inside:

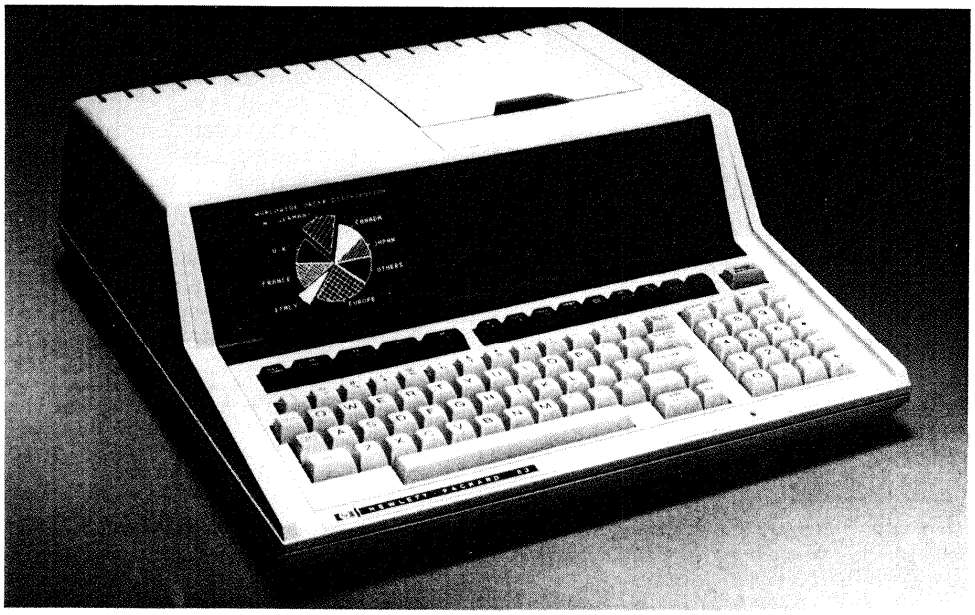
- Three new application pacs
- A complete personal graphics system
- Binary enhancements to the operating system
- A Dvorak keyboard for Series 80 Computers
- Sort with speed
- Series 80 assembly language is now available to you
- Disc do's and don't's
- Intriguing graphics

contents

basic EXCHANGE

HEWLETT PACKARD Corvallis Division Spring 1981 Vol. 2 No. 1

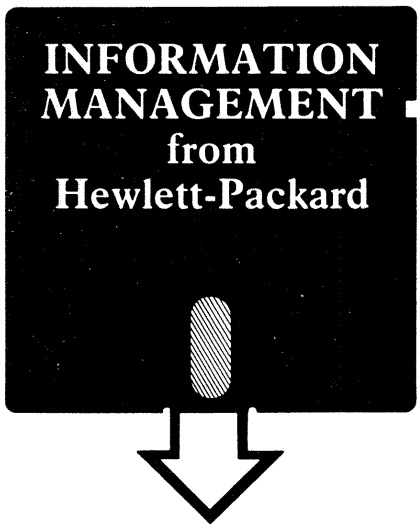
Series 80 Comes On Strong



"Series 80" refers to the entire HP personal computer product line including mainframes, peripherals, and software. The term is based on the mainframe product numbers—the HP-85 and now the HP-83. The new HP-83 is completely compatible with the HP-85; interfaces, ROM's, and all else are interchangeable between these two

products. In fact, they are identical except that the HP-83 does not come with an integrated tape cartridge drive and an integrated thermal printer. It is designed for business and technical professionals who require disc storage and a high-speed, full-width printer and have no need of the tape drive and thermal printer built into the HP-85. The HP-83 saves about a thousand dollars in the cost of their systems. The two functional additions to the HP-83 are autostart from disc and peripheral paper advance control from the keyboard.

The HP-83 and three new application pacs are our latest efforts in broadening the solutions we provide to professionals. The **Information Management Pac** and the **Graphics Presentations Pac** are additional business software we've developed to more completely meet the needs of business professionals. The third pac, **Surveying**, comprises generally useful routines for surveyors. Our plans are to develop more general software while independent software developers concentrate on highly specialized applications.



The Computer
The Software
The Mass Memory Device

If your work routinely involves decision-making, you can make a big impact on your daily performance by adding **IMPac** and an HP 82901M Flexible Disc Memory to your Series 80 system. **IMPac** is an all-purpose information management software tool to help you rapidly store, organize, access, and report large amounts of information. The HP 82901M Flexible Disc Memory allows you to immediately jump to the file of your choice. This speed, combined with large storage capacity, gives you the freedom to explore many more combinations of data to reach better decisions.

