
320 Q$(2)=":":? "INSERT CASSETTE INTO
     TAPE RECORDER.":? "PRESS RETURN
    WHEN READY.":GOTO 335
325 ? "ENTER FULL FILENAME":? "EXAMPL
    E- 'D:PROMO1.MSG'"
330 INPUT Q$
332 TRAP 380
335 OPEN #3,8,0,Q$
340 ? #3;LEN(X$)
350 FOR I=1 TO LEN(X$)
355 PUT #3,ASC(X$(I,I))
360 NEXT I
365 CLOSE #3:? "SAVE COMPLETE.":? "PR
    ESS ANY KEY FOR MENU"
370 GET #1,A
375 GOTO 20
380 ? "DEVICE DOES NOT RESPOND.":? "C
    HECK TO SEE THAT IT IS CONNECTED"
385 ? "TO THE COMPUTER AND IS TURNED
    ON.":? "NOW ENTER THE DEVICE CODE
     AND FILE-"
390 ? "NAME (IF ANY) TO TRY AGAIN.":I
    NPUT Q$:CLOSE #3:GOTO 335
400 TRAP 15:IF X$="" THEN 15
401 GRAPHICS 18:Y$=W$
405 POSITION 1,3:? #6;W$(1,19):P$=W$(
    2):P$(LEN(P$)+1)=W$:W$=P$
410 POSITION 1,7:? #6;Y$(1,19):Z$=Y$(
    2):Z$(LEN(Z$)+1)=Y$:Y$=Z$
415 POSITION 1,5:? #6;A$(1,19):C$=A$(
    2):C$(LEN(C$)+1)=A$:A$=C$:K=PEEK(
    764)
420 FOR TI=1 TO 40:POKE 77,0:SETCOLOR
     INT(RND(0)*4),INT(RND(0)*15),8:I
    F K=255 THEN 405
425 GOTO 20
```

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Restore (N) In Applesoft

Michael Erperstorfer
Vienna, Austria

The usual RESTORE statement in Applesoft simply resets the data list pointer to the first occurrence of a DATA statement in an Applesoft program, though in some applications it would be necessary to READ from a distinct DATA line. With a small machine language program, it is rather easy to build a RESTORE with a parameter.

This is done with the ampersand (&) command. This symbol, when executed as an instruction, causes an unconditional jump to memory location $03F5. At location $03F5 there must be a JMP instruction to your machine language program, which is then terminated with an RTS instruction to pass control back to Applesoft.

The syntax of RESTORE(N) with the ampersand is &N where N is an integer in the range 0-65535. If there is no line number N, the data list pointer will be set to the next DATA line in the program. If there are no more DATA lines, an OUT OF DATA error message will be displayed. Before the first use, the machine language must be linked with CALL 768.

```
0000-                          ;RESTORE(N)...&N
0000-                          ;
0300-  A9 0B      LDA   #$0B   ;LOAD LB OF &-JMP.
0302-  8D F6 03   STA   $03F6
0305-  A9 03      LDA   #$03   ;LOAD HB.
0307-  8D F7 03   STA   $03F7
030A-  60         RTS          ;END OF INITIALIZATION.
030B-  20 67 DD   JSR   $DD67  ;EVALUATES NUMBER AND
                               ;STORES IT IN FP-AAC #1.
030E-  20 52 E7   JSR   $E752  ;CONVERTS FP-ACC #1 INTO
                               ;2BYTE INT ($50,$51)
0311-  20 1A D6   JSR   $D61A  ;SEARCHES FOR LINE#
                               ;(IN $50,$51).
0314-  38         SEC          ;$9B,$9C POINT TO LINK
                               ;FIELD OF DESIRED LINE.
0315-  A5 9B      LDA   #$9B   ;LOAD DATA LIST POINTER
                               ;($7D,$7E)
0317-  E9 01      SBC   #$01   ;CONTENTS OF $9B,$9C-1.
0319-  85 7D      STA   $7D
031B-  A5 9C      LDA   $9C
031D-  E9 00      SBC   #$00
031F-  85 7E      STA   $7E
0321-  60         RTS          ;RETURN TO BASIC.
```

BASIC loader for machine language program:

```
10 FOR I = 768 TO 801: READ V: POKE I,V: NEXT

15 CALL 768
20 DATA 169,11,141,246,3,169,3,141,247,3,96,3
    2,103,221,32,82,231,32,26
30 DATA 214,56,165,155,233,1,133,125,165,156,
    233,0,133,126,96
```

The ML routine can now be saved either on disk with BSAVE RESTORE(N),A$300,L$22 or on tape with 300.321W.

A simple example for the use of &N:

```
10 PRINT CHR$(4)"BRUN RESTORE(N)"
20 INPUT "LINENUMBER: ";LN
30 & LN
40 READ L
50 PRINT "HERE IS LINE #"L
60 GOTO 20
100 DATA 100
110 DATA 110
120 DATA 120
130 DATA 130
140 DATA 140
150 DATA 150
```

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A PET program that allows you to easily move machine language programs from one area of memory to another. You can relocate any section or all, translate internal references, or move it verbatim. It handles JSRs, JMPs, and references to tables.

CODEMOVER

Everett Lumpkin
Modoc, IN

Have you ever created a great machine code utility only to realize that the area of memory in which it resides is needed by another program? Maybe you have wanted to make a copy of Supermon (a high memory monitor utility) for a friend's 8K machine. "Codemover" will move machine code to a new location rapidly and accurately.

Machine language consists of codes that the 6502 executes. The code may process or transfer data, test and branch, and control input and output. All of these instructions use different addressing techniques, and the principal concern of our code-moving program is to translate the proper address along with some jump and other instructions. The instructions can be broken into three groups.

The first group requires the most attention. These are the three-byte codes using absolute, absolute indexed, and absolute indirect addressing. Some examples would be LDA $40FC, JMP $4095, EOR $033A,Y, JMP($033A). Each of the instructions in this group is followed by two bytes containing the address in the normal low, high format. If these two bytes point to an address within the machine language program itself, they will need to be changed to reflect the new location of the program. If they point to an address outside the target program (i.e., a routine in ROM), a new address need not be computed.

The second group contains instructions which require two bytes. Some examples are LDA $FF, CMP #$FF, STA($40,X), ROL $28,X, and BEQ $0352. The branch instructions are *relative*, a *displacement* from their address. As a result, they will point to the correct offset address after they are moved. Branches can simply be moved without any worry.

The last group consists of instructions only one-byte long. They are also just moved with no adjustments necessary because they do not point to an address. Some examples are CLD, PHA, ROL, and ASL.

The Program

The program is relatively self-explanatory, although a few comments may be helpful. It is written in PET BASIC and should be easy to transfer to other machines; it requires about 4K. The lines that do the actual moving are 1325 to 1560. Two subroutines at 100 and 200 convert from hex to decimal and vice versa. At line 300 are stored the opcodes, which are three and two bytes long.

At line 1410 Codemover PEEKs the current memory location and compares it with the three-byte opcodes stored in C3%() array. If a match is found, the program then computes the address from the following two bytes to see if it is within the boundaries of the original machine code. If it is, a new address is computed, using the displacement, and POKEd into the new code. Otherwise, no displacement is calculated.

If the code is not a three-byte opcode, it is then checked against the array of two-byte opcodes. If a match is found, the program then moves two bytes of code. Otherwise, the computer moves only one byte before PEEKing the next machine code instruction.

The program has another mode of moving machine code besides translation of the JMP addresses. You may want to move a lookup table verbatim so that the copy is exactly like the original. Failure to do this may cause the table to be changed slightly.

Now the next time that a machine utility is in an unfortunate or busy location, simply move it, letting the computer do all the work. After all, isn't that what these machines are for?

