Apple PIE + Formatter

Apple PIE (Programma International Editor) and FORMAT (text formatter) offer full strength solutions to today's word processing problems. These versatile, powerful programs provide document preparation and word processing capabilities previously found only on much larger computer systems.

PIE is a general purpose, full screen editor that uses control keys and function buttons to provide a full range of editing capabilities such as search and replace, delete, copy, insert, move. Changes may be made directly anywhere on the screen and are shown as they are performed.

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DOUBLE VISION T.M.
SUPR TERM VERSION T.M.
STANDARD VERSION

*December 1, $129.95.

Programma
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Los Angeles, California 90010

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Is DATA CAPTURE 3.0 just another Smart Terminal program? NO! It is a GENIUS Terminal program for use with the Micromodem II®. It will 'capture' ANYTHING that appears on the screen of your CRT. ANY program or data. If you are using the Source you can even 'capture' CHAT. There is no need to create files in your file space on the other system to transfer data to your Apple. If you can list it you can capture it.

* You can then SAVE the data to disk, dump it to your printer or even do simple editing with DATA CAPTURE 3.0.
* You can use DATA CAPTURE 3.0 to compose text off line for later transmission to another computer. Think of the timeshare charges this will save you!
* Use DATA CAPTURE 3.0 with the Dan Paymar Lower Case Adapter and you can enter UPPER or lower case from the keyboard for transmission to another system. You can also capture UPPER/lower case data from another system.
* A program is also included to convert your programs to text files for transmission using DATA CAPTURE 3.0.
* DATA CAPTURE 3.0 will save you money if you are using any timesharing system.

Requires DISK II®, Applesoft II®
Add $64.95 to order the Dan Paymar Lower Case Adapter

BAD BUY DISKETTE - $9.99

Of course it's a bad buy. If you have issues #2 thru #11 of the NEWSLETTER you can type these programs in yourself. Includes a couple of bonus programs.

Requires DISK II®, Applesoft II®

LCMOD for PASCAL - $30.00

Finally! DIRECT entry of UPPER/lower case into the Pascal Editor. Why pay hundreds of dollars for a terminal just to set lower case entry with Pascal? If you have the Paymar Lower Case Adapter you can use this program.

* Left and right curly brackets for comment delimiters.
* An underline for VARs, program names and file names.
* The ESCape key does the shifting and Control Q is used for ESCape. Have you ever typed in a page or two of text and lost it by hitting ESC accidentally? This won't happen with LCMOD.

Requires Language System and Paymar LCA
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Finding it difficult to keep track of all those magazine articles you are reading? This program will help you do it. MAG FILES is Menu driven with separate modules for creating, editing, displaying and searching for your data. If you are using one drive a program is provided for transferring data to another diskette for backup. A sample data base of over 60 articles is included. The screen formatting and user orientation are what you have come to expect of Southeastern Software.

Requires DISK II®, Applesoft II®

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Requires DISK II®, Applesoft II®

We ship within 3 working days of receipt of order and welcome your personal check. We also accept Visa and Master Charge.

* Apple, Apple II Plus, Disk II and APPLESOFT II are trademarks of Apple Computer Company.
* Micromodem II is a trademark of D.C. Hayes Associates, Inc.
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LOWER CASE +PLUS

for the APPLE II
by Lazer Systems

$59.95 RETAIL

QUALITY. That's why you bought your APPLE II or APPLE II PLUS Computer in the first place. Why compromise the quality of your computer by purchasing a "cheap" looking Lower Case Adapter? LAZER SYSTEMS announces the Lower Case + Plus, the first high quality lower case adapter available for the Apple II.

Compare the features of the top three lower case adapters available for the Apple II:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Lower Case +</th>
<th>Paymar</th>
<th>Uni-Text</th>
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<tr>
<td># of Displayable Characters</td>
<td>128</td>
<td>96</td>
<td>96</td>
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<td>Inverse Upper &amp; Lower Case</td>
<td>Yes</td>
<td>No</td>
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<td>FONT SIZE</td>
<td>7 x 8</td>
<td>5 x 7</td>
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<td># of On Board Character Sets</td>
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<tr>
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<td>Pascal Software</td>
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<td>Optional FONTS Available</td>
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<td>? ? ?</td>
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<td>Single Board Which Works with All Apples</td>
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<td>No</td>
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<td>Expansion Socket for use with Graphics + Plus</td>
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<td>No</td>
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<td>TRUE Descenders on Lower Case Characters</td>
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<td>Yes</td>
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<td>Single Board Construction</td>
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<td>No</td>
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<td>(No Inconvenient &amp; unsightly Wire Jumpers)</td>
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<td>Character Generator 2716-EPROM Compatible</td>
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<td>&quot;Keyboard Filter&quot;</td>
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<tr>
<td>included on Diskette</td>
<td>Yes</td>
<td>No</td>
<td>? ? ?</td>
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<tr>
<td>Extensive User Documentation</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Compatible with Most Major Word Processors</td>
<td>Yes*</td>
<td>No</td>
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</tr>
<tr>
<td>High Quality Double Side PC Board</td>
<td>Yes</td>
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<td>with Silkcreen &amp; Soldermask</td>
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<td>On Board Graphics Character Set</td>
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<tr>
<td>Reset Key Disable</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

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*Apple Writer requires optional character generator for proper operation.

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Editorial

Form and Substance

An Important Announcement: MICRO has not been bought by McGraw-Hill, Hayden, or anyone else. The new look is simply part of MICRO’s evolution. Nor have the philosophy and purpose of MICRO changed.

Form

Since we intend to make MICRO the best journal possible, we engaged a design consultant. This issue incorporates many of his recommended changes. These include:

1. A new MICRO logo. Our new logo, presenting a more modern image, is intended to reflect the fact that we are one of the leaders in the microcomputer explosion.

2. An improved cover. Because over half our sales are through dealers, we want the cover to make a dramatic impact on the magazine rack. The “inside-the-computer-looking-out” concept has been kept, but we have improved the artwork. To help computer store customers in their browsing, we have put the issue number and date on top where they are more visible, and we have added to the bottom of the cover the titles of major articles.

3. A new typeface. We have changed from Helios, a very plain typeface, to a face called Trump, which we believe will be easier to read. Since the purpose of MICRO is to provide printed information, this is perhaps our most important change.

4. Standardized listings. In the past, we photographed and printed most listings as received. Some did not reproduce well, for example, dot-matrix printing and the AIM light blue printouts. The various sizes and shapes of listings also made for an uneven appearance. Furthermore, every assembler had different syntax features. To overcome these problems, we now have our Technical Services staff regenerate all listings. This not only results in standardized syntax and size, it also enables the staff to review the programs in detail. Listings should therefore be more accurate and easier to read.

Substance

Does this attention to form mean that we are neglecting our primary purpose—to provide information about the 6502? Not at all! The substance of MICRO is richer than ever.

1. Improved articles. MICRO was founded in 1977 to provide the important information which the 6502 community needed but was not getting. The backbone of MICRO has always been articles on how to use 6502-based microcomputers more effectively. Since in this field “no one knows everything and everyone knows something,” we have received and published hundreds of articles from computerists of all levels of experience and from various backgrounds. Reader-generated articles will continue to be our mainstay. We are pleased with the quality and quantity of material we are receiving. Now, with an expanded technical and editorial staff, we are in a better position to work with authors, to improve their articles and to make MICRO read better than ever.

2. Additional departments. While articles provide important information, often not available elsewhere, their subject matter is somewhat random. Each author writes about what he feels is important. To fill the inevitable gaps, MICRO has a number of departments to cover the 6502 world systematically. Some departments have been with MICRO a long time. Others are new or still in the planning stage. The old standbys include the 6502 Bibliography, whose numbered entries have now reached the 800 mark (but have covered many thousands of individual items); The Software Catalog, which has presented many new products in its 27 appearances; and the Club Circuit, which continues to publicize 6502-based clubs. New departments have appeared recently and more are scheduled within the coming months.

3. Enlarged staff. Until recently, most members of the MICRO staff had to be able to handle many jobs: editing, circulation, advertising, typesetting, layout, sales, etc. While we put out a good product, it became obvious we needed more people and a better organization. To solve this problem, we have expanded and regrouped our staff. We now have separate groups responsible for Editorial, Production, Circulation, Advertising, Technical Services, and Art. With this expanded and newly organized team, the substance of MICRO will continue to be enhanced.

About the Cover

Computers have played important roles in railroad for years, starting with giant mainframes, then minicomputers, and now microcomputers.

A yardmaster at Santa Fe’s modern Barstow Yard may well have used a computer display like this one to direct the make up of the train. One part of the yard is called a “bump” yard, where an engine backs a string of cars over a hump for automatic sorting. As the car on the end of the string reaches the top, its number and track assignment are automatically displayed, and it is uncoupled from the other cars in front of it. The correct switches are then thrown to allow the car to roll onto the proper track. On the way down, the acceleration of the car is measured, and the proper braking force is applied to make it arrive safely.

The new GP-50 locomotive uses a feedback system, controlled by an on-board computer, to keep the wheels from slipping on the rails.

Some rapid transit systems, such as BART [Bay Area Rapid Transit], in San Francisco, rely on computers for everything from collecting fares to actually running the trains. Loren Wright, MICRO’s PET Vet and resident railroad enthusiast, took this photo in March, 1979, near Beaville, California in the Tehachapi Mountains just south of Bakersfield.
HAS YOUR APPLE READ ANY GOOD PROGRAMS LATELY?
APPLE II DISK SOFTWARE

DATA BASE MANAGER
IFO PROGRAM

The IFO (INFORMATION FILE ORGANIZER) can be used for many applications such as: Sales Activity, Check Registers, Balance Sheets, Client/Patient Records, Laboratory Data Reduction, Prescription Information, Grade Records, Mail, A/R, Job Costing and much more. This can be accomplished without prior programming knowledge.

Up to 1,000 records with a maximum of 20 headers (categories) and 10 report formats (user defined) can be stored on a single diskette. Information can be sorted on any header, both ascending and descending in an alphabetic field. Mathematical functions can be performed on any 2 fields to manipulate the information. Information can be searched on any header using >, <, =, >, =, and first letter. Master list format provided. Fast assembly language Sort, Search and Read routines. Many error protection devices provided. Put your application program together in minutes instead of hours.

Program Diskette and Instruction Manual .................................$100
Mailinng List Program and Instruction Manual .........................$40

INVENTORY PROGRAM

2 disk drives, menu-driven program. Inventory categories include: Stock#, Description, Vendor ID, Class, Location, Reader Pt., Reader Qty., Qty. on Hand. All records can be entered, changed, updated, deleted or viewed. Reports can be sorted in ascending or descending order by any category. There are 7 search reports (5 automatic, Calculates $ VALUE of inventory and YTD, MTD, and period items sold, accumulates inventory over a 13-month period. Requires a 132-column, serial/parallel printer, total turnover operation with bootstrap diskette.

Program Diskette and Instruction Manual .................................$140

PAYROLL PACKAGE

2 disk drives, menu-driven program. Employee history include: Name, Address, # Address, City, State, Zip, Federal Exemption, State Exemption, Social Security #, Date Employed, Dept. #, Code, Employee #, Status, Marital Status, Pay Rate, OT Rate, Vacation Rate, Vacation Hours and Vacation Plan. Program can generate weekly or biweekly payrolls. Prints W-2, Qtr. W-2, Annual W-2, 1099, W-3, W-4, W-5, Last Check, Federal and State withholding taxes are built into program. Maintains a Cash Disbursement journal accumulates payroll for a 53-week period. Generates numerous type of payroll reports. Allows data to be searched, sorted and edited. Prints Deduction Register and more. Maintains up to 125 Employees/Expenses for quick and easy Payroll. Numerous error protection devices provided.

Program Diskette and Instruction Manual .................................$240

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APARTMENT MANAGER

2 disk drives, menu-driven program written in assembly language and APPLESOFT II. All you need is a printer and printer cable. Handles up to 6 buildings with a maximum of 120 units each. Complete turnkey operation. Data categories include Apt. #, Type, Tenant Name, Pets, Children, Security Deposit, Pet Deposit, Pool Deposit, Misc. Deposit, Rent Allowances, Date Move In, Vacancy Date, Refund, Condition of Apt., Damage Amt. and Comment Line. Search, sort, enter and edit and vacate tenants. Maintains MTD and YTD rent receipts as well as complete utility reports, rent lost by vacancies. Maintains Expenses, Vacated Tenants Report and much more.

Program Diskette and Instruction Manual .................................$325

PROFESSIONAL TIME AND BILLING

2 disk drive program written in assembly language and APPLESOFT II. Completely menu driven. Maintain all billing of clients and personnel. Generates and invoices. Numerous reports based on all types of criteria. Easy data entry forRates, Clients, and Matters. Has Search, Sort, Change (on screen editing). View and Balance Forward. If you are a Job Contractor, Attorney, Accountant, General Consultant, or anyone that needs to charge for time, this program is a must. Complete turnkey operation. Many Reports are produced to aid in the Time Analysis Process.

Program Diskette and Instruction Manual .................................$325

All Programs require 48K and APPLESOFT II on ROM or and
APPLE II PLUS. All Software is compatible with RASCAL
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GRAPHING RATIONAL FUNCTIONS

This general-purpose graphing program for a high-resolution screen—though applied here to graphical rational functions on an Apple II—is simple enough for high school students to use.

Ron Carlson
44625 Kirk Ct.
Canton, MI 48187

This is a general graphing program even though it is applied to graphical rational functions, such as

\[ y = \frac{x(x-4)(x+3)}{(x-1)(x+5)} \]

If you want to graph any type of function, either remove the denominator function, \( FN \ DEN(X) \), or merely \( DEF \ FN \ DEN(X) = 1 \). Therefore you could graph \( y = x | \sin(x) | \) by the following lines:

60 DEF FN NUM(X) = X * SIN(X)
70 DEF FN DEN(X) = 1

This program has evolved from plotting \( x \)'s on a printer to the versatile graphics output of the APPLE II. Even the program on the APPLE II went through changes, ranging from graphing with an origin in the center of the screen, graphing any quadrant and choice of scale, to this version of choosing the location of the origin on the screen and the scale. High school students appear to have no difficulty using either of these options.

The program is broken into several parts: first the directions and functions section explains to the user how to define the numerator and denominator functions and how to use the program. Any legal BASIC expression can be used for the definition of the numerator and denominator. Any non-rational function can be graphed by \( DEF \ FN \ DEN(X) = 1 \). I chose the definition method of inputting the function to make the program more easily transferable to other versions of BASIC.

Another section needed for the preparation is for arrangement of the scale and determination of the location of the origin. I use the low-resolution screen with a colored cursor in the center. The user can move the cursor up, down, left, or right by using the following keys: U, D, L, R, and F when finished. The relative final position of the cursor \( (A, B) \) is changed to represent the location of the origin on the high-resolution grid of 280 x 192.

The main body of the program is the graphing section. In order to graph functions, two problems had to be overcome. The first is that the upper left corner of the screen is the origin, making it effectively upside down. The second is that I wanted to have different origins for different applications.

![Graph of Rational Function](image)

**Sample points:**
- \( (240,150) \) \( \rightarrow (x', y') \)
  - \( x' = \frac{(240 - 200)}{10} = 4' \)
  - \( y' = \frac{(240 - 150)}{10} = -6' \)
- \( (20,40) \) \( \rightarrow (x', y') \)
  - \( x' = \frac{(20 - 200)}{10} = -18' \)
  - \( y' = \frac{(20 - 40)}{10} = 5' \)
- \( (200,90) \) \( \rightarrow (x', y') \)
  - \( x' = \frac{(200 - 200)}{10} = 0' \)
  - \( y' = \frac{(200 - 90)}{10} = 0' \)

**Sample conditions:**
- Origin \( (200, 90) \)
- Scale = 10
A mathematical transformation formula will change the HGR coordinates to \( x \) and \( y \) or \( x \) and \( y \) to HGR coordinates.

\[
\text{[real x coord.]} = \{\text{HGR x coord.]} - \{\text{x coord. of origin}\}
\]

\[X = H - A\]

\[
\text{[real y coord.]} = \{\text{y coord. of origin}\} - \{\text{HGR y coord.}\}
\]

\[Y = B - V\]

When the scale factor, \( S \), is considered, then the transformation formulas look like:

\[X = (H - A)/S \]

\[V = B - Y*S\]

The strategy for graphing is to start \( H \), the HGR coordinate, at 0 and continue the loop until \( H \) is 279. Translate \( H \) to the real \( x \) coordinate and substitute \( X \) into the function. Check for an asymptote, and solve for the real \( y \)-coordinate. The transformation formula will give the HGR vertical coordinate, which can be checked to make sure it is on the screen, and plot the point. When the graphing loop is finished POKE -16302,0 displays the bottom portion of the screen. The graph stays on the screen until the user depresses any key, thus giving plenty of time to make any important notes. The user is offered the choice of keeping the same function and changing the position of the origin and changing the detail by means of the scale, or starting over with a new function.

**Sample points:**

- \((30,180) \rightarrow x' = (30 - 50)/20 = -1' = (-1', -6')\)
  \[y' = (60 - 180)/20 = -8'\]

- \((50,60) \rightarrow x' = (50 - 50)/20 = 0' = (0', 0')\)
  \[y' = (60 - 60)/20 = 0'\]

- \((250,80) \rightarrow x' = (250 - 50)/20 = 10' = (10', -1')\)
  \[y' = (60 - 80)/20 = -1'\]

- \((180,30) \rightarrow x' = (180 - 50)/20 = 6.5' = (6.5', 1.5')\)
  \[y' = (60 - 30)/20 = 1.5'\]

**Figure 2**

**Sample run using:**

\[y = \frac{x(x + 3)(x - 4)}{(x + 1)(x - 1)(x + 5)}\]

Scale = 12
Listing 1

10 REM GRAPHING RATIONAL FUNCTIONS
20 REM BY RON CARLSON
30 REM
40 GOTO 440: REM THE NUMERATOR FUNCTION IS TO BE AT LINE 60
50 REM PLACE DENOMINATOR FUNCTION HERE
60 REM DEF FN DEN(X)=1 >> IF YOU HAVE A NON-RATIONAL GRAPH
70 HOME: INPUT "THERE ARE 280 HORIZONTAL DOTS. HOW MANY DOTS/UNIT DO YOU WANT?"; S
80 VTab 21: PRINT "INDICATE THE INTENDED LOCATION OF THE ORIGIN BY MOVING THE CURSOR WITH THE L R U D KEYS P=FINISHED"
90 REM THIS ALLOWS THE USER TO SELECT WHICH AREA OF THE GRAPH TO VIEW.
100 GOSUB 620: REM TO POSITION THE ORIGIN
110 REM S WILL BE THE SCALE
120 REM DETAIL INCREASES AS S INCREASES
130 REM APU: PRINT "AFTER THE BOTTOM HALF OF THE GRAPH IS FINISHED, HIT ANY KEY"
140 PRINT "THERE IS A HASH MARK ON THE AXIS FOR EACH UNIT"
150 HGR : HCOLOR= 7
160 REM AXIS, WITH THE REAL ORIGIN AT (A,B)
170 REM HAXIS EVERY UNIT ON THE AXIS IS
180 FOR H = A TO 279 STEP S: HAXIS H,E - 2 TO H,E + 2: NEXT
190 FOR V = B TO 191 STEP S: HAXIS V,B - 2 TO V,B + 2: NEXT
200 FOR V = B TO 279 STEP S: HAXIS V,A - 2 TO V,A + 2: NEXT
210 REM ACTUAL GRAPHING
220 FOR H = 0 TO 279
230 REM TRANSFORM THE HGR COOR TO THE REAL VALUE
240 X = (H_A) / S:D = FN DEF(X
250 REM DRAW THE VERTICAL ASYMTOTES IF NECESSARY
260 IF D = 0 THEN HCOLOR = 3: HAXIS H,O TO H,191: HCOLOR= 7: GOTO 350
270 Y = FN NUM(X) / D;V = B - Y * S
280 REM TRANSFORM THE REAL Y VALUE TO H GR AND SEE IF IT IS STILL ON THE SCREEN
290 IF V > 191 OR V < 0 THEN 350
300 HAXIS H, V
310 NEXT H
320 REM THIS POKE WILL DISPLAY THE BOTTOM
330 REM QUARTER OF THE GRAPH
340 POKE - 1502, 0: GET A$
350 TEXT : HOME
360 REM DO YOU WANT TO SHIFT THE ORIG IN AND CHANGE SCALE? "$; A$
370 IF A$ = "YES" THEN GOTO 90
380 POKE 830
390 POKE "DIRECTIONS FOR RATIONAL FUNCTIONS"
400 PRINT "YOU MUST DEFINE YOUR FUNCTION IN TERMS OF NUMERATOR AND DENOMINATOR"
410 PRINT "FOR EXAMPLE IF YOU WISH TO GRAP THE FOLLOWING:" 
420 PRINT "(X-1)(X+2)"
430 PRINT "Y = -----------"
440 PRINT "X(X-7)"
450 PRINT "YOU WOULD TYPE THE FOLLOWING:"
460 PRINT "60 DEF FN NUM(X)=(X-1)*(X+2)"
470 PRINT "60 DEF FN DEN(X)=X*(X-7)"
480 PRINT "RUN"
490 PRINT "FLASH : PRINT "REMEMBER :"
500 PRINT "60 DEF FN NUM(X)=": NORMAL : PRINT "LEGAL BASIC EXPRESSION"
510 PRINT "60 DEF FN DEN(X)=": NORMAL : PRINT "LEGAL BASIC EXPRESSION"
520 PRINT "RUN"
530 GOTO 830
540 REM POSITIONING THE ORIGIN ON THE SCREEN (40 BY 40)
550 REM USING L R U D AND P
570 GET A$
580 A1 = A:B1 = B
590 IF A$ = "NO" THEN B = B - 1: GOTO 710
600 IF A$ = "P" THEN B = B + 1: GOTO 710
610 IF A$ = "Y" THEN A = A - 1: GOTO 710
620 IF A$ = "NO" THEN A = A - 1: GOTO 710
630 IF A$ = "P" THEN 600
640 REM BLANK OLD POSITION
650 COLOR= C: PLOT A1,B1: COLOR= 3
660 REM PLOT NEW POSITION
670 PLOT A,B
680 GOTO 630
690 A = 7 * A:B = B * 192 / 40
700 REM CHANGE SCALE TO REFLECT HGR (280 BY 192)
710 TEXT : HOME : RETURN
720 END
Finally . . .

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DEALER INQUIRIES INVITED
Here are “secrets” of the Challenger—one user’s notes on graphics, ACIA, and tape control—which may save you time and frustration.

Robert L. Elm
446 Rothbury Ave.
Bolingbrook, IL 60439

In the last year, I have developed a notebook of things Ohio Scientific didn’t tell me about my C1P. Perhaps I can share some of this information with you and save you frustrations.

Getting Started

The dealer showed me how to hook everything up, and verified that it worked. When I got home I couldn’t even load the demonstration tape without errors! I was almost ready to take it back when a friend suggested I plug only one cord into the recorder at a time. Suddenly it worked! It seems my recorder feeds noise or something around within itself if the input cord is plugged in while playing a tape. The resulting interference causes errors. The solution is either to build a switch box, or simply plug in one cord at a time.

After I got by that one, I found that I could not SAVE a program without errors. This problem took a couple of days to diagnose, since I didn’t know if the trouble was in the SAVE or subsequent LOAD.

I hadn’t modified my T.V. monitor yet to limit the scan width so I was responding to the “TERMINAL WIDTH” prompt with “23”. I noticed that the errors occurred only on long lines such as PRINT statements. Somehow the line feed at 23 characters (rather than the software supplied 24) disturbs synchronization of the LOAD routine. The solution is not to narrow the terminal width. Instead, I got busy and narrowed the T.V. scan width by making a minor adjustment in the T.V. horizontal circuitry.

Graphics

Once I started playing with the graphics, I noticed many symbols that can be added together to form larger objects. Notebook Item 1 lists those I have noted and there may be more. At any rate, it would have been nice if Ohio Scientific had told us what it had in mind with the original graphic design, rather than making all the users hunt and guess for themselves.

To see what the graphic symbols look like, you can POKE them to successive screen locations or use PRINT CHR$ (xxx). If you do the latter, you will find there are certain decimal values that will not print via CHR$. The reason is, they are control codes in ASCII for use with a printer. There are three of these:

CHR$ (7) = Bell
CHR$ (10) = Line Feed
CHR$ (13) = Carriage Return

Another handy piece of information concerns the cursor. Its value is 95 and its “home residence address” is D.54117. If you break this into the two-byte decimal format you will get 211 for the high byte and 101 for the low byte. The low byte is stored in memory at D.512 and is incremented to keep track of the cursor location as it is moved. This information should inspire some thoughts about the possibilities of cursor control in your program.

PEEKing and POKEing Around

Several authors have expanded on the memory map in the pages of MICRO so I won’t go over available information. However, it would have been helpful if the operating manual had revealed where the MEMORY SIZE and TERMINAL WIDTH data are stored during a cold start. If you have something already in memory, upper memory can be reserved by POKEing a new value into D.133, D.134, and the terminal width can be changed by POKEing into D.15. This beats saving the program on tape and reloading it after another cold start.

<table>
<thead>
<tr>
<th>Item 1:</th>
<th>Graphic Object Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal Values</td>
<td></td>
</tr>
<tr>
<td>5 + 6</td>
<td>Submarine - left side</td>
</tr>
<tr>
<td>7 + 8</td>
<td>Submarine - right side</td>
</tr>
<tr>
<td>9 + 10</td>
<td>Starship Enterprise - left side</td>
</tr>
<tr>
<td>11 + 12</td>
<td>Starship Enterprise - right side</td>
</tr>
<tr>
<td>181 + 182 + 179 + 6</td>
<td>Battleship - left side</td>
</tr>
<tr>
<td>182 + 179 + 180</td>
<td>Battleship - right side</td>
</tr>
<tr>
<td>232 + 234 + 235 + 232</td>
<td>Spacecraft</td>
</tr>
<tr>
<td>196 + 234 + 235 + 198</td>
<td>Spacecraft</td>
</tr>
<tr>
<td>173 + 234 + 235 + 174</td>
<td>Spacecraft with aimable guns</td>
</tr>
<tr>
<td>244 + 234 + 235 + 247</td>
<td>Spacecraft with aimable guns</td>
</tr>
<tr>
<td>243 + 234 + 235 + 246</td>
<td>Spacecraft</td>
</tr>
<tr>
<td>242 + 234 + 235 + 245</td>
<td>Spacecraft</td>
</tr>
</tbody>
</table>

No. 31 – December 1980

MICRO – The 6502 Journal
Understanding The Cassette Port

Very little has been written on the internal workings of the cassette port. The memory map only states its address as hex F000-F001. This equates to decimal 61440-61441. One of my earlier programming projects was to teach my CIP to send Morse Code using the cassette port audio tone. It normally rests at 2400 cycles, and I found I could shift it to 1200 cycles and back again using POKE statements into 61440. My program ultimately worked well except that after running it, the SAVE function operated strangely and I had to warm start it to solve the problem. Investigation led back to the cassette port itself and resulted in more notebook entries.

The ACIA is a 6850 chip which is programmable and contains four accessible registers. The Transmit Data Register is a write only register used to send data out to tape. It is accessible using POKE 61441. The same address also contains the Receive Data Register where each word is stored as it comes in from tape. It is a read only register and is accessible using PEEK [61441].

The Status Register is a read only register you can access by PEEK [61440]. Its layout is shown in Notebook Item 2. Bits 2 and 3 reflect the state of pins 23 and 24. In our circuit they are tied to ground, so they should always read zero. Bit 7 reflects the state of pin 7 which is a non-connect in the CIP. However, it can be set internally so don’t write it off. The rest of the bits appear to be strictly status-reporting as defined in Item 2.

The Control Register is perhaps the most important in terms of using the cassette port in your programs. It is writable using POKE 61440 and it is here that I got into trouble with my Morse Code program.

The layout for this register is shown in Item 3. Bits 0 and 1 control an internal clock divider to allow a software selectable ratio of 1/1, 1/16 and 1/64. The clock supplied to the 6850 will support a 4800-baud data rate so the data rates shown in Item 3 are available.

A quick look at the CIP schematic reveals that the RS-232 circuitry is controlled by the clock output from the 6850. Therefore, if you have access to a 4800-baud printer, a quick POKE into D.61440 will allow full-speed printing! The same is true for 75 baud, if you happen to have an old “100 speed” printer lying around.

Incidentally, the Master Reset sets up a condition the SAVE software is not designed to handle. If you go to the SAVE mode while these bits are both set, the CIP will lock up waiting for the Status Register to change state. I have found that this can also happen while POKEing other values into 61440, but there is a way around it. POKE the Control Register to a decimal 3 followed immediately by the value you want. This can be done by multiple statements per line. For example, POKE 61440, 3: POKE 61440,16 will set up the 4800-baud rate.