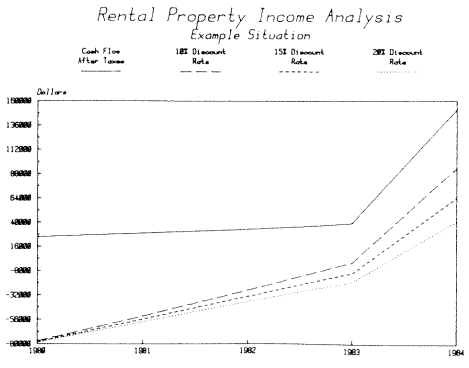
The dual-drive configuration also gives you the flexibility to keep programs on one disc and data on the other so that different programs and data can be used interchangeably.

The major features and functions of the **Information Management Pac** are:

- Each record can be from 20 to 1,024 bytes long.
- Up to 10,000 records can be handled.
- Each record can contain up to 99 elements, or fields.
- Fields can be defined as *Dollars, Alphanumeric,* and *Numeric-only.*
- Using the *CREATE* program, new fields can also be added to an existing master file, and existing fields can be renamed.
- The UPDATE program allows you to add new records, modify the values of fields in existing records, or delete entire records.
- The *SEARCH* program allows you to set as many as 15 conditions to use in locating records.
- File and record sizes can be changed after creation with the *EXTEND* program.

In addition, a querying system and a report writer are included, as well as sorting capabilities and data base statistics (like totaling). The pac also includes a program specifically for mailing lists.

But it is the graphics capabilities that take this pac beyond most personal computer data management systems. With **IMPac**, you can create line, curve, bar, and pie charts for use in reports and presentations. Thus, you can extend the report writing capability of **IMPac** into graphs, charts, and tables with color and impact.



Finally, **IMPac** provides support as you use it with the *HELPER* program. *HELPER* acts as a mini-user's manual available whenever you use **IMPac**.

IMPac is a general-purpose data manager with many possible uses—client lists; product lists; the structural and processing characteristics of different plastics could be stored and accessed by engineers. In short, any activity that can categorize clients, accounts, products, items, or components by multiple fields can benefit from **IMPac**. Creating, updating, and printing customer mailing lists, inventory records, catalogs, and other data bases are quick and easy with these programs. ■

Graphics For Decision Making

by Bryan Butler, Product Manager
Hewlett-Packard, San Diego Division

There is a revolution going on in how business and technical professionals analyze data and make decisions. More and more people are using computer-generated graphics to turn complicated tables of numbers into easy-to-understand charts and graphs. Their goal is efficiency. For example, an article in *Business Week* magazine reported how the use of computer graphics has shortened meetings from 2-hours to only 20 minutes! But efficiency is not the only benefit. When presented graphically, trends or danger signs may be quickly spotted. The same article describes how General Mills credits their graphics exhibits with warning them of a dangerous disparity between sales and production growth. Quick reaction prevented a product shortage.

The common forms used for graphically displaying data should be familiar to readers of most news and business magazines. They are:

- Pie charts—for showing how components add up to a whole. Often two pies are shown side by side to highlight changes between two points in time.
- Bar charts—for comparing distinct values. Bars can be single, stacked, or clustered, depending on the data being presented.

- Line graphs—for plotting one variable against another. Often one of the variables is time, for spotlighting trends.

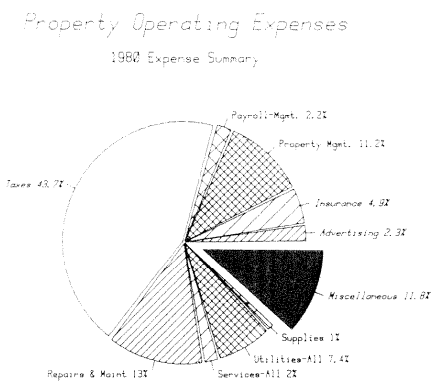
Whether drawn on paper for individual use or on overhead transparency film for group viewing, these graphic forms will improve the speed and quality of data analysis.

Once these high-quality graphics could only be produced by skilled artists, a costly and time consuming process. However, now with personal computer graphics, they can be produced in minutes, by you, without even having to write a single line of a program! And you already have at least one component of a computer graphics system—your Series 80 Personal Computer. The other necessary elements are: an HP 7225 Graphics Plotter with an HP 17601A personality module (interface); a 16K Memory Module; a Plotter/Printer ROM; an HP-IB interface; and **VisiCalc™ PLUS,** the **Graphics Presentations Pac,** or **IMPac.** ■

VisiCalc™ is a trademark of Personal Software, Inc., and designates a software product produced under license from Personal Software, Inc. and Software Arts, Inc.