```
30 DI$="0123456789ABCDEF"
40 DIM C3%(47),C2%(73)
50 REM*********VARIBLES**************
52 REM
54 REM  BO    --BEGIN OF ORIGINAL CODE
56 REM  LO    --LAST OF ORIGINAL CODE
58 REM  BC    --BEGIN OF COPY CODE
60 REM  LC    --LAST OF COPY CODE
62 REM  D     --DISPLACEMENT OF CODE
64 REM  I1    --BEGIN OF SECTION
66 REM  I2    --END OF SECTION
68 REM  C3%(47)  --3 BYTE OPCODES
70 REM  C2%(73)  --2 BYTE OPCODES
72 REM  ADD      --FORMER ADDRESS
74 REM  NADD     --COMPUTED ADDRESS
76 REM
78 REM*******************************
99 GOTO 900
100 REM SUB TO TRANSLATE DECIMAL TO HEX:ENTER ~
```

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Command-O or Command-O-Pro?

It's called the Command-O-Pro in Europe, Command-O in the U.S.

But whatever you call it, this 4K byte ROM will provide your CBM BASIC 4.0 (4016, 4032) and 8032 computers with 20 additional commands including 10 Toolkit program editing and debugging commands and 10 additional commands for screening, formatting and disk file manipulating. *(And our technical writer dug up 39 additional commands in the course of doing a 76-page manual!)*

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NOTE: For a full range of word processing products see page 9.

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```
    AS A$--RETURN A$ AS DECIMAL
120 A=VAL(A$):A$=""
130 FORI=3TO1STEP-1:B=INT(A/(16^I))
140 A$=A$+MID$(DI$,B+1,1):A=A-B*16^I
150 NEXTI
160 A$=A$+MID$(DI$,A+1,1)
170 RETURN
200 REM SUB TO TRANSLATE HEX TO DECIMAL:ENTER ~
    AS A$--RETURN A$ AS DECIMAL
205 A=0
210 FORI=LEN(A$)TO1STEP-1:FORJ=1TO16
220 IFMID$(A$,I,1)=MID$(DI$,J,1)THENA=A+(J-1)*
    16^(LEN(A$)-I)
230 NEXTJ,I
240 A$=STR$(A):RETURN
300 REM 3 BYTE OPCODES
310 DATA76,32,173,174,172,109,45,14,44,205,236
    ,204,206,77,238,78
320 DATA 13,46,110,237,141,142,140,125,61,30,2
    21,222,93,254,189
330 DATA 188,94,29,62,126,253,157,121,57,217,8
    9,185,190,25,249,153,108
340 REM 2 BYTE OPCODES
350 DATA 101,37,6,36,197,228,196,198,69,230,16
    5,166,164,70,5
360 DATA 38,102,229,133,134,132,105,41,201,224
    ,192,73,169,162,160
370 DATA 9,233,97,33,193,65,161,1,225,129,113,
    49,209,81,177
380 DATA 17,241,145,117,53,22,213,214,85,246,1
    81,180,86,21,54
390 DATA118,245,149,148,144,176,240,48,208,16,
    80,112,182,150
400 REM SUB TO READ OPCODES
420 FORI=0TO47:READC3%(I):NEXT
430 FORI=0TO73:READC2%(I):NEXT
440 RETURN
899 REM ********MAIN PROGRAM*********
900 A$="CODEMOVER"
910 PRINT"{CLEAR}{02 DOWN}"TAB(30)A$
920 FORI=1TO9
930 PRINT"{HOME}{02 DOWN}"LEFT$(A$,I)TAB(30);:
    FORJ=0TOI:PRINT" ";:NEXT:PRINTRIGHT$(
    A$,9-I);
940 FORJ=1TO350:NEXT
950 NEXT
960 PRINT"{DOWN}BY{DOWN}EVERETT LUMPKIN"
1000 PRINT"{HOME}{07 DOWN}THIS PROGRAM WILL MOV
    E A SECTION OF "
1010 PRINT"MACHINE CODE TO A NEW LOCATION TRANS
    LAT-"
1020 PRINT"{UP}ING ALL THE JMP'S AND OTHER ADDR
    ESSES."
1030 PRINT"BECAUSE SOME PARTS OF THE PROGRAM WI
    LL"
1040 PRINT"NEED TO BE MOVED VERBATIM (TABLES EC
    T.),"
1050 PRINT"{UP}THIS PROGRAM WILL PROCESS THE CO
    DE A"
1060 PRINT"SECTION AT A TIME.{DOWN}":GOSUB400
1070 PRINT"ENTER THE BOUNDRIES OF ENTIRE PROGRA
    M.  FOLLOW EXAMPLE FORMAT."
1075 PRINT"  B000-B7FF{UP}":INPUTA$
1077 B$=RIGHT$(A$,4):A$=LEFT$(A$,4)
1080 GOSUB200:BO=VAL(A$):A$=B$:GOSUB200:LO=VAL(
    A$)
1090 PRINT"{DOWN}YOUR PROGRAM IS AT ";BO;"DECIM
    AL TO"
1100 PRINT LO;"DECIMAL AND IS ";LO-BO;"BYTES LO
    NG."
1110 PRINT"{DOWN}ENTER THE BOUNDARIES WHERE YOU
     WOULD LIKE{UP}"
1120 PRINT"{UP}THE PROGRAM TO BE COPIED.  TYPE ~
    ????"
1130 PRINT"IF YOU WANT THE COMPUTER TO COMPUTE ~
    AN"
1140 PRINT"ADDRESS.":PRINT"  B000-B7FF{UP}"
1145 INPUTA$:B$=RIGHT$(A$,4):A$=LEFT$(A$,4)
1150 IFLEFT$(A$,1)="?"THEN1170
1160 GOSUB200:BC=VAL(A$)
1170 IFLEFT$(B$,1)="?"THENLC=BC+(LO-BO):GOTO119
    0
1180 A$=B$:GOSUB200:LC=VAL(A$):BC=LC-(LO-BO)
1190 PRINT"{DOWN}YOUR NEW PROGAM WILL BE"
1200 PRINTBC"-"LC"IN DECIMAL
1210 A$=STR$(BC):GOSUB100:PRINTA$"-";
1220 A$=STR$(LC):GOSUB100:PRINTA$" IN HEX"
1225 I1=BO:I2=LO:D=BO-BC
1230 PRINT"{DOWN}ENTER THE {REV}SECTION{OFF} OF
     CODE TO BE MOVED."
1240 A$=STR$(I1):GOSUB100
1250 PRINT"  "A$"-";:A$=STR$(I2):GOSUB100
1260 PRINTA$"{UP}":INPUTB$
1270 A$=LEFT$(B$,4):GOSUB200:I1=VAL(A$)
1280 A$=RIGHT$(B$,4):GOSUB200:I2=VAL(A$)
1290 PRINT"{DOWN}IS IT TO BE {REV}T{OFF}RANSLAT
    ED OR MOVED {REV}V{OFF}ERBATIM"
1300 GETA$:IFA$=""THEN1300
1310 IFA$="T"THEN1400
1320 IFA$<>"V"THEN1290
1325 REM MOVE VERBATIM
1330 FORI1=I1TOI2:A%=PEEK(I1):B=I1-D:PRINTB,A%"
    {UP}":POKEB,A%:NEXT
1340 IFI1>=LOTHEN1600
1350 I1=I2+1:I2=LO:GOTO1230
1400 REM TRANSLATE ADDRESS'S AND MOVE
1405 I1=I1-1
1410 I1=I1+1:A%=PEEK(I1):PRINTI1,A%"{UP}":IFI1>
    I2THEN1340
1420 REM IS IT 3 BYTE OPCODE?
1430 FORJ=0TO37:IFC3%(J)<>A%THENNEXTJ:GOTO1510:
    REM NOT 3BYTE
1435 REM 3 BYTE OPCODE
1440 POKEI1-D,A%
1450 ADD=PEEK(I1+2)*256+PEEK(I1+1)
1460 IF(ADD>LO)OR(ADD<BO)THEN I1=I1+1:A%=PEEK(I
    1):GOTO1540
1470 NADD=ADD-D
1480 POKE(I1+2-D),INT(NADD/256)
1490 POKE(I1+1-D),NADD-INT(NADD/256)*256
1500 I1=I1+2:GOTO1410
1510 REM IS IT A 2 BYTE OPCODE?
1520 FORJ=0TO73:IFC2%(J)<>A%THENNEXTJ:POKEI1-D,
    A%:GOTO1410:SINGLE BYTE OPCODE
1530 REM 2 BYTE OPCODE
1540 POKEI1-D,A%:I1=I1+1
1550 A%=PEEK(I1):POKEI1-D,A%
1560 GOTO1410
1600 PRINT"{CLEAR}YOUR PROGRAM HAS NOW BEEN MOV
    ED"
1610 PRINT"{02 DOWN}OLD LOCATION        NEW LOC
    ATION"
1620 PRINT"$";:A$=STR$(BO):GOSUB100:PRINTA$"-$"
    ;
1630 A$=STR$(LO):GOSUB100:PRINTA$;TAB(20);
1640 A$=STR$(BC):GOSUB100:PRINT"$"A$"-$";
1650 A$=STR$(LC):GOSUB100:PRINTA$
1660 PRINTBO"-"LO;TAB(20);BC"-"LC
1670 PRINT"{03 DOWN}ALTHOUGH THIS PROGRAM HAS T
    RANSLATED"
1680 PRINT:PRINT"THE JMP'S, JSR'S AND OTHER ADD
    RESSES"
1690 PRINT:PRINT"THERE MAY BE OTHER PROBLEMS WI
    TH THE NEW"
1700 PRINT"LOCATION WHICH ARE HIDDEN.  IN OTHER
    "
1710 PRINT:PRINT"WORDS, SAVE THE NEW CODE BEFOR
    E TRYING"
1720 PRINT:PRINT"IT.--GOOD LUCK!"
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This month, I will follow through with at least one of my promises for some heavier assembly language stuff: the discussion and source for the fix to the 850 handler LOMEM problem. Unfortunately, I did not manage to complete the other promised project, the BASIC Cassette Verify program.

That program has proven more difficult to write than I had suspected it would, primarily because it's hard to get the debugger and BASIC to cooperate. With some luck I will have the problem fixed very shortly.

In any case, I've also got a few little tidbits to share with you, so let's tackle them first.

Atari-CP/M Revisited

First, I would like to clear up a misunderstanding (on my part) about the Vincent Cate (USS Enterprises) Atari-to-CP/M connection, mentioned a couple of issues ago. I stated that one problem with the system was that you would not be able to use standard Atari diskettes. Not totally true. If you have (or have access to) an Atari compatible 810 drive, you *can* copy programs from the 810 to the CP/M host. (Vincent claims that the system is even capable of properly simulating self-booting disk games, etc., though I would imagine that some of the heftier protection schemes might defy his standard system.)

Anyway, the address for USS Enterprises is 6708 Landerwood Lane, San Jose, CA 95120. I hope this doesn't seem too much like an ad or endorsement: I have *not* used the system. I have, however, heard from people who have and who say it does what it claims to do.

In the same column, I mentioned a new product to be introduced soon which would function either as an Atari disk controller (810 emulator) and/or as a CP/M system in which the Atari console was a smart terminal. That project is apparently at the reality stage, so I guess in fairness I should now mention it by name.

The company producing the product is Software Publishers, Inc., of Arlington, Texas. (I know, I know. *Software* publishers?) The base price of the controller, I have been told, is about $500 without disk drive. The CP/M add-on will be (is?) about $250. Perhaps someone will soon give us a review of the viability of this concept.

Double No-Trouble

Speaking of viability: We have been using our Percom drives (one double density, one double sided and double density) for about three months now. We are more than satisfied with their reliability. And, of course, the new OS/A+ we produced for use on the larger drives allows considerable flexibility. Perhaps the Atari can be used as a business machine after all.

And to be sure that we don't slight anyone, I need to mention that our MPC double density system has been here about a month now also and seems to be working fine.

So far, all the things we've tried seem better for most purposes than the 810 drives, though all of them seem to have trouble with some heavily protected diskettes. Moral: buy the drive, forget the diskettes. (Side issue and pet peeve: If it's that heavily protected, it will have trouble even on a slightly out of speed Atari 810. So far, I have plunked down my scarce dollar only three times for copy-protected disks. I think I will try to be thriftier in the future.)

Percom DOS

By now it should be general knowledge that the "new and improved DOS" that Percom has been publicizing is none other than OS/A+. But it is a significant change from our "old" OS/A+, which is really just a CP/M-like keyboard interface hooked to the Atari DOS 2.0S File manager. Thanks to the efforts of Mark Rose, our youngest associate and a junior at Stanford University, we have managed to produce an all new, random access DOS designed to interface to any and all disk drives from 128 kilobytes to 16 megabytes. The "random access" description implies that you are not tied to the tyrany of NOTE any more (and POINT is now reasonable: you POINT to a byte position *within a file*, just like on the big guys' systems, and better than CP/M).

This may sound like an advertisement for OSS and Percom, but it really isn't. First of all, our profits aren't really tied to the sales of this new DOS, so it isn't really an ad for us. And second, it appears that OS/A+ will be used by all the other Atari-compatible drive manufacturers, so Percom is offering it first but not alone. Anyway, the real reason I brought this up (aside from wanting to pat Mark Rose on the back in public) is to pass on a few of the things that you should watch out for if you are thinking of moving to either more or larger

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LOMEM On The Tot-Mem Poll

I am sadly dismayed to see so many Atari-produced and Atari-compatible products being introduced nowadays which violate one of the prime rules for running on an Atari: *don't put anything lower in memory than LOMEM.*

After all, the operating system provides these nice, convenient locations LOMEM and HIMEM, which contain the addresses of the bottom and top of usable memory. Why not use them?

But no, let us assume that we will run under Atari DOS 2.0S, with two single density drives, with our blinders on (so that we cannot see the future). Phooey. How about a little table to show the values of LOMEM under various DOS configurations, with various numbers of drives and files available?

LOMEM With Various DOS's

Dos Used	Number Of Drives	Number Of Files	Contents Of LOMEM
Atari DOS 2.0S	2-S	3	$1C00
Atari DOS 2.0S	4-S	7	$1F00
Atari DOS 2.0S	2-D	3	$1E80
Atari DOS 2.0S	2-S, 2-D	5	$2180
Atari DOS 2.0S	4-D	7	$2380
OS/A + ver 2.0	2-S	3	$1F00
OS/A + ver 2.0	4-S	7	$2100
OS/A + ver 2.0	4-D	7	$2680
OS/A + ver 4.0	2-D	3	$2C00
OS/A + ver 4.0	4-DD	7	$3300

legend: -S means single density drives
-D means double density drives
-DD means double sided, double density

Surprised? It gets worse: if you load the RS-232 handler for the 850 Interface Module, you must add almost $700 to all the table figures! (And I left out K-DOS simply because I don't know the correct figures there, but I understand that they are all over $3000.)

"But," you say, "how come you show Atari DOS with double density drives?" Aha! You didn't know that Atari DOS will handle double density drives for most user programs? (The menu can get confused, especially for duplicating disks, but BASIC – for example – runs just fine.)

We agonized a long time over coming out with OS/A + version 4, the Percom (et al.) random access DOS, with its much higher LOMEM values. But then we realized that, given that you will use double density and larger disks, there is simply no way to stay completely compatible. So, if you're going to do it, do it right.

Incidentally, Percom's initial patches to Atari DOS 2.0S solved the problem in a different way: they moved the disk buffers to the top of memory and dropped HIMEM. Of course, then they ran into trouble with the programs that ignore HIMEM. Like BASIC A+? Wellllll, I guess we have to take our lumps, too. Sigh. But we're working on it, honest.

So this has gone on long enough. The moral: if you're writing assembly language programs, pay attention to the rules. If you're stuck with an interpreter or compiler that does it wrong, go yell at the company that palmed it off on you.

Mishandler

Since I am ranting on about LOMEM anyway, let's tackle the problem I presented last month: the Atari RS-232 handler for the 850 Interface Module does not handle the RESET key properly when the disk device (or other previously loaded handlers) is present.

The result is that LOMEM will be reset to what the disk handler thinks it is, rather than above the 850's driver. And, of course, this means that any program which uses LOMEM properly will zap the RS-232 (Rn:) drivers. Which might not be so bad except that the Rn: name will still be recognized by CIO. Which might be a real disaster.

Why did all this come about? Because Atari didn't follow their own advice. When you steal DOSINI from DOS, in order to link yourself into the RESET chain, the *first* thing you should do is call the old DOSINI. Instead, the 850 handler does all its initializing, resets LOMEM to above itself, and *then* calls the old DOSINI! (And, of course, poor old FMS doesn't know that R: exists, so it moves LOMEM to just above itself. And, admittedly, you *could* fix the problem by having DOS change LOMEM only if the change is upward. This is left as an exercise to the reader.)

So what do we do about this bug? If you are using BASIC (or BASIC A+), forget about it. BASIC maintains its own LOMEM pointer, which is initialized only at BASIC coldstart time (e.g., at power-up). In fact, many system programs either do similar things or have been purposely assembled in higher memory to avoid all possible drivers. (Except see that good old table. Maybe they aren't all high enough?)

However, if you need to fix this problem, chances are you need to fix it quickly and thoroughly. The machine language program below seems to do a reasonably good job of patching the mess. But, of course:

Caveats: (1) This program works as shown with *my* 850 Interface Module. I know for a fact that Atari has made more than one version of this beast, so I can *not* guarantee it will work on yours. (2) This program works by patching the AUTORUN.SYS (also known as AUTORUN.232 or

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RS232.OBJ or RS232.COM) file. If you are not using Atari DOS (or OS/A+, for RS232.OBJ or RS232.COM), then this will work only if you can load and execute this routine at the addresses shown in the listing.

So how does this program work? To understand it, we must first understand how the Rn: handler is loaded from the 850.

Here I Am

When the Atari computer is powered up, it finds out if a disk drive is attached by sending out a status request command (via SIO). If, indeed, disk drive number one is alive and well, then the disk boot proceeds. But if the 850 is alive and well, it is also sitting on the serial bus, looking at SIO sending status request command(s) to the disk. SIO will try 13 times to boot the disk before giving up. But here is where the 850 gets sneaky: if the disk doesn't answer after about ten of those tries, the 850 jumps on the bus and says "Here I am! I'm the disk drive! Boot me!"

And, of course, the computer indeed "boots" the disk – whether it actually is the drive's controller chip responding or whether it is an 850 in chip's clothing. And that's how those 1800 or so bytes of code get into the computer when all you have is an 850.

But how does that code get pseudo-booted when you *do* have a disk? Well, one way would have been to distribute the handler on the disk. But why waste all that good code sitting out in the 850, just waiting to be executed? So AUTORUN.SYS (in any of its aliases) is a very small routine that performs just the right operations to load the 850's serial handlers.

In building the program presented here, I have cheated. Quite frankly, I have not investigated why and how the code used in AUTORUN.SYS works. And quite franker, I don't care. What I have done is simply build my program around that code. And here's what my program does.

First, I get the current contents of DOSINI (presumably the address of the FMS initialization routine) and save them for later use. Then I fall through and let the 850's code be loaded and initialized. If this process is successful, I then find the new contents of DOSINI (the Rn: driver's initialization routine address) and save them also. And where do I save the two initialization addresses? In the middle of the patch to be applied to the 850 driver.

Then all I need do is move the patch into the middle of the driver and relink DOSINI to point to the patch. Now, the cute part of all this is: where do we put the patch? Why, right on top of the erroneous call to the FMS initialization. (The one that occurs *after* the 850 init, remember?)

Ummm, but I'm patching a JSR to the FMS init followed by a JMP to the 850 init. How does all that fit into the space of one (previous) JSR? And what about the code immediately preceding the patch? Here it comes, the kludge. The code we are replacing includes a check of the warmstart location, since the handler does not bother to call the FMS initialization if it doesn't need to. Well, with our code patch, the FMS always gets called to init itself. But so what? It doesn't hurt anything, just slows the loading of this 850 interface code an unnoticeable amount.

Anyway, if you can follow the code, you will note where the patch is being applied. The byte immediately before the patch location *must* be a CLC instruction. (Check it out by loading the RS-232 handlers and then using a debugger to list the code.) If it is not, then your 850 differs too much from mine to use this routine as is. (And if you figure out where to patch it, why not tell all of us.)

Last but not least, notice that the patch is intrinsically relocatable, just as is the 850 handler. It should work in virtually any memory and/or disk drive and/or DOS configuration.

Whew! That was lengthy and heavy, right? Well, cheer up, there's more to come next month. Like how to add a default drive specifier to Atari DOS and OS/A+. If you have two drives, wouldn't it be convenient to be able to specify that "D:..." meant "D2:..." once in a while? Watch this space.

Atari 850 Fixer Upper
or: when in doubt, punt.