### Item 2:

<table>
<thead>
<tr>
<th>ACIA Status Register</th>
<th>Hex F000</th>
<th>Decimal 61440</th>
<th>READ ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRQ</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>PE  ( \overline{R} )</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>OVRN  ( \overline{T} )</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE  ( \overline{D} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTS  ( \overline{C} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCD  ( \overline{C} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- RDRF - Receive Data Register Full = 1, Reset by data read or reset
- TDRR - Transmit Data Register Empty = 1
- DCD - Data Carrier Detect = 1 for loss of carrier
- CTS - Clear To Send = 1 if pin 24 goes high
- FE - Framing Error = 1 if first stop bit is missing indicating character synchronization error, bad transmission, or a Break condition. Bit resets when condition clears.
- OVRN - OverRun error = 1 if RDRF = 1 when next character arrives. Reset by data read.
- PE - Parity Error = 1 if parity of received data does not agree with preselected odd or even parity.
- IRQ - Interrupt ReQuest = 1 to generate interrupt via pin 7. Set by DCD = 1, TDRR = 1 or RDRF = 1 depending on how TC bits of Control Register were set.

### Item 3:

<table>
<thead>
<tr>
<th>ACIA Control Register</th>
<th>Hex F000</th>
<th>Decimal 61440</th>
<th>WRITE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>REE</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>TC2  ( \overline{D} )</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

- CDS2  \( \overline{C} \) | 0        | 1/1 [4800 Baud] |
- CDS1  \( \overline{C} \) | 0        | 1/16 [300 Baud - normal for CIP] |
- 1       | 1/64 [75 Baud] |
- 1       | Master Reset = clears Status Register |

- WS3  \( \overline{S} \) | 0        | 0             | 8          |
- WS2  \( \overline{S} \) | 0        | 0             | 8          |
- WS1  \( \overline{S} \) | 0        | 0             | 8          |

- Word Select bits

- TC2  \( \overline{D} \) | 0        | 0             | 1          |
- TC1  \( \overline{D} \) | 0        | 0             | 1          |

- Transmitter Control bits

- RIE Receiver Interrupt Enable = 1 to enable interrupt output in receiving mode. Allows RDRF to generate IRQ.
The Word Select bits allow the variable word characteristics shown in item 3. The CIP software sets WS3 only and supports only that configuration from tape, so I have never had a reason to change it.

The two Transmit Control bits can be used to shift the cassette port tone from 2400 to 1200 cycles and back. When both bits are set, a break is transmitted and the shift to 1200 cycles takes place. Any other value shifts it back. Normally, the CIP software initializes these bits to zeros.

The Receive Interrupt Enable bit is the last one in the Control Register. It is initialized to zero and setting it will cause a corresponding change in the interrupt Request bit of the Status Register. I haven't found out if the CIP software uses it.

Using the above information, Item 4 shows the correct data to POKE into 61440 to get only the reaction you want.

**Reading A Tape Without Loading It**

Often I find I want to load more than one program into memory. Since Ohio Scientific allowed for separate LOAD and NEW commands, I only have to be sure the statement of numbers of the different programs do not overlap. A problem arises in trying to find the start of a program if there is more than one program on a tape. I can only read the tape using Load and that puts it in memory automatically, perhaps destroying what is already there.

The solution is the one line program of Item 5. I assigned it statement number 63999, so it can stay in memory and probably never get overwritten. It takes advantage of the WAIT function in Ohio Scientific 8K BASIC and capitalizes on the fact that all data is stored in ASCII form on tape. RUN 63999 gets it going for perfect copy without entering anything in memory, and "CTRL C" or RESET and a warm start stops the program when you have found the right spot on the tape. LOAD then functions normally.

I hope you are able to use some of these thoughts and comments. Perhaps you have found something that allows the completion of a stubborn program or application. If so, that is what I intended and I hope you will share your notes with the rest of us CIP users.

---

**Item 4:**

POKE 61440, 3 to reset Status Register (followed by POKE to valid state)
" " 17 to initialize normal CIP state
" " 16 for 4800 baud data rate
" " 18 for 75 baud (100 speed) data rate
" " 113 to shift cassette port tone to 1200 cycles (actually anything from 96 to 127 will work as long as you shift back with a 17)

**Item 5:**

Tape Reader
63999 WAIT 61440,1: PRINT CHR$[PEEK (61441)]; GOTO 63999

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MICRO - The 6502 Journal
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Drawing A Line On PET's 80 x 50 Grid

A collection of flexible, machine language routines. Allows plotting of individual points—or lines between pairs of points—using PET's quarter-box graphic characters. Additional features include erasing and screen inversion.

Harvey S. Davis
Dept. of Mathematics
Michigan State University
East Lansing, MI 48824

The purpose of this article is to provide some machine language subroutines, which are callable from BASIC, that will enable the user of a PET personal computer to draw either a point or a line on the screen, at double the resolution of the ordinary screen grid. The point or line drawn may be either plotted or erased.

An interesting feature of these subroutines is that the graphics are drawn on the screen between successive hardware updates of the screen. This means that the "snow" that results when the PET competes with the character generator video RAM will not be present. (For related programs see the interesting articles by Sherburne and Velders given in the bibliography.)

The reader should note that these subroutines are designed for use on a PET with the original ROMs. Extensive use made of the BASIC input buffer for zero page storage. These variables would have to be relocated. Also there are calls to $E840 to determine the status of the update of the screen.

<table>
<thead>
<tr>
<th>Machine Language Subroutines</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADLO * $0001</td>
</tr>
<tr>
<td>ADHI * $0002</td>
</tr>
<tr>
<td>XCHR * $0033 WRITTEN FOR 2.0 ROM'S</td>
</tr>
<tr>
<td>XADL * $0034 MOST OF THESE PAGE</td>
</tr>
<tr>
<td>XADH * $0035 ZERO ADDRESSES MUST</td>
</tr>
<tr>
<td>BFRNXT * $0036 BE CHANGED FOR 3.0</td>
</tr>
<tr>
<td>BBFRLO * $0037 BASIC ROM'S.</td>
</tr>
<tr>
<td>BBFRHI * $0038</td>
</tr>
<tr>
<td>COUNT * $0039</td>
</tr>
<tr>
<td>XO * $003A</td>
</tr>
<tr>
<td>YO * $003B</td>
</tr>
<tr>
<td>XI * $003C</td>
</tr>
<tr>
<td>YI * $003D</td>
</tr>
<tr>
<td>DX * $003E</td>
</tr>
<tr>
<td>DY * $003F</td>
</tr>
<tr>
<td>XLO * $0040</td>
</tr>
<tr>
<td>XHI * $0041</td>
</tr>
<tr>
<td>YLO * $0042</td>
</tr>
<tr>
<td>YHI * $0043</td>
</tr>
<tr>
<td>XVAL * $0044</td>
</tr>
<tr>
<td>YVAL * $0045</td>
</tr>
<tr>
<td>ZALO * $0046</td>
</tr>
<tr>
<td>ZAH1 * $0047</td>
</tr>
<tr>
<td>QUAD * $0048</td>
</tr>
<tr>
<td>FLAG * $0049</td>
</tr>
<tr>
<td>ZTABLE * $004A</td>
</tr>
<tr>
<td>VIAADD * $E840</td>
</tr>
</tbody>
</table>

1B00 20 88 1F SNGLPT JSR FRSTPT CALLED BY BASIC--
1B03 20 F9 1B JSR BFROUT DRAWS SINGLE POINT AT (XVAL),(YVAL).
1B06 60 RTS

1B10 20 00 1F LINE JSR AIM CALLED BY BASIC--
1B13 20 38 1F JSR PREDW DRAWS LINE FROM
1B16 20 88 1F JSR FRSTPT XO,YO TO XI,YI.
1B19 20 60 1F JSR DRAW
1B1C 20 F9 1B JSR BFROUT
1B1F 60 RTS

1B5F 9D 40 E8 BFROUT LDA VIAADD WAITS FOR
1BFC 29 20 AND #$20 HARDWARE UPDATE
1BFE D0 F9 BNE BFROUT OF SCREEN
1C00 60 BUFFER RTS SUBROUTINE CREATED

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Display Grids

The PET displays characters on its screen with reference to a 25 x 40 grid. Each screen location is associated with an address in memory, according to the following formula:

\[ \text{ADDRESS} = 32 \times 1024 + 25 \times Y + X \]

X denotes the column \((0 \leq X \leq 39)\) and Y denotes the row \((0 \leq Y \leq 24)\). The positive x-axis points to the left, while the positive y-axis points down. Thus address \(32 \times 1024\) is associated with the upper left-hand corner of the screen. I will refer to these conventions as the "screen grid".

In order to discuss the generation of graphics having twice the resolution of the screen grid, I shall use two other grids which I shall call the observer's grids.

The observer's grid positive down is an 80 x 50 grid \((0 \leq X \leq 79, 0 \leq Y \leq 49)\) with the origin in the upper left hand corner, the x-axis proceeding from left to right and the y-axis proceeding from top to bottom.

The observer's grid positive up is an 80 x 50 grid \((0 \leq X \leq 79, 0 \leq Y \leq 49)\) with the origin in the lower left hand corner, the x-axis proceeding from left to right and the y-axis proceeding from bottom to top.

<table>
<thead>
<tr>
<th>Location</th>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1E00 20</td>
<td>TABLE = 20</td>
<td>THIS IS A TABLE OF ALL SIXTEEN POSSIBLE QUARTER-BOX CHAR.'S.</td>
</tr>
<tr>
<td>1E01 6C</td>
<td>= 6C</td>
<td></td>
</tr>
<tr>
<td>1E02 7B</td>
<td>= 7B</td>
<td></td>
</tr>
<tr>
<td>1E03 62</td>
<td>= 62</td>
<td></td>
</tr>
<tr>
<td>1E04 7C</td>
<td>= 7C</td>
<td></td>
</tr>
<tr>
<td>1E05 E1</td>
<td>= E1</td>
<td></td>
</tr>
<tr>
<td>1E06 FF</td>
<td>= FF</td>
<td></td>
</tr>
<tr>
<td>1E07 FE</td>
<td>= FE</td>
<td></td>
</tr>
<tr>
<td>1E08 7E</td>
<td>= 7E</td>
<td></td>
</tr>
<tr>
<td>1E09 7F</td>
<td>= 7F</td>
<td></td>
</tr>
<tr>
<td>1E0A 61</td>
<td>= 61</td>
<td></td>
</tr>
<tr>
<td>1E0B FC</td>
<td>= FC</td>
<td></td>
</tr>
<tr>
<td>1E0C E2</td>
<td>= E2</td>
<td></td>
</tr>
<tr>
<td>1E0D FB</td>
<td>= FB</td>
<td></td>
</tr>
<tr>
<td>1E0E EC</td>
<td>= EC</td>
<td></td>
</tr>
<tr>
<td>1E0F A0</td>
<td>= A0</td>
<td></td>
</tr>
<tr>
<td>1E10 A2 0F</td>
<td>INIT</td>
<td>LDX #$0F</td>
</tr>
<tr>
<td>1E12 BD 00 1E</td>
<td>LOAD</td>
<td>LDA TABLE,X TO PAGE ZERO</td>
</tr>
<tr>
<td>1E15 95 4A</td>
<td>STA</td>
<td>ZTABLE,X BEGINNING AT</td>
</tr>
<tr>
<td>1E17 CA</td>
<td>DEX</td>
<td>ZTABLE=$004A</td>
</tr>
<tr>
<td>1E18 10 F8</td>
<td>BPL</td>
<td>LOAD</td>
</tr>
<tr>
<td>1E1A 60</td>
<td>RETURN</td>
<td>RTS</td>
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<tr>
<td>1E1B A5 44</td>
<td>POINT</td>
<td>LDA XVAL</td>
</tr>
<tr>
<td>1E1D 30 F8</td>
<td>BPL</td>
<td>RETURN</td>
</tr>
<tr>
<td>1E1F C9 50</td>
<td>CMP</td>
<td>#$30</td>
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<tr>
<td>1E21 10 F7</td>
<td>BPL</td>
<td>RETURN</td>
</tr>
<tr>
<td>1E23 A5 45</td>
<td>LDA</td>
<td>YVAL</td>
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<tr>
<td>1E25 30 F3</td>
<td>BPL</td>
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</tr>
<tr>
<td>1E27 C9 32</td>
<td>CMP</td>
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<tr>
<td>1E29 10 EF</td>
<td>BPL</td>
<td>RETURN</td>
</tr>
<tr>
<td>1E2B 24 49</td>
<td>ORIENT</td>
<td>BIT FLAG</td>
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<td>1E2D 10 07</td>
<td>BPL</td>
<td>PREP</td>
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<td>1E2F A9 31</td>
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<td>#$31</td>
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<td>SEC</td>
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<td>1E32 E5 45</td>
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<td>YVAL</td>
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</tr>
<tr>
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<td>LDA</td>
<td>YVAL</td>
</tr>
<tr>
<td>1E39 29 01</td>
<td>AND</td>
<td>#$01</td>
</tr>
<tr>
<td>1E3B 0A</td>
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<td>A</td>
</tr>
<tr>
<td>1E3C 65 46</td>
<td>STA</td>
<td>ZALO</td>
</tr>
<tr>
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<td>LDA</td>
<td>XVAL</td>
</tr>
<tr>
<td>1E40 29 01</td>
<td>AND</td>
<td>#$01</td>
</tr>
<tr>
<td>1E42 66 46</td>
<td>ADC</td>
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<td>1E44 AA</td>
<td>TAX</td>
<td></td>
</tr>
<tr>
<td>1E45 A9 1C</td>
<td>LDA</td>
<td>#$10</td>
</tr>
<tr>
<td>1E47 4A</td>
<td>LOOPA</td>
<td>LSR</td>
</tr>
<tr>
<td>1E48 CA</td>
<td>DEX</td>
<td></td>
</tr>
<tr>
<td>1E49 10 0C</td>
<td>BPL</td>
<td>LOOPA</td>
</tr>
<tr>
<td>1E4B 85 48</td>
<td>STA</td>
<td>QUAD</td>
</tr>
<tr>
<td>1E4D 46 44</td>
<td>LSR</td>
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</tr>
<tr>
<td>1E4F 46 45</td>
<td>LSR</td>
<td>YVAL</td>
</tr>
<tr>
<td>1E51 A9 80</td>
<td>LOCAD</td>
<td>LDA #$80</td>
</tr>
<tr>
<td>1E53 85 02</td>
<td>STA</td>
<td>ADH1</td>
</tr>
<tr>
<td>1E55 A9 00</td>
<td>LDA</td>
<td>#$00</td>
</tr>
<tr>
<td>1E57 85 01</td>
<td>STA</td>
<td>ADLO</td>
</tr>
<tr>
<td>1E59 85 47</td>
<td>STA</td>
<td>ZAH1</td>
</tr>
<tr>
<td>1E5B A5 45</td>
<td>LDA</td>
<td>YVAL</td>
</tr>
<tr>
<td>1E5D 0A</td>
<td>ASL</td>
<td>A</td>
</tr>
</tbody>
</table>

2 * PARITY(YVAL) + PARITY(XVAL) = 2 * PARITY(YVAL + XVAL) = QUAD = 2 * (4-XR+1)
Character Graphics

The character that is displayed at a given location on the screen is completely determined by the byte value stored at the corresponding address.

Among the characters that the PET makes available are 16 that allow the user effectively to double the resolution simultaneously in each direction. These characters can be visualized as a square with each of its quadrants either blank or lit. Table 1 gives these characters and their byte equivalents.

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>value</th>
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<td>0</td>
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<td>0</td>
<td>6C</td>
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<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7B</td>
<td></td>
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<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7C</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>E1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>FF</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>FF</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7E</td>
</tr>
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<td>7F</td>
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<tr>
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<td>0</td>
<td>1</td>
<td>61</td>
<td></td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>FC</td>
<td></td>
</tr>
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<td>1</td>
<td>0</td>
<td>E2</td>
<td></td>
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<td>1</td>
<td>0</td>
<td>FB</td>
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<td>1</td>
<td>1</td>
<td>EC</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>AO</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>a = 0 if and only if quadrant a is blank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b = 0 if and only if quadrant b is blank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c = 0 if and only if quadrant c is blank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d = 0 if and only if quadrant d is blank</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Some Notation Conventions

If XXX denotes an address, then [XXX] will denote the byte value stored at that address. [XXX] may also, in the appropriate context, denote the character represented by that byte value.

If XXX and YYY denote addresses, then [XXX, YYY] will denote the address whose low byte is [XXX] and whose high byte is [YYY]. [XXX, YYY] will denote the double precision number whose most significant byte is [XXX] and whose least significant byte is [YYY].

AC, XR, and YR denote the byte values at the accumulator, the x register and the y register.

BASIC Subroutines (for drawing a single point at X,Y on the observer’s grid)

1. Set the observer’s grid positive down. This is done by setting the most significant bit of FLAG = $0049 = 73 to 0.
   10 POKE 73, PEEK (73) AND 127
      RETURN

2. Set the observer’s grid positive up. This is done by setting the most significant bit of FLAG = $0049 = 73 to 1.
   15 POKE 73, PEEK (73) OR 128
      RETURN

3. Set draw mode to PLC. This is done by setting the second most significant bit of FLAG to 0.
   20 POKE 73, PEEK (73) AND 191
      RETURN

4. Set draw mode to ERASE. This is done by setting the second most significant bit of FLAG to 1.
   25 POKE 73, PEEK (73) OR 64
      RETURN

5. Draw the point at X,Y. This is done by setting [XVAL] = X, [YVAL] = Y and calling subroutine SNGLPT.
   30 POKE 68,X: POKE 69,Y : SYS (6912): RETURN

(continued)
| 1F40 A5 30 | LDA YI |
| 1F42 E5 38 | SBC YO |
| 1F44 85 3F | STA DY |
| 1F46 A5 3A | LDA XO |
| 1F48 85 44 | STA XVAL |
| 1F4A 85 41 | STA XHI |
| 1F4C A5 3B | LDA YO |
| 1F4E 85 45 | STA YVAL |
| 1F50 85 43 | STA YHI |
| 1F52 A2 80 | LDX #$80 PLOTS LINE |
| 1F54 86 40 | STX XLO FROM X0, Y0 TO |
| 1F56 86 42 | STX YLO X1, Y1 BY |
| 1F58 A2 00 | LDX #$00 COMPUTING AND |
| 1F5A 86 39 | STX COUNT PLOTTING |
| 1F5C 60 | RTS 256 CONSECUTIVE POINTS |
| 1F60 A5 3E | DRAW LDA DX |
| 1F62 18 | CLC |
| 1F63 65 40 | ADC XLO |
| 1F65 85 40 | STA XLO |
| 1F67 90 02 | BCC INCRY |
| 1F69 E6 41 | INC XHI |
| 1F6B A5 3F | INCY LDA DY PLOTS POINT AT |
| 1F6D 18 | CLC XVAL, YVAL |
| 1F6E 65 42 | ADC YLO |
| 1F70 85 42 | STA YLO |
| 1F72 90 02 | BCC CALLPT INITIALIZE AND |
| 1F74 E6 43 | INC YHI PLOT FIRST |
| 1F76 A5 41 | CALLPT LDA XHI PRINT |
| 1F78 85 44 | STA XVAL IS THIS ADDRESS |
| 1F7A A5 43 | LDA YHI SAME AS THAT |
| 1F7C 85 45 | STA YVAL OF LAST POINT |
| 1F7E 20 A0 1F | JSR NEXTPT |
| 1F81 E6 39 | INC COUNT |
| 1F83 D0 DB | BNE DRAW END OF BUFFER |
| 1F85 4C D8 1E | JMP BFRIN |
| 1F88 20 10 1E | FRSTPT JSR INIT |
| 1F8B 20 1B 1E | JSR POINT |
| 1F8E 20 88 1E | JSR GETCHR BUFFER TO SCREEN |
| 1F91 20 A0 1E | JSR UPDATE RESET TO NOMINAL |
| 1F94 20 C8 1E | JSR SETBFR LAST CHR. TO BUFF |
| 1F97 20 D8 1E | JSR BFRIN CHR. AT NEXT ADDR |
| 1F9A 60 | RTS |

To use the BASIC subroutine for drawing a line from X,Y to U,V on the observer's grid positive up, the draw mode may be set by BASIC subroutines 20 and 25 above. The drawing is done by setting [X0] = X,[Y0] = Y,[X1] = U,[Y1] = V and calling subroutine LINE.

40 POKE 58,X : POKE 59,Y :
POKE 60,U : POKE 61,V
42 SYS(6928) : RETURN

The user should note that if a BASIC program intertwines point and line commands, the orientation of the observer's grid must be reset by either subroutine 10 or 15, before each point command that immediately follows a line command. It need not be reset between successive point commands. The line command subroutine 40 always assumes that the observer's grid is positive up.

Bibliography
Sherburne, J.R., High Resolution Plotting for the PET, MICRO [10:19].

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<th>KIM</th>
<th>SYM</th>
<th>PET</th>
<th>S44-BUS</th>
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<td>$385.00</td>
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<td>$279.00</td>
<td>$199.00</td>
<td>$49.00</td>
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with

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The School of the Ozarks
Point Lookout, MO 65726

and

Russell V. Lenth
Dept. of Statistics
University of Iowa
Iowa City, IA 52242

In September 1979 I noticed an article in MICRO (16:29) by M.L. DeJong in which he described a Morse Code send and receive program. I was so impressed that I felt it was time to press forward and have available a random code program to provide the additional tool for teaching Morse Code. Since those days I have been using it with a local Amateur Radio operator, Russell V. Lenth, who is quite conversant in BASIC. On short notice he produced a program to generate random character groups, but not in Morse Code. Neither of us knew how to join it with a Morse Code generation program, so I sent a letter to M.L. DeJong detailing what we wished to accomplish, and included the BASIC program. He was kind enough to write another BASIC program and a machine language program which generally accomplished what was desired. We worked over the two programs to do a number of additional things. Below are listed the functions of the refined program.

1. Characters are generated at 15 w.p.m. or faster.
2. Characters are presented in groups of 5.
3. User has option to input specific characters for random sending.
4. Program provides for the 42 characters available in the look-up Table.
5. Spacing between characters is varied below 15 w.p.m. to control presentation rate.
6. Program prints each line of characters after the entire line is sent.

Some years ago in learning the Morse Code, I decided on a technique for learning and teaching it. By sending the individual characters at a rate greater than 13 w.p.m. (words per minute), with increased spacing to lower the presentation rate, the student would be able to learn the actual character sound sooner, rather than taking the character apart mentally, counting the various dots and dashes, and then deciding which character was sent. At higher code transmission rates (13 w.p.m. and up) character recognition has to be virtually instantaneous.

An accompanying learning problem is lesson material. A recording or tape of text (even random groups) is soon memorized and its effectiveness is lost. Randomly generated character groups are difficult to memorize and give no clues as to what character may be heard next. I thought this whole approach could be accomplished with a small computer. All that was needed was some software and a little hardware.

An article appeared in MICRO February 1980 (21:19) by M.L. DeJong that described a Morse Code send and receive program. I was so impressed that I felt it was time to press forward and have available a random code program to provide the additional tool for teaching Morse Code. I discussed it with a local Amateur Radio operator, Russell V. Lenth, who is quite conversant in BASIC. On short notice he produced a program to generate random character groups, but not in Morse Code. Neither of us knew how to join it with a Morse Code generation program, so I sent a letter to M.L. DeJong detailing what we wished to accomplish, and included the BASIC program. He was kind enough to write another BASIC program and a machine language program which generally accomplished what was desired. We worked over the two programs to do a number of additional things. Below are listed the functions of the refined program.

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An accompanying learning problem is lesson material. A recording or tape
The hardware to generate the code sounds and/or operate an external relay for keying a transmitter or code practice oscillator was taken from several articles by M.L. Dejong. We believe there are sufficient hardware options to cover most users' needs. An additional option is shown in figure 1 from a private note from M.L. Dejong, modified by E.V. Weiner.

The machine language program which generates the Morse Code is relatively short. When activating BASIC, limit memory to 2048 bytes. The look-up table is located above $0F20. The Morse Code send routine starts at $0F5C.

### RANDOM CHARACTER MORSE CODE

**BY EUGENE V. WEINER, MARVIN L. DEJONG, RUSSELL V. LENTH**

**FOR THE AIM 65**

### AIM EQUATES

- **UDRAH**: *A001* DATA REG A
- **UDDRA**: *A003* DATA DIR REG A
- **UTIL**: *A004* TIMER 1 COUNTER LOW
- **UTILA**: *A005* TIMER 1 COUNTER HIGH
- **UACR**: *A00B* AUX CONTROL REGISTER
- **DIV**: *A497* DIVIDE BY 1024 TIMER

### AIM SUBROUTINES

- **OUTPUT**: *E97A* OUTPUT A CHARACTER
- **XXX**: *C0D1*

### PROGRAM EQUATE

- **TABLE**: *0F00*

### ORG $0F5C

- **0F5A A9 81** START
- **0F5E 8D 01 A0** STA UDRAH
- **0F61 8D 03 A0** STA UDDRA
- **0F64 A9 C0** LDA #$C0
- **0F66 8D 0B A0** STA UACR
- **0F69 A9 00** LDA #$00
- **0F6B 8D 04 A0** STA UTIL
- **0F6E A9 04** LDA #$04
- **0F70 8D 05 A0** STA UTIL
- **0F73 A5 38** LDA $0038
- **0F75 48** PHA
- **0F76 A8** TAY
- **0F77 AD 00 0F** LDA TABLE
- **0F7A F0 21** BEQ LBLF
- **0F7C 0A** LBLA ASL A
- **0F7D F0 0F** BEQ LBLD
- **0F7F 48** PHA
- **0F80 80 06** BCS LBLB
- **0F82 20 A2 0F** JSR LBLG
- **0F85 4C 8B 0F** JMP LBLC
- **0F88 20 BB 0F** LBLB JSR LBLK
- **0F8B 6B** LBLC PLA
- **0F8C D0 EE** BNE LBLA
- **0F8E A0 02** LBLD LDY #$02
- **0F90 20 C0 0F** LBLE JSR LBLL
- **0F93 88** DEY
- **0F94 D0 FA** BNE LBLE
- **0F96 68** PLA
- **0F97 20 7A E9** JSR OUTPUT
- **0F9A 4C D1 C0** JMP XXXX
- **0F9D A0 04** LBLF LDY #$04
- **0F9F 4C 90 0F** JMP LBLE
- **0FA2 A0 01** LBLG LDY #$01
- **0FA4 CE 01 A0** LBLH DEC UDRAH
- **0FA7 20 C0 0F** LBLI JSR LBLL
- **0FA8 88** DEY
- **0FAB D0 FA** BNE LBLI
- **0FAD AD 01 A0** LDA UDRAH
- **0FBA 44** LSR A
- **0FBB 80 07** BCS LBLJ
- **0FBD CE 01 A0** INC UDRAH
- **0FBE C8** INY
- **0FBB 4C A7 0F** JMP LBL1
- **0FBA 60** LBLJ RTS
- **0FBB A0 03** LBLK LDY #$03
- **0FB0 4C A4 0F** JMP LBLH
- **0FC0 A5 37** LBLL LDA $0037
- **0FC2 8D 97 A4** STA DIV
- **0FC5 2C 97 A4** LBLM BIT DIV
- **0FC8 10 FB** BPL LBLM
- **0FCA 60** RTS
The basic program allocates memory for the characters to be sent in statements 10 and 20.

- 30 to 50 generate the numbers.
- 60 to 80 generate the letters.
- 100 defaults to all the characters in the look-up table.
- 110 to 140 input desired characters other than default set.
- Speed is entered at 150.
- 151 to 180 provide for character spacing.
- 190 to 200 enter speed values into machine language subroutine.
- 210 to 220 specify starting address for the machine language subroutine.
- 230 to 260 fill the “A” array with 20 random characters.
- 270 to 400 send and display the characters.
- 290 puts characters into memory.
- 300 to 310 generate character spacing.
- 320 sends and displays the characters.
- 330 prints 20 characters after they are sent and displayed.
- 360 to 390 put timed spaces between groups of 5 characters.
- Starting at 410 is a subroutine which determines how many lines of 20 characters are to be sent before stopping and requesting a change in speed.

After the two programs are entered, the BASIC program is initialized. If all 42 characters are desired, the number 42 is entered on Prompt. Any speed may be entered on the speed Prompt. After 100 characters are sent, a speed Prompt will appear. A speed change may then be made which retains the original set of characters specified in either Statement 100 or 110. The number of lines to be sent may be altered by changing “If x = 5 then 150” to some other integer value of “x”.

This program has been used on a regular basis for several months. People who have listened to the code lessons generated by this program have responded favorably.

We hope to modify the program to enable entering text and having it sent as Morse Code by the variable speed and space routines described above.

Bibliography


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**Basic Listing 1.**

```plaintext
10 DIM A(20), C(50)
20 C(1) = 44 : C(2) = 45 : C(3) = 46 : C(4) = 47
30 FOR I = 1 TO 16
40 C(I) = I + 43
50 NEXT I
60 FOR I = 17 TO 42
70 C(I) = I + 48
80 NEXT I
90 PRINT "ENTER NUMBER OF CHARACTERS DESIRED": INPUT N
100 IF N = 42 THEN 15
0
110 PRINT "ENTER CHARACTERS DESIRED": INPUT A$ 
120 FOR I = 1 TO N
130 C(I) = ASC(MID$(A$, I, 1))
140 NEXT I
150 PRINT "ENTER SPECIFIED": INPUT S
151 Z = S: X = 0
155 T = 1: U = 7500 / S
160 IF S = 14 THEN 19
0
170 T = 7500 / S - 500
180 S = 15
190 S = INT(1172 / S + 0.5)
200 POKE 55, S
210 POKE 04, 92
220 POKE 05, 15
230 FOR I = 1 TO 20
240 J = INT(N * RND(1) + 1)
250 A(J) = C(J)
260 NEXT I
270 J = 0
280 FOR I = 1 TO 20
290 POKE 55, A(I)
300 FOR C = 1 TO T
310 NEXT C
320 Y = USR(0)
330 IF I = 20 THEN PRINT
340 INT: GOTO 400
350 J = J + 1
360 IF J <= 5 THEN 40
0
370 FOR J = 1 TO U
380 NEXT J
390 J = 0
400 NEXT I
410 X = X + 1
420 IF X = 5 THEN 150
430 GOTO 230
```

---

No. 31 - December 1980 MICRO – The 6502 Journal
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Look for Hi-Res Football coming soon
The game of life is made a little easier with this flexible storage program which provides for translation, rotation, and reversal of patterns.