Graphics Presentations Pac

The **Graphics Presentations Pac** is a versatile set of programs that lets the user make four-color overhead projection transparencies or report copies of text, bar charts, pie charts, and line charts. Management reports, customer presentations, sales seminars and other meetings and reports can all benefit from the graphics this pac generates.



Even those who have never used a computer before discover it's easy to generate quality slides and charts with a Series 80 Personal Computer, a plotter, and the **Graphics Presentations Pac**. And right away! After creating a few slides and charts with the manual as a reference, you can proceed by following the instructions and messages contained in the program. For easy reference, brief descriptions of the various screen formats, called Help Numbers, are located in a section in the back of the manual.

The slide creation section of the manual shows many detailed examples of slides from start to finish. In addition to the creation of slides, the examples also cover some of the editing features and the storage capability built into the pac. The examples include a text slide, a pie chart, a line graph, and a bar chart. Situations unique to a particular type of slide or chart are demonstrated in these examples.

The **Graphics Presentations Pac** has the following features and capabilities:

TEXT MODE—nine letter sizes; three type styles that can be either upright or slanted; four pen colors; three alternative highlighting capabilities (centered, underlined, both) in addition to no highlight; and several special characters including many Greek letters and European characters.

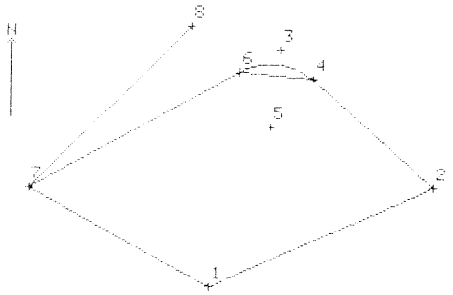
PIE CHARTS—1 or 2 pies; 2 to 25 slices per pie (each slice can be exploded independently); 6 hatching (shading) types; 4 pen colors; 15-character labels; optional percentage labeling; and 32-character titles and subtitles.

BAR CHARTS—normal, clustered, or stacked bars; 1 to 25 bars (clusters); 6 hatching (shading) types; 4 pen colors; axes labels; and 32-character titles and subtitles.

LINE CHARTS—2 to 25 points; 6 line types; 4 pen colors; axes labels; and 32-character titles and subtitles. ■

Surveying Pac

The **Surveying Pac** contains a set of programs chosen to aid surveyors in many of their most-often-encountered computations. This pac allows for fast and easy calculations, improves computational accuracy, and maintains coordinate point storage for easy recall of data. And by using an executive program, you have easy access between programs without losing stored data. The **Surveying Pac** also enables you to manipulate up to 150 traverse points in a Series 80 Personal Computer. With the addition of the 16K Memory Module you can work with up to 550 points. These points can be entered, edited, or recalled for future use. And most of the programs contain graphics routines that let you plot data and layouts either right on the CRT or on a peripheral plotter.



Programs included in the **Surveying Pac** allow you to:

- Reduce field data for traverses, inverses, and sideshots. Slope distances and curved sides may be included.
- Make traverse adjustments by compass, transit, or Crandall's Rule.
- Use closure routines to determine areas and distances traversed.
- Calculate coordinate transformations.
- Compute intersections and offsets from a point to a line.
- Solve universal triangles.
- Calculate horizontal curve layout, vertical curves, grades, and the parameters of circular curves.
- Compute earthwork volume using the method of Average End Area.
- Compute the volume of a Borrow Pit.
- Compute resection points and land parcels with predetermined areas. ■

Toll-Free Number

We have a toll-free number for:

1. Locating the HP dealer nearest you.
2. Product or literature inquiries.
3. Service information.
4. Information on new product availability.

You may call 800-547-3400 excluding Alaska and Hawaii (in Oregon call 758-1010) between the hours of 6:00 a.m. to 6:00 p.m., Pacific Time, Monday through Friday. ■

Application Pac	Required System Elements Using HP-83 As Mainframe	Required System Elements Using HP-85 As Mainframe
BASIC Training	A	
VisiCalc PLUS	A, C, F	C
graphics portion	A, B, C, F	B, C, D
Graphics Presentations	A, B, C	B, C, D
Information Management	A, C, F	A, C
graphics portion	A, B, C, F	A, B, C
Financial Decisions	A	
Linear Programming	A	
Text Editing	A, F	
Math	A	
Data Communications	A, E, C	E, C
General Statistics	A	
Basic Statistics and Data Manipulation	A	
Regression Analysis	A *	*
AC Circuit Analysis	A	
Waveform Analysis	A	
Surveying	A	
Games	A	