```
0000          1010        .PAGE  "  or:  when in doubt, punt."
              1020 ;
              1030 ; Some equates
              1040 ;
0043          1050 FIXOFFSET = $43        ; read the text
000C          1060 DOSINI =    $0C        ; the cause of all this
              1070 ;
              1080 ;
              1090 ; This first code is simply to save the original
              1100 ;   contents of DOSINI for later use, like the
              1110 ;   850 code should have done in the first
              1120 ;   place.  Sigh.
              1130 ;
0000          1140        *=   $3800-10
              1150 NEWLOADER
37F6 A50C     1160        LDA  DOSINI     ; presumably, we are saving
37F8 8D7738   1170        STA  PATCH2+1   ; the FMS init vector for
37FB A50D     1180        LDA  DOSINI+1   ; later use, but the beauty of
37FD 8D7838   1190        STA  PATCH2+2   ; this: it works w/o FMS also
              1200 ;
              1210 ;
              1220 ; Now we begin the original Atari loader code.
              1230 ;
              1240 ; If your code doesn't agree with this, it
              1250 ;   is possible that your 850's internal
              1260 ;   is different also.  If so, apply the
              1270 ;   patches with caution.  Read the text.
              1280 ;
              1290 ; CAUTION: this code is uncommented, simply
              1300 ;   because I'm not sure exactly what it
              1310 ;   is doing.  But who cares...it works.
              1320 ;
3800          1330        *=   $3800     ; where the Atari code was found
              1340 LOADER
3800 A950     1350        LDA   #$50
3802 8D0003   1360        STA   $0300
3805 A901     1370        LDA   #$01
3807 8D0103   1380        STA   $0301
```

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```
380A A93F  1390        LDA   #$3F
380C 8D0203 1400       STA   $0302
380F A940  1410        LDA   #$40
3811 8D0303 1420       STA.  $0303
3814 A905  1430        LDA   #$05
3816 8D0603 1440       STA   $0306
3819 8D0503 1450       STA   $0305
381C A900  1460        LDA   #$00
381E 8D0403 1470       STA   $0304
3821 8D0903 1480       STA   $0309
3824 8D0A03 1490       STA   $030A
3827 8D0B03 1500       STA   $030B
382A A90C  1510        LDA   #$0C
382C 8D0803 1520       STA   $0308
382F 2059E4 1530       JSR   $E459
3832 1001  1540        BPL   $3835
3834 60    1550        RTS
3835 A20B  1560        LDX   #$0B
3837 BD0005 1570       LDA   $0500,X
383A 9D0003 1580       STA   $0300,X
383D CA    1590        DEX
383E 10F7  1600        BPL   $3837
3840 2059E4 1610       JSR   $E459
3843 3006  1620        BMI   $384B
3845 200605 1630       JSR   $0506
3848 4C4C38 1640       JMP   FIXIT     ; this WAS a 'JMP (DOSINI)'
384B 60    1650        RTS
           1660 ;
           1670 ; Now the 850 has loaded its code into memory...
           1680 ;   so we can patch its boo-boos
           1690 ;
           1700 ;
           1710 ;
           1720 FIXIT
384C A50C  1730        LDA   DOSINI    ; The 850 code has patched
384E 8D7A38 1740       STA   PATCH3+1  ; its init entry point into
3851 A50D  1750        LDA   DOSINI+1  ; 'DOSINI' ... we will jump
3853 8D7B38 1760       STA   PATCH3+2  ; to it at the end of our patch
           1770 ;
3856 A043  1780        LDY   #FIXOFFSET ; for my 850!  read the text
3858 A200  1790        LDX   #0        ; loop index
           1800 ;
           1810 ; We move our patch code into the 850's code
           1820 ;
           1830 PATCHLP
385A BD7538 1840       LDA   PATCH1,X  ; a byte of patch...
385D 910C  1850        STA   (DOSINI),Y ; into the 850 code
385F C8    1860        INY             ; next patchloc
3860 E8    1870        INX             ; next byte of patch
3861 E008  1880        CPX   #8        ; unless done
3863 D0F5  1890        BNE   PATCHLP
           1900 ;
3865 A944  1910        LDA   #FIXOFFSET+1 ; again, caution...read text
3867 18    1920        CLC
3868 650C  1930        ADC   DOSINI    ; we move DOSINI to point
386A 850C  1940        STA   DOSINI    ; to our patch...which in
386C A50D  1950        LDA   DOSINI+1  ; turn will jump back to
386E 6900  1960        ADC   #0        ; the 850's init code.
3870 850D  1970        STA   DOSINI+1
           1980 ;
3872 6C0C00 1990       JMP   (DOSINI)  ; and this actually goes to our
                                         patch!
           2000 ;
           2010 ;
           2020 ; This patch area has two addresses placed
           2030 ;   in it and then it is moved en masse
           2040 ;   into the 850 code, as a patch thereto
           2050 ;
           2060 PATCH1
3875 60    2070        RTS             ; gets rid of some unneeded code
           2080 PATCH2
3876 200000 2090       JSR   0         ; becomes JSR FMSINIT, or some
                                         such
           2100 PATCH3
3879 4C0000 2110       JMP   0         ; to original reset point
387C 00    2120        BRK
           2130 ;
           2140 ; This is just to make it a LOAD AND GO file
           2150 ;
           2160 ; You might wish to use $2E2 instead if you
           2170 ;   understand the implications thereof
           2180 ;
387D       2190        *=    $2E0
02E0 F637  2200        .WORD NEWLOADER
02E2       2210        .END
```

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Here's what a father and his eleven-year-old son came up with when they first brought their VIC home.

Checkbook

Harvey B. Herman
Associate Editor

Harvey Gets A Computer

For many months I had been hearing about a wonderful new personal computer which Commodore markets. After using it for several days, I came to believe that the hyperbole put out about it was justified and Commodore has a best seller, possibly the first gold microcomputer. It surely will rival their earlier PET model (er, sorry, CBM), but it is intended for a different clientele (everybody).

If it is true that millions of consumers are buying VIC and other machines, it follows that not all of them can be experienced computer hobbyists. It would be a shame if someone brought one home, without a plug-in cartridge or other program (software), and did not know what to do with it, even after reading the manual. This article is intended to illustrate one application for a personal computer. The program, checkbook balancer (called Checkbook), can be used to demonstrate to friends, neighbors, and spouses the hidden potential in our e.t. (expensive toys). We don't want them to ever get the idea that its only use is for playing games. Later you can show off a fun program if you have one. VIC and a color TV play some great games. However, in a demo, applications programs first is the rule.