John Conway’s game of Life has one of the largest followings of any computer simulation ever devised. My own interest dates back to my first “cellular excursion” in 1972, on a Hewlett-Packard 2000c machine. Since then I’ve collected half a dozen versions and have played with several more, all widely different in execution. One serious drawback nearly every version shares, however, is the sheer drudgery of entering from 2 to 200 sets of coordinates each time a simulation is to be run. I’ve seen several programs with systems to capture coordinates for a given figure—some plain and some incredibly complex. All of these though, are hampered by the fact that Life devotes rarely input the same pattern at exactly the same location and orientation twice, and they usually like to combine figures for interactive effects. One system attempting to circumvent these problems had over 120 individual figures on paper tape, most duplicated up to 8 times for different orientations, and all marked and cataloged. Now that’s dedication!

Being basically lazy myself, (after all, I bought a computer to save myself work), I decided that I needed a few simple routines that would let me name and save figures to disk, and then call them back to the screen at virtually any location, at any reasonable orientation, and in combination with any other pattern on file. My goal then, and the subject of this article, is simply to make Life a little easier. [Pun intended.]

The platform I chose to build my routine on is an excellent machine code/Integer BASIC hybrid program written by Dick Suitor. It appeared most recently in Best of Micro, Volume II. Probably the best and most versatile of all the versions I have seen, it has features like variable generation speed, the ability to set random cells alive in a selected field, and the use of contrasting color to show cell development.

My first task was to come up with a method of storing and retrieving the figures. The obvious solution was to save the x,y coordinates in a sequential text file. In order to make the figures completely relocatable however, I needed a way to make the stored coordinates independent of the screen coordinates. The method I chose was to select an arbitrary centerpoint for the figure, prior to input. Then as each coordinate set was typed in, the x, y values of the center point would be subtracted from the x, y values of the point being entered. The result is a set of codified x, y values, positive and negative, which are relative only to the centerpoint, and therefore totally independent of their current screen location. All that’s required to relocate the figure then, is to change the centerpoint when calling the figure back from storage.

This method, in conjunction with APPLE’s system of screen coordinates, does introduce an irregularity which will become important as we proceed. In normal coordinate systems x values increase as we move to the right, and y values increase as we go up. With the APPLE II, y values increase as we descend on the screen. Further, all screen coordinates are positive, while the codified values may be positive or negative, since they essentially make up a coordinate grid of their own, with the x (horizontal) and y (vertical) axes intersecting at the chosen centerpoint. Unlike normal grids, therefore, y values will be negative above this x axis and positive below it. It will be necessary to keep this in mind, as it is the codified values we will be manipulating in the coming paragraphs when we determine how to reorient the figures.

This second task, that of finding a way to bring the stored figure back to the screen in a different attitude than originally entered, was somewhat more difficult than simply making it relocatable. However, it quickly became clear that all possible orientations could be achieved by reversing the figure, rotating it, or both.

Rotation is obtained by moving each point clockwise around the center some distance (depending on the degree of rotation), while reversal takes the two dimensional image and flips it over, as one would turn over a playing card. Obviously reversal requires us to know which axis the figure is to be reversed around.

Defining an algorithm to rotate and reverse the figures was an interesting exercise, (actually three exercises and three algorithms). I’m sure that somewhere in the field of coordinate mathematics there exists specific rules for such operations. Being more a tinkerer than a scholar, however, I chose to discover those rules by trial and error. Armed with graph paper and pencil, I defined a center, and x and y axes, and began examining what happened to various sets of coordinates when the points they described were reversed or rotated. The first thing I discovered was that for any single set of coordinates, rotation or reversal involved only two operations: either the unsigned magnitude of the x and y
values being swapped, or the signs of one or both values being changed. One, or a combination of these two alterations will produce all feasible orientations. I also learned that rotations in other than 90° increments were not feasible for the purposes of the Life game, but the proof of that is left as an exercise for the reader.

The reversal mechanism turned out to be the simplest. A little paper and pencil work showed that no matter which axis was used for reversal, any point remained the same distance from each axis when reversed. The magnitudes of the x and y values then must remain the same. The signs, however, do not. A reversal around the y axis, for example, sends points from the upper right quadrant \(+x, -y\) to the upper left quadrant \(-x, +y\), and from lower right \(+x, +y\) to lower left \(-x, -y\). Obviously then, reversal on the y axis changes the sign of the x values only. By the same token, an x axis reversal changes the sign of the y values only. Translated into a sequence of program steps this mechanism is implemented in program lines 1070-1110 and 350-400. I also resolved the further question of whether multiple reversals were desirable, that is, two reversals around one axis, or one around each. I determined they were not, but as a second exercise, for fun, the reader may wish to prove why they were not.

Rotation was a little harder as the cases of 90°, 180°, and 270° rotation all had to be allowed for. Easiest to discover was the 180° process. Just as in the reversal case, a point rotated 180° still remains the same distance from each axis, and therefore, the x and

---

### BASIC Listing

```basic
010 LOMEM: 2560
10 DIM HFX$: (30)
20 HFX$ = "0800K94PE.85FM NESSAG"
30 FOR I = 1 TO LEN(HFX$): POKE 511 + I, ASC (HFX$(I)): NEXT I: POKE 72, 0: CALL -144
40 DEL 0, 40
50 GOTO 800
60 POKE -16302, 0: COLOR = 0: FOR X = 40 TO 4
70 HLLN 0, 39 AT K: NEXT K
80 KX = FDL (O) - 10: IF KX < 240 THEN KX = KX1 = IF KX > 0
90 K1 = KX * 6: K2 = KX * 2: K3 = 500 / (K1 + 50) + 1
100 FOR I = 1 TO K3
110 CALL GEN
120 FOR K = 1 TO K2: NEXT K
130 CALL MOP
140 FOR Y = 0 TO SIZE: COLOR = 0
150 NEXT I
160 GOTO 80
170 FOR I = 1 TO SIZE: COLOR = 11
180 X = XCTR * K (I): Y = YCTR + (Y (I)
190 IF X < 0 OR X > 39 OR Y < 0 OR Y > 39 THEN 1
210 200 PLOT X, Y : NEXT I
210 RETURN
220 FOR I = 11 TO 12: FOR J = 1 TO J2
230 COLOR = 11: IF RND (1) THEN COLOR = 0
240 PLOT I, J
250 NEXT J: NEXT I
260 GOTO 60
270 FOR I = 1 TO SIZE
280 X = Y (I) * X (I)
290 IF Y (I) THEN X = X * -1
300 X (I) = X (I) * Y
310 NEXT I: RETURN
320 FOR I = 1 TO SIZE
330 X (I) = X (I) * 1: Y (I) = Y (I) * -1
340 NEXT I: RETURN
350 FOR I = 1 TO SIZE
```

(continued)
750 INPUT "INPUT X,Y",X,Y
760 IF X=99 OR Y=99 THEN 60
770 IF X<0 OR X>39 OR Y<0 OR Y>39 THEN 790
780 COLOR=11: PLOT X,Y: GOTO 750
790 PRINT "OUT OF RANGE!": GOTO 750
800 TEXT
810 DIM X(255),Y(255),A$(50),B$(2),D$(1)
820 GEN=2088: MOP=2265:X1=1: K2=1: D$="": R
830 CALL -936: VTAB 5: TAB 9: PRINT"CONWAY'S GAME OF LIFE": FOR I=1 TO 700: NEXT I
840 OR
850 PRINT "DO YOU WISH TO: 1.PLAY OR 2.RETE";
860 INPUT "A NEW PATTERN FILE (1/2).",C1
870 IF C1=2 THEN 1140
880 INPUT "SPEED=PDL(0): SET DEFAULT (0-255)";K1
890 PRINT "DO YOU WISH TO: 1.RANDOM PATTERN"
900 INPUT "SPEED=PDL"
910 INPUT "FROM DISK OR 3.STANDARD: (1/2/3)";C1
920 IF C1=3 THEN 990
930 INPUT "X DIRECTION LIMITS ",I1,I2
940 IF I1<0 OR I2>39 OR I1>2 THEN 950
950 INPUT "Y DIRECTION LIMITS ",J1,J2
960 IF J1<0 OR J2>39 OR J1>2 THEN 950
970 INPUT "ONE IN 'N' CELLS WILL LIVE: ENTER N",L
980 GOTO 220
990 PRINT "ENTER YOUR PATTERN (X,Y):99,99,9"
1000 GOTO 750
1010 INPUT "WHAT FIGURE NAME",A$
1020 INPUT "ENTER CENTER COORD'S (X,Y)";XCTR,YCTR
1030 INPUT "ENTER ROTATION (0/90/180/270)",ROT
1040 IF ROT=180 OR ROT=270 THEN HALF=1
1050 IF ROT=90 OR ROT=270 THEN ROT=1
1060 IF ROT<>1 THEN ROT=0
1070 INPUT "ENTER 1.REVERSED OR 2.STANDA RD (1/2)";REV
1080 IF REV>1 THEN REV=0: IF NOT REV THEN 1110
1090 INPUT "REVERSE ON 1.X-AXIS OR 2.Y-AXIS (1/2)";XAX
1100 IF XAX=1 THEN XAX=0
1110 GOSUB 410
1120 INPUT "ANOTHER FIGURE (Y/N)";BS: IF BS=NO THEN 60
1130 PRINT "CAUTION:FIGURES MAY OVERWRITE ERROR!": GOTO 1010
1140 INPUT "ENTER CENTER COORD'S (X,Y)",XCTR,YCTR
1150 PRINT "ENTER ALL LIVE CELLS (X,Y): 99,99 EXITS"
1160 GOSUB 650
1170 INPUT "ENTER NAME FOR THIS FIGURE",A$
1180 GOSUB 550
1190 PRINT "TESTING": GOSUB 410
1200 GOTO 60
1210 PRINT "PLOT ABORTED/Figure went off screen"
1220 PRINT "MOVE CENTERPOINT:X AND Y WHEN ABORTED"
1230 PRINT "WERE ",X",";Y: POP: POP
1240 IF I1 THEN 1220: IE=I-1: COLOR=0:
1250 GOTO 1020
1260 REM ADAPATION BY GREG TIBBETTS OF RICHARD SUITOR'S PROGRAM IN
1270 REM BEST OF MICRO VOLUME II 1979
1270 REM LINES 0-50 PROGRAM SET-UP
1280 REM 60-160 SPEED AND GENERATION
1290 REM 170-210 GENERAL PLOT SUBR.
1300 REM 220-260 RANDOM PLOT SUBR.
1310 REM 270-340 ROTATION SUBR'S.
1320 REM 350-400 REVERSAL SUBR.
1330 REM 410-540 DISK READ SUBR.
1340 REM 750-790 STANDARD INPUT SUBR
1350 REM 800-840 INITIALIZATION
1360 REM 850-920 MODE SELECTION
1370 REM 930-1200 USER INPUT/SELECT
1380 REM 1210-1250 PLOT ABORT SUBR.
1400 END
$y$ magnitudes remain the same. Signs however, do not follow the same pattern as during reversal. Since the points in the upper right quadrant (+$x$, $-y$) move to the lower left ($-x$, +$y$), lower right (+$x$, +$y$) to upper left ($-x$, $-y$) and vice versa, it becomes clear that both $x$ and $y$ values must change sign. A 180° rotation therefore is accomplished by simply multiplying the two values by -1. This is implemented in lines 1030-1060 and 320-340.

A 90° rotation is not so straightforward. It is best seen by using the example of a clock face with the $x$ axis running through the 9 and 3, and the $y$ axis through the 12 and 6. A 90° rotation of this clock face moves the point at numeral 1 to the position of numeral 4. For the first time, the magnitude of the $x$ and $y$ values have changed. The distance of the point from the $y$ axis in its original position has become the distance from the $x$ axis after rotation and vice versa. What happens in a 90° rotation then, is that the magnitudes of $x$ and $y$ are simply exchanged. The signs, unfortunately, do not follow such a clear cut pattern. Nevertheless, a pattern does exist. I found it by examining the four quadrants in sequence and noting what happens to their associated $x$ and $y$ signs. Starting at the upper right (+$x$, $-y$) and moving to the lower right produces (+$x$, +$y$). Another 90° rotation produces ($-x$, +$y$), and the final rotation ($-x$, $-y$). Study here shows that the sign of $x$ in the original quadrant is the sign $y$ will have in the new quadrant. Since the magnitude of $x$ becomes the magnitude of $y$ also, we can simply give $y$ the signed value of $x$ for every point to be rotated. You can also see that the sign of the new $x$ value is the opposite of the old $y$ value. To get the new $x$ value we must multiply the old signed value of $y$ by -1. These two steps complete the 90° algorithm and it is implemented in lines 1030-1060 and 270-310. To keep the program as short as possible, 270° rotations were made by using the 90° and 180° subroutines together. This completes the screen output design.

Disk storage is achieved by saving the $x$ and $y$ arrays into a sequential text file; each figure to a separate file. Though this is somewhat wasteful of disk space, I set it up this way to avoid complex file management routines, and to allow for easy renaming and catalog display. The final step was to insert tests in the plot sequence to prevent range errors from crashing the program if a center point was selected that would cause the figure to plot off the screen, and having to restart the program from scratch. The original center-point is not stored with the codified values, and consequently is not available for later examination.

<table>
<thead>
<tr>
<th>Machine Code Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDA $0005</td>
</tr>
<tr>
<td>STA $0003</td>
</tr>
<tr>
<td>LDA $0004</td>
</tr>
<tr>
<td>STA $0002</td>
</tr>
<tr>
<td>CLC</td>
</tr>
<tr>
<td>ADC #$80</td>
</tr>
<tr>
<td>STA $0004</td>
</tr>
<tr>
<td>LDA $0005</td>
</tr>
<tr>
<td>ADC #$00</td>
</tr>
<tr>
<td>CMP #$08</td>
</tr>
<tr>
<td>BNE LBLA</td>
</tr>
<tr>
<td>LDA $0004</td>
</tr>
<tr>
<td>ADC #$27</td>
</tr>
<tr>
<td>CMP #$52</td>
</tr>
<tr>
<td>BPL LBLB</td>
</tr>
<tr>
<td>STA $0004</td>
</tr>
<tr>
<td>LDA $0004</td>
</tr>
<tr>
<td>LBLA $0005</td>
</tr>
<tr>
<td>LBLR</td>
</tr>
<tr>
<td>RTS</td>
</tr>
<tr>
<td>SEC</td>
</tr>
<tr>
<td>BCS LBLR</td>
</tr>
<tr>
<td>JSR LBS</td>
</tr>
<tr>
<td>JR LBL1</td>
</tr>
<tr>
<td>BCC LBLC</td>
</tr>
<tr>
<td>RTS</td>
</tr>
<tr>
<td>LBY #$27</td>
</tr>
<tr>
<td>TYA</td>
</tr>
<tr>
<td>TAX</td>
</tr>
<tr>
<td>LDA #$00</td>
</tr>
<tr>
<td>STA $0940,Y</td>
</tr>
<tr>
<td>STA $0970,Y</td>
</tr>
</tbody>
</table>
The program as it appears in the listing, is set up to run on a 48K APPLE II, using APPLE DOS to store and retrieve the patterns. The instructions for setting up the program, however, are universal with respect to RAM size. I believe that the program could also be converted to use a cassette-based DOS imitator as off-line storage, but that is beyond the scope of this article, and the ingenuity of the writer as well. The machine code runs resident at $800 (2048), and the program has been modified to load both sections as a unit, and relocate the machine portion when run. To enter the program, first the machine code must be typed in (from the hex dump below), to occupy the top 261 bytes of RAM. HIMEM; and PP (program pointer) must then be moved down to protect it, the BASIC portion entered, and then HIMEM; moved back to its original value. The BASIC program is thus altered to automatically move LOMEM; when run and relocate the code to this protected area. Readers familiar with these procedures may skip the instructions which follow. For the purposes of these instructions however, it is assumed that the reader is knowledgeable in the process of converting decimal to hexadecimal and back, and is familiar with APPLE's low order, high order byte storage and the method of converting this to whole number values or visa versa.

**REM: Entering the Machine Code**

1. Boot DOS, type INT and PEEK memory locations 76 and 77 (HIMEM;:). Convert these two numbers to their whole number equivalent and that to its hex equivalent. Record all of these numbers.

2. Compute the starting address for the code by subtracting 262 from the whole number value of HIMEM:. Convert this to hex and again record the numbers.

3. Call -151 and enter the 261 bytes of code, starting at the hex address you calculated in step 2. Once entered, type [CTRL] C and$SAVE LIFE OBJ, ASXXXX, L261; where XXXX is the hex address from step 2.

4. Now convert the above starting address, minus 1 byte, from a decimal whole number to its low order and high order values. POKE these values as follows: POKE 76, low; POKE 77, high; POKE 202, low; and POKE 203, high. Code is now protected.

**REM: Entering the Basic Program**

5. Enter line 0 and line 40 as PRINT statements to avoid the SYNTAX ERROR message that would come if LOMEM; and DEL were entered as deferred commands.

6. Enter line 20 exactly as shown with two exceptions. Where the listing shows 94FB, substitute the hex value

---

(continued)

```
0884 85 06 STA $0006
0886 C9 03 CMP $03
0888 F0 0E BEQ LBLK
088A 90 04 BCC LBLJ
088C C9 04 CMP $04
088E F0 0E BEQ LBLL
0890 B1 02 LBLJ LDA ($02),Y
0892 F0 0A BEQ LBLL
0894 29 85 AND #$85
0896 50 04 BVC LBLM
0898 B1 02 LBLK LDA ($02),Y
089A 09 30 ORA #$30
089C B1 02 LBLM LDA ($02),Y
089E 18LBLL CLC
089F A5 07 LDA $0007
08AD 7F 09 ADC $096F,Y
08A5 38 SEC
08A7 F9 29 SBC $0972,Y
08AA B5 07 STA $0007
08AC C9 03 CMP $03
08AE F0 0E BEQ LBLP
08B0 90 04 BCC LBLN
08B2 C9 04 CMP $04
08B4 F0 0E BEQ LBLT
08B6 29 85 AND #$F8
08B8 30 04 BVC LBLV
08BA B1 04 LBLP LDA ($04),Y
08BE 09 03 ORA #$03
08C0 91 04 LBLV STA ($04),Y
08C2 88 LBLT DEY
```

```
08C3 F0 02 BEQ LBLU
08C5 10 B3 BPL LBLW
08C7 4C 2B 08 LBLU JMP LBLX
08CA A9 04 LBLS LDA #$04
08CC 85 05 STA $0005
08CE A9 00 LDA #$00
08D2 8D 68 09 STA $0968
08D5 8D 88 09 STA $0988
08D8 60 RTS
08D9 20 CA 08 JSR LBL5
08DC 20 00 08 LABD JSR LBL1
08DF 90 01 BCC LBLY
08E1 60 RTS
08E2 A0 27 LBLY LDY #$27
08E4 B1 02 LBL0 LDA ($02),Y
08E6 F0 0A BEQ LBLZ
08E8 29 7F CMP #$7F
08EA C9 10 BPL $10
08EC 30 02 BM1 LABA
08EE 09 80 ORA #$80
08F0 91 02 LABA STA ($02),Y
08F2 B1 04 LBLZ LDA ($04),Y
08F4 F0 0A BEQ LABB
08F6 29 F7 AND #$7F
08F8 6A ROR A
08F9 90 02 BCC LABC
08FB 09 04 ORA #$04
08FD 2A LABC ROL A
08FE 91 04 STA ($04),Y
0900 88 LABB DEY
0901 F0 09 BEQ LABD
0903 10 DF BPL LBL0
```
you calculated in step 2. Where it shows 95FF, substitute the original value of HIMEM: from step 1, minus 1 byte. The format of this string must be exact, as it becomes an APPLE monitor command when the program is run. Be sure the spacing etc., match. Enter all other statements normally.

7. To create the LOMEM: and DEL statements, PEEK locations 202 and 203 [PP] to find the starting address of the BASIC program. Convert these to a single hex value and Call – 151. Beginning with that location, examine sequential locations until a byte 62 is found, [this should be within the first 5 bytes]. This is the token for the print in line 0. Change this byte to an 11, the LOMEM: token. Keep reading sequentially until a second 62 is found and change this to 09, the DEL token. You must also change the 49 three bytes further on to 0A, changing the PRINT comma to a DEL comma.

8. Now by entering [CNTRL] C and LIST 0, 40; you should see your listing match the one in this article. For safety’s sake, save the BASIC program as LIFE B.

REM: Combining the Two

9. Take the original low order and high order byte values for HIMEM: from step 1, and POKE these into locations 76 and 77, respectively. DO NOT RUN THE PROGRAM YET! Now when you SAVE LIFE, the APPLE will obediently save everything from PP to HIMEM:, tricking your machine code safely at the end of your BASIC program.

At this point the program may be run, listed and even changed without difficulty. I would suggest, however, that you keep LIFE OBJ and LIFE B until the combined program is thoroughly use-tested. REM lines at the end of the listing will aid trouble shooting if it becomes necessary. The program is completely automated and self-prompting, therefore I have only a few helpful hints.

First, patterns are best developed on, and input from graph paper numbered along the top and side to match the screen. This gives a backup as well as a hard copy visual image to check the screen output. Second, the centerpoint you select to input the figure is not automatically set as a live cell. Consequently, it can literally be any point on the screen. You must remember though, that all figures are rotated and reversed around this relative center, and therefore, it should be chosen with care. Third, with really large figures where the choice of center point is critical to keep from plotting the figure off screen, it is helpful to include the center coordinates in the figure name as a guide during recall. Last, due to the finite field limits established by Mr. Suiwor’s program, known patterns may not behave normally if they contact the edge. Gliders for example, turn to boxes as they hit the edge, rather than continue to move off screen. This is no cause for alarm; simply a fact of Life.

For fun, create a pattern file with the coordinates listed below. Name this figure PULSAR SEED, and use an initial centerpoint of say 19,19. When you run it the results may surprise you. In any case, have fun!

\((x,y)\): \{10,8\}; \{9,9\}; \{11,9\}; \{9,10\}; \\
\{11,10\}; \{9,11\}; \{10,11\}; \{11,11\}; \{9,12\}; \\
\{11,12\};\{9,13\}; \{11,13\}; \{10,14\}; \{99,99\}.

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---

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32 MICRO - The 6502 Journal No. 31 - December 1980
COMMODORE'S RECENT ANNOUNCEMENT OF SEVERAL NEW PRODUCTS HAS DIVERTED ME, FOR THE MOMENT, FROM MY COVERAGE OF EXISTING PRODUCTS.

VIC 20 LOW-COST, FULL-FEATURE COMPUTER

The most exciting new product is the VIC 20, billed as "the first full-featured, expandable color computer system selling under $300." VIC 20 includes 5K of RAM and connects to any TV or monitor. To work with the 6502 in this new computer, MOS Technology has designed a special chip, which includes CRT control, RAM, and ROM. As a result, the VIC features color, sound, programmable function keys, high resolution graphics (176 x 184), and support for joysticks, paddles, and light pens. Other features include a standard-size typewriter keyboard, 23-line by 22-column display, graphics characters, and an expanded PET BASIC. Memory is expandable to 32K RAM, and provision is made for plug-in ROM cartridges, which will include a wide variety of games, educational and special-application programs. Commodore plans several peripherals for use with the VIC's serial bus (IEEE-488 is not supported) and for the RS-232 port. One of these, the CBM 2031 disk drive, has already been announced. Other peripherals planned are a tape cassette unit, a printer, and add-on accessories.

"User-friendly" is a theme Commodore applies to the VIC 20, and this goes especially for the documentation, as described in the company's press release:

Commodore will provide excellent documentation for first-time users as well as software writers and computer entrepreneurs, in the form of books and manuals — some of which will be written and marketed by outside publishers, with Commodore's support.

The VIC, already on sale in Japan, has met with even greater response than expected. Production in the U.S. has begun already and display units will be distributed to dealers in January 1981. General availability should follow shortly thereafter. If you had planned your Christmas dollars for another computer, you should strongly consider waiting for the VIC 20.

CBM 2031 SINGLE FLOPPY DISK DRIVE

The CBM 2031 will be a low-priced single-drive floppy disk unit, available in both IEEE-488 and serial versions. Serial-written disks will be readable on parallel disk drives, and vice versa, barring incompatibility in the programs themselves (such as trying color commands on a PET). Additional 2031's or dual-drive units may be added later, as needs and budgets dictate. The cost of the 2031 will be under $600.

CBM 8061/8062 "IBM-COMPATIBLE" 8-INCH FLOPPY DISK DRIVE

The CBM 8061 and 8062 are new "IBM-compatible" 8-inch floppy disk-drive units. "'IBM-compatible" means that the IBM 3740 data exchange format is followed.) The 8061 can handle 1.6 megabytes, using a single side of each diskette, and the 8062 can write 3.2 megabytes, using both sides of the two diskettes.

Programs written on a PET or CBM can be transferred easily to a larger computer system, and, of course, the opposite is true. At the same time, compatibility with Commodore's smaller disk-drive products is maintained. Translation through the CPU is easily accomplished with the appropriate programs. These will be available in early 1981.

80 x 50 PET GRAPHICS

CBM 8096 96K BUSINESS COMPUTER

The CBM 8096, containing 96K of user RAM, has been added to the business line. This is essentially an 8032 with an added 64K RAM. Large, sophisticated programs will be usable, including the interesting possibilities of running FORTRAN and COBOL programs. CBM 8096 is available now.

WORDCRAFT 80 WORD PROCESSOR FOR CBM 8032

Two new business software packages—OZZ and Wordcraft 80—were announced. Both were demonstrated in prototype versions at the National Small Computer Show in New York, which I attended on November 1. Wordcraft 80 is a powerful word-processor program designed specifically for the CBM 8032. Combined with the 8032, a disk-drive unit, and a letter-quality printer, the cost of a Wordcraft 80 system is about $5000. This compares very favorably with some dedicated systems which cost a lot more. Some of its features include merging from disk files for form letters, automatic centering and right margin justification, transfer of text from one page to another, character string search and replace, and automatic underlining and embedding of text. Wordcraft 80 is available now.

OZZ—THE INFORMATION WIZARD

"OZZ—The Information Wizard" was also designed specifically for the 8032. It is a very flexible machine code program that allows the user to set up and format information on the screen. Boxes are labeled, and then may be combined in user-specified calculations to update the contents of other boxes. These calculations may also be easily changed. Access to disk files is by record number, index title, or by search on a "key word." There is a document editor for printed information such as reports, lists, and mailing labels. The commands are easy to remember, but a "help" feature allows the user to refresh his memory at any time. Commodore applies "user-friendly" to OZZ's documentation. It is conversationally written, with many examples. OZZ is available now.

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(See Davis article, this issue, p. 15)
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Structure: Disk, Applesoft (48K ROM)

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Structure: Disk, Applesoft (32K ROM)

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Creating An Applesoft BASIC Subroutine Library

There's more than one way to run a BASIC program on your APPLE with DOS. Using EXEC files offers increased flexibility over the RUN command. In this article the author uses the power of the EXEC command to link Applesoft programs from a common library of disk-resident subroutines.

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Marietta, GA 30062

DISK FULL! Well, of course it was full. I had over a dozen lengthy programs stored on it. In each of those programs over fifty percent of the code was identical BASIC routines. Besides the problem of disk space, maintaining identical copies of software is almost impossible. After any given period of time identical software will differ. This is a corollary to somebody's DP axiom that "identical data bases aren't".

The first problem is to find a way to append the subroutines to the main programs. To do this, we need to know how BASIC programs are stored in RAM. With ROM BASIC, the user program usually starts in location 2049 ($801). RAM (cassette) BASIC normally starts at 12289 ($3001). All of the examples in this article assume and were executed with the ROM version of Applesoft BASIC. This start address is stored in locations 103-104 ($67-$68). Similarly, the end of the program is pointed to by locations 175-176 ($AF-$B0). This is shown graphically in figure 1, step 1. If we change the start of the program pointer to the end of our program (figure 1, step 2), then load our subroutines (figure 1, step 3) we need only change our start of program pointer back to its original value (figure 1, step 4), to to have successfully merged our two programs. To do this manually, first:

```
LOAD MAIN PROGRAM
```

where MAIN PROGRAM is the name of the file containing your BASIC program minus your subroutines. Next type:

```
1 = PEEK(176)★256 + PEEK(175) − 2
```

As we stated before, decimal locations 176-175 ($AF-$B0) contain the address of the end of the program currently in RAM. Now type:

```
POKE 104,INT(1/256)
POKE 103,INT(1/256)★256
```

![Figure 1](image_url)
Decimal locations 103-104 contain the address of the start of the BASIC program. This is normally 2049 [801]. The above two statements changed the starting address to now point to the end of our main program. Now we type:

NEW
LOAD SUBROUTINES

where SUBROUTINES is the name of the file containing the routines required by MAIN PROGRAM. SUBROUTINES has now been loaded behind our first program, leaving our original program still intact in RAM. Finally we type in:

POKE 103,1
POKE 104,8

These two statements changed the pointer to the start of our program back to its original value (2049 decimal, 801 hex). Assuming that you haven't made any typing errors, if you now type LIST, you will see that you have successfully appended SUBROUTINES to MAIN PROGRAM.