16K Memory Module Price Reduction

You can double system memory in Series 80 mainframes with an HP 82903A 16K Memory Module. It plugs into any one of the four ports in the back of the computer, adding 16K bytes instantly. Large data files and long programs can automatically take advantage of the new capacity. Several application pacs also require the memory module—refer to the Software/Hardware Matrix above. Oh yes, the new price is only $295.† ■

† *All prices in this newsletter are U.S. prices excluding state and local taxes. For information outside the U.S. please contact the sales office or dealer nearest you.*

Key:

A: HP 82937A HP-IB, HP 82900-Series Flexible Disc Memory or HP 9895A Flexible Disc Memory, HP 82936A ROM Drawer, HP Mass Storage ROM (00085-15001).
B: HP 7225 Plotter, HP 17601A Personality Module, HP Plotter/Printer ROM (00085-15002).
C: HP 82903A 16K Memory Module.
D: HP 82937A HP-IB, HP 82936A ROM Drawer, HP Plotter/Printer ROM (00085-15002).
E: HP 82939A Serial Interface, HP 82936A ROM Drawer, HP I/O ROM (00085-15003), Modem (any manufacturer's).
F: Printer recommended, HP Plotter/Printer ROM (00085-15002). (See your HP dealer for interfacing options.)
* Basic Statistics and Data Manipulation Pac.

The Ultimate Graphics Tool

by Rosemary Kramer, Sr. Advertising and Sales Promotion Specialist
Hewlett-Packard, Greeley Division

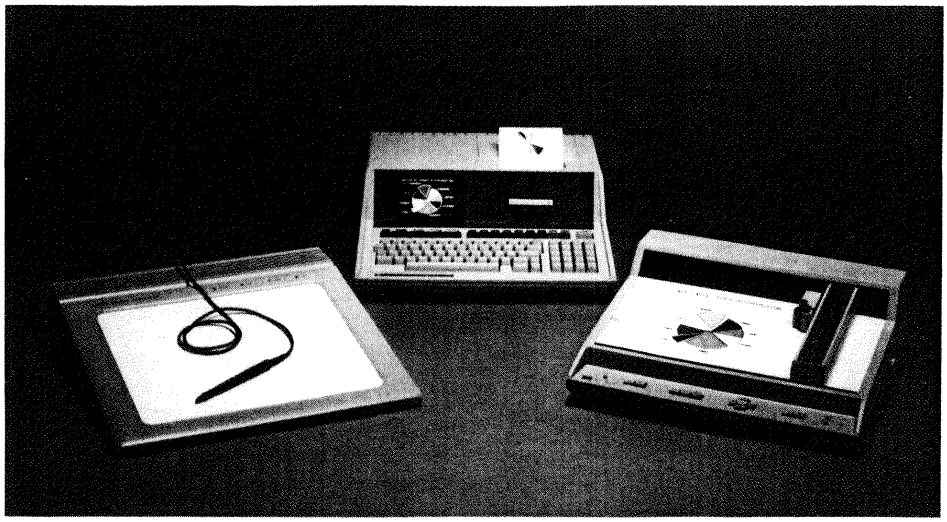
The HP 9111A Graphics Tablet actually lets you draw on the graphics screen. As you move a pen-like stylus around the tablet, the tablet translates your movements into digital code and transmits the code to the computer. Points are entered whenever the stylus is pressed down or continuously while you draw. The HP 9111A acts as a cursor mover, bypassing the keyboard.

The HP 9111A Graphics Tablet comes with a software pac that includes a drawing utility, a graphics entry utility, and a planimeter utility program. The programs can be used as-is or incorporated into your own applications programs.

The drawing utilities help you create graphics with ease, executing all the graphic routines necessary right from the tablet. For example, you can create a drawing, store and retrieve it, and plot the drawing on the plotter using commands on the tablet. (There are those famous HP softkeys again.)

The capabilities provided by the software include:

- Drawing—a point entered can be interpreted by the program as the end of a line, center of a polygon, or corner of a rectangle.
- Freehand sketching—you can do freehand sketching or trace existing documents—drawings, diagrams, charts, or photographs. The graphics tablet continuously sends points to the program, which traces the movements onto the graphics screen.
- Erasing—once a drawing is in the computer, it can be easily modified. You need only to enter the changes, not redraw it.
- Scaling—take the entire drawing and scale it ... enlarge a portion or reduce it.
- Panning—pan across the entire drawing for a complete look at the whole picture. Shift up and down, right or left.
- Windowing—frame an area of the drawing by simply indicating two points, then the program will enlarge that framed area to fit the CRT.



Convert Graphics Into Data Files

If your application calls for quick data manipulation and graphical interpretation, and not the precise accuracy and high-resolution provided by larger digitizers, then the graphics tablet can provide the immediate answers you're after.