The Kids Take Over

My kids kicked me off the VIC shortly after I brought it home and set it up (super easy to do, set up – not kick me off, as I scream and carry on a lot). The eleven year old, Mark, typed in a program he had seen demonstrated on a PET at his elementary school. This program and mine, discussed below, do not make use of the color features of the VIC. I am still a novice in that area. However, our experience with PET BASIC transferred easily to the new machine as the commands are identical. When it is given your age in years, Mark's program calculates how many days old you are. The program is not perfect. For example, leap years are not allowed for. However, he was very cocky after it worked. I mention this experience because I feel the reader is probably over 11 years old and should not allow a kid to show him up. Teach yourself VIC BASIC, if you have not already done so, and learn to be a better computer programmer than my eleven year old son. It really is not difficult.

Harvey Regains Control

At this point I asserted my authority (such as it is) and took over command of the VIC. On paper I composed a checkbook balancing program, typed it in, and, after correcting a few mistakes, had a working program. The whole process took about two hours, which I would guess is probably about average for an experienced BASIC programmer like myself (no brag). The Checkbook program (like any other) can be divided logically into three sections: input, calculations, and output. First, the previous month's balance is asked for. Then queries about the number and amount of deposits and checks follow. Calculations are done after each input operation. The only result, the new checkbook balance, is output at the end, along with a reprise of the input data for checking purposes.

You Can Do It Better

If the program is unintelligible to you because you have not learned VIC BASIC, you can still type it in and show it to your friends. (Make sure you know how to SAVE and LOAD short programs on tape before typing in a program as long as this one.) Of course the Checkbook program could be improved and even customized. Part of the allure of personal computers is that we can make them do what we want rather than vice versa. For example, if you feel that it is important to save the data on tape for future reference, read the manual on tape files and add this feature to the program.

Checkbook has now become, in part, your program of which you can be proud. The fact that you have added even more practical utility makes it

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that much sweeter. Tell your friends about "your program," but please try not to be too cocky. Happy computing on your VIC!

VIC Technical Notes

1. RETURN as a sole response to INPUT does not stop program as in previous Microsoft BASICs. Program continues using old value of variable.

2. INPUT with prompt in quotes has a restriction. Length of prompt should be 20 characters or less (not counting cursor control characters). Otherwise, prompt message is included in response string.

3. All programs on tape begin loading at hex 1001. PET tapes made with 2.0 (Upgrade) ROMs load into VIC normally. PET tapes made with 1.0 (Original) ROMs have first line garbled.

4. VIC tapes can be loaded into PET if an append procedure is used. First NEW, then append (with tool kit or similar program), and VIC tapes will load normally.

5. As with PET, the STOP key does not work when the program is waiting for input. Instead, press RUN/STOP and RESTORE. VIC will stop without losing your program. This method should get you out of many other awkward spots, but will not work if certain critical pointers are lost (say by an errant machine language program).

6. It helps to keep a list of the color graphics symbols handy (and for that matter, cursor control also) when typing programs from a printed list. This will save much frustration caused by trial and error pecking during program entry.

Program 1.

```
10 REM CHECK BOOK BALANCE PROGRAM
20 REM HARVEY B. HERMAN
30 REM
40 DIM D(20),C(50):REM 20 DEPOSITS, 50 C
   HECKS
50 PRINT "{CLEAR}     {REV}CHECK BOOK":PR
   INT
60 INPUT "DO YOU WANT{12 RIGHT}INSTRUCTI
   ONS";A$
70 GOSUB 710
80 ON J GOTO 110,100,90
90 PRINT "WHAT?":PRINT:GOTO 60
100 PRINT:PRINT "PROGRAM ASKS FOR
   EVIOUS BALANCE,     DEPOSITS AND
    CHECKS"
110 PRINT
120 INPUT "PREV. BAL.";PB:NB=PB
130 PRINT
140 INPUT "ANY DEPOSITS";A$
150 GOSUB 710
160 ON J GOTO 250,180,170
170 PRINT "WHAT?":PRINT:GOTO 140
180 PRINT
190 INPUT "HOW MANY";N
200 PRINT
210 FOR I=1 TO N
220 INPUT "DEPOSIT";D(I):PRINT
230 NB=NB+D(I)
240 NEXT I
250 PRINT
260 INPUT "ANY CHECKS";A$
270 PRINT
280 GOSUB 710
290 ON J GOTO 370,310,300
300 PRINT "WHAT?":PRINT:GOTO 260
310 INPUT "HOW MANY";M
320 PRINT
330 FOR I=1 TO M
340 INPUT "CHECK";C(I):PRINT
350 NB=NB-C(I)
360 NEXT I
370 PRINT "HIT A KEY WHEN READY"
380 GET A$:IF A$="" THEN 380
390 PRINT
400 PRINT "{CLEAR}     {REV}DATA SUMMARY"
410 PRINT
420 PRINT "PREV. BAL.","  NEW BAL."
430 PRINT PB,NB
440 PRINT
450 PRINT "HIT A KEY WHEN READY"
460 GET A$:IF A$="" THEN 460
470 IF N=0 THEN 580
480 PRINT "{CLEAR}     {REV}DATA SUMMARY"
490 PRINT
500 PRINT
510 PRINT "     DEPOSITS"
520 FOR I=1 TO N
530 PRINT "DEPOSIT";I;"  $";D(I)
540 NEXT I
550 PRINT
560 PRINT "HIT A KEY WHEN READY"
570 GET A$:IF A$="" THEN 570
580 IF M=0 THEN 690
590 PRINT "{CLEAR}     {REV}DATA SUMMARY"
600 PRINT
610 PRINT
620 PRINT "     CHECKS   "
630 FOR I=1 TO M
640 PRINT "CHECK";I;"  $";C(I)
650 NEXT I
660 PRINT
670 PRINT "HIT A KEY WHEN READY"
680 GET A$:IF A$="" THEN 680
690 PRINT "{CLEAR}":PRINT" {REV}SEE YOU N
   EXT MONTH"
700 END
710 IF LEFT$(A$,1)="Y" THEN J=2:RETURN
720 IF LEFT$(A$,1)="N" THEN J=1:RETURN
730 J=3:RETURN
```

Program 2. Mark's Program

```
10 PRINT"{CLEAR}
20 PRINT"THIS IS A GAME THAT SHOWS HOW M
   ANY DAYS OLD YOU ARE."
30 PRINT"ENTER YOUR AGE SO YOU WILL LEAR
   N."
40 INPUT A
50 PRINT"YOU ARE";A * 365;"DAYS OLD"
```

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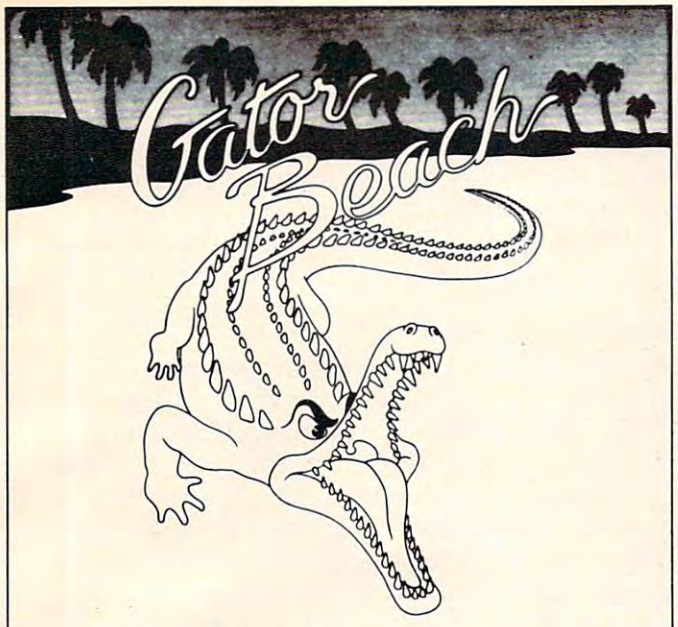

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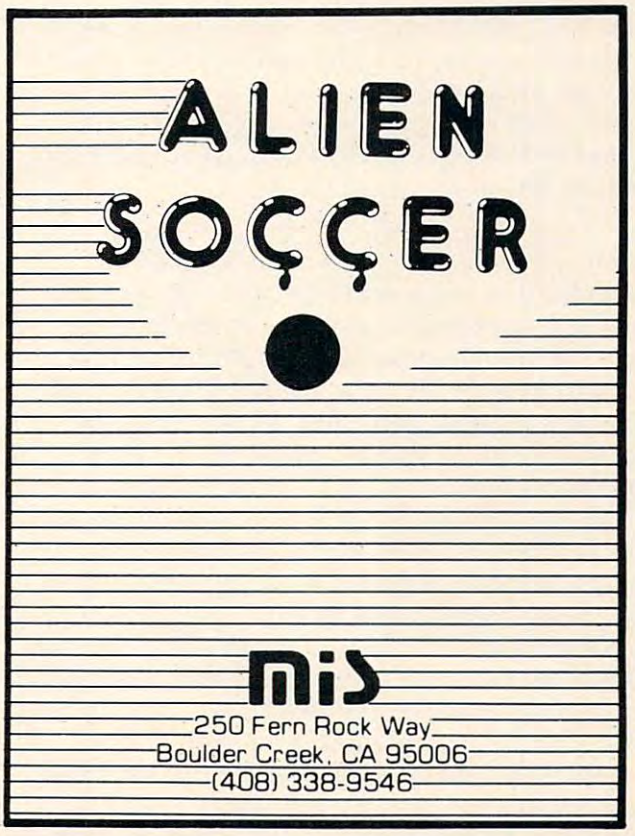

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A Monthly Column

Machine Language:

Hexed!

Jim Butterfield
Associate Editor

You often find nonsense printed about hexadecimal numbering systems. For example, one source says, "We use hexadecimal numbers when programming in machine language, since that's what the computer uses." Balderdash! There is no such thing as a hexadecimal computer – they're all binary.

It may seem hard to believe at first, but hexadecimal numbers are for human convenience. The computer is happy with binary – in fact, binary is all it's got – but we are not likely to wax enthusiastic if we are asked to place a value of 00001100 into location 1110100001001100. To make it easier for people, we like to condense binary.

Binary

The computer is made up of circuits and wires. Each wire carries either of two kinds of electrical signal – full voltage or no voltage. There's no volume control needed here: it's all or nothing. This two-condition situation is called binary, for its two states: voltage or no voltage, on or off, yes or no, up or down, one or zero.

The one/zero name for the two conditions is handy: it allows us to describe a group of logic signals by a stream of digits. If the computer has a group of eight wires, three of which are carrying full voltage while the others have no voltage, we can describe these wires' states concisely and accurately with the expression 00101100.

Now, there's a very important group of 16 wires called the *address bus*. These wires "call up" a certain part of memory. We might write out such an address as 1110100001001100, giving the condition of each wire of the address bus. The contents of each memory location is delivered on a group of eight wires, called a *data bus*; we might store 00001100 into a location. A group of eight "bits" of information is called a "byte".

But it seems unwieldy to write the individual bits out, one by one.

Enter Hexadecimal

We can shorten these values by grouping the bits together, four at a time. Thus, the address 1110100001001100 may be broken up into 1110-1000-0100-1100. Further, we can give a name to each of the 16 combinations that four bits can have. For example, 0000 can be written as digit 0; 0001 as digit 1; 0010 as digit 2; and so forth. The weighting of the four bits is 8-4-2-1, so that we can quickly see that 0101 can be represented as 4 + 1 or 5.

This works well for the first ten combinations: 0000 is written as 0 and 1001 as 9. But there are six combinations that total ten or more. Our objective is to write one digit to represent the four bits, so we can't write binary 1010 as 10 for ten; that's two digits. We pick a new scheme for these values: 10 is written as a letter A, 11 as a B, and so on, until we reach 15, which is written as F. The whole table becomes:

0000 - 0	0100 - 4	1000 - 8	1100 - C
0001 - 1	0101 - 5	1001 - 9	1101 - D
0010 - 2	0110 - 6	1010 - A	1110 - E
0011 - 3	0111 - 7	1011 - B	1111 - F

Now we can write address 1110100001001100 as hexadecimal E84C, which is more compact and easier to remember. We can go the other way easily, too: if we see a value of hex 85 we can write it immediately as binary 10000101 if we need to. Note: this is not the same as the decimal value eighty-five, and we tend to say "eight-five" to keep the two number systems clear.