When we have many programs using the same set of subroutines, this process will save core, but it doesn't result in user-oriented software. There's an easier way! The process can be handled with an EXEC file. APPLE DOS EXEC files allow you to store on a disk file what you would normally type in at the keyboard. When you EXEC a file, APPLE DOS processes each line exactly as if it had been typed in at the keyboard. This is an extremely powerful tool. This article explores just one use of that power.

Program listing 1 contains code for a generalized EXEC file writer. It requests an EXEC file name, creates or replaces the file and then writes the quoted lines contained in the program's DATA statements onto the named text file. Any apostrophes ['] in the DATA statements are converted to quotes ["] before writing to the EXEC file. This feature allows us to write PRINT statements to the EXEC file.

If we run the program shown in listing 1, we produce the EXEC file shown in listing 2. Let's look at a simple example of how to use this EXEC file.

For this example, the file called MAIN PROGRAM (our main program) contains the instructions shown in listing 5. Our subroutine file, SUBROUTINES, contains the instructions shown in listing 6. If we type EXEC MERGE [the name of the EXEC file in listing 2], we would have the following [user input is underlined]:

LOAD MAIN PROGRAM
EXEC MERGE

What we've just done is create a library routine loader! While this approach has proven adequate for development work, expecting an end user to remember which main program must be used with which EXEC file is expecting a human being to adapt to the requirements of the computer. Unfortunately, this kind of design mentality has been prevalent in the industry and is responsible for much of the public's distaste for computers. A more professional approach is possible.

There are several ways that the linking operation can be made invisible to the user and more production oriented for the developer. Our previous example could have included both the LOAD MAIN PROGRAM and RUN statements. Listing 3 contains an EXEC file with these changes. Using this EXEC file results in the following:

The problem with this approach is that it requires a separate EXEC file to execute each program. Every disk file requires a minimum of one sector of overhead plus one sector minimum for the program. This approach is not completely compatible with our original goal of minimizing storage requirements. A better approach, in my opinion, is to write a menu program that determines the names of the programs to be linked together by our EXEC file. These file names are stored by the menu program in RAM, and then the linking EXEC file is EXECed under program control. The EXEC file retrieves the names from RAM and runs the combined program. Listing 7 contains a sample menu program that illustrates this concept.

In our menu, program lines 1000-1190 display the menu shown in figure 2. Lines 1200-1340 request the user to enter the number of his request [the line ENTER YOUR REQUEST NUMBER... is "crawled" along the bottom of the screen]. Line 1290 checks to see if a key has been
depressed, and if it has, line 1340 converts it from ASCII code to a digit. Lines 1350-1450 map the request number into a main program name. Since all of the programs require the same subroutine file, the name of that file is set in line 1530. The loop in lines 1550-1580 POKEs the two file names into locations 768-819 ($330-$333D). Locations 768-829 are generally available to the user. Finally, line 1610 EXECs the file MASTER MERGE shown in listing 4 and runs the desired combined programs.

I have been using various permutations of the techniques described in this article for several months and have found them to be extremely workable. The only obvious restriction is that subroutine line numbers must be larger than the last line of the main program. In practice, I’ve limited my main programs to lines 1-29999 and my subroutines to lines 30000-65000. The small amount of discipline that this restriction imposes is more than offset by the twin benefits of more effective disk space utilization and easier software maintenance.

```
1020 REM QUOTES IN THE DATA STATEMENTS
1021 REM ARE USED ONLY AS DELIMITERS AND + CHR$(34)
1022 REM WILL NOT APPEAR ON THE EXEC 1220 NEXT
1023 REM Are APOSTROPHES IN THE DATA 1230 PRINT A$
1024 REM STATEMENTS WILL APPEAR AS QUO- 1240 GOTO 1170
1025 REM TATION MARKS IN THE EXEC FILE. 1241 REM
1026 REM 1245 REM CHECK FOR CORRECT ERROR CODE
1027 DS = CHR$(4) 1246 REM (#42=OUT OF DATA)
1080 HOME: PRINT CHR$(7) 1247 REM
1090 INPUT "NAME FOR EXEC FILE?";FILES 1250 IF PEEK (222) = 42 THEN GOTO 1255
1100 HOME 1251 PRINT "ERROR "; PEEK (222)
1110 PRINT DS; "MON O" 1252 PRINT "IN LINE "; PEEK(218) + PEEK(219) * 2556
1120 PRINT DS; "OPEN";FILES 1253 STOP
1130 PRINT DS; "DELETE";FILES 1255 POKE 216,0
1140 PRINT DS; "OPEN";FILES 1259 PRINT DS; "NOMON O"
1150 PRINT DS; "WRITE";FILES 1260 PRINT DS; "CLOSE";FILES
1160 ON ERR GOTO 1250 1270 REM
1162 REM READ IN LINE AND REPLACE 1280 REM BEGIN DATA STATEMENTS DEFINING
1163 REM APOSTROPHES WITH QUOTES 1290 REM TEXT TO BE PLACED IN EXEC FILE
1164 REM 1300 REM
1170 READ SS$ 1310 DATA "I=PEEK(176)*256+PEEK(175)-2:POKE I/256,1-INT(I/256)*256"
1180 A$ = ""
1200 IF MIDS($S$,I,1) <> "" THEN A$ = A$ + MIDS($S$,I,1)
1210 IF MIDS($S$,I,1) = "" THEN A$ = A$

Listing 1: Generalized EXEC File Writer Program

```

```
LOAD MAIN PROGRAM

HOME: I=PEEK(176)*256+PEEK(175)-2:POKE 10 4,INT(I/256):POKE 103,I-INT(I/256)*256
LOAD SUBROUTINES
HOME: POKE 103,1:POKE 104,8:PRINT "SUBROUTINES LOADED...";CHR$(7)
RUN

Listing 2: EXEC File MERGE

```

```
LOAD MAIN PROGRAM

HOME: I=PEEK(176)*256+PEEK(175)-2:POKE 10 4,INT(I/256):POKE 103,I-INT(I/256)*256
LOAD SUBROUTINES
HOME: POKE 103,1:POKE 104,8
RUN

Listing 3: EXEC File TITLE DEMO

```

```
LOAD MAIN PROGRAM

HOME: I=PEEK(176)*256+PEEK(175)-2:POKE 10 4,INT(I/256):POKE 103,I-INT(I/256)*256
LOAD SUBROUTINES
HOME: POKE 103,1:POKE 104,8
RUN

Listing 4: EXEC File MASTER MERGE

```

(continued)
Listing 5: MAIN Program

100 REM
110 REM DEMONSTRATION MAIN PROGRAM
120 REM
130 HOME
140 TITLES$ = "FIRST LINE OF TITLE"
150 GOSUB 10000
160 TITLES$ = "SECOND LINE"
170 GOSUB 10000
180 END

Listing 6: SUBROUTINE File

1010 REM
1020 REM MENU DEMONSTRATION PROGRAM
1030 REM
1040 REM
1050 REM DISPLAY THE MENU
1060 REM
1070 PRINT TAB(10); "SUBROUTINE LIBRARY"
1080 PRINT TAB(9); "USAGE DEMONSTRATION"
1090 INVERSE
1100 FOR I = 4 TO 14
1110 HTAB 5
1120 VTAB I
1130 PRINT TAB(35)
1140 NEXT
1150 VTB 5: HTAB 7: PRINT "1) MAIN PROG RAM DEMO"
1160 VTAB 7: HTAB 7: PRINT "2) DISPLAY 10 TITLES"
1170 VTAB 9: HTAB 7: PRINT "3) DIAMOND FORMAT"
1180 VTAB 11: HTAB 7: PRINT "4) BLOCK TITLES"
1190 VTB 13: HTAB 7: PRINT "5) VERTICAL TITLE"
1200 REM
1210 REM REQUEST AND WAIT FOR INPUT
1220 REM
1230 A$ = "ENTER YOUR REQUEST NUMBER..."
1240 VTB 22
1250 HTB 5
1260 A$ + MIDS(A$,2) + LEF$T$ (A$,1)
1270 PRINT A$;
1280 FOR I = 1 TO 8
1290 X = PEEK(-16384)
1300 IF X < 128 THEN 1330
1310 NEXT

Listing 7: MENU Program

1320 GOTO 1240
1330 POKE -16368,0
1340 X = X - 176
1350 REM
1360 REM DETERMINE WHICH PROGRAM TO
1370 REM APPEND SUBROUTINES TO AND
1380 REM THEN RUN THAT PROGRAM VIA
1385 REM THE EXEC FILE
1390 REM
1400 IF X = 1 THEN MAINS$ = "MAIN PROGRAM"
1410 IF X = 2 THEN MAINS$ = "TEN TITLES"
1420 IF X = 3 THEN MAINS$ = "DIAMOND"
1430 IF X = 4 THEN MAINS$ = "BLOCK TITLES"
1440 IF X = 5 THEN MAINS$ = "VERTICAL TITLE"
1450 IF MAINS$ = "" THEN PRINT CHR$(7): GOTO 1240
1460 NORMAL
1470 REM
1480 REM POKE NAME OF MAIN PROGRAM INTO
1485 REM LOCATIONS $300-$31E AND NAME
1490 REM OF SUBROUTINE FILE INTO
1500 REM LOCATIONS $31F-$33D
1510 REM
1520 K1 = 767:K2 = 798
1530 SUBRS$ = "SUBROUTINES"
1540 MAIN$ = LEF$T$S (MAINS$ + "",30)
1550 FOR I = 1 TO 30
1560 POKE K1 + I, ASC(MIDS(MAINS$,I,1))
1570 POKE K2 + I, ASC(MIDS(SUBRS$,I,1))
1580 NEXT
1590 HOME
1600 PRINT CHR$(7)
1610 PRINT CHR$(4); "EXEC MASTER MERGE"
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No. 31 — December 1980
PBASIC-DS VERSION TWO™

1. Microcomputers which can use product: PBASIC-DS VERSION TWO was written to be used with all Apple II Computers.

2. System hardware requirements: The Apple II Computer should have either 32K or 48K of installed RAM. One disk is required. The program will output to a printer if desired. Thus, a printer is an optional item.

3. System software requirements: The Apple II Computer should have Integer BASIC and also Applesoft floating point BASIC. The floating point BASIC may be either in the RAM or ROM version.

4. Product features: PBASIC-DS makes possible the use of structured programming techniques. Structured programming permits the development of large BASIC programs in either the integer or floating point version. It provides four (4) special logic features which facilitate structured programming: (a) Two Way Conditional Test; (b) Multi-Way Conditional Test; (c) Loops — I. Test Before Loop and II. Test After Loop; (d) Subroutines.

5. Product performance: The system runs well. The disk contains two (2) programs. On command, they both compile, load and run, producing good results. The user is kept advised of the program actions.

6. Product quality: The disk and manual are of good quality with timely interactive advice.

7. Product limitations: The PBASIC system does much that was not possible in BASIC. For what it does, there does not seem to be any shortcoming.

8. Product documentation: The documentation is printed and bound. The material is well organized and easily readable. The manual contains 17 pages consisting of summaries, explanation of principal features and appendices. The manual explains the concepts of structured programming and provides diagrams to characterize important logic mechanisms. Five (5) figures show representative program action. The disk contains two (2) programs to illustrate special PBASIC facilities, "Quicksort" and "Even".

9. Special user requirements: If the user has had any prior experience with FORTRAN or PASCAL he can readily appreciate the power and desirability of structured programming. Still, no supplementary language familiarity is required. The principles involved are well explained in the manual.

   The compiler action of PBASIC is very welcome. The organization of a new program is well tested before an attempt is made to execute the program with data.

10. Price/feature/quality evaluation: PBASIC is reasonably priced ($35.00). The manual, disk and mailing obviously represent some real costs. Apparently the price of PBASIC is based on the expected distribution of several hundred copies.

11. Additional comments: Anybody who has tried to convert a simple FORTRAN program to run in BASIC can appreciate the need for PBASIC-DS. This system gives you several sorely needed logical manipulations: it cleans up and indents the listings and it compiles the program into a RUN-ready BASIC program. This system is in its second offering. Where possible, the editing and compiling are done in RAM, greatly hastening the compile and loading process. Being a second generation system shows up in many of the convenience features that are implemented in the Command Glossary provided to actuate the system.

   Systems like PBASIC-DS can do much to improve the professional organization of hobbyist programming efforts.

12. Reviewer: Gordon Thompson, P.E., 724 Kewanna Avenue, Pittsburgh, PA 15234.

13. Manufacturer: Decision Systems, P.O. Box 13006, Denton, TX 76302.
Speed up your PET programming with The BASIC Programmer's Toolkit, now only $39.95.

Don't waste valuable programming time if there's an easier way to go. Here it is: The BASIC Programmer's Toolkit, created by Palo Alto ICs, a division of Nestar. The Toolkit is a set of super programming aids designed to enhance the writing, debugging and enhancing of BASIC programs for your PET.

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**HELP** is used when your program stops due to an error. Type **HELP**, and the line on which the error occurs will be shown. The erroneous portion of the line will be indicated in reverse video on the screen.

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STUFFIT:
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Use this data-stuffing program on your PET to create a large file system or to expand your present data base—without going to a second cassette.

Roger C. Crites
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Stand-alone data bases, for such applications as recipe files or phone directories, are often based on packed data statements. The preparation, or extension, of such data statements can be expedited with STUFFIT—the data stuffing program. Incorporated within a file program, STUFFIT takes over when you wish to build, or expand the data base.

Upon entry, STUFFIT displays "DATA ENTRY MODE" in reverse field, and the number of bytes of RAM free. A nonblinking cursor appears about halfway down the screen and data to be stored is simply typed in. The delete key may be used in the usual way to correct errors. When the return key is pressed, STUFFIT assigns a line number, applies the "DATA" key word, and programs the new data statement. The number of bytes free is updated, to keep you informed of the remaining memory space. If the line exceeds the 80-character input buffer allowed by PET, STUFFIT supplies an automatic return, and adds an asterisk to the data statement to indicate a continuation to the next data line number. The data line number and basic key word are applied and the new data statement is stored in a completely transparent fashion. The operator simply types in the information he wishes to be stored.

Line 410 clears the screen, displays the amount of free memory, and positions the cursor. Line 415 turns the video on if it is off. Line 420 gets a character from the keyboard. This character is tested to see if it is a carriage return or an escape [lines 430 and 435]. If it is neither, it is added to the input string. The length of the input string is checked to make sure it will not exceed the 80-character limit. Line 450 outputs the current line to the screen and loops back to get the next character. If the input character is a return, the program jumps to line 460, which reads the last data line number and increments it. Line 465 shuts off the video, for appearances, and line 470 positions and prints the input data string on the now dark screen. Line 480 prints the new line number in a data statement. Line 490 prints a direct GOTO command and repositions the cursor so that when the end statement [line 510] is executed, and the program stops, the cursor will lie on the new data line printed by line 470.

Line 500 performs the magic. It tells the PET that the return key has been hit three times. Since the program has stopped, the PET is now in the direct command mode. The screen is blank but the data statement containing the current line number, the line of data to be stored, and a direct GOTO have been printed on the screen. The PET thinks that these lines have been punched in by hand, and the screen editor dutifully passes these lines to BASIC, which modifies the program accordingly. The current line number and the new data are thereby automatically programmed. The direct GOTO is executed, getting STUFFIT running again, collecting input for the next cycle.

On a stand-alone basis, STUFFIT is useful for loading data statements in non-file programs. When writing any program that requires extensive data, I load STUFFIT and use it to enter the required data. I then erase STUFFIT from memory, leaving the data statements, and proceed with the rest of the program. STUFFIT could, of course, be modified so that when the escape character is hit, it erases itself. However, it is sufficiently short so that manually punching in its line numbers is not very time consuming.

Although very useful in this mode, STUFFIT was written to provide a flexible data entry module for use within BASIC file routines. Specifically, it is intended for use where fast bulk storage disks are not available. It enables the user to rapidly enter new data, and then return to search, sort, or process functions without stopping the program. Upon filing additional data, the program is simply saved on cassette tape. Since STUFFIT automatically appends the new information as data statements, full file support is maintained with a single cassette deck.

To illustrate the symbiotic relationship between STUFFIT and a file program, consider the following—PERSONAL DIRECTORY. This program was written to provide a business file, containing various subcontractors and professional services. It should serve to illustrate the fundamental process, and could easily be modified to provide a custom stand-alone data file for small systems without disk support.

This directory program will search by name or occupation. Under occupation, any additional pertinent information (up to 256 characters) may be stored and retrieved. Searches are based on left-justified string comparison, that is, a search for Smith would find Smith, Smothers, and anyone else with a name starting with an SM. A search under occupation for PL would turn up Plumber, Plastic Dealers, etc. Of course, a search for Plumber would only find Plumbers, as a name search for Smith—Joe would only find Joe Smith.
When run, the program asks you to choose between data entry mode and search mode. A backslash is the escape character for either mode. If data entry is selected, the program jumps to STUFFIT [at line 400]. To facilitate editing, information, STUFFIT is slightly modified to add the data line number of each data statement to the information stored in that statement. This is done transparently. The only impact to the programmer is to reduce the number of characters that may be entered before an automatic return is executed. Names, phone numbers, occupations, addresses, and miscellaneous information are simply typed in. STUFFIT functions as previously described, appending the new information as data statements. When the new information is filed, an escape (backslash) returns the program to the mode selection sequence. If the search mode is selected, the program jumps to line 200. This routine asks you to select a name search or an occupation search. Upon receiving the desired name or occupation, the program jumps to a search subroutine at line 1000. This short subroutine performs the actual search. It also checks for the presence of an auto-return flag [asterisk] and joins sequential data statements as necessary, to reproduce the original data string.

The results of the search are passed back to the main routine for display. Upon reaching the end of the file, the program pauses to allow the displayed data to be used. At this point, hitting any key returns the program to the start of the search routine. A backslash will terminate the search mode and return the program to the mode selection sequence. A backslash in the mode selection sequence will stop the program.

If the amount of information to be filed is large, it may be necessary to create two or more volumes: separate tapes. For instance, a name file could be broken into Volume 1, A through M, and Volume 2, N through Z. The amount of information that can be stored in one volume depends entirely on available memory.

STUFFIT and packed data statements allow the user of a PET (without disk drive or second cassette) to achieve much of the utility of larger disk-based systems—at least insofar as phone directories, recipe files, book index files, etc. are concerned. STUFFIT also presents and illustrates a method of altering a program interactively while it is running.

---

Listing 1

```
5 REM**** PERSONAL DIRECTORY ****
10 ? "ce"TAB(10)"rPERSONAL DIRECTORY"
20 ?:?:? TAB(9)"GP MODES & ENTRY CODES"
30 ? TAB(9)"
40 ? TAB(9)"SEARCH & DISPLAY";TAB(29)"S"
50 ? TAB(9)"ENTER NEW DATA";TAB(29)"I"?:
60 ? TAB(9)"EXIT ANY MODE";TAB(29)"E"
70 ?:??:?"MODE CODE="?
90 GET A$;IF A$="" GOTO 230
100 IF A$="S" GOTO 200
120 IF A$="I" GOTO 370
130 IF A$="E" THEN END
140 GOTO 90
200 REM*** SEARCH & DISPLAY ***
210 ?"csrvSEARCH & DISPLAY":?:?;RESTORE:
220 "READ LL
230 ?:?"SEARCH BY NAME(N) OR OCCUPATION (O )?"
235 IF A$="" GOTO 230
240 IF A$="N" GOTO 270
250 IF A$="O" GOTO 260
260 GOTO 230
270 ?:?:"INPUT"NAME PLEASE";M$;GOTO 290
280 ?:?:"INPUT"OCCUPATION";M$
290 GOSUB 1000:REM*** GO SEARCH ***
300 IF F$<1 GOTO 325
310 ?:? NS;TAB(23)"PHONE"F$
320 ? CS;PRINT"FILE LINE NO."L$?:
325 IF F$=1 THEN ?"rvEND OF FILE":GOTO 3
40
330 ?:?:GOTO290:REM* CONTINUE SEARCH *
350 GET A$;IF A$="" THEN 350
360 GOTO200
370 ?:?"csrvDATA ENTRY MODE"?:?
380 ?:?DATA MUST BE ENTERED IN THREE FIEL
390 "DS;"
395 ?:?"FIRST- NAME(LAST NAME FIRST)"
398 ?:"SECOND- PHONE NUMBER"
400 ?:"THIRD- OCCUPATION & MISC. INFO."
405 ?:??:?"FIELDS MUST BE SEPARATED WIT
410 H A COMMA"
415 ?:?"NO COMMA'S ALLOWED WITHIN A FIEL
420 D"
425 REMOTE: IF A$="" GOTO 420
430 POKE 59409,60
```

(Continued)
(Listing 1 continued)

430 IF A$=CHR$(13) GOTO460
435 IF A$="\" THEN RUN
440 R$=R$+A$:IF LEN(R$)<59 GOTO 450
445 R$=R$+"\".GOTO 460
450 ?"ch[10cd]":"R$":"GOTO 420
460 RESTORE:READ N=N+10
465 POKE 59409,52
470 ?"chdedc"N"DATA"N","R$
480 ?"10000 DATA"N
490 ?"GOTO 410":"ch
500 POKE525,3:POKE527,13:POKE528,13:POKE
529,13
510 END

1000 REM*** SEARCH ROUTINE ***
1010 READ LS:REM GET LINE NO.
1015 FX=0:FX=0:IPVAL(LS)=LL THEN FX=1:
1020 READ N$,FS,CS
1030 IF RIGHTS(OS,1)="" GOTO1060
1040 IF A$="N" AND M$=LEFT$(N$,LEN(M$))
THEN FX=1:RETURN
1050 IF A$="O" AND M$=LEFT$(OS,LEN(M$))
THEN FX=1:RETURN
1060 IPVAL(LS)=LL THEN FX=0:FX=1:RETURN
1090 READ CS:=CS=LEFT$(OS,LEN(OS)-1)+CS
1100 GOTO 1030
10000 DATA 10000

These programs are written for the
2.0 BASIC ROMs. Substitution of line
500 in PERSONAL DIRECTORY will
allow it to run with the 3.0 BASIC
ROMs.

500 POKE 158,3:POKE 623,13:
POKE 624,13:POKE 625,13

Also remove lines 15 and 65 from
STUFFIT. 3.0 BASIC doesn't support
screen blanking.

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renameB80 SCRATCHB80 DIRECTORYB80 INITIALIZE85 MERGETB85 EXECUTE85
SCROLLed OUTed SETed KILLEd EATed PRINT USING85 SEND85 BEEP85

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Section A

160 GOSUB 130
135 PRINT USING C$ A B$
120 INPUT “TIME:” C$
115 IF B$<A$ THEN 105
105 FOR I TO 105
100 PRINT (I) NEXT
15 RETURN
200 J=E:10
READY
RENUMBER 10 10 105 184
READY
LIST
100 GOSUB 130
110 PRINT USING C$ A B$
105 INPUT “TIME:” C$
100 IF B$<A$ THEN 110
110 FOR I TO 105
100 PRINT (I) NEXT
15 RETURN
200 J=E:10
READY

Section B

MERGE D1 "BUY NOW"
SEARCHING FOR MEMCMP*
LOADING
READY
RENUMBER 00 10
READY
FIND RS
110 PRINT USING D$ D$ D$ C$ D$ 200 33 "NOW IS THE TIME"
READY

Section C

180 FOR A "096789A" TO KEA B 00:1 PRINT
T B:IF 200 THEN B B 215 PRINT B
TRACE

Section D

580 BA 1
590 RA 13755520 BA 10
600 IF B$<A$ THEN 580
610 RETURN
620 CS "PROFIT $", "DAILY"
630 PRINT USING C$ D$
640 DB "LOSS $", "DAILY"
650 PRINT USING D$
RUN
PROFIT $ 1 234.6 DAILY
LOSS $ 0.00 DAILY
READY

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A book for both 6502 microcomputer novices as well as for knowledgeable 6502 users who want to know more about 6502-based systems available today.

CONTENTS: Part I: Programming the 6502—Introduction to Microcomputers—Objectives; Introduction, What is a Microcomputer? The 6502 Microprocessor; Introduction to Experiments; Experiments 1 through 3. Writing and Executing Simple Programs Using Data Transfer Instructions—Objectives; Introduction; Microcomputer Instructions; Addressing Modes; The Microcomputer Program—A Simple Program; Writing a Program; Loading and Executing a Program; The BRK Instruction; The Single-Step Mode; Introduction to the Experiments; Experiments 1 through 7. Simple Input/Output Techniques—Objectives; Introduction; Input/Output Ports; I/O Port Symbols; Input/Output Programming; JMP Instruction; INC and DEC Instructions; INX, INY, DEX, and DEY Instructions; Introduction to the Experiments; Experiments 1 through 8. Logical Operations—Objectives; Introduction; Logical Operations; AND, ORA, and EOR Instructions; Using ORA, AND, and EOR Instructions to Control Bit Values; Other Uses of Logical Operations; Introduction to the Experiments; Experiments 1 through 8. Arithmetic Operations—Objectives; Introduction; 6502 Processor Status Register; Flag Mollification Instructions; ADC Instruction; Multibyte Addition; Decimal Addition; Two's Complement Arithmetic; Signed Number Arithmetic; Signed Arithmetic and Overflow Status Bit; Experiments 1 through 8. Branches and Loops—Objectives; Introduction; Branch Instructions; Modifying the Processor Status Register; Processor Instruction Set; Bit Test Instruction; ASCII to Hexadecimal Conversion; Using Branch Instructions for Time Delays; Introduction to the Experiments; Experiments 1 through 6. Register-Shift Instructions—Objectives; Introduction; Getting Acquainted With Register-Shift Instructions; A 4-Bit Multiplication Program; An 8-Bit Multiplication Program; Hex to ASCII; Decimal to Hexadecimal; Hexadecimal to Decimal; Experiments 1 through 8. Indexed Addressing—Objectives; Introduction; Absolute Indexed Addressing; Zero-Page Indexed Addressing; Data Tables; Code Conversion Programs; Multiple-Byte Arithmetic; Indirect Addressing; Indirect Indexed Addressing Mode; A Simple Monitor; Indexed Indirect Addressing; Introduction to the Experiments; Experiments 1 through 7. Subroutines, The Stack, and Interrupts—Objectives; Introduction; Subroutines; The Stack; Nested Subroutines; Use of the Stack for Storage; Interrupts; Experiments 1 through 7. Interval Timers—Objectives; Introduction; 6530 Interval Timer; 6531 Interval Timer; 6522 Interval Timers; Using T2 Timer as a Counter; Using T1 Timer; Precision Timing Program; Using T1 Timer to Implement Frequency Counter; Making Music Using T1 Timer; Experiments 1 through 8. Part II: Interfacing the 6502—Address Decoding—Objectives; Introduction; Address Decoding; Address Decoding for R/W Memory; I/O Port Address Decoding; Address Decoding Circuit for 6522 Interface; 6502 Instructions and Device Select Pulses; Introduction to the Experiments; Experiments 1 through 5. Control Signals, Output Ports, and Applications—Objectives; Introduction; Clock Signals, φ0 [IN], φ1 [OUT], and φ2 [OUT]; R/W Control Signal; Using Control Signals for an Output Port; Memory-Mapped, Latched Hexadecimal Display; Memory-Digital I/O Analog Converter and an Application to Music Synthesis; Other Control Pins on 6502; Experiments 1 through 5. Data Bus, Buffering, and Applications—Objectives; Introduction; Why Buffer? Memory-Mapped Analog-to-Digital Converter; An ASCII Keyboard Input Port; Experiments 1 through 5. Applications—Objectives; Digital-Analog and Analog-Digital Conversion Using the KIM-1; Employing the KIM-1 Microcomputer as a Timer and Data Logging Module; Employing the KIM-1 as a Precision Frequency and Message Sender; Catching Bugs With Lights: A Program Debugging Aid; Lunar Occultation of a Star. Appendix A: Decimal, Binary, and Hexadecimal Number Systems—Objectives; introduction; Numbers; Decimal Numbers; Binary Numbers; Hexadecimal Numbers; Exercises; Exercise Answers. Appendix B: Instruction Set Summary. Appendix C: Microcomputer Technical Data. Appendix D: Pin Configuration of Frequently Used SN7400-Series Chips. Appendix E: Pin Configuration of 81L597. Index.


An introduction to microprocessors for students of electrical engineering. Focuses on the AIM-65 microcomputer, based on the 6502 microprocessor.