Through the HP 9111A's Graphic Data Entry Program, you can take existing graphical source documents—strip charts, maps, photos—and digitize them right at your desk into x-y-coordinates. Then you can analyze the data using other Series 80 software.

Accurate Measurement

Through the HP 9111A's Area/Distance Measurement Program, you can measure areas and the lengths of lines and curves with the mere press of the stylus. Just lay the document on the tablet. The program will calculate the scaled distance you move the stylus, or the area inside a figure you've traced.

Menuing

In addition to these applications, you can use the graphics tablet to pick from a menu. A menu is a customized keyboard which you design yourself. Simply draw it on paper, and place it on the tablet. Then, write a program to interpret the menu for the computer. For example, you can define one area of the tablet to display a phrase. When using the menu, all you'll have to do is press the stylus once in that area to enter the entire phrase. The HP 9111A has 16 softkeys across the top of the platen that can be used to represent the list of elements on your menu. If more elements are needed, the entire active platen area can be converted into menu areas.

Comfortable, Durable Design

The design is human-engineered for maximum comfort and reliability. The glass ceramic selected for the work surface is incredibly durable and will not scratch or pit. The axes lines and 16 softkeys are permanently fired into the platen surface. Our research proved that users prefer the comfort of a sloping surface to that of a flat pad. The resulting shape is convenient, comfortable, and completely self-contained.

On-Going Testing

The HP 9111A has the capability to perform extensive verification of proper operation. An electronic self-test is initiated by the computer every time the HP 9111A is powered on. Also, a series of tests take place on the internal hardware at power-up to help isolate any problems should they arise.

The graphics tablet and software require a 16K Memory Module, an HP-IB interface, and the Plotter/Printer ROM. To see just how the HP 9111A Graphics Tablet can add to your Series 80 graphics system, visit your local dealer for a dynamic demonstration. ■

Users' Library

Software Supplier Program

The Series 80 Software Supplier Program is now well under way. There are over a dozen suppliers currently in the program and, of these, three have products listed in the Catalog.

A fine example of what you can expect this program to produce is the structural

engineering software available from **ECOM Associates, Inc.**, of Milwaukee, Wisconsin. ECOM has six structural design pacs in the Catalog for steel and concrete column and beam design as well as flat slab and plane frame analysis. Structural engineers should peruse the description in the *Series 80 Software Catalog*.

Binary Utilities

Binary programs can reside unobtrusively in memory with BASIC programs, adding powerful BASIC commands, statements, and functions to the repertoire built into the machine. With the equivalent of the Assembler ROM, our engineers have developed 23 binary programs that are now available to you through the Users' Library. These programs define about 100 BASIC key words that add some great new capabilities to your machine.

Suppose, for example, that you have to enter names into a data file—Jones, Harvey P. That comma makes life difficult because the INPUT statement thinks you have entered two names when it has only asked for one. If instead of INPUT, you use LINPUT, you can input any character including commas, quotation marks, and leading blanks—Green, "Mean" Joe. But before the program can execute the LINPUT statement, the binary program "LINKEY" must be in place. LOADBIN "LINKEY" is programmable, so this may be accomplished automatically in the BASIC program, unbeknown to the user.

"LINKEY" adds four other BASIC key words in addition to LINPUT. The KEY ON statement can be used to define any key on the keyboard as an immediate-execute key that will behave just like the soft keys, K1 through K8, built into the system. All or a subset of the keys so defined can be turned off using the KEY OFF statement. "LINKEY" also provides cursor control. MOVE CURSOR lets you move the cursor to any location on the display.

Remember, there can be at most one binary and one BASIC program in memory at one time. But the SCRATCHBIN command provided by "LINKEY" lets you erase the binary program without scratching the BASIC program. Since SCRATCHBIN is programmable, a BASIC program can erase one and load another binary program when necessary. Pretty tricky. And "LINKEY" only uses 889 bytes of memory!

Want to create your own typing aids? "SOFKEY" is a binary program that returns up to 96 characters with the touch of one key. A special feature of the SOFT KEY statement is that you can optionally cause the string to be executed as a command immediately upon display, like AUTO, which is built into the system.

"PCOL" is a binary program that assigns the capabilities of the HP-85 graphics screen to the print-head of the built-in printer. "BPLOTB" provides two more extremely helpful graphics functions: a BREAD that reads groups of dots from the graphics screen and generates a corresponding character string; and a BPLOT that performs an OR (rather than an EXOR) with existing dots on the screen.

"GCURS" allows you to place the cursor on the graphics screen at specified coordinates, maneuver it around using the edit keys, and read the x-y-coordinates of the cursor location.