So we can view hexadecimal notation as a compact way of writing the computer's binary numbers. Hexadecimal, by the way, means "based on 16". You can see that there are 16 combinations, 16 different digits.

Converting To Decimal

If we have a hexadecimal number like 85, we sometimes would like to know its equivalent value in decimal. For example, if we PEEK the number in BASIC, we would see a value of 133 stored in the same location – that's the decimal value. We often need to do conversion. Even to PEEK, we'd need to change the hexadecimal address into decimal so that we could tell BASIC where to look.

In the early days (remember?) we used to be told that a number like 263 means "two hundreds, and six tens, and three units." Same rules for

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hexadecimal, except that we use powers of 16 instead of powers of 10. So 85 is "eight sixteens, and five units"; or, to put it mathematically, 8 x 16 + 5. This works out to 133, as mentioned before. An address like E84C works out as 14 x 4096 + 8 x 254 + 4 x 16 + 12. The 14 is the value of the E digit, and 4096 is the third power of 16. The whole thing works out to 59468.

You can do this quickly on your computer (don't forget to use the asterisk for multiplication). If you have a pocket calculator, there's an easier method. Type in the value of the first digit. If there are any more digits, multiply by 16 and add the value of the new digit. Repeat until you run out of digits.

Let's try this with E84C. Type in 14 (that's the E). Multiply by 16 and add the 8. Multiply by 16 and add the 4. Multiply by 16 and add 12 (for C). That's it: you should get 59468 as before.

Decimal To Hexadecimal

You will often have a decimal number that you would like to convert to hexadecimal. There are several different methods of doing this.

An easy manual method is to divide repeatedly by 16: the remainder is the next hexadecimal digit, going from right to left. If we started with 133, dividing by 16 gives 8 with a remainder of 5. The 5 is the right-hand digit. Now divide the 8 by 16: you get zero with a remainder of 8. This goes to the left of the 5 to give a result of 85 hex.

Remainders are hard to do on calculators and computers. Here's a method I prefer that works easily on either:

If the number is less than 256, divide by 16; otherwise divide by 4096. You'll get a number which has a whole and fractional part. The whole value is your first digit; make a note of it and then subtract it. Now multiply by 16 and repeat the whole procedure: you'll get two digits for numbers less than 256, and four for greater numbers.

Suppose we have 59468 on our hand calculator. Divide by 4096; you'll get a number like 14.51855. The 14 is your first digit, E: write it down and then subtract the 14. Multiply the remaining .51855 by 16 and you'll get 8.2968. Note the 8 behind the E, subtract 8, and you're ready for the next multiplication by 16. Keep going and you'll get the 4, and finally the last digit will be 12 (it may be 11.99, but we can stretch a point), for which we write down C. Result: hexadecimal E84C.

Hexadecimal numbers are for our convenience. They are very close to the computer's internal notation – binary – but a little more compact and easier for us.

We've talked about simple conversion methods from hexadecimal to decimal and back. They are useful for small computers. If you are a numbers freak, there's lots more for you to dig into: negative numbers, fractions, and even floating point hexadecimal. But the basics will take you a long way.

Some beginners wonder if machine language programmers know secret spells and incantations to make their programs work. I tell them that it's purely logical – no special secrets are required. But it's nice to know how to deal with a hex... number.

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Mike Steinberg
Brooklyn Park, MN

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Line Pacer, will make listing and editing more effective and enjoyable, without the need of a printer, disk drive or assembler-editor. It's so simple to enter and use, you can have it up and running even if you've only read chapter one of the *Atari BASIC Manual.*

A few notes are helpful before you put Line Pacer to work. The program occupies lines zero through nine. This is necessary since most other programs begin on line ten or higher. This enables Line Pacer to co-exist with any program starting at line ten or higher.

Another handy feature is the ability to determine the speed at which your listing will progress. In order for Line Pacer to work, it must be recorded on tape (or disk) using the LIST rather than the SAVE command.

When you're ready to use Line Pacer, enter your main program first – making sure it starts at line ten or higher. Next, call up Line Pacer from the cassette or disk where you've stored it. Use the ENTER rather than the LOAD command.

Since Line Pacer is a program itself, when you hit RUN and return, Line Pacer will take over with its "read" mode. Once you've determined the number of lines, the SELECT button will control the forward movement and the OPTION button will allow you to backtrack.

The "edit" mode can be entered by pressing the BREAK key. Once you've made your edit, you can go back to Line Pacer by typing CONT and hitting the return key.

When you're done editing or reading and want to run your program, just type GOTO and the number of the first line of your actual program, hit RETURN, and you're off and running.

```
0 ? :? "{13 SPACES}LINE PACER
  {14 SPACES}":? :? "{4 SPACES}AN M.J.
  S.A. PROGRAM (C) 1981":? :?
1 PRINT " TO ADVANCE PRESS 'SELECT'":
  ? :? " TO BACKUP PRESS 'OPTION'":?
  :?
2 PRINT "PRESS BREAK FOR EDIT MODE":?
   :? "TYPE 'CONT' AND PRESS RETURN W
  HEN YOU HAVE FINISHED YOUR EDIT"
3 ? :? "HOW MANY LINES PER SELECT";:I
  NPUT LIN:? :?
4 FOR LST=9 TO 50000 STEP LIN
5 LIST LST+1,LST+LIN
6 IF PEEK(53279)=5 THEN GOTO 9
7 IF PEEK(53279)=3 THEN LST=LST-LIN:G
  OTO 5
8 GOTO 6
9 NEXT LST:GOTO 5:REM ** SHOULD BE CO
  DED ON TAPE OR DISK WITH 'LIST'  AN
  D CALLED WITH 'ENTER'                ©
```

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A Graphics Plot For The Epson MX-80 Printer

William L. Osburn
Wyoming, DE

For those Atari owners with an Epson MX-80 printer and the Macrotronics Parallel Printer Interface, here is a short BASIC routine which will copy a graphics mode 7 display onto the printer.

Before running this routine, X$ must be DIMensioned to 80 characters. The graphics you want copied must already be displayed on the screen.

```
5200 REM SET UP GRAPH PRINTER PLOT
5210 LPRINT CHR$(27);CHR$(65);CHR$(131);
     CHR$(27);CHR$(50);CHR$(15)
5230 FOR I=0 TO 159
5240 FOR J=0 TO 79:POSITION I,J:GET #6,A
5250 IF A=0 THEN X$(79-J+1,79-J+1)=" ":
     GOTO 5270
5255 IF A=1 THEN X$(79-J+1,79-J+1)=".":
     GOTO 5270
5260 X$(79-J+1,79-J+1)="*"
5270 NEXT J
5280 LPRINT X$
5290 NEXT I
5295 LPRINT CHR$(7);CHR$(7)
5300 END
```

Line 5210 sets up the horizontal and vertical spacing of the Epson MX-80. The commands CHR$(27); CHR$(65); CHR$(131); CHR$(27); CHR$(50) set the vertical line spacing to 3/72 of an inch. The line spacing can be set to any 1/72 of an inch. CHR$(15) sets the horizontal printing to 132 characters per line. Lines 5230 and 5240 direct the pixel scan of the screen. The command LOCATE I,J,A can be used in place of POSITION I,J: GET #6, A in line 5240. The returned value of variable A will be either 0,1,2, or 3, depending on the COLOR exp used for that pixel. Lines 5250, 5255 and 5260 set the X$ array for printing depending on the value returned for A. In this case I used "." for the border and "*" for the curve. The border and the curve were in different colors. Line 5280 prints the string array X$ (x=I, y=0 to 79). Line 5295 rings the MX-80 buzzer after the printing is done. The plot takes about nine minutes to complete and this allows me to do something else.

The result is a copy of the screen onto paper. The routine rotates the plot 90° clockwise in order to print.

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This handy input routine makes a program crash-proof. See the substitution in Program 2 for VIC.

Flashing Prompt For VIC And PET

Glenn Murray
Fredericton, N.B.

Displaying longer passages of information on the screen means choosing how to pause at an appropriate point to let the user digest one section, and then move along to the next. This is especially important in CAI programs for schools, or any time you're relating instructions or outputting a lengthy report.

A computer novice, I began to use a CBM 8032 for word processing last year, and was soon lured into writing simple programs to convey information on local history and astrology via the microcomputer. This usually involves long passages of text and graphics, needing more than one screenful for display.

Earlier Versions

At first, I used simple INPUT statements to create a pause, such as: "Type 'C' to continue", but this required pressing both the C-key and RETURN to move forward. Also, the possibility always existed of simply striking RETURN and falling out of the program altogether. To avoid this, I tried ending each passage with a time-delay (FOR I = 1 TO 20000: NEXT to allow 20 seconds for reading that segment, for instance). I soon discovered that people read at widely differing speeds, and are sometimes interrupted long enough for an important passage to whiz past unread. Obviously, this was not the answer.

Reverting to INPUT statements, I tried inserting default values at the response-point, so that most users would find the appropriate response already in place and could simply press RETURN to continue. Using cursor-controls, I had the cursor pause and flash right on the default value, like so:

```
100 INPUT"ANOTHER ROUND?...'Y'OR'N'...
   {02 RIGHT}Y{03 LEFT}";R$
110 IFR$<>"Y"ANDR$<>"N"THEN100
```

This was better than anything I'd tried earlier, but it still wasn't appropriate when the program simply needed a cue to continue. I then discovered the value and immediacy of the GET statement. Using GET instead of INPUT means that, even without default values, the user has to touch only a single key to register his response. Now, when the prompt said "PRESS 'C' TO CONTINUE..." that was really all that was required. How wonderful!

The trouble now was that no single letter-key on the PET/CBM keyboard is quite so noticeable or quite so familiar (even to the casual user) as the large RETURN key. I still felt the most sensible and completely comfortable suggestion was:

PRESS 'RETURN' TO CONTINUE...

The other problem was that I'd become fond of the flashing cursor with its self-contained default value as an attention getting device at the end of a passage of text. Obviously, then, the "ideal" prompt would be to see the above cue (PRESS RETURN TO CONTINUE) appear at the bottom of the screen and flash slowly until the response was entered.

The Blinking Prompt

The enclosed subroutine accomplishes this in a very simple fashion. It can be loaded before writing a program or added to already existing programs, and accessed by simply using "GOSUB 10000" where you might otherwise use an INPUT, GET, or time-delay to hold a screenful of text before moving on. The words "PRESS RETURN TO CONTINUE" will flash on the bottom line of your screen (line 23 – hence cursor-down 22 times in line 10110) until the RETURN key is pressed, and then the program continues.

The short demo-program illustrates the use of this device to beginning-programmers and has plenty of REM statements to make its simplicity obvious. It should work on most micros, although the position of the flashing prompt might need adjustment to appear at the bottom-center of your monitor screen. This version is for the 40-column PET, but adding 20 extra spaces to the TAB indicators (that goes for line 10110 in the subroutine too!) makes it look fine on the 80-column machine as well.

If you don't want the flashing to begin instantly when the screenful of information changes, insert a simple time-delay of several seconds immediately before your "GOSUB 10000" (as seen in line 260 of the demo-program). This will give the user time to digest most of your information before the blinking prompt appears at the bottom of the screen.