CONTENTS: Introduction to Microcomputer-Based Design—Evolution of the Microcomputer; Microprocessor Applications; Engineering Design of Microcomputer-Based Systems; Educational Demands Created by the Microprocessor; Objectives of this Book. General Aspects of Microprocessor-Based Systems—Microprocessors and Microcomputers; Classification of Computers and Computer Systems; General Features of Microcomputer-Based Systems; Information Flow in Microcomputers; Central Processing Hardware Elements; Addressing Modes; Microprocessor Instruction Sets; Microprocessor Word Length; Symbolism in Digital Computers; Arithmetic Operations in Microcomputers; Interrupts and Subroutines; Technological Factors in Microprocessors. The 6502 Microprocessor and Peripheral Parts—Introduction to 6502, Programming Model; Data Paths; Concept of Operation of 6502 Instructions; Complete Description of Operation Codes; 6502 Specifications; Peripheral Interface Chips; Example Problems. Software Aids—Introduction; The Software Design Process; Elements of Program Translation; Text Editors; Simulators; Special Program Debug Features; In-circuit Emulation; Logic State Analyzers; From Programmers. Microcomputer Interfacing and System Design—Introduction, Guidelines for System Design; Miscellaneous Advice on System Design; Interfacing Examples; Input, Output- TTL, Speed, Bits, Serial Parallel Conversions; Address Maps and Organization; Memory and I/O Selection; System Design Examples. Introduction to the 6502 Microprocessor—Introduction: Principal Characteristics; Some 6502 and 6800 Differences; 6800 Programming; Electrical Characteristics of the 6800; 6800 Microcomputer Example, Sample Problems, Introduction to 8080 Microprocessor—Characteristics; 8080 Architecture and Programming Model; Data Paths; 8080 Instruction Set; 8080 Example Program; Electrical Characteristics of the 8080. A Case Study—The AIM-65, Introduction; Memory Interface; LED Display Interface, Keyboard Interfacing, Printer Interface, Teletype Interface; Interrupt Handling; User Port Interface, Monitor Subroutines. A: A 6502-Based Microprocessor—The AIM-65; B: The System 65—A 6502 Development System; C: 2's Complement Arithmetic in the 6502, Index.
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Microprocessors in Medicine: The 6502

By Jerry W. Froelich, M.D.

The column this month and last month, written together with Jack W. Smith, M.D., informs readers on various uses of computers in medical education and provides examples of how the 6502 microprocessor is able to perform tasks in medical education nearly as well as large computer systems. (Dr. Smith is a Clinical Fellow in Pathology, Instructor in Allied Health, and Ph.D candidate in Computer Science at Ohio State University, Columbus, Ohio.)

Last month, we described various types of programs: computer-aided instruction (CAI), computer-assisted evaluation (CAE), and simulation. This month, we will cover "APPLE-ED," a program produced by Computer Methods Supplements (CMS, of Ann Arbor, Michigan) for educating physicians and technologists in nuclear cardiology.

Last month, no mention was made of problems with computers in medical education, and there are some disadvantages. Therefore, before we move on to the APPLE-ED, let's discuss the problems. The lack of uniformity in computer systems makes transfer of programs difficult. Lack of agreement of information content in programs increases the difficulty of transfer. At present, there is no formal production-distribution system to make available the programs which exist. Prior to the development of microprocessors, computer-aided instruction required large computer systems. Currently, there are three large medical institutions with large investments in computers for use in medical education. They are the Massachusetts General Hospital in Boston, Massachusetts, the University of Illinois at Urbana, and Ohio State University in Columbus, Ohio.

At all three institutions, the students interact with a CRT terminal which is connected to the host computer via telephone lines. Personnel not based at the institutions have limited access.

With the advent of microprocessors and languages such as BASIC and PILOT, the production-distribution system for medical knowledge is potentially enhanced. However, consistently-updated, high-quality material is still not available.

One application which I would like to describe is called, APPLE-ED. This is a microprocessor-based system produced by Computer Methods Supplements. APPLE-ED is, as the name implies, written for an APPLE computer.

The programs are written in BASIC and are designed so that once the system has been "booted up," the program will sequence itself through the three floppy disks to a fourth disk which is a testing program. The APPLE-ED programs present a series of complete lectures on the use of computers in Nuclear Medicine and Nuclear Cardiology. (Perhaps at a future time we can give an in-depth description of computer applications in nuclear medicine.) The lecture content is based on the textbook entitled, Computer Methods: The Fundamentals of Digital Nuclear Medicine, published by C.V. Mosby Company and edited by David E. Liberman of CMS.

The three sections of the APPLE-ED programs are: "Basic Elements of Computers"; "Display and Processing of Nuclear Medicine Studied"; and "Nuclear Cardiology Techniques." The examination disk is structured so that the participant takes an examination. The results are recorded on the disk, and at some point the disk is returned to CMS for grading.

At Massachusetts General Hospital, the residents and visiting fellows use the system and have found it an excellent introduction to the field of computers in nuclear medicine.

Summary

We have reviewed the types of computer programs in medical education (CAI, CAE, etc.) and concluded with a description of APPLE-ED, a 6502 application. APPLE-ED requires no hardware more sophisticated than a microcomputer and a disk drive. The disk is only required to make the loading of the programs quicker. If you are willing to tolerate the speed of tape, then tape is a viable storage medium.

The programs are written in BASIC, which allows text to be printed and which queries the user on the content of the material presented. Based upon the participant's response, the program then branches. It either progresses further into the material or reinforces points, and reviews material that has already been covered.

To quote a user of APPLE-ED, "It sounds quite beneficial for us. We don't have a training program for technologists, but our residents could benefit from the continuing education, and it's a fraction of the cost of sending someone to a clinical seminar. Thanks for your help!" (APPLE-ED can be either purchased or leased from Computer Methods Supplements.)

Note to Readers

Thank you for the response to my first column. I will begin to incorporate suggestions into future columns. Anyone wishing to share his application, please drop me a line. I must apologize, but because of the number of letters, if you would like a response please include a stamped, self-addressed envelope. Please send all correspondence to me at: c/o Massachusetts General Hospital, Boston, MA 02114.
Apple Fun

We've taken five of our most popular programs and combined them into one tremendous package full of fun and excitement. This disk-based package now offers you three great games:

Mimic—How good is your memory? Here's a chance to find out! Your Apple will display a sequence of figures on a 3 x 3 grid. You must respond with the exact same sequence, within the time limit.

There are five different, increasingly difficult versions of the game, including one that will keep going indefinitely. Mimic is exciting, fast paced and challenging—fun for all!

Air Flight Simulation—Your mission: Take off and land your aircraft without crashing. You're flying blind—on instruments only.

A full tank of fuel gives you a maximum range of about 50 miles. The computer will constantly display updates of your air speed, compass heading and altitude. Your main instrument is the Angle of Ascent/Bank Indicator. It tells if the plane is climbing or descending, whether banking into a right or left turn.

After you've acquired a few hours of flying time, you can try a flying course against a map or doing aerobic maneuvers. Get a little more flight time under your belt, the sky's the limit.

Color เพ—Test your powers of deduction as you try to guess the secret color code in this Mastermind-type game. There are two levels of difficulty, and three options of play to vary your games. Not only can you guess the computer's color code, but it will guess yours! It can also serve as referee in a game between two human opponents. Can you make and break the color code?

Star Ship Attack—Your mission is to protect our orbiting food station satellites from destruction by an enemy star ship. You must capture, destroy or drive off the attacking ship. If you fail, our planet is doomed.

Trilogy—This contest has its origins in the simple game of tic-tac-toe. The object of the game is to place three of your colors, in a row, into the delta-like, multi-level display. The rows may be horizontal, vertical, diagonal or wrapped around, through the "third dimension". Your Apple will be trying to do the same. You can even have your Apple play against itself!

Minimum system requirements are an Apple II or Apple II Plus computer with 32K of memory and one monitisk drive. Mimic requires Applesoft in ROM, all others run in RAM or ROM Applesoft.

Order No. 0161AD $19.95

Solar Energy For The Home

With the price of fossil fuels rising astronomically, solar space-heating systems are starting to become very attractive. But is solar heat cost-effective for you? This program can answer that question.

Just input this data for your home: location, size, interior details and amount of amount of space. It will then calculate your current heat loss and the amount of gain from any south-facing windows. Then, enter the data for the contemplated solar heating installation. The program will compute the NET heating gain, the cost of conventional fuels vs. solar heat, and the calculated payback period—showing if the investment will save you money.

Solar Energy for the Home: It's a natural for architects, designers, contractors, homeowners...anyone who wants to tap the limitless energy of our sun.

Minimum system requirements are an Apple II or Apple II Plus with one disk drive and 28K of RAM. Includes AppleDOS 3.2.

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Math Fun

The Math Fun package uses the techniques of immediate feedback and positive reinforcement so that students can improve their math skills while playing these games:

Hanging—A little man is walking up the steps to the hangman's noose. But YOU can save him by answering the decimal math problems posed by the computer. Correct answers will move the man down the steps and cheat the hangman.

Sprellbilder—You are a magician battling a computerized wizard. In order to cast death clouds, fireballs and other magic spells on him, you must correctly answer problems involving fractions.

Whole Space—Pilot your space craft to attack the enemy planet. Each time you give a correct answer to the whole number problems, you can move your ship or fire. But for every wrong answer, the enemy gets a chance to fire at you.

Car Jump—Make your stunt car jump the ramps. Each correct answer will increase the number of bases your car must jump over. These problems involve calculating the areas of different geometric figures.

Robot Duel—Fire your laser at the computer's robot. If you give the correct answer to problems on calculating volumes, your robot can shoot at his opponent. If you give the wrong answer, your shield power will be depleted and the computer's robot can shoot at yours.

Sub Attacks—Practice using percentages as you maneuver your sub into the harbor. A correct answer lets you move your sub and fire at the enemy fleet.

All of these programs run in Applesoft BASIC, except Whole Space, which requires Integer BASIC.

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Skybombers

Two nations, separated by the Big Green Mountain, are in mortal combat! Because of the terrain, there's an air war—a war of SKYBOMBERS! In this two-player game, you and your opponent command opposing fleets of fighter-bombers armed with bombs and missiles. Your orders? Fly over the mountains and bomb the enemy blockhouse into dust! Flying a bombing mission over that innocentlooking mountain is no milk run. The opposition's aircraft can fire missiles at you or you may even be destroyed by the bombs as they drop. Desperate pilots may even ram your plane or plunge into your blockhouse, suicidally.

Flight personnel are sometimes forced to parachute from badly damaged aircraft. As they float helplessly to earth, they become targets for enemy missiles.

The greater the damage you deal to your enemy, the higher your score, which is constantly updated at the bottom of the display screen.

The sounds of battle, from exploding bombs to the pathetic screams of wounded parachutists, remind each micro-commander of his bounden duty. Press On, SKYBOMBERS—Press On!

Minimum system requirements: An Apple II or Apple II Plus, with 32K RAM, one disk drive and game paddles.

Order No. 0271AD (dsk-based version) $19.95

Paddle Fun

This new Apple disk package requires a steady eye and a quick hand at the game paddles! It includes:

Invaders—You must destroy an invading fleet of 55 flying saucers while dodging the carpet of bombs they drop. Your bomb shelters will help you—for a while. Our version of a well known arcade game! Requires Applesoft in ROM.

Howitzer—This is a one or two person game in which you must fire upon another howitzer position. This program is written in high resolution graphics using different terrain and wind conditions each round to make this a demanding game. The difficulty level can be altered to suit the ability of the players. Requires Applesoft in ROM.

Space Wars—This program has three parts: (1) Two flying saucers meet in laser combat—for two players, (2) two saucers compete to see which can shoot out the most stars—for two players, and (3) one saucer shoots the stars in order to get a higher rank—for one player only. Requires Applesoft.

Golf—Whether you win or lose, you're bound to have fun on our 18 hole Apple golf course. Choose your club and your direction and hope to avoid the sandtraps. Losing too many strokes in the water hazards? You can always increase your handicap. Get off the tee and onto the green with Apple Golf. Requires Applesoft.

The minimum system requirement for this package is an Apple II or Apple II Plus computer with 32K of memory and one monitisk drive.

Order No. 0163AD $19.95

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Buon giorno, signore!

Welcome to the province of Santa Paravia. As your steward, I hope you will enjoy your reign here. I feel sure that you will find it, shall we say, profitable.

Perhaps I should acquaint you with our little domain. It is not a wealthy area, signore, but riches and glory are possible for one who is aware of political realities. These realities include your serfs. They constantly request more food from your grain reserves, grain that could be sold instead for gold florins. And should your justice become a trifle harsh, they will flee to other lands.

Yet another concern is the weather. If it is good, so is the harvest. But this may use much of our surplus and we have had years of drought when famine threatened our population.

Certainly, the administration of a growing city-state will require tax revenues. And where better to gather such funds than the local marketplace and mills? You may find it necessary to increase customs duties or tax the incomes of the merchants and nobles. Whatever you do, there will be far-reaching consequences and, perhaps, an elevation of your noble title.

Your standing will surely be enhanced by building a new palace or a magnificent castle. You will do well to increase your landholdings, if you also equip a few units of soldiers. There is, alas, no small need for soldiery here, for the unscrupulous Baron Peppino may invade you at any time.

To measure your progress, the official cartographer will draw you a mappa. From it, you can see how much land you hold, how much of it is under the plow and how adequate your defenses are. We are unique in that here, the map is the territory.

I trust that I have been of help, signore. I look forward to the day when I may address you as His Royal Highness, King of Santa Paravia. Buona fortuna or, as you say, “Good luck”. For the Apple 48K:

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No. 31 - December 1980
MICRO - The 6502 Journal
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VIDEO PLUS II -

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56 MICRO - The 6502 Journal
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128 colors on the screen at one time? Explore some of the many, extraordinary features ATARI provides, but doesn’t always tell you about.

Len Lindsay
1929 Northport #6
Madison, WI 53704

Atari Safari

The ATARI 400 and 800 computers are quite amazing machines. The more I learn about them, the more amazing they seem. They offer 3 different text modes and 6 different graphic modes. But they don’t tell you that you can mix and match different modes on the screen at the same time. BASIC allows you to use any 6 of the 128 possible colors at one time, but did you know that it is possible to have all 128 on the screen at one time?

I hope to share information and programming tips with you, to help you use your ATARI computer for amazing things. So let’s get started. This month I will explain some quick little programming tricks and methods. Watch for a future article explaining the things I have mentioned. If you have any ATARI programming tips you would like to share please contact me:

Len Lindsay
c/o MICRO, P.O. Box 6502
Chelmsford, MA 01824

TV Screen Protect Feature

If you leave the same exact picture on your TV screen for an extensive period of time, it will “burn” an image into the screen. This can ruin your good color TV set. ATARI realized this when they designed their computers, and built in a feature to protect your screen. If you don’t hit a key on the keyboard for several minutes, the computer goes into attract mode, changing the color registers every several seconds. The screen image remains the same, just the colors change, dark to light, to medium, etc. Changing the colors helps to prevent the image from “burning” into your screen.

Memory location 77 is used by the ATARI as a sort of counter, and is reset to 0 each time the keyboard is accessed. Every few seconds it increments by one. When it reaches 128, the computer goes into attract mode. You may write a program that uses a joystick for input, or one that continually generates dynamic computer art. Thus several minutes will go by without any keyboard access, but you do not want the colors to begin changing. To prevent it, just add this one line in the appropriate place:

```
200 POKE 77,0 : REM RESET ATTRACT MODE COUNTER TO ZERO
```

When this line is executed, the computer thinks a key has been hit, and the counter is reset back to zero. Of course you can do the exact opposite and start attract mode at any time as well. Just use this line:

```
500 POKE 77,128 : REM START ATTRACT MODE
```

When executed, the computer will go into attract mode, changing the color registers every few seconds, providing you with an easy method to have your screen change colors.

Keyboard Buffer

The ATARI is always looking at its keyboard, even while doing other things under program control. It remembers the last key hit. For example, if you hit the “A” key while the computer is drawing something on the screen, it will remember that you hit the key. ENTER THIS PROGRAM:

```
10 REM BUSY WORK
20 PROGRAM
30 FOR DELAY = 1 TO 999
35 NEXT DELAY
```

Now RUN the program, and hit the “A” key while it is thinking. When the program is done, watch an A appear on the screen. The computer remembered that you hit the key. Try it again, but hit several keys. Only the last key you hit will be remembered. This feature has its uses, but can be annoying at times. For instance, an INPUT statement in your program will use the key in the keyboard buffer as the first character of the INPUT. Try the following program:

```
10 REM CHEATING ON THIS IS EASY
15 PRINT "HIT A KEY WHEN I SAY GO"
20 FOR DELAY = 1 TO RND(1)*500 + 500
30 NEXT DELAY
40 PRINT
50 PRINT "GO"
60 OPEN #1,4,0,"K:" : REM OPEN THE KEYBOARD FOR A GET COMMAND
70 GET #1,KEY : REM WAIT TILL A KEY IS HIT
80 CLOSE #1 : REM CLOSE FILE
90 PRINT "THANK YOU"
```

RUN the program. Hit a key after it says GO, and it will respond THANK YOU. However, you can cheat very easily. Just hit a key immediately after you RUN the program.

There is an easy way to prevent cheating of this nature. Add this one line to your program and try to cheat:

```
65 POKE 764,255 : REM CLEAR KEYBOARD BUFFER
```

It is always a good idea to use this statement just before any INPUT in your program, for example:
100 PRINT "WHAT IS YOUR AGE?"
110 POKE 764, 255
120 PRINT "INPUT AGE"

Clearing the buffer makes sure that you have a fresh start for your INPUT.

Dynamic Keyboard

You just saw how to clear the keyboard buffer. Now, what if you would like to add something to it? This may seem like a silly idea, but I will show that it is very practical. Your program can list an individual line of your program to disk with this command:

600 LIST "D:LIST", 10 ;REM LIST LINE 10 TO DISK—FILE NAME 'LIST''

Your program will continue executing after this command is executed. Line 10 can be a line of DATA or some other varying aspect of your program.

You also can ENTER new program lines from disk, while the program is running. The program can thus change itself as it RUNs. This line will ENTER a new line 10 into the program [if a line 10 was previously put to disk with the LIST command!]

700 ENTER "D:LIST" ;REM ENTER NEW PROGRAM LINES FROM DISK

However, after the program executes an ENTER command, it stops program execution, and waits for keyboard commands. To have the program continue executing you would then have to type in:

CONT

There is a way to have all this done automatically for you. All we have to do is trick the computer into thinking that you just typed in CONT (or a GOTO command) and hit RETURN. First, here is a program that will record line 99 in your program onto disk:

10 REM LIST LINE 99 TO DISK
20 PRINT "RECORDING LINE 99 TO DISK"  
30 LIST "D:LINE99". 99
40 PRINT "DONE —"  
99 PRINT "THIS IS LINE 99"

RUN this program. It will save line 99 to DISKETTE. We will use it for input to the next program.

Now here is a program that will ENTER program lines from diskette, thus altering itself while it is running. [Remember to type NEW first.]

10 REM ENTER PROGRAM LINE FROM DISKETTE
20 PRINT "READING LINE FROM DISK"
30 PRINT "[DOWN][DOWN] GOTO 50[UP][UP]"
35 POKE 784, 12 ;REM TRICK ATARI TO THINK YOU HIT THE RETURN
40 ENTER "D:LINE99"
50 PRINT "DONE —"

Run this program with the diskette still in your drive. Surprise! It printed DONE and also THIS IS LINE 99. Try the program without line 35. It will still add line 99 from diskette, but quits executing at that point.

NOTE: the above program requires cursor movements to be programmed into line 30. [DOWN] means to program a cursor down. Do not type it in literally. To program in a cursor down, simply hit the ESC key, then hit CONTROL CURSOR DOWN. The same applies to [UP], which means program in one cursor up.

ATARI High Resolution Text

The ATARI lets you enjoy every high resolution graphics mode—GRAPHICS 8. Normally, the screen can only plot points. However, this routine can be used to put text on the screen along with your graphic display. Here is the subroutine:

23000 ZL = PEEK(560) + PEEK(561)*256
23020 ZM = PEEK(ZL + 4) + PEEK(ZL + 5)*256
23030 FOR ZW = 1 TO LEN(ZA$)
23040 ZT = 57344 + ((A S C ( Z A $ ( Z W , 
ZW) - 32) * 8)
23050 ZC = ZM + ZY*40 + ZW*(ZW - 1)
23060 FOR ZR = 0 TO 7
23070 POKE ZC + ZR*40, PEEK(ZT + ZR)
23080 NEXT ZR
23085 ZY = ZY + ZZ
23090 NEXT ZW
23099 RETURN

RUN this program. Notice that all variables used begin with Z. That means that conflicts with variables in your main program will probably not occur, or you will be alerted to each Z variable you use.

ZA$ is the test to be printed
ZC is the column to start printing (0 - 39)
ZY is the row to start printing (0 - 191)
ZC is the siant of the printed line
ZL, ZT, ZC, ZW, ZR are temporary variables used

To utilize the routine, simply set ZAS to the text you want, set ZC and ZY to the starting coordinate and GOSUB 23000. If you want your text printed in a straight line, ZZ should equal 0. Try ZZ = 1 and ZZ = -1. An example line to call the subroutine might be this:

500 ZA$ = "TESTING TEXT"
X = 5: ZY = 40: ZZ = 1: GOSUB 23000

You might wish to fool with the subroutine to make it print wavy lines:

23085 ZY = ZY + ZZ: ZZ = -ZZ

You can also fool with the concepts in the routine to print the text in vertical lines as well as horizontal.

Upper, or Lower, or Graphics

Graphics mode 2 is the large TEXT mode. ALL PRINT#6 commands are printed to the screen in extra large size. For example:

10 GRAPHICS 2 : REM LARGE TEXT MODE
20 PRINT#6,"TESTING"

The word TESTING is printed on the screen in large gold letters. Now try the same program, but change line 20 so that the word you print is in lower case letters. Example:

10 GRAPHICS 2 : REM LARGE TEXT MODE
20 PRINT#6, "testing"

This time the word TESTING is prined on the screen in large light green letters. But the letters are all upper case. Next, try typing the word TESTING in reverse field. [Hit the ATARI symbol key just before typing the first letter in the word TESTING. After typing the word TESTING in reverse field, hit the ATARI symbol key again to be back to normal.] Try printing both UPPER and lower case letters in reverse field.

You now see that you can get 4 different colored UPPER case large letters on the screen by varying how you type them in the PRINT statement. But
what if you really want lower case letters on the screen? Simple, one POKE will do the trick:

```plaintext
POKE 756,226 : REM LOWER CASE CHARACTER BASE
```

Type in that POKE statement after running your program. Surprise!

**Everything Is Upside Down**

With one simple command you can turn all of the characters on the screen upside down. And from that point on, all characters printed will also be upside down. Just enter this command:

```plaintext
POKE 755,4 : REM UPSIDE DOWN CHARACTERS
```

Now type anything you want and watch it come out upside down. Hit the SYSTEM RESET button, and all will return to normal. Or enter this command:

```plaintext
POKE 755,2 : REM BACK TO NORMAL
```

This can be used within a program for special effects. Try this quick example:

```plaintext
10 PRINT: "TESTING"
20 PRINT: "THIS IS U-D"
30 PRINT: "UPSIDE DOWN"
40 X = 2 : REM INITIALIZE VARIABLE FOR POKEs
50 POKE 755,X : REM UPSIDE DOWN AND THEN BACK AGAIN
60 FOR C = 1 TO 200 : REM PAUSE A SECOND
70 NEXT C
80 FOR C = 1 TO 200 : REM PAUSE A SECOND
90 NEXT C
100 FOR C = 1 TO 200 : REM PAUSE A SECOND
110 NEXT C
120 RETURN
```

This program will print the string above from 0 to 199, then back again.

I discovered this use of the quotation marks in Applesoft when I needed to enter a list of names, last name first, and remembered how such strings were entered in BASIC on the DEC and CDC machines I programmed in college. I know this information will be a great help to all those Applesoft users who have been trying to enter commas and colons into their strings.

Charles W. Hall
3262 Olive Place
Fort Worth, Texas 76116

Dear Editor:

I thought your readers might be interested in a slightly more enhanced version of EDTIPLUS. All of the original features are the same, plus the following: (1) 'ESC' 'H' will clear and home the screen, (2) 'ESC' 'P' performs a POKE 33,33 to change the screen width to 33 columns for easier editing of literals (string values inside quote marks) and (3) 'ESC' 'N' returns the screen width to a normal 40 columns. Listed below is a memory dump of the improved version, located at $300. Just type it in and 'CALL 768'. It's set up for use with 48K of memory and 3.2 DOS. To revise it for other configurations, see the EDTIPLUS article in the June issue of MICRO and the necessary revisions will be apparent.

It sure makes editing easier, and it works in Integer BASIC, Applesoft and in the Monitor. Also, the enhancements make it of value to the owners of APPLE II Plus computers.

---

Let Cain
2606 Grand Ave.
Grand Junction, Colorado 81501

Dear Editor:

I appreciated Mr. Childress' article in the May issue (24:45) on entering lowercase and punctuation into Applesoft strings, but I would like to point out that it is possible to enter punctuation into INPUT strings without the use of special routines. If the string is enclosed in quotation marks (e.g., "HALL, C.W."), all characters between the quotation marks will be accepted as part of the string. The only character I have not been able to enter this way is the quotation mark (''), which delimits the string. However, if the string is not delimited with quotation marks, they may be entered anywhere in the string.

Craig Peterson
1743 Centinela Ave. #101
Santa Monica, California 90404

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Continued on page 94
SOFTWARE FOR OSI

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MICRO - The 6502 Journal
No. 31 - December 1980
Relocating OSI ROM BASIC Programs

This BASIC program relocator will help users of Ohio Scientific computers with BASIC in ROM to better understand how their Microsoft BASIC and monitor are used.

William L. Taylor
246 Flora Road
Leavittsburg, OH 44430

Two articles recently published in MICRO inspired this article. The article entitled “Some Useful Memory Locations and Subroutines for OSI BASIC in ROM” by S.R. Murphy, that appeared in the November 1979 MICRO [18:9], gave a list of zero page locations used by the Ohio Scientific Challenger computers as a scratch pad memory. This memory map along with the article “Relocating PET BASIC Programs” by Michael Tulloch, that appeared in the December 1979 MICRO [19:23], inspired me to try a BASIC program relocator for Ohio Scientific computers.

To begin with, since Microsoft wrote the BASIC that is used in Ohio Scientific Challengers and Commodore PET computers, it would seem there would be similarities. This is true. Both versions of BASIC use low memory in the same manner as a scratch pad. Zero page, for example, is used as a scratch pad to store BASIC’s parameters. A list or memory map for the Challengers and PET is listed in table 1. From the table it can be seen that both the Challengers and PET use the same pointers. There are differences between the version for the PET and the one for the Challengers and how they use some locations in zero page; but both versions use identical pointers for memory allocation, for the beginning of BASIC work space, etc. One difference between the versions is that Ohio Scientific uses page 3 of the system memory as a part of BASIC program memory workspace.

Ohio Scientific computers with BASIC in ROM perform the same tests on memory as do PETs. That is, hex 24 is loaded into memory locations from 0301 hex upwards, depending on the memory size. When Ohio Scientific’s BASIC in ROM machines are brought up under cold start, the user may define memory size or allow BASIC to utilize all the available memory in the system from hex 0301 upward.

After BASIC tests memory for available space and determines the upward limit, this available size is stored in a zero page location called the memory size pointer. On initialization, there are several other parameters set up in the scratch pad memory in zero page under ROM BASIC. These parameters are called pointers. We have already used this term and have defined two of these pointers. Ohio Scientific ROM BASIC always sets its pointers to begin at 0301 hex or 769 decimal for a starting point.

Table 1:
Relocating Ohio Scientific BASIC Programs

<table>
<thead>
<tr>
<th></th>
<th>PET</th>
<th>OSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC START</td>
<td>122 dec.</td>
<td>121 dec.</td>
</tr>
<tr>
<td></td>
<td>7A hex</td>
<td>79 hex</td>
</tr>
<tr>
<td>Single</td>
<td>123 &quot;</td>
<td>122 &quot;</td>
</tr>
<tr>
<td>Variable</td>
<td>124 &quot;</td>
<td>123 &quot;</td>
</tr>
<tr>
<td>Array</td>
<td>125 &quot;</td>
<td>124 &quot;</td>
</tr>
<tr>
<td>Variable</td>
<td>126 &quot;</td>
<td>125 &quot;</td>
</tr>
<tr>
<td>Array Space</td>
<td>127 &quot;</td>
<td>126 &quot;</td>
</tr>
<tr>
<td>Available</td>
<td>128 &quot;</td>
<td>127 &quot;</td>
</tr>
<tr>
<td>String</td>
<td>129 &quot;</td>
<td>128 &quot;</td>
</tr>
<tr>
<td>Bottom</td>
<td>130 &quot;</td>
<td>129 &quot;</td>
</tr>
<tr>
<td>Top</td>
<td>131 &quot;</td>
<td>130 &quot;</td>
</tr>
<tr>
<td>String</td>
<td>132 &quot;</td>
<td>131 &quot;</td>
</tr>
<tr>
<td>Top</td>
<td>133 &quot;</td>
<td>132 &quot;</td>
</tr>
<tr>
<td>Memory</td>
<td>134 &quot;</td>
<td>133 &quot;</td>
</tr>
<tr>
<td>Size</td>
<td>135 &quot;</td>
<td>134 &quot;</td>
</tr>
<tr>
<td>Present</td>
<td>136 &quot;</td>
<td>135 &quot;</td>
</tr>
<tr>
<td>BASIC Line</td>
<td>137 &quot;</td>
<td>136 &quot;</td>
</tr>
<tr>
<td>Line #</td>
<td>138 &quot;</td>
<td>137 &quot;</td>
</tr>
<tr>
<td>at BREAK</td>
<td>139 &quot;</td>
<td>138 &quot;</td>
</tr>
<tr>
<td>Pointer For</td>
<td>140 &quot;</td>
<td>139 &quot;</td>
</tr>
<tr>
<td>CONT.</td>
<td>141 &quot;</td>
<td>140 &quot;</td>
</tr>
</tbody>
</table>

The Commodore PET has BASIC program work space set to begin at 0401 hex. Ohio Scientific has the BASIC work space set to begin at 0301 hex.