Normally, a Series 80 machine stores programs in its own unique internal language. DSAVE, provided by "DGTSAV", saves a program as string data, one program line per string. One use for "DGTSAV" that comes quickly to mind is transferring programs over the telephone. DGET loads a program previously saved with the DSAVE command or any string data file consisting of valid BASIC statements preceded by line numbers, stored one line per string. The program lines that are read into program memory are merged with any program lines already in memory. A line with the same number would replace the original line.

Here, then, is a way of having a program modify other programs or even itself. Note that DGET is not programmable, so that while a program can rewrite itself, it can't execute the new program. Still, you can do some interesting things, like packing programs using @'s to combine program lines, in order to pinch memory. DGET is also a convenient way to merge two programs.

"IPBIN" provides a high degree of control over the keyboard and the CRT. A few of the capabilities it provides are illustrated in the Dvorak and Dynatyper articles elsewhere in this issue. "IPBIN" would be an excellent choice for your premium selection. (See page 11.)

"STRNGB" enhances the string manipulation capabilities of your machine. With it, you can underline strings, reverse the order of string elements, rotate the elements, and delete leading and trailing blanks. You can even find the number of times a particular string occurs. And SAR$ (string expression, match string, replacement string) allows you to perform a search and replace operation, where the match string will be replaced by the replacement string every time it occurs in the string expression.

In addition to these, there are statistical functions, math functions, and commands to re-dimension arrays and verify tapes. If you have access to a Hewlett-Packard desktop computer like an HP 9845A, there are binary programs that will help you transfer data and programs back and forth between systems. You can read all about the binary utility programs in the *Series 80 Software Catalog* (Catalog Nos. 900-0003 through 900-0024). They may be ordered from the Users' Library for $12† each plus media cost ($26 for tape and $18 for disc including the first program). Or, you can get all 23 recorded on either medium for only $150.

Moon and Stick People

An amazing program by **R. B. Goyer** of North Hollywood, California provides a half-hour of sheer enjoyment as your CRT becomes a window on a moonlit country scene. It's kind of a Currier and Ives cartoon—a snow-covered hillside with lots of people milling about, a barking dog, and smoke curling up the chimney. Imagine, animation on the graphics screen. You'll be continually surprised and delighted by Mr. Goyer's imagination.

The program requires the 16K Memory Module and uses every bit of it. In fact, you may have to remove your ROM drawer; even the small amount of RAM that some ROM's would allocate for their own use is used. You can get a copy from the Users' Library. Order program #900-0026, and I recommend you have it recorded on disc or tape; I can't imagine typing it in. Neither can I imagine what Mr. Goyer would do armed with the new graphics binary utilities and an HP 9111A Graphics Tablet. ■

Revised O. S.

The HP-85 has been providing solutions for thousands of professionals with business and technical problems since its introduction in January of 1980. During that time the quality and reliability of the product have impressed even veteran HP customers—no small feat with a group that is not accustomed to settling for less than the best. Still, products of that complexity are never totally free of problems and the HP-85 is not without a few minor ones. The more serious operating limitations we've found are discussed below. Though few of you are likely to ever encounter them, you should be aware of their existence: 1)When a non-integer number is assigned to an integer variable, or is used as a parameter of a function requiring integer parameters, or is used as an array index, the number is first rounded by the HP-85. This rounding is done incorrectly in the range $-1 < X < +1$. In this range the number will always round to zero. 2) Short precision variables may round incorrectly. Real numbers in the range $.999995 \leq X \leq .999999999999$ round to .01 in short precision and real numbers in the range $-.999999999999 \leq X \leq -.999995$ round to $-.01$ in short precision. 3) When making string comparisons the HP-85 will always find a longer string to be greater than a shorter string, regardless of the characters in the strings, e.g., "Z" < "AA". 4) Comments following statements that include logical operators (AND, OR, NOT, etc.) can cause the HP-85 to stop accepting keyboard inputs. To regain control of the computer you may have to turn it off.

These anomolies in the HP-85's operating system have been eliminated and future HP-85's will be shipped with the revised operating system. All HP-83's also contain the new operating system.

You can determine which operating system you have by pressing the HP-85 (TEST) key and checking the characters printed at the end of the test. If the last two characters are OL, you have the revised operating system; earlier models will print OL.