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Program 1: Subroutine and Demonstration

```
10 REM  BLINKING PROMPT SUBROUTINE
     DEMONSTRATION
100 PRINT"{CLEAR}"
200 PRINTTAB(7)"{08 DOWN}THIS WILL ~
    DEMONSTRATE THE USE"
210 PRINTTAB(7)"{DOWN}OF A BLINKING
     PROMPT TO CREATE"
220 PRINTTAB(7)"{DOWN}A PAUSE, AND ~
    THEN QUICKLY RESUME"
230 PRINTTAB(7)"{DOWN}ANY PROGRAM W
    HEN THE USER IS"
240 PRINTTAB(7)"{DOWN}READY TO PROC
    EED..."
260 FORI=1TO3000:NEXT:  REM  WAIT T
    O START FLASHING
270 GOSUB10000
300 PRINT"{CLEAR}"
310 PRINT"{06 DOWN}LIST THE PROGRAM
     & SEE HOW IT WORKS."
320 PRINT"{02 DOWN}THE SUBROUTINE I
    S AT LINE 10000."
330 PRINT"{02 DOWN}USE IT ANYTIME V
    IA GOSUB STATEMENTS."
500 END
10000 A$="{REV}"
10010 FORL=1TO1000
10100 PRINT"{HOME}"
10110 PRINTTAB(10)A$;"{22 DOWN}HIT RE
    TURN TO CONTINUE"
10120 GETR$:IFR$=CHR$(13) THEN RETURN

10130 FORI=1TO333:NEXT
10150 IFA$="{REV}" THEN A$="{OFF}":GO
    TO10300
10160 IFA$="{OFF}" THEN A$="{REV}":GO
    TO10300
10300 NEXT L
```

Program 2: Make this substitution to use this technique on the VIC.

```
10110 PRINTTAB(2)A$;"{20 DOWN}HIT RETURN TO
    CONT"
```


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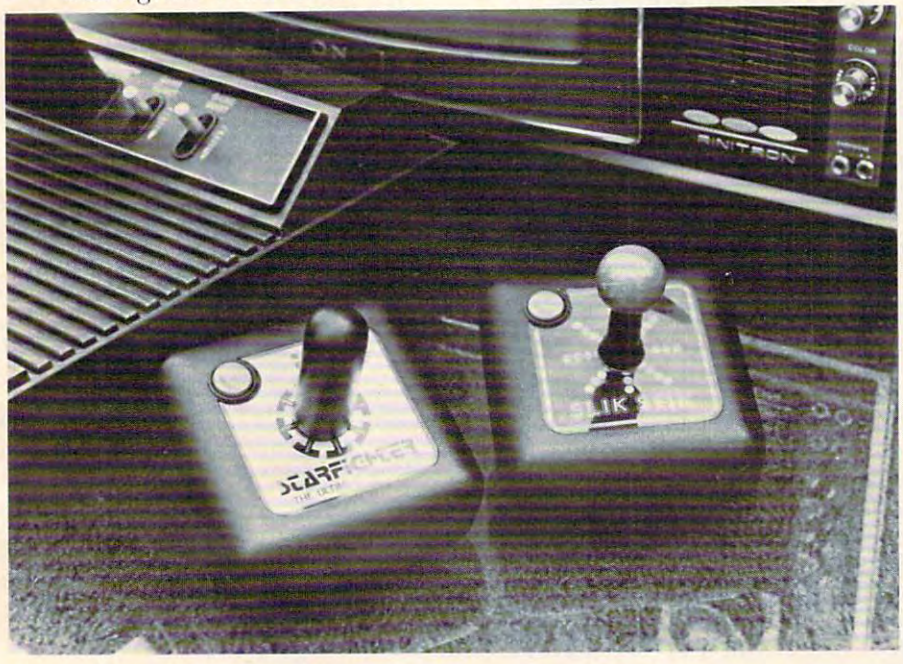

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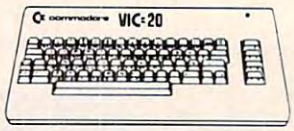

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light sensitive pen barrel connected to electronic circuitry by a three foot lightweight cable. Since the electronics circuit is on a board, the pen barrel is thinner. The circuit board plugs into the VIC's user port and is ready to use with only minor "tuning."

A free demonstration program accompanies the unit, as well as complete documentation on installation, operation, and programming. The Touch-n-Light Pen retails for $75. Also available is educational and recreational software which retails for $9.95 to $14.95.

Sunshine Peripherals Inc.
1229 East 28th Street
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CyberLOGO Turtle For The Apple

Cybertronics has released the CyberLOGO Turtle, an open-ended computer literacy learning environment. It runs on any Apple II in 48K (no language card is required). The CyberLOGO Turtle provides these LOGO features:

Turtle graphics
Full screen editor
Filing system for saving both programs and pictures
Sound
Color pictures and backgrounds
Global and local variables

The CyberLOGO Turtle also includes a STEP mode for easy debugging. This facility allows a student to execute a program one line at a time to locate programming errors.

A CyberLOGO Turtle SKETCH mode is included for the exploring student. In SKETCH, students can move the CyberLOGO Turtle and draw pictures by pressing single keys.

Unlike any other LOGO product, the CyberLOGO Turtle offers on-line HELP. HELP provides guidance for the first-time user, a complete description of the CyberLOGO Turtle language, and quick solutions to students' most frequent problems.

The CyberLOGO Turtle manual, written in friendly, jargon-free language by Dr. Pamela Sharp of the Stanford University Psychology Department, is designed specifically for the novice user.

The CyberLOGO Turtle is priced at $99.95. To order, write or call:

Cybertronics International, Inc.
Software Publishing Division
999 Mount Kemble Avenue
Morristown, NJ 07960
(201)766-7681

A Financial Wizard From Computari

Computari has released *A Financial Wizard*, version 1.5, which supersedes their *Personal Finance* for the Atari.

A Financial Wizard is capable of storing 100 checks per month (220 checks with the two drive option) and allows 26 major and 36 sub- expense categories. Available core programs include Check Entry, Budget Entry, Check Search, Tabulations, Bargraph, Check Balancer, Checkwriter, and Utilities (which includes an audit program).

All data is entered through the Check Entry program, which allows users to scan and correct previous entries with ease. Colorful graphics using a custom display list format and defined data fields makes data entry easy. All data resides on the program disk, so there is no disk switching.

Household budgets are created with Budget Entry. The COPY MONTH and COPY CATEGORY features allow rapid creation of a year's budget.

Check Search allows single or multiple (up to seven) parameter searches at one time.

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Tabulations lists expenses by month, year to date, or by category over a twelve month span, while Bargraph provides the same data in bargraph form. With an 80-column printer with graphics capability, the user can reproduce the bargraph on paper.

Check Balancer offers a fast way to balance the computerized checkbook and includes a correction mode. Checkwriter will print checks which are obtained through Abacus Software.

Those who have the earlier *Personal Finance* package may update to the new version by sending $10 and their PF disk to: On-Line Computer Center, 10944A N. May Avenue, Oklahoma City, OK 73120.

The new *Financial Wizard* costs $34.95. A clear plastic disk case, for storing up to ten FW diskettes, is available for an additional $4.

Computari
9607 Athlone
Dallas, TX 75218
(214)327-4649

Software For Timex And Sinclair

Software Development Associates has cassette-based software for the Sinclair ZX-81 and the Timex/Sinclair 1000. The software includes programs to entertain, educate, and assist in financial planning. An introductory cassette containing five games (SDA-Match23, SDA-Battlecard, SDA-Gunner, SDA-Mugwumps, and SDA-Snark) is available for $3.95. A free catalog is also available by sending a SASE to:

Software Development Associates
Dept. C1, 2240 W. McRae Way
Phoenix, AZ 85027

Joystick And Terminal Program For The Color Computer

Spectrum Projects has announced two new products, the Spectrum Stick and the Colorcom/E terminal program.

The Spectrum Stick is a new joystick for the Color Computer. Its features are:

- Hair trigger fire button.
- Swivel-ball type component.
- Extra long cable.
- Brush aluminum knob.
- Sturdy construction.
- A red LED indicator.

The Spectrum Stick costs $39.95 plus $2 for shipping and handling.

The Colorcom/E, a terminal program for the Color Computer, comes in a ROM Cartridge ready to plug in and run. Colorcom/E's features and capabilities include:

- On-line and off-line scrolling.
- Off-line printing of data.
- Receiving and sending cassette files.
- Support of any serial printer.
- Full and half duplex.
- An optional word mode to eliminate word wrap.

Data can be easily edited before printing or writing to cassette.

The price is $49.95.

Spectrum Projects
93-15 86 Drive
Woodhaven, NY 11421
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SuperPET Upgrade Board For CBM 8032

Commodore Business Machines has announced the availability of a single board upgrade that converts the CBM 8032 microcomputer into a SuperPET.

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Price $12.50

BOLDFACE

This program utilizes three specially designed letter types that you can use to create on your VIC printer personalized headlines and messages in a variety of sizes. A plethora of applications. Program requires 8K memory expansion for VIC-20.

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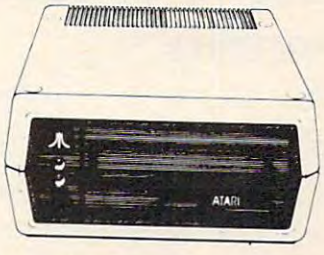

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The standard CBM model 8032 contains 32K of RAM and includes Commodore BASIC. With the SuperPET board, the upgraded machine will feature an RS-232 interface, 64K additional RAM in 8K RAM chips, and a standard 6502 microprocessor as well as a pseudo 16 bit 6809 based processor. An external switch for processor selection also allows programs designed for the 8032 to operate without modification.

The upgrade board also provides six languages, including Waterloo Computing Systems Limited's microBASIC, microPascal, microFORTRAN, microAPL, microCOBOL, and 6809 Assembler. Applications developed on the SuperPET can be up-loaded to a mainframe system, and executed without modification.

The upgrade board (part number 900003501) sells for $795.

Commodore Business Machines, Inc.
Computer Systems Division
The Meadows
487 Devon Park Drive
Wayne, PA 19087
(215)687-9750

Printer Programming Manual For VIC And Epson MX-80

Robert E. Huffman, of Munster, Indiana, has written a 53-page booklet titled *VIC-20: MX-80 Connection*. It is a printer programming manual for making the VIC-20 work with the Epson MX-80 with Graftrax-Plus.

Written for beginners, the booklet carefully explains each program – line by line, step by step. The programs present techniques that can be used by anyone with an understanding of BASIC fundamentals.

The booklet costs $15. Copies may be obtained by writing to:

Robert E. Huffman
9607 Dogwood Lane
Munster, IN 46321

Personal Finance Records For The Atari

SCITOR has announced the Personal Finance and Record Keeping package for the Atari 800 computer with 40K RAM, 1 810 disk, and BASIC.

The SCITOR Personal Finance and Record Keeping package provides homes and small businesses with a complete yet simple automated records system. You can organize and keep track of expenses, checks, credit cards and other personal records. Reports, high resolution graphics, and color bar charts can be generated from the records, providing insight into expenses, budgets, and progress

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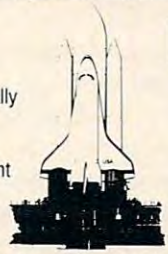

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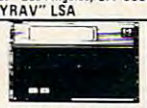

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The Programmer's Workshop includes disk to cassette transfer, BASIC program comparison capabilities, cassette baud rate increase, and two types of program code analysis.

The Disk Workshop includes disk editing capabilities, fast copying of disks, a formatted disk directory which can be sent to a printer, use of machine language character strings in BASIC, a screen dump for the MX-80 Epson Printer with Graftrax or Graftrax Plus, and transfer capabilities of large files to disk or cassette.

Both packages require an Atari 400/800 computer with 32K and one disk drive. The price for each package is $34.95.

Synergistic Software
830 N. Riverside Dr., Suite 201
Renton, WA 98055
(206)226-3216

PET Joystick Interface

J Systems Corp. announces the immediate availability of its new PET Joystick Interface. This versatile interface card adds joystick/paddle capabilities to all PET/CBM computers. The device enables the PET to accept inputs directly from two Apple joysticks, four Apple game paddles, or two Atari joysticks. Interface is complete and ready to plug into the user port.