Scratch Pad Area
As was noted by Mr. Tulloch in his article on relocating PET BASIC programs, there are several pointers in the scratch pad memory that must be changed to initiate a relocation of BASIC programs. These pointers are: the beginning of BASIC program, the beginning of the single variable, the beginning of array variables, the available space for DIM array variable, and, finally, the top of strings and the bottom of strings. All of these pointers must be changed to point to the location for a BASIC program, if a new starting area is to be used. As stated before, the listing in table 1 will show the location in the scratch pad where the pointers are located. In addition, I will describe how to use these pointers to allow you to relocate your Ohio Scientific BASIC programs.

The Ohio Scientific Microsoft BASIC in ROM uses addresses hex 79 and 7A or decimal 121 and 122 as the BASIC start pointer locations. On a BASIC cold start, these locations contain a pointer that points to hex 0301 or decimal 769. The data stored in these locations must be in the 6502 format, that is, low byte followed by the high byte (for example, 0079 01 007A 63). All the pointer locations are two bytes wide and must have their data in this format. As an example, if you wished to have your BASIC program start at, say, hex 0400, then this address would have to be stored in 0079 and 007A as 00,04. To relocate your programs to start at hex 0400, you would have to change all the pointers in the same manner. The seven pointers that must be changed are listed in table 1.

As an example, let's reinitialize the pointers in zero page for a BASIC program start address to begin at hex 0600. To have the program begin at hex 0600, we will need to change the high byte of the pointers for BASIC program start, simple variable start, array variable start, available space, and string top and string bottom. To make this change, bring up BASIC in cold start. Reset the computer. Bring up Monitor Mode by typing "M" on the keyboard. Once in Monitor Mode, you can call up the pointer addresses and change the data, to point to the new BASIC program starting point. In address mode, call up 007A hex. Enter Data Mode by typing a slash [/] on the keyboard. Now load the required data at this address, in this case hex 08. Enter hex 08 at locations 007C, 007E, and 0080. Return to Address Mode. Call up 0800 hex. Examine the data stored at 0800. If this data is not 00, then change this data to read hex 00. Reset the computer. Call up BASIC in warm start with "W" on the keyboard. Now type NEW followed by RETURN. If all went well the computer should respond with OK. Your BASIC work space has now been changed to begin at page 8 and your BASIC programs will be written upward from this point.

The last example is only one method of re-initializing the pointers. A different approach to this task is demonstrated in program listing 1. This program provides a BASIC and machine language program that can be saved on cassette tape and can be loaded into the C1P or other Ohio Scientific systems when the need arises. Refer to listing 1 for the following description.

The BASIC portion of the program is used as an executive in connection with the machine language routine that actually does the work in initializing the scratch pad area pointers. The machine code program is stored in the memory area between 0200 hex and 0300 hex. This area in memory is little used and rarely mentioned in most articles. The memory area between 0222 and 02FF hex is not used by BASIC or the Ohio Scientific monitor and is free for machine language routines or any other machine code programs that can fit into this area. This is a perfect location for our machine code routine used in this program. Once the machine code routine is stored in this area, it can be called at any time the need

<table>
<thead>
<tr>
<th>BASIC Program Relocator</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 REM OS 1 ROM BASIC PROGRAM RELOCATOR</td>
</tr>
<tr>
<td>7 PRINT&quot; ROM BASIC PROGRAM RELOCATOR&quot;</td>
</tr>
<tr>
<td>10 FOR Q=546 TO 573</td>
</tr>
<tr>
<td>20 READ P: POKE Q,P</td>
</tr>
<tr>
<td>30 NEXT Q</td>
</tr>
<tr>
<td>50 INPUT&quot; START&quot;;A</td>
</tr>
<tr>
<td>60 POKE 547,A</td>
</tr>
<tr>
<td>70 POKE 570,A</td>
</tr>
<tr>
<td>80 POKE 11,34:POKE 12,2</td>
</tr>
<tr>
<td>90 X=USR(X)</td>
</tr>
<tr>
<td>100 DATA 169,0,133,122,133,124,133,126</td>
</tr>
<tr>
<td>110 DATA 133,128,133,144,133,173,133,165</td>
</tr>
<tr>
<td>120 DATA 133,167,133,196,169,0,141,0,0</td>
</tr>
<tr>
<td>130 DATA 76,0,0</td>
</tr>
</tbody>
</table>

<p>| Disassembled Object Code |</p>
<table>
<thead>
<tr>
<th>Located at 0222 through 023D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0222 A9 00: LDA $000</td>
</tr>
<tr>
<td>0224 85 7A: STA $007A</td>
</tr>
<tr>
<td>0226 85 7C: STA $007C</td>
</tr>
<tr>
<td>0228 85 7E: STA $007E</td>
</tr>
<tr>
<td>022A 85 80: STA $0080</td>
</tr>
<tr>
<td>022C 85 90: STA $0090</td>
</tr>
<tr>
<td>022E 85 AD: STA $00AD</td>
</tr>
<tr>
<td>0230 85 A5: STA $00A5</td>
</tr>
<tr>
<td>0232 85 A7: STA $00A7</td>
</tr>
<tr>
<td>0234 85 C4: STA $00C4</td>
</tr>
<tr>
<td>0236 A9 00: LDA $000</td>
</tr>
<tr>
<td>0238 8D 00 00: STA $0000</td>
</tr>
<tr>
<td>023B 4C 00 00: JMP $0000</td>
</tr>
</tbody>
</table>

MICRO – The 6502 Journal  No. 31 – December 1980
arises to re-initialize the BASIC start pointers. The BASIC program in listing 1 contains the parameters needed to store the machine code in user memory and provides for user input in changing the BASIC pointers.

At line 10 through 30, the machine code program is stored in user memory beginning at hex 0222 or decimal 546. The machine code is stored in the BASIC program in DATA statements at lines 100 through 130. These data are READ and POKEd into memory with the FOR... NEXT loop at lines 10 through 30. The remainder of the BASIC program simply obtains the operator's input for a new BASIC start address. This start address is obtained at line 50 and stored in the "A" variable. At line 60 and 70, this new address data is stored or POKEd into the machine code areas at 0223 or 547 decimal and 023A or 570 decimal. The USR vector is set at line 80 to point to the machine code routine beginning at 0222 hex or 546 decimal. Line 90 is a statement using the USR function of BASIC. This statement causes a jump through the USR vector to 0222 hex and executes the machine code routine.

When the program is run, the pointers will be changed to reflect the new start address. When the machine code program has reset the pointers, it jumps to BASIC warm start at hex 0000 or decimal 0. The CIP responds with OK. To set up the new BASIC work space, simply type NEW and a carriage return.

Once the BASIC program in listing 1 has been keyed into the CIP or other Ohio Scientific computer, you should SAVE the program on cassette tape for later use. This cassette program can be loaded into any relocated BASIC program space, as can any SAVED BASIC program. The Ohio Scientific SAVE and LOAD cassette commands can be used regardless of where you have relocated your BASIC program workspace.

In conclusion, I believe this information will help owners and users of Ohio Scientific computers with BASIC in ROM to better understand how the Ohio Scientific Microsoft BASIC and the OSI monitor are used. Good luck.
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MICRO – The 6502 Journal
No. 31 – December 1980
Cassette I/O for SYM BASIC

Expand the capabilities of SYM BASIC with this cassette I/O handler. Access your cassette as a data file—not just as a place to save programs.

Nicholas J. Vrtis
5863 Pinetree S.E.
Kentwood, MI 49508

CASSETTE I/O FOR SYM BASIC

One of the features I missed when I started working with SYM was the lack of any program input or output capability to the cassette. It seemed a shame to use up a lot of memory with DATA statements which were only used once to initialize an array. They use up a lot of memory fast, since they don’t get compressed much. For any type of inquiry program, even a lot of memory isn’t enough. Ten minutes of cassette will hold around 90,000 characters, more than the total 6502 address space.

One Method

I considered two methods of getting the data to and from the cassette. The first was to take the data directly from SYM’s variable area. It wasn’t hard to snoop around SYM enough to find out how and where it kept variables. The usage in SYM would have been via two USR functions; one to read, and one to write. The only argument would have been a string containing the variable name. The assembler routine to write to tape would have been almost trivial after the variable data area was located. The SYM monitor routines only need a starting and ending address. This method also had the advantage of being able to save a large array in one write to the cassette, with no data conversion. It would, however, have been a very inefficient way to handle a non-dimensioned variable (at the rate of four bytes at a time), since you do need some SYNC bytes and leader for motor startup each time you write to the tape. There are many problems that come up, moreover, when you want to read the stuff back in. The SYM routines need to know both the starting and ending address, if you want to read data back into a different area from whence it came. Due to the way BASIC dynamically allocates variables, it wouldn’t be a safe bet to count on everything being in the same place as it was when written. Finding the beginning address to go back to wouldn’t be too hard, since the input to the read routine would be the variable to read into, and we can find that. The ending address could again be calculated from the BASIC data, but it has to be the same length as before. For numeric data, that is easy to control with a DIM statement. Strings complicate the process even further, since their length is determined by use, not a DIM statement. Of course, one could always rewrite the SYM routines to accept starting address and length as a parameter list. I decided that there had to be an easier way.

Another Method

The second method is a little harder to use in BASIC, but turns out to have a couple of extra uses I hadn’t planned on. The idea was to make the cassette respond similarly to the paper tape reader/punch on an ASR Teletype. For those unfamiliar with the beast, there are four control characters used to turn the paper tape on and off (usually called DC1 through DC4) from a remote terminal or computer. The plan was to intercept all the terminal I/O via the INVEC and OUTVEC system RAM vectors, and look for these characters to control data to or from a cassette buffer. This would mean that INPUT and PRINT statements could be used to get at the cassette. After experimenting with this for a while, I decided to make a separate routine which took care of turning cassette input and output mode on and off. This made the routines transparent to any character. (But beware, INCHR does some things after a character is obtained.) It also simplified making the output from a BASIC program suitable as input to BASIC.

The Routines Described

Since the routines intercept data via INVEC and OUTVEC, they are usable with any software written for the standard SYM, such as TINY BASIC or assembler programs. Except for the first and last buffers, filling and emptying is taken care of automatically, so you don’t have to worry about how much data will fit in one buffer. In fact, data can extend from one buffer to the next and your program would never know the difference. It even turns out that the routines can be used for a ‘‘free’’ merge for BASIC programs. Simply LIST the programs to the cassette, and then read them back in. BASIC will think you are entering the lines from the terminal and sort the line numbers, etc.

There are four separate ‘‘entry points’’ in these routines. INITT takes care of initialization and setup; CTURN handles turning cassette mode on and off, and forcing first and last buffer handling; CHRN replaces INCHR as the vector address for
SYM input; and finally, CHROUT handles character output in place of TOUT. INITIT and CTURN are the only two called directly by the user. The other two are used indirectly by normal input and output.

INITIT Starts the Process

INITIT really has two purposes in life. The first and foremost is to put the address of CHRIN and CHROUT into INVEC and OUTVEC in system RAM. This could have been done with a couple of SD monitor commands, but these are messy to do when you are in BASIC. The second purpose is to initialize the current FILEID to zero. Additionally, the routine also saves the current OUTVEC address in three spare system RAM locations. This is because I have a separate routine to drive my Quick Printer II, and I want to be able to use both routines. Normally, INITIT would only be called once, but it still checks to make sure it doesn’t have its own address already in OUTVEC. If it saved this as the terminal output address, things could get circular.

Do’s and Don’ts

For INITIT, don’t have trace on while it is executing. Trace will try to use OUTVEC after it gets half changed. The program assumes that CHRIN and CHROUT start on the same page ($8000). If you end up relocating it to someplace where this isn’t true, you will have to add some code to put in the correct starting page for one of the routines. INVEC is not saved anywhere. If you have a custom input routine, you will have to add code to save it, and change the JSR INTCR at $F28 to use it. If you decide not to save OUTVEC, you will have to change the JSR NUVEC at $F41 and $F57 to a JSR TOUT (@$8AAA). INITIT doesn’t require any parameters, and it doesn’t attempt to save or restore any registers. BASIC takes care of that for itself. You will have to watch it if you are using the routines from assembler. Obviously, it must be called before any data will go to the buffer. It may be called more than once, but any previous data in the buffer may be lost (see the discussion of input parameter value 3 for CTURN).

CTURN Controls I/O Routine

The routine CTURN is used as a common entry point for controlling the status of the I/O routines. I chose to use a single entry point for two reasons.

<table>
<thead>
<tr>
<th>Listing 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASSette I/O ROUTINES FOR SYM-1 BASIC</td>
</tr>
<tr>
<td>SYM-1 MONITOR CALLS</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>1000</td>
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<tr>
<td>1000</td>
</tr>
<tr>
<td>1000</td>
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<tr>
<td>1000</td>
</tr>
<tr>
<td>SYM-1 MONITOR VARIABLES</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>1000</td>
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<tr>
<td>1000</td>
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<tr>
<td>0E00</td>
</tr>
<tr>
<td>0E00</td>
</tr>
<tr>
<td>0E00</td>
</tr>
<tr>
<td>0E00</td>
</tr>
<tr>
<td>BUFFER AREA - FIRST BYTE IS MAX INDEX VALUE</td>
</tr>
<tr>
<td>0E00 00</td>
</tr>
<tr>
<td>0E0A</td>
</tr>
<tr>
<td>0EFA</td>
</tr>
<tr>
<td>0EFA 20 8B 8F 0B</td>
</tr>
<tr>
<td>0EFD 9B</td>
</tr>
<tr>
<td>0EFE F0 18</td>
</tr>
<tr>
<td>0FF0 3D 00</td>
</tr>
<tr>
<td>0FF2 0D 53 A6</td>
</tr>
<tr>
<td>0FF5 C0 03</td>
</tr>
<tr>
<td>0FF7 D0 08</td>
</tr>
<tr>
<td>0FF9 2C 0F</td>
</tr>
<tr>
<td>0FFC 0C 02</td>
</tr>
<tr>
<td>0F0E 60</td>
</tr>
<tr>
<td>0F0F 88</td>
</tr>
<tr>
<td>0F10 9B</td>
</tr>
<tr>
<td>0F11 20 53 A6</td>
</tr>
<tr>
<td>0F14 8D 53 A6</td>
</tr>
<tr>
<td>0F17 60</td>
</tr>
<tr>
<td>0F18 AD 53 A6</td>
</tr>
<tr>
<td>0F1B 29 01</td>
</tr>
<tr>
<td>0F1D F0 6C</td>
</tr>
<tr>
<td>0F1F 20 45 OF</td>
</tr>
<tr>
<td>0F22 D0 6B</td>
</tr>
</tbody>
</table>
First, it is easier to remember a single address instead of half a dozen, and secondly, BASIC requires at least one parameter so it can distinguish a function, so I figured I might as well use it to pass on useful information. Note that the low order of the basic calling parameter is passed on the Y register by BASIC. There are six input parameter values to CTURN, 0, 1, -1, 2, -2, and 3.

Four of the input values are rather trivial, and merely involve turning a bit on or off in TECHO. These bits are used to indicate that cassette input or output is active. Bit zero is used to control input mode. If it is on, input characters will be obtained from the cassette (via the buffer). Off means that input is from the terminal as normal. Bit one of TECHO performs the same function for cassette output mode. Having both bits on at the same time could cause some strange results, since there is only one buffer, and one routine would be putting characters in while the other was taking them out. The input values 1 and 2 correspond to the bit values needed to turn the appropriate mode. I decided for user simplicity to use the negative of the turn-on value to indicate a turn-off request. Note that -1 is $FF in hex, and by subtracting one we get $FE, which coincidentally has a zero in just the bit we want to turn off. (Amazing—these computers, aren’t they?) The same thing happens to -2 when we subtract one from it.

The other two parameter values of zero and three require some detailed explanation, since they have different meanings depending upon whether you are in the read or the write mode. Normally, the buffer gets filled (or emptied) automatically as it gets used up. PZBIDX is an incrementing pointer that indexes to the last character used in the buffer. The first byte of the buffer area is used to hold the number of bytes in the buffer, including itself. The buffer is considered "used up" when PZBIDX equals this value. Normally, this value would be the number of bytes in the buffer. The problem occurs because a buffer is not necessarily a "logical record."

A buffer is written only when all the characters are used up normally. If my program has done all the writing I want it to do, but hasn’t used up an even number of buffers, what do I do with the odd piece of data left in the buffer? Calling CTURN in output mode with a zero value will force a write of this short buffer. When we get around to reading this short buffer back in, there
has to be some way to keep track of how many bytes were used in each buffer. The short buffer may not be the last record on the tape if you decide to add data in a subsequent run of the program. This is why BUFULL transfers the current value of PZBIDX to the start of the buffer before it gets written out. That way, when it gets read back in, the maximum length is set automatically.

In the read mode, we don’t have to worry about the last record being short. The write routines took care of that already. There is no end-of-file record or indicator maintained. It is up to the calling program to do that. The problem in the read mode occurs for the read of the first buffer. There are no logical grounds for counting on PZBIDX to point to the end of a buffer the first time I need to get a character. As a matter of fact, it stands a better chance of being zero, since INITTT leaves it that way. Since read is the opposite of write, it makes as little sense to have zero for the read mode indicate the first buffer instead of the last as it does for the write mode. Calling CTURN with an input value of zero in read mode will force a read of the first buffer from the cassette. From then on, read buffers will take care of themselves.

The final input parameter value for CTURN is three. The actual code sets PZBIDX to zero, and sets the maximum buffer value to the length of a buffer. The “logical” meaning of this depends on what you are going to do next. It was originally designed to be used before the first write to the buffer, since the above setting indicates to the write operation that the buffer has nothing in it. In the read mode, the same setting would mean that the buffer was just read in and characters could be removed.

At first, I couldn’t think of why anybody would want to set the buffer full for a read without actually doing one, but then... If you write a small amount of data to the buffer [less than one full buffer], you could LOAD another program in and read the data back in by setting PZBIDX back to zero. This would be a way of getting around the fact that a LOAD clears all variables and would allow “passing” data between programs.

CHRN Handles Character Input

All character input is handled by CHRN. It never gets called directly by the calling program. The user still calls INCHR whenever he wants an input character. INCHR saves the caller’s registers and gets to CHRN via INVEC. Since INCHR has already saved the registers, CHRN doesn’t bother doing it. The first thing that it does do is check the low bit in TECHO to see if cassette input mode is on. If we aren’t in cassette mode, the process is to get a character from the terminal by using INTCHR, and use an RTS to get back to the last part of INCHR, and from there back to the calling program.

When cassette input mode is on, a character has to be obtained from the buffer. PZBIDX is incremented and compared to the end of buffer value by a call to NXTBUF. If there is a character available, it is obtained from the buffer.

| 0F9A BE 4A A6 | STX P3L |
| 0FDA A5 FA | LDA PZBIDX |
| 0FF0 F0 21 | BEQ NWRITE |
| 0FA1 8D 00 0E | STA BUFFER |
| 0FA4 A6 FB | LDX PZCURR |
| 0FA6 E8 | INX |
| 0FA7 E0 FF | CFX #$FF |
| 0FA9 D0 02 | BNE BUFULX |
| 0FA9 A9 01 | LDA #$01 |
| 0FAD 86 FB | BUFULX STX PZCURR |
| 0FAF 8D 4E A6 | STA P1L |
| 0FBA AD 30 A6 | LDA TAPDEL |
| 0FB5 48 | PHA |
| 0FB6 A9 02 | STA TAPDEL |
| 0FB8 8D 30 A6 | STA TAPDEL |
| 0FB9 2A 87 | JSR SAVCAS |
| 0FBE 68 | PLA |
| 0BF9 8D 30 A6 | STA TAPDEL |
| 0FC2 A9 FA | NWRITE LDA #BUFLEN |
| 0FC4 8D 00 0E | STA BUFFER |
| 0FC7 A2 00 | ZERIDX LDX #$00 |
| 0FC9 86 FA | STX PZBIDX |

GET CURRENT BUFFER INDEX AND BUMP FOR NEXT TIME

| 0FCB E6 FA | NXTBUF DEC PZBIDX |
| 0FCD A6 FA | LDX PZBIDX |
| 0FCF EC 00 0E | CPX BUFFER |
| 0FDD 60 | RTS |

ROUTINE INITIALIZATION - SET UP ADDRESSES

| 0FD3 20 86 8B | INITL JSR ACCESS |
| 0FD6 A2 02 | LDX #$02 |
| 0FDB C9 0F | CMP #$0F |
| 0FD8 8D 63 A6 | LDA OUTVEC1,X |
| 0FDE 9F 0F | CMP #$0F |
| 0FDD F0 06 | BEQ NOSAV |
| 0FDF 9D 4E A6 | STA NVEC,X |
| 0FE2 CA | DEX |
| 0FE3 10 F3 | BPL UNPROTECT |
| 0FE5 A9 00 | NOSAV LDA #$00 |
| 0FE7 85 FB | STA PZCURR |
| 0FE9 A9 0F | LDA #$0F |
| 0FEB 8D 62 A6 | STA INVEC+01 |
| 0FEE 8D 65 A6 | STA OUTVEC+01 |
| 0FF1 A9 24 | LDA #$24 |
| 0FF3 8D 61 A6 | STA INVEC |
| 0FF6 A9 6C | LDA #$6C |
| 0FF8 8D 64 A6 | STA OUTVEC |
| 0FFB D0 C5 | BNE NWRITE |

SET UP INDECES

| 0FFD FF | =$FF |
| 0FFE FF | =$FF |
| 0FFFF ZZZEND | =$FF |
In order to provide the capability to echo input as INCHR would, the ECHO bit (bit 7 of TECHO) is checked. If it is on, the input is echoed to the terminal by way of the old OUTVEC that was saved by INITTT. Either way, return is to INCHR by an RTS, the same as above.

At some point, the buffer has to run out of characters. At this point, we have physically to read another buffer from the cassette. It is really a simple matter of passing the desired FILEID to the SYM monitor and letting it do the work. The FILEID is kept in PZCURR. This value is set to zero by INITTT, and is incremented just prior to each physical read and write. A check is made to make sure it doesn't reach $FFFF, since the monitor treats that as a special ID. Zero is also avoided for the same reason. The FILEID is needed in case there is a problem reading the tape and we want to backup and retry the read. After the call to the SYM monitor, the carry is checked to see if the read was successful. If the carry is clear, the read worked, PZBIDX is set to one, a character is obtained, and return is to INCHR, the same as before.

When there is an error (the carry is set), ERMMSG is called to let the monitor display the standard Error message. Now the problem is to determine what to do about the error. If the error code was $8C, the load was aborted by the CR key during sync search. This obviously means that the user has given up, so we might as well too. This is done by branching to CTURN with $FF in the Y register to turn off cassette mode. From then on, characters are obtained from the terminal. For other load errors, the program waits for any character to be entered on the keypad (via a call to GETKEY). At this point, the cassette remote control still is off, but you get a chance to stop it manually before trying again. If you hit any key other than CR, the program loops back and tries to read the same FILEID again. Don't forget to rewind the tape a little before putting it back in play mode. The program will continue to try reading a tape until it gets it right, or you give up.

Caution: aborting the cassette input mode does not stop your BASIC program. In order to stop your BASIC program after aborting the cassette input mode, enter an @ to delete the characters already received from the buffer, and then enter a carriage return. Otherwise, your program will take what it has and probably loop back and turn the cassette input mode back on.

Keep cassette input mode on as little as possible in your program, and double check for syntax errors. Otherwise you may end up feeding data from the buffer to BASIC instead of to your program.

Also note that since these routines are normally called via INCHR, you won't be able to read anything you couldn't enter from the terminal. These routines will handle any bit combination, but INCHR strips parity, and upper cases everything. If you want to be able to write object code or upper and lower case and don't want to reassemble these routines, I would suggest patching out the input character echo (starting at $F5C), and replacing it with:

TAX  ; Save the input character for now
PLA  ; Discard normal return from stack
TXA  ; Return input to A as expected
JMP $843C  ; Go compare to CR & return

This will bypass the editing normally done by INCHR.

CHROUT Handles Character Output

The basic flow for CHROUT is the same as for CHRIN. Bit two in TECHO is checked instead of bit one, and characters are put into the buffer instead of removed, but the process is mostly the same. BUFSIZE is called when there is no room to put the current character into the buffer. It can also be called from CTURN to write the last buffer, so it checks to make sure there are actually some used characters in the buffer, since there is no need to write a buffer with nothing in it. A full buffer is always written, but the current value in PZBIDX is moved to the first byte of BUFFER so CHRIN will use it as the maximum buffer length when it gets read in later. The current value of PZCURR is incremented, and that is used as the FILEID for the call to the SYM monitor. Here again the values of $FF and $00 are avoided because they would pose problems reading them back in.

Note that the character is output to the terminal via the old OUTVEC value which was saved by INITTT whenever cassette output is not in effect. The amount of tape leader time is changed from the current value to two before the write, and restored after. This is an attempt to save some sync leader time. Depending on how fast your recorder starts and stops, you may want to change this. Zero will never work, since sync search on a read requires at least ten SYNC's before admitting that things are in sync. I found that a value of one did not allow enough time for my recorder to get up to speed. The value of two is marginally enough, but I am tempted to trade time for safety, and change it to three.

The maximum buffer size is 255 bytes (not 556), of which 254 are for data, and one is reserved for maximum valid buffer length. I chose 250 bytes because it made the end of the program come out about right. The page zero addresses used for PZBIDX and PZCURR are those used by the monitor as RAM input pointers for the EXECUTE command, so don't expect to use it and pick up where you left off. Change the addresses if it bothers you to use monitor locations. I chose to start the buffer at $E00 for two reasons. First, I don't use the TRIG routines much, especially in the inquiry type programs I planned for these routines. Second, the TRIG routines are self-relocating, so they will fit in front of these easily. Relocate these routines with a little bit of caution. There are a couple of places where parts of addresses are used in load immediate instructions. These have been indicated in the listing. There is no requirement that the programs in buffer occupy adjacent areas. They could be widely separated if that turns out to be convenient.

Reading and Writing Tricks

There are a couple of tricks to writing things out and reading them back into a BASIC program. The main thing is to make your output look as it would if you keyed it in. Don't forget to put commas between items, and remember that strings need quotes around them if they have commas. Probably the hardest part is remembering that BASIC only has a 72-character input buffer. If you create an output line bigger than that and then try to read it back in, you will get beeped and "EXTRA IGNORED". Setting the output line length to 72 or less doesn't help, since all that does is put a carriage return where you don't want it. In case you are interested, the line feeds which BASIC puts out after the carriage return are conveniently ignored by BASIC upon input.

Finally, the 16-bit checksum from $EFA to $FFF is $7C66. This will give you something to check against when you enter the program.
EXCERT, INCORPORATED

*** AIM 65 ***

Pin

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
<th>QTY 1-9</th>
<th>Price</th>
</tr>
</thead>
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<tr>
<td>A65-1</td>
<td>AIM-65 w/1K RAM</td>
<td></td>
<td>$275</td>
</tr>
<tr>
<td>A65-4</td>
<td>AIM-65 w/4K RAM</td>
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<td>$420</td>
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<td>A65-A</td>
<td>Assembler ROM</td>
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<td>A65-B</td>
<td>BASIC ROM</td>
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<tr>
<td>A65-PL</td>
<td>PL/65 ROMS</td>
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<td>$125</td>
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ACCESSORIES

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<th>Description</th>
<th>QTY 1-9</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZPR3S</td>
<td>+5V at 3A, +24V at 1A w/m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRA5</td>
<td>+5V at 2A, +5V at 3.3V, w/m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE55</td>
<td>+5V at 3A, +24V ±15% at 2A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From The Enclosure Group

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| ENC1A| AIM-65 case w/1 expansion  |         | $ 49  |

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| ENC1A| ENC1 A w/PR35 mounted inside |         | $110  |
| ENC4 | ENC4 w/PR45 mounted inside   |         | $ 90  |
| ENC4A| ENC4 w/PR45 mounted inside   |         | $104  |
| ENC5 | ENC5 w/PR55 mounted inside   |         | $125  |
| ENC5A| ENC5 w/PR55 mounted inside   |         | $129  |

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The 6502 processor may not provide for fast multiplication—but here are five routines to speed up multiplication on any 6502 system.

Brooke W. Boering
Vagabond Enterprises
1300 E. Algonquin 3G
Schaumburg, IL 60195

The search for the ultimate multiply routine seems never-ending. For those APPLE owners who have been using the monitor 'MUL' routine in order to get assembly language efficiency, and for others just looking for some fast 6502 multiply code, the following should be of interest.