If these anomolies are of concern to you in your applications there are ways to program around most of them. For information, give us a call at Corvallis Customer Service (503) 757-2000. If your applications depend heavily on these features you should consider having a revised operating system installed in your HP-85. This can be done by returning your computer to any Hewlett-Packard Field Repair Center. Before returning your HP-85 you should check with the repair center to make sure they have the parts on hand so there will be no delay. There will be no charge for installing the revised operating system. ■

Dynatyper™

I recently had a chance to use Rochester Data's Dynatyper. Perhaps you've seen it advertised. Essentially, it is a mechanical interface to a typewriter, where solenoids actually press the typewriter keys. The idea has a lot of merit. Since the Dynatyper merely rests on top of the typewriter keyboard, you don't have to tamper with the typewriter and void the manufacturer's warranty. And you can get the ultimate in letter-quality, hard-copy output. It probably also represents the lowest cost alternative hard-copy device if you already have a typewriter.

The Dynatyper clearly shows how easy it is to interface Series 80 systems; some of you will find a look at how they did it informative and interesting. Note that this product is not available from, nor is it supported or endorsed by Hewlett-Packard. You may get more information directly from Rochester Data, Inc./3000 Winton Road South/Rochester, New York 14623/U.S.A.

The software driver is a BASIC program, as opposed to a binary program. This is only possible beacause of the powerful capabilities provided by the GPIO Interface and the I/O ROM. For example, the Dynatyper's logic requires about a 2-millisecond strobe pulse to latch the data, with positive-true logic for the data and negative-true logic for the strobe. All this is accommodated using three CONTROL statements.

In order to be typed, a character's ASCII code has to be converted into the 6-bit address of the appropriate solenoid. This is accomplished in one statement—CONVERT OUT 4 PAIRS; X$.

Now you might think that a driver written in BASIC vs. machine language would be too slow, but the system types about 115 WPM (9.6 CPS), which is right up against the mechanical limitations of most typewriters. In fact, the driver uses another powerful feature of Series 80 BASIC, the WAIT statement, to slow down the operation.

The driver supports all the keys on the typewriter, including backspace and tab. It also provides for putting a pause symbol right in the text to permit changing line spacing or changing the typing element.

The driver is the smaller part of the software that comes from Rochester Data. The bulk of it makes the computer act like a smart typewriter when you're entering text.

When the computer is powered up, it displays the soft key assignments and asks what the margin width is to be. Then, when you type to within five spaces of the right margin, a "bell" rings; every subsequent keystroke causes a beep until (END LINE) is pressed. This feature makes margins independent of the size of the CRT and gets around wrap-around.

The program also includes some simple text editing features. You can use the edit keys to move the cursor around the screen, delete characters, and insert up to five characters per line. To accomplish this, the program uses the binary program "IPBIN." Becuase of this and because of the way their program is written, it's easy to incorporate the Dvorak keyboard conversion (below) into their program. Essentially, you would just replace line 150 of their program with lines 50-70 of the Dvorak listing. ■

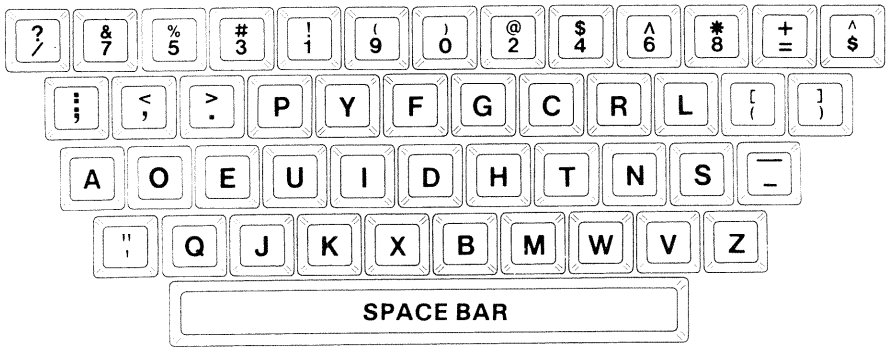
Dynatyper™ is a trademark of Rochester Data, Inc.

Dvorak Keyboard

The QWERTY keyboard found today on virtually every computer was developed in the 1870's for a klunky mechanical typewriter. The keys were actually arranged so as to slow down the typist to prevent the crude mahcine from jamming. Well, obviously, computers don't suffer any such mechanical constraints, but all attempts to supplant the *de facto* standard have failed.

What makes this all the more incredible is that a keyboard some 20 times more efficient was developed in the 1930's. The simplified keyboard was the fruit of 10 years of research and development by **Professor August Dvorak** at the University of Washington.

What you notice most when you type on a Dvorak keyboard is how infrequently you have to move your fingers off the home-row. All the vowels are positioned under the fingers on the left hand with the major consonants under the fingers on the right hand. In fact, Dvorak's statistics show that the total distance the fingers travel is reduced 95%. They also show that awkward keystrokes are reduced by 90%. Just think what that means to your error rate! The Dvorak keyboard attempts to use the fingers according to their strengths. It assigns the



SERIES 80 DVORAK KEYBOARD

left hand only 44% of the work as opposed to the 57% the QWERTY keyboard does.