All modes of operation are software selectable. The device features short access time (less than ten milliseconds/joystick) and high resolution digitization (greater than eight bits). This makes the interface ideal, not only for joysticks and paddles, but also for connecting any four resistive sensors to the PET/CBM. Fast machine language input routines, callable from a BASIC program, are included.

The price of the PET Joystick Interface is $49.95. This price includes the card, power supply, documentation, and sample software. The device can be ordered directly from:

J Systems Corp.
1 Edmund Place
Ann Arbor, MI 48103
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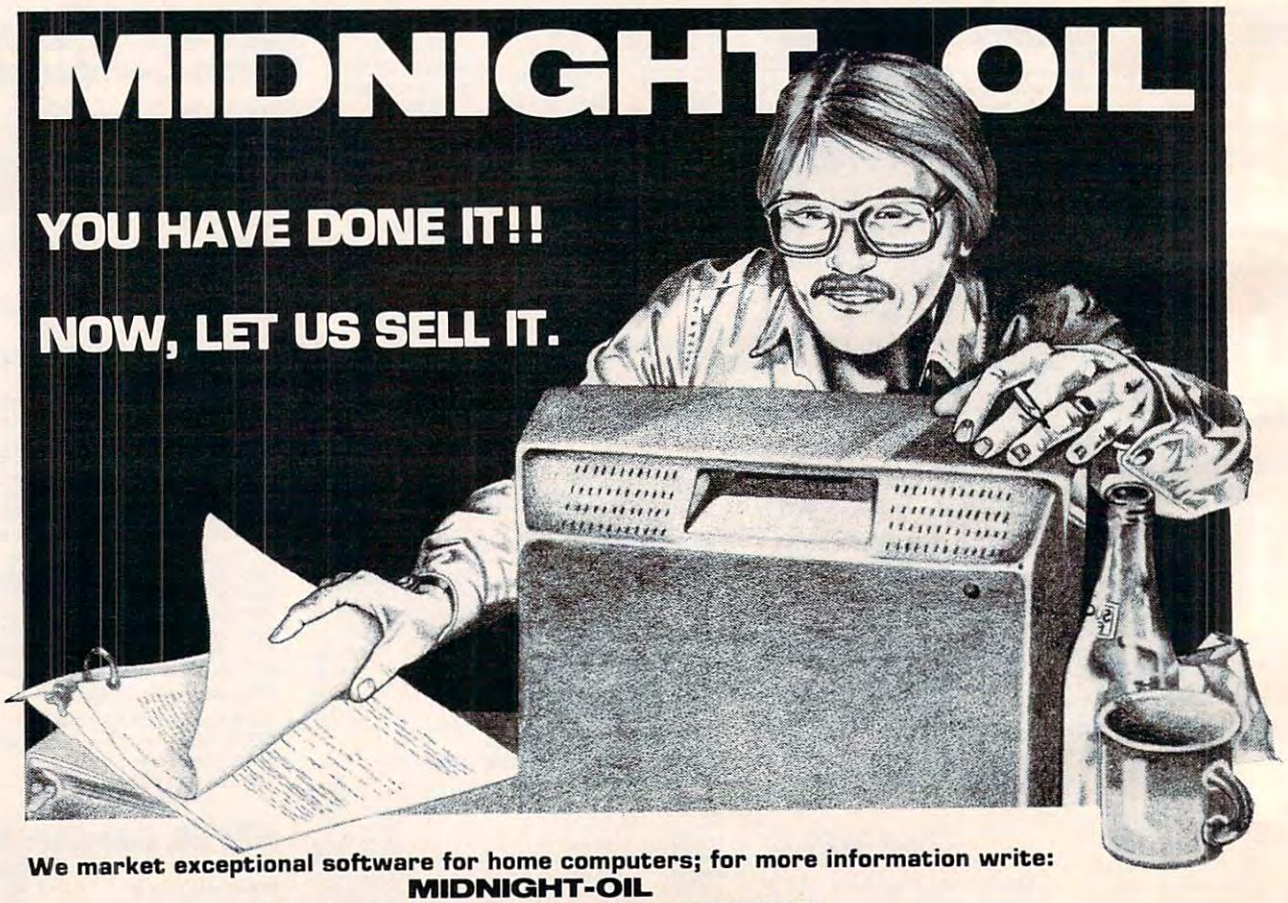
Skill/Action Game For Atari

PlatterMania, a ROM cartridge for the Atari 400/800, is a new action game from EPYX. The game can be played by one or up to four players.

A player begins with four spinning plates on top of four rods. He must be fast and accu-



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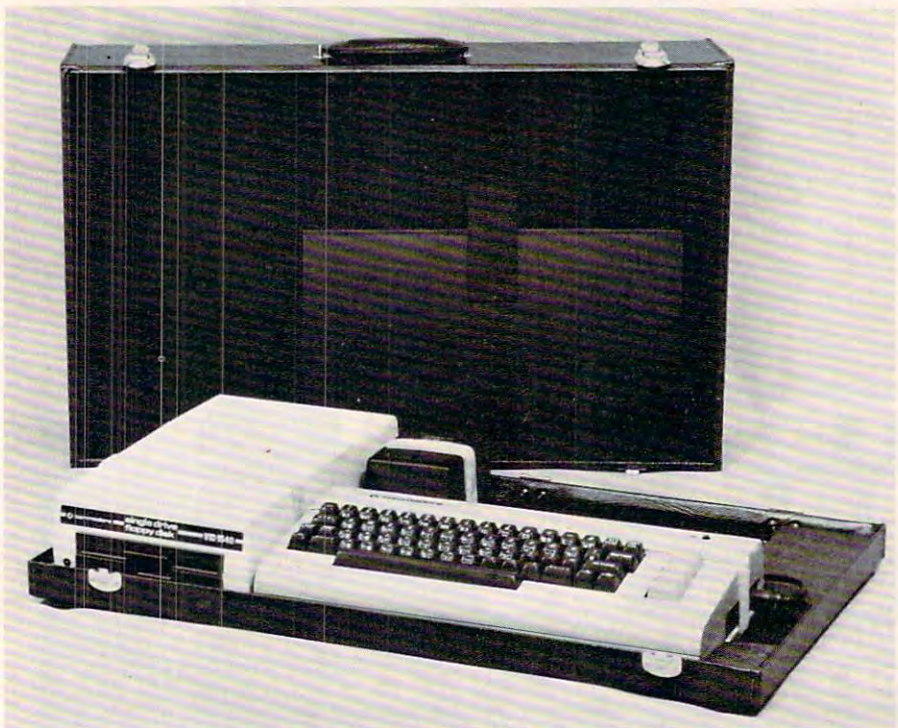
rate as he moves from rod to rod – making sure that no plate spins hard enough to fly off or slows enough to fall off. As the player's skill improves, the game increases in difficulty, providing up to 12 rods balancing plates.

PlatterMania is available on ROM cartridge for the Atari (with joystick or paddle controller). The suggested retail price is $39.95.

EPYX/Automated Simulations, Inc.
1043 Kiel Court
Sunnyvale, CA 94086



Carrying case holding Commodore computer, disk drive, and power supply.

Carrying Case For Commodore 64 And VIC

The Computer Case Company has recently added two cases for the Commodore 64 computer. The CM703 case will hold the Model 64 computer and one or two 1541 disk drives, as well as the power supply. The CM704 case will hold the Model 64 computer along with the dataset program recorder and the power supply. Both cases have ample room for additional equipment, working papers, manuals, etc. The cases can also be used for the Commodore VIC and related equipment.

These cases are not only portable but also provide a convenient and safe method of storage. Replacing and locking the lid protects the computer and software from tampering and unauthorized use. The tops are easily removed so that the equipment can be operated without removal from the case. Cables and plugs are protected from possible inadvertent damage or failure resulting from repeated connecting and disconnecting.

The cases are constructed of luggage material with hard sides, padded handles, brass hardware, and key locks. Rubber pads protect furniture, and steel lugs on the bottom protect the case. The outside is covered in scuff-resistant, brown textured vinyl.

Computer Case Company
5650 Indian Mound Court
Columbus, OH 43213
(614)868-9464 or (800)848-7548

Games From Avalon Hill

New game releases from Avalon Hill are:

Legionnaire, a realtime war game for the Atari 400/800. The player assumes the role of Julius Caesar and commands ten legions against the barbarian tribes. The scrolling battlefield allows the player to inspect the entire ten square foot map stored in the computer's memory. The game features high-resolution graphics and sound effects and requires 16K. The cost for the cassette is $35.

A one or two-player game, *Moon Patrol* is an arcade-style game for the Atari. Players circle the moon, trying to touch down at the landing site, while dodging and destroying enemy invaders. Available on cassette, the game requires 16K and costs $25.

Telengard is for Apple II and TRS-80 Models I and III computers with 48K memory. It is a fantasy role-playing game that requires players to descend into a 50-level dungeon. Before his journey, a player may choose the character attributes he thinks will help him defeat the monsters within the dungeon and return with wealth and power. *Telengard* is a realtime game and emphasizes quick decision-making: if a player doesn't make a decision in five seconds, the computer will make it for him. A manual of rules and suggestions is included. Available on diskette, the game costs $28.

G.F.S. Sorceress is a space adventure set in the year 2582. The player assumes the role of Joe Justin, wrongly accused and convicted of mutiny, and sentenced to drift in space for the rest of his life. The player's goal is to vindicate Joe Justin. The game is available for the Atari 400/800, Apple II, and TRS-80 Models I and III. The cassette version is $30; the diskette, $35.

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Another strategy simulation game, *Andromeda Conquest* requires players to form and protect galactic empires. They must locate star systems with the highest resource values for colonization, but they also face opponents wanting the same star system. Cassette and disk versions are available ($18 and $23, respectively) for the Apple II+, Atari 400/800, TRS-80 Models I and III, and PET/CBM 2001 (no disk version for PET). The game requires 16K. There is also a 48K disk version for the IBM personal computer.

The Avalon Hill Game Company
4517 Harford Road
Baltimore, MD 21214
(301)254-5300

Memory Expansion For The Atari

Axlon Inc. has introduced a 48K memory expansion module for the Atari 400 home computer. Called the RAMCRAM Plus 48K, the new product provides 49,062 bytes of Random Access Memory in a single module.

This memory module allows Atari 400 owners to upgrade their computers to equal the computing power of its larger, more expensive brother, the Atari 800. With the RAMCRAM Plus 48K, Atari 400 users will have full access to software enjoyed by Atari 800 users.

The module requires no soldering modifications to the Atari 400 and can be easily installed with only a screwdriver in less than ten minutes. It offers gold plated contacts and a fully socketed board and is fully compatible with existing Read Only Memory (ROM) cartridges. The retail price is $229.95.

Axlon, Inc.
170 N. Wolfe Road
Sunnyvale, CA 94086
(408)730-0216

Adventure Game From Computerware

Computerware has introduced *El Diablero*, an adventure game for the Radio Shack Color Computer and TDP System 100.

The player is isolated in the middle of a desert in the Southwest. He has been a student of an aged sorcerer, but the sorcerer is missing. The player has apparently forgotten the sorcery techniques he's been taught, but he has two clues to work with. He can remember that a "diablero" had become his teacher's enemy, and he can recall a curious verse.

El Diablero costs $19.95 on cassette or $24.95 on disk (plus $2 for shipping and handling).

Computerware
Box 668
Encinitas, CA 92024
(714)436-3512

Communications Packages For VersaModem

Bizcomp has introduced two companion communications software packages for its Model 1080 VersaModem. *Term Emulator II* allows an Apple II Plus computer to communicate with The Source, Dow-Jones and University Computers, and *mini-McTerm* brings the same capabilities to Commodore PET/CBM.