Fast multiplication has always been very desirable. Over the years, processors have often provided this as a hardware command. Not so, however, on our favorite 6502. The new 16-bitters and some hybrid 8-bitters now provide it, and execution speed is on the order of 10 to 30 microseconds.

Taking the APPLE 'MUL' routine as a starting point [fig. 1], we can calculate execution speeds based on the number of bits 'on' in the multiplier as follows:

<table>
<thead>
<tr>
<th>Multi. bits 'on'</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 (maxi.)</td>
<td>1511 µs.</td>
</tr>
<tr>
<td>8 (aver.)</td>
<td>1223 µs.</td>
</tr>
<tr>
<td>0 (min.)</td>
<td>935 µs.</td>
</tr>
</tbody>
</table>

In addition to execution time, we must add the overhead of pre-loading or zeroing working bytes and/or registers, and the entry instruction [JSR]. This is significant only when such overhead is materially different when comparing alternate techniques. In the case of the

Machine Language Subroutines

MULTIPLYING ON THE 6502
BY BROOKE W. BOERING

ORG $1000

WORKING BYTES FOR ALL ROUTINES

ACL       $0050
ACH       ACL+01
XTNDL     $0052
XTNDH     XTNDL+01
AUXL      $0054
AUXH      AUXL+01
AUX2L     AUXL+02
AUX2H     AUXH+02

Figure 1

APPLE "MUL" ROUTINE
16X16 MULTIPLY
ON ENTRY: MULTIPLICAND IN AUXL, AUXH
MULTIPLIER IN ACL, ACH
XTNDL, XTNDH MUST BE ZERO

A, X, Y NOT SAVED

ON EXIT: 32-BIT RESULT IN XTNDH, XTNDL, ACH, ACL

1000 A0 10 MUL LDY #$10 INDEX FOR 16 BITS
1002 A5 50 MUL2 LDA ACL ACH * AUX + XTND
1004 4A LSR A TO AC, XTND
1005 90 0C BCC MUL4 IF NO CARRY,
1007 18 CLC NO PARTIAL PRODUCT
1008 A2 FE LDX #$FE
100A B5 54 MUL3 LDA AUXL,X ADD MULTIPLICAND
100C 75 56 ADC AUX2L,X TO PARTIAL PRODUCT
100E 95 54 STA AUXL,X
1010 E8 INX
1011 D0 F7 BNE MUL3
1013 A2 05 MUL4 LDX #$03
1015 76 50 MUL5 ROR ACL,X
1017 CA DEX
1018 10 FB BPL MUL5
101A 88 DEY
101B D0 E5 BNE MUL2
101D 60 RTS

(continued)
‘MUL’ routine, this amounts to an additional 39 microseconds due primarily to the requirements of working byte pre-loading.

An examination of the actual code used in ‘MUL’ reveals that a very bad tradeoff was taken, which increased execution time by a whopping 70-75%! It did save 2 bytes of code, however. By replacing both internal loops with ‘in line’ code, this flaw is remedied (fig. 2).

The revised routine cannot be ‘stuffed into’ the ROM monitor and, therefore, must be executed somewhere in our own code. Once this negative factor is accepted, it is feasible to examine other possible improvements in both speed and convenience.

Fig. 3 shows a repackaging of the revised ‘MUL’ routine. It has allowed us to incorporate two improvements. First is the removal of some pre-entry overhead by having the caller simply load 2 registers, and completing the storing internally in this new ‘MUL16X’ routine. Secondly, we have ‘frontended’ MUL16X to test for a multiplier of 8 bits or less.

The technique of loading registers with arguments rather than requiring the caller to perform the STORE code does not improve overall execution time. Its primary virtues are reduced code in the caller’s pre-entry sequences and improved flexibility within the service routine.

The idea of testing for an 8-bit (or less) multiplier is to be able to affect some improvement in execution speed whenever that condition is true. Such a test performed at the start of MUL16X allows for dynamic variation in multiplier length. There are other times, however, when the programmer knows for certain that the multiplier is limited to 8 bits or less. To cover both cases and continue to provide exit conditions common to ‘MUL’, a new routine, MUL816 is shown in fig. 4.

### Figure 2

REVISED "MUL" ROUTINE
16x16 MULTIPLY

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101E</td>
<td>00001000</td>
<td>RMUL</td>
</tr>
<tr>
<td>1020</td>
<td>00001010</td>
<td>RML2</td>
</tr>
<tr>
<td>1022</td>
<td>00001011</td>
<td>LDA A</td>
</tr>
<tr>
<td>1023</td>
<td>00001100</td>
<td>LSR A</td>
</tr>
<tr>
<td>1025</td>
<td>00001101</td>
<td>LDA XTNDL</td>
</tr>
<tr>
<td>1027</td>
<td>00001111</td>
<td>CLC</td>
</tr>
<tr>
<td>1028</td>
<td>00010000</td>
<td>ADC AUXL</td>
</tr>
<tr>
<td>103A</td>
<td>00010110</td>
<td>STA XTNDL</td>
</tr>
<tr>
<td>102C</td>
<td>00010001</td>
<td>LDA XTNDH</td>
</tr>
<tr>
<td>102E</td>
<td>00010010</td>
<td>ADC AUXH</td>
</tr>
<tr>
<td>1030</td>
<td>00010100</td>
<td>STA XTNDH</td>
</tr>
<tr>
<td>1032</td>
<td>00010101</td>
<td>RMUL4</td>
</tr>
<tr>
<td>1034</td>
<td>00011000</td>
<td>ROR XTNDL</td>
</tr>
<tr>
<td>1036</td>
<td>00011001</td>
<td>ROR XTNDL</td>
</tr>
<tr>
<td>103B</td>
<td>00011010</td>
<td>ROR A</td>
</tr>
<tr>
<td>103A</td>
<td>00010111</td>
<td>DEY</td>
</tr>
<tr>
<td>1039</td>
<td>00010101</td>
<td>BNE MUL2</td>
</tr>
<tr>
<td>1058</td>
<td>01010010</td>
<td>RTS</td>
</tr>
</tbody>
</table>

### Figure 3

ON ENTRY: MULTIPLIER IN ACH, ACH
MULTIPLICAND LOW IN Y
MULTIPLICAND HIGH IN X REG.

ON EXIT: 32-BIT RESULT IN XTNDH, XTNDL, ACH, ACH

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>103C</td>
<td>00011000</td>
<td>MUL16X LDA ACH 8-BIT MULTIPLIER?</td>
</tr>
<tr>
<td>103E</td>
<td>00011010</td>
<td>BEQ MUL5X YES, GOTO COMMON</td>
</tr>
<tr>
<td>1040</td>
<td>00011100</td>
<td>LDA #510 SET 16-BIT MULTIPLY</td>
</tr>
<tr>
<td>1042</td>
<td>00011101</td>
<td>(FALL THROUGH TO COMMON CODE)</td>
</tr>
<tr>
<td>1044</td>
<td>00011110</td>
<td>MUL STY AUXL SAVE MULTIPLICAND LO</td>
</tr>
<tr>
<td>1046</td>
<td>00011111</td>
<td>STX AUXH SAVE MULTIPLICAND HI</td>
</tr>
<tr>
<td>104A</td>
<td>00010000</td>
<td>TAY Multiplier Count to Y</td>
</tr>
<tr>
<td>1049</td>
<td>00010010</td>
<td>LDA #300 ZERO PARTIALS</td>
</tr>
<tr>
<td>104B</td>
<td>00010100</td>
<td>STA XTNDL</td>
</tr>
<tr>
<td>104D</td>
<td>00010101</td>
<td>STA XTNDH</td>
</tr>
<tr>
<td>104F</td>
<td>00010110</td>
<td>MUL3X LDA ACH ACL * AUX + XTND</td>
</tr>
<tr>
<td>1050</td>
<td>00011000</td>
<td>LSR A TO AC, XTND</td>
</tr>
<tr>
<td>1052</td>
<td>00011010</td>
<td>LDA XTNDL ADD MULTIPLICAND</td>
</tr>
<tr>
<td>1053</td>
<td>00011011</td>
<td>CLC TO PARTIAL PRODUCT</td>
</tr>
<tr>
<td>1055</td>
<td>00011100</td>
<td>ADC AUXL</td>
</tr>
<tr>
<td>1057</td>
<td>00011101</td>
<td>STA XTNDL</td>
</tr>
<tr>
<td>1059</td>
<td>00011110</td>
<td>LDA XTNDH</td>
</tr>
<tr>
<td>105B</td>
<td>00011111</td>
<td>ADC AUXH</td>
</tr>
<tr>
<td>1060</td>
<td>00101011</td>
<td>STA XTNDH</td>
</tr>
<tr>
<td>1064</td>
<td>00101100</td>
<td>MUL4X ROR XTNDH SHIFT INTERIM RESULT</td>
</tr>
<tr>
<td>1066</td>
<td>00101101</td>
<td>ROR XTNDL</td>
</tr>
<tr>
<td>1068</td>
<td>00101110</td>
<td>ROR A</td>
</tr>
<tr>
<td>106B</td>
<td>00101111</td>
<td>DEY DECREMENT COUNT</td>
</tr>
<tr>
<td>106C</td>
<td>01011000</td>
<td>BNE MUL3X LOOP TIL DONE</td>
</tr>
</tbody>
</table>
MUL816 is entered when the multiplier is known to be 8 bits or less. It provides an execution time improvement on the order of about 37% over the use of the revised ‘MUL’ routine.

Shown along with MUL816 is a special ‘MUL8HI’ routine, which is actually an alternate entrance to MUL816 whenever the 8-bit multiplier is known to be the HI order byte of a normally 16-bit multiplication. Its primary virtue lies in combining the efficiency of an 8X16 operation with the same exit protocols of MUL16X, since both must supply 32-bit answers.

By this time it should be obvious that we can improve things even more if we address ourselves to the 8-bit by 8-bit multiply as a separate matter. Note that we are building a ‘family’ of routines which we can count on to execute at top speed with ease of use.

Fig. 5 shows this last member of our family, MUL8X8. Its features are several. There is no pre-storing to working bytes. Both the preload by caller and the result are register-oriented, since the multiplier and multiplicand are both 8-bit, while the answer is limited to 16 bits. It requires only 25 bytes of code.

The use of MUL8X8, whenever both the values are 8-bit limited, results in a further improvement in execution time of about 50%, when compared to using MUL816. Compared to ‘RMUL’, the speed increases by some 69% while a whopping 82% improvement is seen over APPLE’s ‘MUL’ routine in its ROM version!

For those interested, the execution times quoted here are based on average ‘bits on in the multiplier’ of 8 for 16-bit executions and 3 for 8-bit guys. Both maximum and minimum calculations were also performed and changed the percentages only 2% or 3% for comparable multipliers.

Here is a rough breakdown of average execution times:

<table>
<thead>
<tr>
<th>Routine</th>
<th>16-Bit</th>
<th>8-Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘MUL’</td>
<td>1262 µs</td>
<td>1082 µs</td>
</tr>
<tr>
<td>RMUL</td>
<td>726 µs</td>
<td>631 µs</td>
</tr>
<tr>
<td>MUL16X</td>
<td>725 µs</td>
<td>394 µs</td>
</tr>
<tr>
<td>MUL816</td>
<td>215 µs</td>
<td>212 µs</td>
</tr>
<tr>
<td>MUL8X8</td>
<td>192 µs</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
(continued)

| 1090  | ANSLO  | * $0050  |
| 1090  | PLIER  | * $0051  |
| 1090  | CAND   | * $0052  |
| 1090  | 85 51 | MULX8 STA PLIER SAVE (MULTI)PLIER |
| 1092  | 84 52 | STY CAND SAVE (MULTI)PLIER CAND |
| 1094  | A9 00 | LDA #$00 RA=RESULT HIGH |
| 1096  | A0 08 | LDY #$08 SET 8-BIT COUNTER |
| 1098  | 46 51 | MUL 1Y LSR PLIER TEST NEXT BIT |
| 109A  | 90 03 | BCC MUL2Y IF OFF, GO ROUND |
| 109C  | 18   | CLC |
| 109D  | 65 52 | ADC CAND IF ON, ADD |
| 109F  | 6A   | MUL2Y ROR A SHIFT ANSWER 1 BIT |
| 10A0  | 66 50 | ROR ANSLO * |
| 10A2  | 88   | DEY DECREMENT POS. COUNTER |
| 10A3  | D0 F3 | BNE MUL 1Y LOOP UNTIL DONE & BITS |
| 10A5  | A8   | TAY |
| 10A6  | A5 50 | LDA ANSLO A=RESULT LOW BYTE |
| 10A8  | 60   | RTS |

### Summary

Note that although these routines are presented as improvements on the APPLE ROM routine, they are usable on all 6502 systems as they are free-standing.

While 192 microseconds for an 8x8 multiply may not be spectacular compared to 15 or 20 for a hardware command, it should be close to the fastest available on our 1-MHz 6502. For those who don't see any need for this speed, there is at least one chip maker that thinks super fast multiplication will be in high demand. Advanced Micro Devices has a new chip, the AM25555 (the 'RABBIT') which attacks an 8X8 multiply in, get this, 45 nsec! Furthermore, the latched version supports cascading 4 of these chips to do 16x16 operations in 100 nsec.

---

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19 Winchester Drive
Merrimack, NH 03054
Purpose: "To further the knowledge of the PET and to share information."

New York City Area User’s Group
Meets the first Thursday of each month at 7:00 p.m. David Gillette is the president, and the club now has 40 members. For more information, please contact:
Mike Bassman
39-65 52nd St.
Woodside, NY 11377
To enlighten OSI users as to what can be done on an OSI.

APPLE Power Users Group
Meets the second or third Wednesday of every month [7:00 p.m.] at Syosset High School, Syosset, Long Island, New York. To contact the club concerning membership, library program exchanges, newsletter exchanges, etc., please write to:
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Meets on the third Thursday of the month at 7:30 p.m. at the Upstate Computer Shop [629 French Road, Campus Plaza, New Hartford, N.Y.]. Bill Etters is President for this group of 20. Contact Tony Violente, Public Relations at:
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Campus Plaza
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"Aim to offer support to new Apple owners and support local school projects. Aid in software and hardware problem solution."

Delmarva Computer Club
Meets for a business meeting on the 1st Wednesday of each month and an informal meeting on the 3rd Wednesday of each month, both at 7:30 p.m. Address correspondence to Jean Trafford, Secretary, at:
P.O. Box 36
Wallops Island, VA 23337
"Primary objectives: Aiding the handicapped, bringing computer awareness to the community, providing the opportunity to the community to use and program computers. Non-profit organization — marketing a manual alphabet tutorial program for the PET computer, with all proceeds going to fund club projects."

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Ralph V. Johnson, Sec.
OSI — MUG
3247 Lakewood Avenue
Ann Arbor, MI 48105

SLACC
St. Louis Area Computer Club
Meets on the first Thursday of every month at 7:00 p.m. Membership numbers around 120. Dennis W. Jolly is spokesperson and President. Meetings are held at the Thornhill Branch of the St. Louis County Public Library at Willowyck and Fee Fee Road. Contact:
SLACC
P.O. Box 28924
St. Louis, MO 63132
"Promotes the understanding and growth of microcomputing through group activities. We are a processor non-specific club. We are a non-profit registered organization with a monthly newsletter. Meetings are open to the public and membership is not required in order to attend."

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Meets on the first and the third Tuesday of each month at 7:00 p.m. at various computer stores in Oklahoma City area. Andy Gin is the President. Contact:
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Secretary
Greenbriar Digital Resources
P.O. Box 1857
Edmond, OK 73034
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Arlington, TX 76013
To develop, review and discuss applications of, and software for the Apple Computer related to business and personal data processing. We are NOT a software exchange group!

APPLE B.U.G. [Bakersfield Users Group]
Meets the first Friday of each month, at 7:30 p.m. For location of meetings, please check with the Computer Warehouse. President is Gary F. Aitchison, and membership stands at 25. For more information please contact:
Bob Geisler
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Meets every second Wednesday of each month at different members' homes. Stacy Goff is the president and membership totals 20. Address correspondence to:
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Box 6502
Chelmsford, MA 01824
C.R. MacCluer of East Lansing, Michigan has some updates to his article, "Satellite Tracking with the AIM 65" which appeared in the August 1980 MICRO [27:13].

The text in the third column of page 13 should read:

\[
\begin{align*}
100 & \ A = 7281; \ E = 0; \ P = 103; \\
& \ K = 99; \ W = 0 \\
300 & \ \text{FOR T = 0 TO P} \\
\end{align*}
\]

And in the listing:

- Line No. 110: Was E = 67627, Should Be E = 67627
- Line No. 340: Was -M1)(O1 - , Should Be -M1)(O1 -
- Line No. 350: Was 102 - B, Should Be 10 - B
- Line No. 460: Was THEN 470, Should Be THEN 480
- Line No. 470: Was NEXT T, Should Be NEXT T
- Line No. 420: Was 108 - B, Should Be 10 - B

From Shankill, County Dublin, Ireland, Charles H. Putney writes: I read with interest the article in August 1980 MICRO [27:17] by Frank Chipchase on RENUMBER. I prefer a cruder approach of making RENUMBER easier to use. The program listed below creates a text file which when EXEC'ed saves the current program, runs RENUMBER, and restores the program being worked on. Be sure to put RENO on the same diskette as RENUMBER. During a session when RENUMBER is needed just EXEC RENO.

```
PROGRAM: CREATE RENO
10 D$ = "REM CNTL D"
20 PRINT D$; "OPEN RENO"
30 PRINT D$; "WRITE RENO"
40 PRINT D$; "SAVE RENOFILE"
50 PRINT "NEW"
60 PRINT "RUN RENUMBER"
70 PRINT D$; "REM ANSWER TO INSTRUCTIONS NEEDED?"
80 PRINT D$; "LOAD RENOFILE"
90 PRINT D$; "DELETE RENOFILE"
100 PRINT "PRINT" ;CHRS$(34); "RENUMBER LOADED";CHRS$(34)
110 PRINT D$; "CLOSE"
120 END
```

To make a blank shape, simply type "Q". The program will place a zero in the shape table, followed by a zero end-of-record mark.

1. In figure 3, the zero should have one more dot placed in its center. The dots are so close together that you can't tell the difference on the screen, but the missing dot becomes very noticeable if you plot the character display on a printer. Three bytes in the shape table must be changed. Run the program, end it, then type the following:

```
POKE 20044, 44
POKE 20045, 12
POKE 20046, 4
BSAVE SHAPEFILE NUMERALS, A20000, L188
```

2. Some applications require the use of a blank shape, such as using the space bar within a different alphabet set. To allow this, change line 3100 to 3102 and add new line 3100:

```
3100 IF PEEK (ADDR - 1) = 0 THEN POKE ADDR, 0: ADDR = ADDR + 1: GOTO 3170
```

3. Line 2460 should read "GOTO 2520" rather than "GOTO 2570". This caused the cursor from the last shape to appear in the next shape, and caused some dots to appear in the upper right corner of the screen.

4. Line 4510 should read "XDRAW" instead of "DRAW". This one requires some explanation. The article states it is possible to erase a plotted point by plotting another point over the top of it. This only works if you use "XDRAW" to draw the shape. As the shape is drawn, the point will be plotted in white the first time and in black the second time, thus erasing it.

Don't forget to save the program again after all the changes have been entered.

---

Pete Cook of Mesa, Arizona writes: A few Microbes have become apparent in the article "Creating Shape Tables, Improved!" [28:7].

Gary M. Ganger of New Carlisle, Ohio caught this error: I would like to point out an error on page 5 of #27. In the description of the front cover the Space War Game was first on the DEC PDP-15, not on a PDP-1. [There never was a PDP-1.]
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Send payment plus $1.00 shipping and handling to Creative Computing Software, P.O. Box 785-M, Monmouth, NJ 07750. NJ residents add $1.00 sales tax. Bankcard orders may be called in toll free to 800/631-8112. In NJ call 201/640-0445.

**sensational software**

**creative computing software**
Name: Rental Manager
System: APPLE II or APPLE II + or
Language System
Memory: 48 K
Language: Applesoft
Hardware: APPLE II, Disk II w/2
Drives, Printer
Description: A total system for rental
property management. It handles
accounts receivable, accounts payable
and the general ledger. Maintains the
chart of accounts and buildings,
listings for present and future tenants,
and will print reports and notices for
"problem tenants." Automatically
posts entries between systems and
creates back-up copies of information
entered. Includes a separate in-
structional version and full user
documentation.
Price: $695.00
Author: Bill Tesnow [a property
Manager]
Available: Blue Lakes Computing
438 N. Frances
Madison, WI 53703

Name: R & G DATABASE
System: APPLE II and APPLE II
Plus
Language: Applesoft
Hardware: APPLE II with Disk,
Optional Line Printer
Description: A keyed random access fil-
ing system, providing rapid access to
items on file under full user control.
The suite of more than five programs is
run by explicit questions and simple
keyboard responses. This allows even
the non-programmer to set up a profes-
sional filing system. The report
generator works with screen or line
printer. Reports are selective and result
fields can be generated, as can new
headers. Print and screen format are
under full control of the user. It
prompts the user when he is likely to
make a mistake. An unusual feature is
the easy to use comprehensive date
validation specified by the user and
then used by the system for all further
file inputs. State Configuration. [No. of
Drives etc.]
Price: $85.00 plus shipping
Includes: Manual and Disc
Author: John Robinson
Available: R & G MICRO's,
550 Midgeland Rd,
Blackpool, Lancashire,
England

Name: Restaurant Evaluation
System: Apple II, Apple Plus
Memory: 16K
Language: Applesoft II
Hardware: Optional: Disk II, printer
Description: Evaluates potential
restaurant/site location and thereby
reduces the margin of risk involved
in purchasing a new or existing business.
All the necessary percentages and for-
mulas are programmed to evaluate
whether a potential site will be pro-
fitable or not. The program is also
structured for use by present
restaurateurs to evaluate whether or
not their present business is operating
at cost and profit efficiency. Calculates
monthly gross, computes monthly loan
notes (or mortgages), and reports weekly,
monthly and annual net profit/loss
in dollar amounts and percentages.
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Available: Mind Machine, Inc.
31 Woodhollow Lane
Huntington, N.Y. 11743

Name: Wind Energy
Calculations
System: Apple II or Apple II Plus
Memory: 16K
Language: Applesoft II
Hardware: Printer optional
Description: This program allows the
prospective wind-charger buyer,
builder, or experimenter to familiarize
himself with the theory behind obtain-
ing power from the wind. Simply input
values for various parameters and
choose how they are to be incremented
for the calculations. Learn what pro-
pellor parameters are compatible with
any size generator, what effect an in-
crease or decrease in height has on
power output, and what to expect from
any combination of system size, effi-
ciency, and wind velocity. Parameters
that can be calculated include size,
RPM, and tip-speed-ratio of propellers,
useful watts available, kilowatt-hours
per day output, and more.
Price: $9.50 postpaid on cassette
Available: Charles O'Neill
3-C Liberty Lane
Elk City, Okla. 73644

Name: Hi-Res Shape Encode
System: Apple II
Memory: 16K
Language: Integer BASIC
Description: This is a 16K Integer
BASIC program that uses standard
40x40 graphics to encode several
shapes into a Shape Table for display in
graphics. The program displays both
plot and non-plot moves. After en-
coding, non-plot moves may be erased.
The bytes of each shape are stored in a
Shape Table for writing on cassette
tape. Shapes are changed by tracing for-
ward or backward along a shape's
moves. Text and graphic displays allow
moves to be erased, changed, or in-
serted. The program has options to delete,
copy, move, replace, or swap
entire shapes in a Shape Table.
Documentation includes features,
cassette operation, new shapes, reading
and writing Shape Tables, modifying
shapes and tables, examples, and pro-
gram structure.
Price: $7.50, check or money
order
Includes: Program and shape table
on cassette, documentation
Author: Harry L. Pruetz
Available: MICROSPAN Software
709 Caldwell St.
Yoaum, TX 77995

Name: The Aliveness Life
Dynamic
System: Apple II
Memory: 48K
Language: Applesoft, Machine
Hardware: Apple II, Disk II
Description: Adds up to a long and in-
tense look at, and "workshop" on, all
the major barriers to aliveness. Deals
with life-awareness, and increasing the
understanding of the interrelationships
between feelings, aliveness, rational
vs. irrational, neurosis and awareness.
Most of the disc centers on three
unique games [in Hi-Res with shape
tables]: The Primal Oil Fields, The
Keys to Awareness, and Rationality!
You'll love them as games, learn from
them as enlightening experiences.
Price: $15.95
Includes: Disk, game card
Available: Avant-Garde Creations
P.O. Box 30161 MCC
Eugene, OR 97403
Name: Empire of the Stars  
System: OSI CIP  
Memory: 8K  
Language: 8K Basic-in-ROM  
Hardware: CIP or Superboard  
Description: Grand scale strategic simulation of the rise to power of 1 to 4 interstellar empires. Players wield fleets of up to thousands of ships in an attempt to rule the galaxy. Captured and colonized worlds produce new ships.  
Price: $9.95  
Author: Gorpile the Rigellian  
Available: Hoxton Computing  
P. O. Box 479  
Mendham, NJ 07945

Name: Diskolog  
System: APPLE II  
Memory: 48K  
Language: Applesoft  
Hardware: APPLE II, Disk II  
Description: A utility program that will alphabetically catalog a large number of programs. Features include: FIND A DISK—locates disk name by inputting program name or characters in name; CATALOG A DISK—lists all programs on a disk; LIST ALL PROGRAMS—lists all programs on file and indicates disk name; ADD A DISK—adds a new disk to file (using screen read format); DELETE A DISK—deletes a disk from file; LIST BY TYPE—lists all programs by type (A, B, I, T); RENAME A DISK—changes name of disk in file; and LIST ALL DISKS—lists disks in file and indicates number of sectors remaining.  
Price: $14.95  
Includes: Disk, Instructions  
Available: Computeck  
28275 Enderly Street  
Canyon Country, CA  
91351

Name: DATA HANDLER  
System: APPLE II, APPLE II Plus, PET  
Memory: 7K  
Language: Applesoft, PET BASIC  
Hardware: Floppy disk drive  
Description: A disk oriented data manager software package. Easy data file creation and powerful record handling. User can sort, merge, add, delete, update, view, print, write data files and more. Special features include mass updating and sorting by fields. Code is easily modified. Excellent for office use!  
Price: $25.00 postpaid  
Includes: Software on floppy disk, documentation, and example applications  
Author: Rick Keck  
Available: Business Computer Services Co.  
9020 Eby  
Overland Park, KS 66212

Name: OPTIMIZED EP-2A SOFTWARE  
System: Any 6502  
Memory: 128K  
Language: Assembly  
Hardware: Standard EP-2A  
Description: Turns the EP-2A into a professional quality EPROM programmer. Five commands are available: ERASE verify, PROGRAM, PROGRAM verify, COPY PROM to RAM, EXIT. Full address prompting is performed; appropriate messages are printed (e.g., PROGRAMMING...). Extensive error checking is performed. Cassette available for AIM, KIM, and SYM systems; others may load object or source from listing provided. Loads at $0200. Specify system!!!  
Price: $19.95 Listing and instructions  
$2.00 Cassette [ASK FAMILY ONLY], $2.00 Custom Assembly  
Author: Jeff Holtzmann  
Available: Jeff Holtzmann  
6820 Delmar—203  
St. Louis, MO 63130

Name: C RAE  
System: Apple II or Apple Plus  
Memory: 48K  
Language: Applesoft on ROM  
Hardware: 3.2 DOS & Disk  
Description: Co-resident Applesoft Editor for Applesoft programs. Perform global change/finds to most anything in your Applesoft program, quote a range of lines, a stop-list that produces a fault optimized listing, dump, a very fast renumber, APPEND, AUTOLINE Numbering. All commands invoked with one key command and needs to be loaded only once while you are developing and running your program.  
Price: $14.95 on disk  
Available: Highlands Computer Services  
14422 SE 132nd  
Renton, WA 98055

Name: BrownPak I Diskette  
System: APPLE II  
Memory: 16K-48K  
Language: Applesoft in ROM  
Hardware: Disk II is preferable  
Description: A diskette of utility routines. Machine language routines include print using, sort, packing and unpacking, data, and a special input command. Applesoft BASIC routines include auto diskette menu, disk-free utility, Hi-Res shape utilities and a general input routine.  
Price: $39.95  
Author: Ronald Brown  
Available: The Computer Emporium  
3711 Douglas  
Des Moines, IA 50310

Name: APARTMENT MANAGER  
System: APPLE II or APPLE II Plus  
Memory: 48K [Firmware Card if APPLE II]  
Language: Applesoft II and Assembly  
Hardware: 2 Disk Drives, 132 column printer  
Description: Maintains financial and managerial data for up to 6 separate complexes; each complex can contain a maximum of 120 units [user determined]. Maintains TOT, YTD rental income for all tenants on file. Calculates security deposit interest. Generates operating statements, and rental totals as well as much more.  
Price: $325 includes manual  
Author: Gary E. Haffer  
Available: Software Technology for Computers  
P. O. Box 428  
Belmont, MA 02178

Name: Video Games 1  
System: OSI, C2, C4, C8 BASIC-in-ROM  
Memory: 8K  
Language: BASIC  
Hardware: None special  
Description: Video Games 1 consists of three games; Head-On, Tank Battle, Trap. Head-On is an arcade-style game for one. You must try to avoid a head-on crash by changing lanes. Tank Battle is a tank game for two to four players. Trap is a block-style game, with enhancements for one or two. Color and sound for machines so equipped.  
Copies: Just released  
Price: $15 on cassette tape, ppd.  
Author: Mike Bassman  
Available: Orion Software Associates  
147 Main Street  
Ossining, N.Y. 10562

MICRC – The 6502 Journal  
No. 31 – December 1980
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VISA MASTER CHARGE

No. 31 - December 1980 MICRO - The 6502 Journal 81
In the December issue of the Ohio Scientific Small Systems Journal we are presenting a brief description of the new Vocoder software and three, user contributed, game programs.

If you are interested in contributing software or other articles to the Small Systems Journal contact:

Small Systems Journal
c/o Ohio Scientific, Inc.
1333 S. Chillicothe Rd.
Aurora, Ohio 44202

Ohio Scientific manufactures two products which support speech synthesis, the CA-14A and CA-15V. The CA-15V is the Universal Telephone Interface which was described in the Small Systems Journal of the June 1980 MICRO. The CA-14A contains virtually the same speech output circuitry but has a non-populated voice input area designed for experimental use.

Both the CA-14A and the CA-15V generate artificial speech with a VOTRAX® speech synthesis module. The VOTRAX speaks words on a phoneme-by-phoneme basis so it is possible to reproduce nearly every word of the English language.

Phonemes can be considered as the basic building blocks of the spoken word. A few of the phonetic codes used by the VOTRAX are:

**Phoneme** | **Typical Usage**
--- | ---
TH | three
UH | but
EH | ten
ER | her
U | two
O | note

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As you would expect, building words with phonetic codes is very versatile. However, it can also be tedious and time consuming. For example, consider the word "did". Its phonetic construction with the VOTRAX is D,I,D. That was pretty simple, but look at the construction of another short word, "has" — H,A,E,I,S,Z. This is a little more difficult to code but still sort of obvious. As the words become longer, the coding becomes much less obvious—"average" AE1,I3,V,R,I2,D,J.

Ohio Scientific has developed two new software packages to help minimize the difficulties associated with phonetic coding. These are Vocalizer I and Vocalizer II.

Both Vocalizer I and Vocalizer II operate by automatic translation of English text into phonetic code. This is accomplished by examining each individual word as it is encountered, dividing the word into utterable phonemes, and finally, speaking each phoneme through the VOTRAX.

The actual division of words is done by a set of 327 different rules. The bulk of these rules is based on the Naval Algorithm developed at the U.S. Naval Research Laboratory in Washington, D.C. by Honey S. Eliovitz et. al. in 1975. This algorithm results in the correct pronunciation of approximately 90 percent of all words (97 percent of all phonemes) in an average sample of English text. The remaining words typically have single errors which are easily corrected by the listener.

An example of one of the translation rules is that the letter "E", when used as the final letter of a word, is not pronounced if it is preceded by zero or more consonants and one or more vowels. The words "hoe", "parade", "picture", and "bee" illustrate this rule.
Although the Naval Algorithm is obviously quite complex, Ohio Scientific's implementation of it is relatively compact. It requires approximately 4K bytes of memory to store and interpret the rules. The algorithm is also quite fast, translating in less than "real time". This means that a new phoneme is ready before the VOTRAX has finished pronouncing the previous one. This is true even with "older" Ohio Scientific systems operating with a one megahertz CPU clock.

The Vocalizer software can be used either as a phonetic code development tool, or as an actual output "device".

In developmental applications, words or phrases can be presented as input to the system, which responds by outputting the proper phonetic codes in a written form. These phonemes can then be modified or optimized at a later time.

The more common use of the Vocalizer is as an additional standard output for Ohio Scientific BASIC. When used in this fashion, all of BASIC's normal output is translated to phonetic code and spoken by the VOTRAX.

For example, this means that instead of having prompts printed at the terminal, they may instead be spoken. In practice, the normal BASIC line

100 PRINT "ENTER THE X COORDINATE";

is changed to

100 PRINT #6, CHR$(1), "ENTER THE X COORDINATE";

and the VOTRAX verbally requests the entry of coordinate data.
Obviously, since the PRINT statement is used, information and data may be used for speaking results as well as prompting for input.

Vocalizer II software has an additional feature: it can search files for vocabulary matches, as well as generating speech via the Naval Algorithm. Also, the user may add special words and abbreviations to the disk-based dictionary.

An example of this is the BASIC reserved word REM. When REM is encountered by Vocalizer II, it is automatically pronounced as "remark". Clearly, this could not be done if only translation by the rules were employed.

The Vocalizer software systems are an extremely important addition to the Ohio Scientific software catalog. For computers that require speech output facilities, the Vocalizer is nearly indispensable.

Vocalizer I is available under OS-65D V3.2 and OS-65U Level I. Vocalizer II is available for both LEVEL I and LEVEL III OS-65U.

BASIC Games

BASIC game programs have always been popular in the Small Systems Journal. This month we are including three contributed games:

- Great Pyramid
- Road Race
- Concentration 2

All of the games include their own instructions.

Two of the games are two-player games. Great Pyramid is a single player game similar to the classic Towers of Hanoi puzzle.

All of the games operate under OS-65D V3 on 4P and 8P disk-based systems.
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Up from the Basements

By Jeffery Beamsley

One of the unique features of Ohio Scientific 6502-based computers is the bus (or mother board) used to interface the various boards that make up the system. Many of my customers and dealers have asked me from time to time why they don’t see more independent vendors providing compatible hardware for Ohio Scientific systems. The bus, its history, and its features may give us the answer to those and other interesting questions.

The 48-pin Ohio Scientific bus is really a model of efficiency. It is made up of four 12-pin Molex-type connectors. Of these 48 pins, only 42 are defined, leaving 6 available for future expansion. The defined pins on the bus include 20 address lines, 6 power lines, 8 data lines, and 8 control lines. The bus supports distributed, fully-regulated DC power. The placement of the power lines causes dead shorts on the bus for any board improperly inserted. The Ohio Scientific bus was one of the first microprocessor busses to support bi-directional data lines. It is passively terminated and probably has a bandwidth of 5 MHz. It is very inexpensive as far as bus structures are concerned and is classed by Ohio Scientific as proprietary.

The bus arrived very early in Ohio Scientific’s growth, about four years ago. It was probably laid out by Mike Cheiky, vice president and motive force behind Ohio Scientific, and it is indicative of much of his thinking at that time. Molex connectors are cheap and don’t use gold. They also make both the mother board and system boards somewhat easier to manufacture. There may have even been some thought about compatibility with Southwest Tech, which at that time, with its 6800-based micro, was a real contender for dominance in the microcomputer marketplace. The actual placement of signals on the bus may have been originally intended to facilitate the construction of the 420 memory board that Ohio Scientific was making at the same time. There is no other logical reason for why the address lines are so jumbled on the bus.

In a classic case of shortsightedness, the 420 memory board was designed to be as single-sided as possible and use no sockets as a cost-saving factor. This meant that the signal paths to the 2102 memories used on the board all had to occur on the foil side of the board, to permit easy desoldering of the IC’s. This understandably put some rather severe restrictions on the layout of the address lines. So, if you can’t design the memory board to fit the bus, why not design the bus to fit the memory board? I’ve always felt that foresight is a function of circumstance much more than good planning, anyway.

The circumstance Ohio Scientific found itself in, with the wane of Southwest Tech, was that it was the only “non-standard” manufacturer in an S-100 world. Rather than fold against the competition, Ohio Scientific made the sort of marketing decisions that has made it the force in the marketplace that it is today. The company decided to sell completely assembled and tested systems at a price competitive with what a hobbyist would have to pay to assemble one from various S-100 kit vendors.

As the first company to enter the microcomputer system market, Ohio Scientific turned its lack of S-100 compatibility into a marketing advantage by creating a captive market of system users completely reliant on Ohio Scientific for products. This choice, though, forced Ohio Scientific into a position where it was required to provide this market of users and dealers—in order to retain their interest—with at least the same variety of machines and accessories that were available to the S-100 user. One of the results, four years later, is a company—the only company—that covers the entire spectrum of microcomputers, from the very low-cost personal machines through the multi-user, hard disk-based computers.

Ohio Scientific is understandably protective of the captive, profitable market it has created. Because the bus is not copyrighted, second source vendors have made attempts to market Ohio Scientific compatible products. Those efforts, though, have met with considerable resistance from the “factory.” It is certainly within a manufacturer’s rights to be concerned about the effect of “foreign” boards in its systems. Ohio Scientific, however, seems to take its concern well beyond that of well-intentioned warnings to its users.

If nothing else, the S-100 world, with all of its shady vendors, has certainly proven the ability of the marketplace to sort out the quality manufacturers. Ohio Scientific has taken the contrary position of being the sole “authorized” source for bus-compatible products for its systems. This sort of position puts considerable pressure on Ohio Scientific to compete at least functionally with the rest of the microcomputer marketplace. The results of such pressure in some cases are features that are favored by some in the marketplace. The results of the pressure are favorable by others. It is very difficult for any single company to compete successfully in all facets and at all levels of the microcomputer market.

This brings us to the conclusion: Ohio Scientific is a market-oriented company. It will do whatever is necessary to sell its product and maximize its profit. That isn’t necessarily bad. Ohio Scientific has consistently exhibited a remarkable ability to respond to what the marketplace demands. Unfortunately, that same attitude also leads the company to attempt to protect its captive market with whatever means are at its disposal.

Although this may be a shortsighted attitude and second-source vendors may, in the long run, take some of the pressures off Ohio Scientific to remain competitive in all areas of microcomputing, there are no indications that Ohio Scientific is going to change its attitude towards those vendors. Partially as a result of that attitude, there is currently a lack of strong second sources for Ohio Scientific hardware. With the increased visibility and vitality of the Ohio Scientific user community, I don’t think this weakness in the marketplace will continue for long.
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744. Recreational Computing 8, No. 6, Issue 45 (May/June 1980)
Lindsay, Len, "Home Video Displays," pgs. 36-37.
General discussion of video displays.

745. The Seed 2, No. 5 (May 1980)
Taylor, Terry N. "New Programs," pg. 9-11.
The Seed librarian lists 429 new programs entered into
the club library of APPLE programs.
Anon, "International APPLE Core," pg. 12.
New policies of the IAC developed at the recent
meeting of the IAC. Dues, access to THE SOURCE, etc.

746. SES Newsletter, Issue 18 (May 1980)
This is a very nice hi-res graphics program for the
APPLE.

Gabelman, Ken, "ONERR GOTO," pgs. 5-6.
A discussion of errors and their management, on the
APPLE.
APPLE data structures, binary and Basic, are discussed.

748. APPLE Bits 2, No. 5 (May 1980)
Sanders, Dwight, "Practical Programs - and Maybe Some
that Aren't," pg. 4.
Listings for APPLE Screen Editor, both Tape and Disk
versions.
Some notes on converting a Basic program into Pascal
on the APPLE.
Goulden, Al, "Stop Watch and Lap Timer," pg. 11.
Here is a stop watch that is a little different.
Townsend, Jeff, "Helpful Hardware Hints," pgs. 13-14.
Interfacing the APPLE to read eight or sixteen switches.
With hardware directions, basic and machine language
listings.
Martie, Ed, "Interfacing an External Terminal to the
APPLE for use with PASCAL," pg. 15.
Discussion and PASCAL software for the Heath
H-19 Terminal with the APPLE.
Anon, "IAC Application Notes," pg. 24-29.
A number of Application Notes from the International
APPLE Core including: Append fix in DOS 3.2;
Applesoft HIRES Routines in Applesoft ROM; Literal
Input which permits you to enter commas, etc. into
Applesoft print statements; Stalking the Wild Left
Bracket-and reverse bracket, underline, etc.; also a list
of 61 known PASCAL Problems.

Learn to spell without vowels, on the Apple.
Mauch, John, "Hyperboloid," pg. 16-21.
Three-dimensional HIRES graphics program.
An Adventure type program to locate the legendary cave
with a fortune in solid gold.
Swenson, Carl, "Right/Left," pg. 50-51.
A training program for small children to teach them the
differences between "left" and "right".
Blackwood, Brian and George, "Intimate Instructions in
Integer Basic," pg. 53-55.
Continuing with Lesson II of this instructional series.

750. FROM THE CORE (May, 1980)
Schmoyer, Jeff, "Now What's Wrong?" pg. 5-10.
A serial interface article with hardware notes and driver
listing. Provides RS-232 EIA interface for the Apple to a
Base 2 Model 80CST printer or a TI 810.
With the instructions in this article you can initialize
Apple disks in 45 seconds instead of waiting 2 minutes.

751. Abacus II 2, Issue 4 (April, 1980)
Program, in Integer Basic, for displaying Apple
memory, byte by byte.
Anon., "Applesoft HIRES Routines," pg. 15.
Entry points to the machine level HIRES graphics.
Anon., "HIRES Screen Function Demo," pg. 16.
Graphics demo for the Apple.

752. The Seed 2, No. 3 (March, 1980)
Knaster, Scott, "Using the 'Old Monitor ROM' with the
Language System," pg. 2.
Hints for using the old ROM, together with a software
fix.
Fokens, Bob, "Geejo," pg. 4.
Tips on easier editing, writing programs with delay
loops, paddle-read program, TV interference, etc. on the
Apple.

753. The Seed 2, No. 4 (April, 1980)
Fokens, Bob, "Geejo," pg. 5.
How to put inverse into catalog listings, mystery pro-
gram, debugging tips, for the Apple.
Mills, Craig A., "Volume Number," pg. 15.
How to change the volume number on your disk, for the
Apple.
754. Apple Gram 1, No. 2 (Feb., 1979)
   Carpenter, Chuck, "A Simple Disk File Program," pg. 3.
   Listing and explanation of the program, for the Apple.
   Program to print information in two columns on the Apple.

755. Apple Gram 1, No. 3 [March, 1979]
   Graham, Johnny, "User Key In Routine," pg. 4.
   Load and Run cassettes with one key-stroke.

756. Apple Gram 1, No. 4 [April, 1979]
   Ferrell, Bobbie, "Bugs and Butterflies," pg. 2.
   Two graphics programs in Apple Hires.
   Carpenter, Chuck, "Apple II Clock," pg. 7-8.
   A machine language program for the Apple.
   A clock program with graphics, Apple Lo-Res.
   A program providing append or join functions for disk files, for the Apple.

757. Apple Gram 1, No. 5 [May, 1979]
   How to put machine language routines into your Applesoft or Integer Basic programs.
   Sander-Cederlof, Bob, "Rounding in Applesoft," pg. 5.
   Rounding off decimals on the Apple.
   A tutorial article on SORTS.

758. Apple-Com-Post 6, (Jan., 1980)
   Schultz, H.I., "H64 Ham-Interface A650 Deluxe RTTY," pg. 4.
   An interface for the Apple II permitting RTTY in ASCII or BAUDOT.

759. Applesauce 2, No. 1 [Jan., 1980]
   Using RWTS, an example—Fake Catalog.
   The third part of a continuing series describes zero page locations used by the Apple Monitor.
   A special language for the Apple based on PASCAL.

760. Apple Gram 1, No. 6 (June, 1979)
   Sander-Cederlof, Bob, "Copying Binary Disk Files," pg. 3.
   How to find the starting address and length of binary files on 16K, 32K, and 48K Apples.
   Carpenter, Chuck, "Apple-80 Simulator," pg. 4-5.
   A program to simulate the 8080 microprocessor on the Apple.
   The second article in a series on SORTS.

761. Apple Gram 1, No. 7 (July, 1979)

Memory, Monitor and Machine Language are explained in a tutorial series.
Lining up the decimal points in Applesoft programs.
This third article describes QUICKSORT for the Apple.

762. Sym-Physio No. 1 (Jan./Feb., 1980)
   Anon., "Relocate for the SYM-1," pg. 7-12.
   Discussion and listing of a relocate program.
   Machine language program for the SYM-1.
   Du Peu, Maurie, "A Program to Display SYM-1 LED Segment Codes," pg. 18.
   A machine language program for the SYM-1.
   Wells, George, "Suggested Hardware Modification," pg. 18.
   Add more PROMS to your SYM-1 board.

763. Apple Gram 1, No. 8 (Aug., 1979)
   Sander-Cederlof, Bob, "Euclid's Algorithm," pg. 4.
   Short explanation and demo listing illustrating "algorithm"
   Laumer, Mike, "How to Get That Weird and Crazy Program Saved to Run from Disk," pg. 6-8.
   How to save 'difficult' tape programs to disk on the Apple.
   This month's installment discusses the Apple Monitor.

764. Apple-Com-Post No. 7 (Feb., 1980)
   Pascal Discussion and program for Apple.
   Short demo graphics program in Apple Hi-Res.

765. Apple Gram 1, No. 9 (Sept., 1979)
   The third M, Machine Language, is discussed in this tutorial on the Apple.
   Broderick, John, "Strings in Integer Basic," pg. 15.
   A short tutorial on strings for the Apple Integer Basic.

766. Apple Gram 1, No. 10 (Oct., 1979)
   Hardware diagram and software listing to interface the Heathkit H-14 printer to the Apple II.

767. Apple Gram 1, No. 11 (Nov., 1979)
   McClelland, George, "Simple Pascal Text Formatter," pg. 7-8.
   Create a text file in the editor, then print it out on the printer with upper and lower case using this Apple Pascal program.
   Some comments on the new version of Apple DOS.
   This time the author of this series discusses another Apple feature, the Mini-Assembler.
768. Apple Gram 1, No. 12 (Dec., 1979)
Sander-Cederlof, Bob, "Tiny Program Displays Text Files," pg. 2.
Program makes it easy to read those Apple Text Files.
Details on how to use the new AIO card from Solid State Music (SSM) to interface the Apple with the Heathkit H-14 Printer.

769. Apple Gram 2, No. 1 (Jan., 1980)
Walston, Joe, "Calendar Generator," pg. 4-5.
An Apple program for day of week, calendar, etc.
A tutorial on the push-down stack together with a demonstration listing.
How to list your Apple Basic programs on a full width of paper and print a complete word without splitting it.

770. Apple Gram 2, No. 2 (Feb., 1980)
Broderick, John, "Please Pass the Pascal," pg. 11.
Notes on getting started in Pascal.
Zant, Robert F., "ON ERR -- Punt?", pg. 12.
Routine for intercepting error conditions using the Apple monitor.
A snazzy 'Hello' program for the Apple Disk.

771. Sym-Physio, No. 2 (Mar./Apr., 1980)
Brown, I.W., "Ultra Renumber for BAS-1," pg. 4-8.
An automatic renumbering program for the SYM-1.
Rinard, Phillip M., "Doodling with the KTM-2," pg. 9-15.
The KTM-2 keyboard Terminal module provides a convenient way to add a video interface to a SYM-1 as well as a keyboard.
A clock program converted to RAE format for the SYM-1.
Luxenberg, H.R., "24-Clock for SYM-1," pg. 20-22.
A simplified version of the previous clock version.

772. Apple Gram 2, No. 3 (March, 1980)
A still fancier 'Hello' program for the Apple.
Firth, Mike, "More Tokens and Errors," pg. 5.
Here is a program to get you started examining BASIC programs to find memory locations that are giving you errors.
Bowser, Bob, "PRINTTT, a Pascal Program for Lower Case Output," pg. 11-14.
Take advantage of the Apple keyboard and the Pascal editor to do limited text processing with this listing.
What goes on in Apple-soft and what to do if you need greater precision, up to 21 digits.
Firth, Mike, "Banner Routine," pg. 17.
A subroutine which permits you to display a lot of data on a single line of the screen.

773. Apple-Com-Post, No. 8 (April, 1980)
Two transistor amplifier makes possible use of a dynamic microphone.
A fix for a DOS error, saving High-Resolution pictures to cassette, packing Applesoft programs.

774. Apple Gram 2, No. 4 (April, 1980)
Firth, Mike, "Finding Tokens In Your Programs," pg. 6.
Examine your own programs in memory.
Hardware addition to the game output port on the Apple.
Several programs, fast and slow, for calculating PI.

775. Appleass, No. 4 (May, 1980)
Fred, Dennis, "Hidden Character," pg. 4.
This short program will display all control characters as inverse flashing in your Apple Catalog.
Anon., "Intermediate Applesoft," pg. 5.
Handling error messages on the Apple.
Assembly language program for the Apple.
Apple commands USR, Cali and Ampersand [@].
Buchler, Dan, "Justification Routine," pg. 9.
This routine will right justify all output to the screen.
Edelstein, Arnold, "Floating Point Tutorial," pg. 10.
This program takes decimal data entered at the Apple keyboard and returns its floating point equivalent as well as the binary equivalent of the first two bytes of the mantissa.
Edelstein, Arnold, "Wait a Bit," pg. 11-12.
Explanation of how floating point numbers are configured.

776. Robert Purser's Magazine (Spring, 1980)
Purser, Robert, "Purser's Magazine.
This magazine is the successor to "Computer Cassettes Review." It covers software for the Apple, Pet and Atari as well as Level II TRS-80. Disk programs are now included. Detailed discussions of programs are given.

777. Peck[65] 1, No. 4 (May, 1980)
Routine for OSI computers useful in game programs.
Peabody, Al, "Framing Errors," pg. 10.
How to avoid Error 17---Framing Error, on your OS 65 U.
Lucas, J.E., "String Handling Problem," pg. 11.
String Handling problem in Microsoft BASIC for OSI computers.
A bug-correction program for the OS-65U Disk.
Discussion of the WAIT instruction and an example listing for OSI computers.
778. The Cider Press (May, 1980)
Thompson, C.J., "The Executive Branch," pg. 6-7.
A tutorial on this useful function with 3 examples.
Fields, Randy, "Screen Disk Commands," pg. 8.
Holds on using the Apple disk program.
Fixes for problems for the EDIT + program, for the
Apple.
Sokal, Dan, "Pascal-PEEKs and POKEs," pg. 10.
Program designed to be added to the Pascal System Library. Includes sample subroutine for keypress.
Tyro, A., "Linellimit," pg. 11.
A Pascal program for the Apple producing a screen pause when 20 lines of text appear on the screen.

779. The Grape Vine (May, 1980)
A Foote sort routine stripped of the custom features so it can have general use. Also given is a Singleton sort. A demo program for illustrating each is given.
Illustrates another method of getting colors to the LoRes screen on the Apple.
Lawson, Stephen M., "Easter Calendar," pg. 5-7.
Updated calendar program including modifications for Ascension Day, Pentecost Sunday, etc.

780. Abacus II 2, Issue 5 (May, 1980)
A dialer system that does not require a modem, only the listed software and a simple relay for the phone line.
Automatic menu for running Catalog programs on the Apple Disk.
Use this erase routine at the end of a program using the Apple Hi-Res screen.
Apple Staff, "Apple Fix in DOS 3.2 & 3.2.1," pg. 9.
The fix involves writing a missing 'end of file' marker.
IAC Staff, "Application Note: List of Known Pascal Problems," pg. 11-14.
IAC will release Application Notes from time to time. Updates and Fixes for this list of Pascal problems will be released later.
IAC Staff, "Application Note: Literal Input," pg. 15-16.
A routine for Applesoft which allows you to enter commas, quotes and colons without getting an 'extra ignored' error.
IAC Staff, "Application Note: Stalking the Wild Left Bracket," pg. 17-18.
Apple keyboard changes to permit typing left bracket, reverse slant and underline.
Hardware Mod to the Apple board so that it will accept your own EPROMS.
Basic and machine language programs to enable listing on a Trecnom 200 printer.

Hertzfeld, Andy, "Andy's Switch," pg. 5-6.
Two programs that allow you to have two completely different Catalogs in a single Apple diskette.

Capella, Mark, "Hide," pg. 7.
This program for the Apple hides program names from appearing on the disk catalog.
This is an updated version of the Integral Data Hi-Res Screen Dump for the IDS 440 Printer.
Stein, Dick, "File Cabinet Changes," pg. 16.
Some corrections to the previously updated version published in the January issue of Steams From Apple.

Broderick, John, "Pull From the Stack to Get Back," pg. 8.
Program for the Apple to show how the stack saves the return address for JSR to a subroutine.
A modified program in which data statements for new listings are added automatically to the program.
Corrections for the important article "Applesoft Internal Entry Points," published in the initial issue of the IAC Apple Orchard.
This one uses CTRL-S on the Apple to change speeds.

783. Apple Cookbook 1, No. 3 (May/June, 1980)
A utility program for disk catalogs, etc.

784. Call-Apple 3, No. 4 (May, 1980)
Hertzfeld, Andy, "Andy's Switch," pg. 7-17.
Put two different catalogs on a single disk side.
You can use the Ampersand in many interesting ways.
Gilder, Jules H., "Printer Fix for Parallel Interface with a Centronics Printer," pg. 36.
This fix is for a problem in which the Centronics Printer ignores carriage return at the beginning of a line on the Apple.
Kipperman, Steven M. et. al., "File Cabinet Update," pg. 41-43.
Several comments, modified listings, etc. for File Cabinet.
Capes, Nelson R., "File Cabinet," pg. 44.
Adding input data to this oft modified and extended program.
A utility for programmers, Part II.
Copy your Apple disks with only one disk drive using this useful utility.
Wagner, Roger, "Boot-Ing Binary Programs," pg. 53.
How to use a binary program as the 'Hello' Program in booting a diskette on the Apple.

785. Apple-Com-Post, No. 9 (May, 1980)
All about accessories for the Game Port output on the Apple.
786. Sym-Physis, Issue 3 (May/June, 1980)

Sinnet, Jay C., "Hardware Modification for Better Tape Reliability," pg. 4.
A hardware modification for the SYM-1 board to improve cassette input reliability.

Luxenberg, H.R., "Cassette Recorder Tips," pg. 3.
Miscellaneous tips on increasing reliability of the SYM-1 cassette subsystem.

Cyr, Jean M., "A Sorting Patch for RAE," pg. 5-6.
A portion of "User Patch for RAE-1" which permits the printing of an alphabetically sorted Label File.

A graphics program in BASIC, for the SYM-1.

Gowans, Bill, "Hi-Density Plotting with the KTM-2," pg. 11-18.
This routine effectively quadruples the KTM-2 graphics density by mapping a virtual 48x160 screen onto the real 24x80 screen.

A couple of novelty demo programs and some music utility programs. Also some discussion of using Hal Chamberlin’s approach to music generation on the SYM-1.

Thompson, Bruce, "Basic and the 2K Symbolic Assembler," pg. 23.
A short program called by BASIC’s USR to dump or load specific memory locations.

Hardware project based on a 4050 chip.

787. The Target (May/June, 1980)

Bresson, Steve, "Renumber," pg. 2-3.
A basic program for the AIM 65 to renumber BASIC programs.

Some assembly routines used to get individual or specific characters in the AIM 65 display.

An interface for running a DECwriter at 300 baud with an AIM.

788. Peeling II 1, No. 1 (May/June, 1980)

Staff, "Peeling II, pg. 2.
Peeling II is a new magazine devoted to the evaluation of Apple II software. The first issue reviews in some detail eight game programs, seven technical programs and several major utilities, etc.

789. Apple Shoppe, No. 6 (May/June, 1980)

An electrical program in Pascal for the Apple.

A tutorial on Graphics machine language.

Anon., "Assembly, Part II," pg. 9-16.
A tutorial leading into a development example of a Text Editor.

Handling of Disk Files with a demo routine.

Amromin, Joel L., "Pascal Linefeed Mod for AIO, etc.," pg. 23-24.
A mod for the Solid State Music AIO peripheral card for the Apple.

Rounding Numbers in Pascal.

790. Nibble, No. 3 (May/June, 1980)

Harvey, Mike, "Text Processing with TOUGH," pg. 7.
Text outputer, updater, and generalized handler for word processing on the Apple II.

Subroutines to take the page 1 graphics of the Apple and convert it for printing on the Paper Tiger.

This screen dump routine will allow you to print all or part of the Apple screen.

Decrease the memory space required and the execution speed by removing those REM statements from your Applesoft listing.

Connolly, Rick, "Improving the Multiple Array Sort," pg. 26-27.
How to realize the speed advantage in sorts such as the Shell-Metzner sort.

791. Rubber Apple User Group Newsletter 3, No. 6

Gabelman, Ken, "Disk Structures II," pg. 4.
Tutorial on random files as applied to a mailing list.

792. The Harvest 1, No. E (July, 1980)

A fast method of handling massive amounts of data is described for the Apple disk system.

A novel graphics program in Apple Hi-Res using some of the principles of Pascal Turtlegraphics.

793. The River City Apple Corps Newsletter (June, 1980)

A graphics tutorial.

Seture, Tom, "Roots," pg. 4-6.
A tutorial on machine language loops using the 6502.

794. The Seed 2, No. 6 (June, 1980)

Basics in the operation of the Apple Disk system.

795. Cider Press (June, 1980)

A patch to DOS 3.2 of the Apple disk system which will make it INT a disk in half the time and boot up in 2 seconds.

796. Abacus II 2, Issue 6 (June, 1980)

Discussion of a variety of monitor subroutines.

Freeman, Larry, "The Hole in Apple's Integer Numbers," pg. 8-10.
A bug, a fix and an instructive explanation of it all.

An explanation of how the Apple Hi-Res colors are generated.
Dear Editor:

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