Both communications packages eliminate the need for interface cards. A special low-cost cable plugs directly into the game jack on the Apple II. Modem operating parameters such as parity, duplex, and stopbits are conveniently changed from a setup menu. The RAM-copy feature permits the Apple to capture data from remote computers.

Using the *mini-McTerm* package, Commodore PET/CBM computers can be interfaced directly via the user port, bypassing the need for RS-232 conversion boxes. The user port interface also prevents excessive loading of the IEEE bus. Simul-

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Prices for the software packages on diskette, complete with interface cable and modular T-adapter, are: $29.95 for the Apple, $74.95 for the Commodore PET/CBM, and $24.95 for the Commodore VIC.

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Technical Education Research Centers, Inc. (TERC) is expanding its workshop series, Microcomputers in Education, to 14 sites throughout the country. The remaining sessions in the winter series will be held in the following locations:

1. St. Louis, MO – Dec. 7-9
2. Boulder, CO – Dec. 13-15
3. Tallahassee, FL – Jan. 18-20
4. Washington, D.C. – Feb. 7-9
5. New York – Feb. 17-19

Workshops are designed for professional development of educators at all levels, elementary through college. Each workshop will emphasize hands-on experience with a variety of microcomputers. Extensive workshop reference materials will be given to participants. Special evening symposia will be held that address topics on current issues in microcomputer applications in education. Hotel accommodations will be available for participants who need them.

Workshop topics include:

1. BASIC and Graphics I
2. BASIC and Graphics II
3. LOGO I
4. LOGO II
5. Pascal I
6. Pascal II
7. Overview of Educational Applications of Microcomputers
8. Administrative Uses of Microcomputers
9. Microcomputers in Mathematics Instruction
10. Microcomputers in Science Instruction
11. Microcomputers as Laboratory Instruments
12. Microcomputers and the Education of Special Needs Students
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For further information on these and upcoming workshops in other locations, write:

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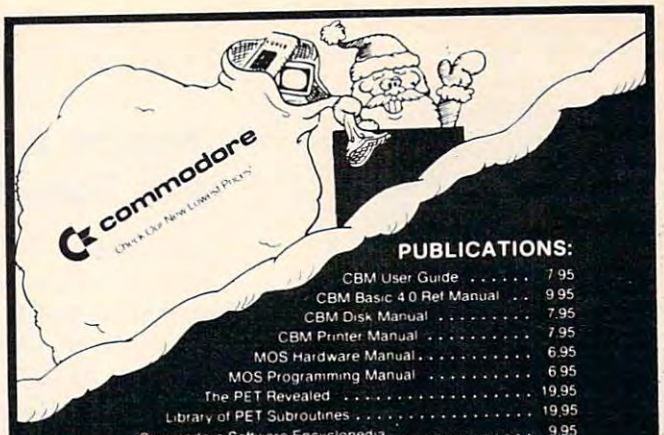

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Space Adventure For The Atari

BRAM has released *Attack at EP-CYG-4*, an arcade-style game for the Atari 400/800.

The player orbits the fourth planet of Epsilon Cygnus. The enemy: the Tartillians, a machine race who destroyed their humanoid creators and have sworn to destroy all humanoids.

The game offers a choice of missions and levels of difficulty. It may be played by one person or by two. A single player is in full control of his ship and its weapons and defenses. Two players – one acting as pilot, the other as gunnery officer – share the decisions of the mission.

Attack at EP-CYG-4 offers:

– 100% machine language; hi-res graphics with sound

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– Advanced joystick control capabilities

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Modifications Or Corrections To Previous Articles

PET Laser Gunner

The following line was missing from the PET/CBM version of this game, November 1982, p. 44:

```
8 PRINT"{CLEAR}";:GOTO85
```

PET Picture Files

Our thanks to author Liz Deal for pointing out that her screen save routine (November 1982, p. 202) will work on 40-column machines except for the Fat-40.

Commodore 64 Memory Map

Just checking to see if you're on your toes. The Commodore 64 memory maps (October 1982, pp. 150-155) contained two minor errors which everybody noticed (and told me about). The "Tape error log" hex addresses should be 0100 to 013E and memory 0800 to 9FFF is of course BASIC RAM memory, not ROM. Good spotting, readers ... Jim Butterfield.

Atari Variable Table Refresh

On page 152 of the July 1982 issue, lines 32000 and 32040 should have a "D: following the first quotation mark (see line 32010 for the correct format).

Micros With The Handicapped

Lines 30 and 210 (October 1982, p. 125) require a backarrow where there is an underline. ©

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COMPUTE!'s Listing Conventions

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

For The Atari

In order to make special characters, inverse video, and cursor characters easy to type in, **COMPUTE!** magazine's Atari listing conventions are used in all the program listings in this magazine.

Please refer to the following tables and explanations if you come across an unusual symbol in a program listing.

Atari Conventions

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

When you see	Type	See	
{CLEAR}	ESC SHIFT <	↰	Clear Screen
{UP}	ESC CTRL -	↑	Cursor Up
{DOWN}	ESC CTRL =	↓	Cursor Down
{LEFT}	ESC CTRL +	←	Cursor Left
{RIGHT}	ESC CTRL *	→	Cursor Right
{BACK S}	ESC DELETE	◂	Backspace
{DELETE}	ESC CTRL DELETE	◧	Delete character
{INSERT}	ESC CTRL INSERT	◨	Insert character
{DEL LINE}	ESC SHIFT DELETE	▣	Delete line
{INS LINE}	ESC SHIFT INSERT	▣	Insert line
{TAB}	ESC TAB	▸	TAB key
{CLR TAB}	ESC CTRL TAB	◪	Clear tab
{SET TAB}	ESC SHIFT TAB	◪	Set tab stop
{BELL}	ESC CTRL 2	◱	Ring buzzer
{ESC}	ESC ESC	↯	ESCape key

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

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

For PET/CBM/VIC

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

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

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

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

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

For The Apple

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

[CLEAR[(Clear Screen) HOME

[DOWN] (Cursor down)
Apple II +: Call -922
POKE 37,PEEK(37)+(PEEK(37)<23)

[UP] (Cursor up)
POKE 37,PEEK(37)-(PEEK(37)>0))

[LEFT] (Cursor left) PRINT CHR$(8);

[RIGHT] (Cursor right)
PRINT CHR$(21)

[RVS] (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the PRINT statement ends with a semicolon.)
INVERSE

[OFF] (Inverse video off) NORMAL

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

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

All Commodore Machines

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

VIC Conventions

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

8032/Fat 40 Conventions

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

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COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

February 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever- expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, The Voracious Butterfly on OSI.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, Vic Color Tips, VIC Memory Map, ZAP: A VIC Game.

February 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Atari P/M Graphics Made Easy, Atari PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April 1982: Track Down Those Memory Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple's Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

June 1982: Outpost Game (multiple computers), Apple Pascal Lister, Income Property (multiple computers), VIC Intelligent Videodisc System, Atari Disk Operating Systems, PET/Apple Search, A Self-modifying Atari P/M Utility, Use Atari Joysticks with VIC, VIC/PET Program Transfers.

July 1982: Gold Miner Game (Atari and VIC), IRA Planner (multiple computers), Atari Video Graphics, Apple DOS Changer, Super QuadraPET, VIC Overview, Maze Race (multiple computers), Direct Access File Editor (PET and Atari), VIC Super Expander Memory Map, Using The 6560 Video Interface Chip, PET Compactor, Headless FORTH Metacompilation, Test RAM Nondestructively (multiple computers).

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, Intelligent Apple Filing Cabinet, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of *TRON*, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Color Computer Graphics, The Apple Pilot Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Editing Atari BASIC With the Assembler Cartridge, Process Any Apple Disk File.

Home and Educational COMPUTING! (Fall 1981 and Summer 1981 – count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters, Alternate Screens, Automatic Line Numbers, Using The Joystick (Spacewar Game), Fast Tape Locater, Window, VIC Memory Map.

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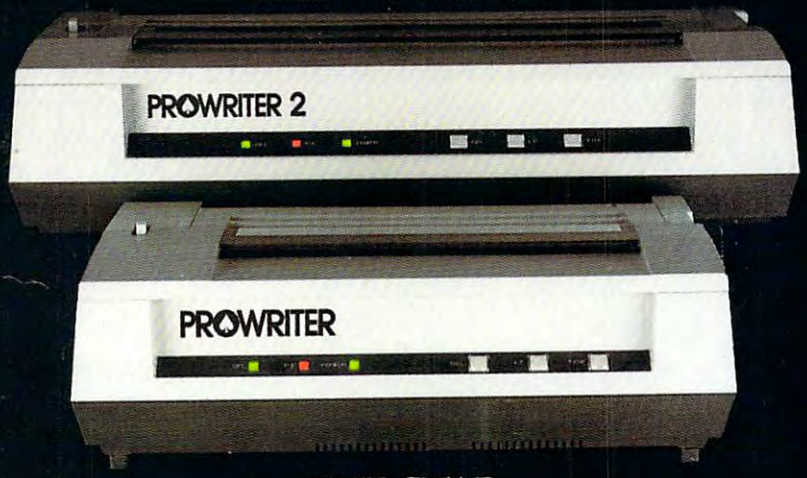

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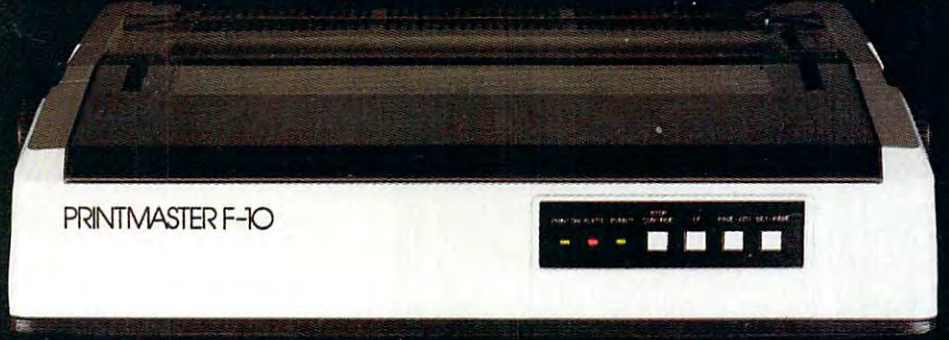

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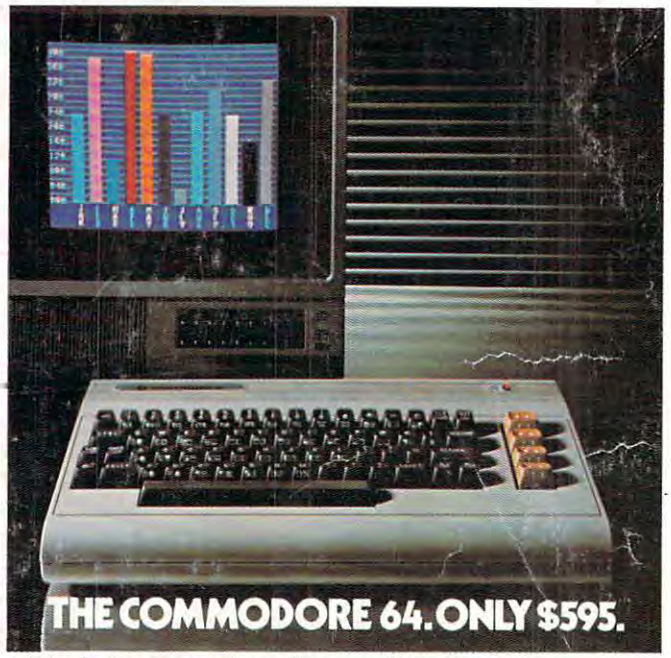

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