While looking over the binary programs in the Users' Library, it occured to me that "IPBIN" provides the statements and functions necessary to convert the standard HP-85 keyboard to a Dvorak keyboard. The BASIC subroutine listed below (which requires the binary "IPBIN") puts the keyboard in Dvorak mode whenever it is called. The routine can be modified and incorporated in other programs—text editors, for example.

You have probably noticed that the numbers on the Dvorak keyboard are also in different locations than they are on the standard keyboard. I recommend that you leave them in their QWERTY positions.(Just delete Z8$ from line 70). Remember that the modification uses a BASIC program that must be running for the Dvorak keyboard to be active, and this isn't always possible (e.g., when you're writing another program). Because the machine can't always be in Dvorak mode, it's nice to have the location of the symbols associated with the number keys (like #, $, &) in the same positions regardless of which keyboard is operational. Then, if you can touch-type on a QWERTY keyboard, you can just label the letter keys for Dvorak mode and move between keyboards with ease. You would expect numbers to occur randomly anyway, so it shouldn't matter much from an efficiency point of view where the number keys are positioned.

To use this subroutine, use a `GOSUB 7777` before every `INPUT` statement. For aesthetic reasons, you may also wish to use prompts in the form `DISP "___?"` instead of `DISP "___";`. END LINE must also be pressed twice rather than once, although you may do it rapidly. And just like on a teletype, a back space is effected by pressing CTRL H (CTRL D on the Dvorak keyboard).

```
 10 DIM Z9$[192],Z8$[96],Z7$[96]
 20 ON ERROR GOTO 40
 30 LOADBIN "IPBIN"
 40 OFF ERROR
 50 Z8$="1/2735435169708294O6-8!
    ?@&#%$##%!^(&)*@_*\$!^"
 60 Z7$="q:w<e>rpty/fugicorplsod
    e@;W,E_RPTYYFUGICORPLSODEFUG
    IHDJHKTLN;S'-Z'XQCJVKBXNB,W.
    W/Z"
 70 Z9$=Z8$&Z7$&CHR$(34)&"_z"&CH
    R$(34)&"fugihdjhktln;sxqcjvk
    bxnb<w>v?z"
100 DISP "DVORAK MODE"
110 DISP "NAME?"
120 GOSUB 7777
130 INPUT N$
140 DISP "THE NAME IS ";N$
150 GOTO 110
7777 ! SUBROUTINE DVORAK
7778 Z5=CCPOS
7779 ON KBD GOTO 7780 @ GOTO 777
     9
7780 CONVERT KBD PAIRS ;  Z9$ @
     Z6$=KBD$ @ IF Z6$=CHR$(154)
       THEN CCURSOR Z5-2 @ RETURN
7781 CDISP Z6$ @ GOTO 7779
```

Sorting

Sorting algorithms are all difficult to follow with their multiple indices and looping within loops. The bubble sort is the exception, which is probably why everybody knows about it. Conceptually, it's delightful—the smallest element "floats" to the top. The program only requires two indices, but the processing workload is horrendous and so is the execution time. In this article, we'll look at some other sorting techniques and discuss a way of deciding which one to use. There is no one "best" algorithm; the best one to use depends on the length of the list and the distribution and order of the list elements. But you don't have to immerse yourself in binary trees and other esoteric concepts to be able to choose a good sorting algorithm. You can use a more pragmatical approach.

A while back, I received a letter from **Eugene Hungate** of Elkhart, Indiana, that pointed out this approach. "On page 177 of the HP-85 Owner's Manual, a program is shown that sorts numbers using a method referred to as a 'bubble sort.' As a novice programmer, I used this technique for sorting. Recently, I have been introduced to a faster sort called the 'Shell-Metzner sort.' To find the speed advantage, I modified the program on page 177 to include some timing statements. I then changed the program to use the 'Shell-Metzner' technique. Sorting the integers 100 to 1 required 2.66 minutes for the 'bubble sort' and only .4 minutes for the 'Shell-Metzner sort.' " Programs for assessing the two algorithms using the internal timer are listed below.

```
 10 OPTION BASE 1
 20 DIM A(100)
 30 DISP "HOW MANY NUMBERS";
 40 INPUT N
 60 FOR I=1 TO N
 70 A(I)=N+1-I
 80 NEXT I
 90 Z1=TIME
100 FOR K=1 TO N-1
110 FOR M=K+1 TO N
150 IF A(K)<=A(M) THEN GOTO 190
160 R=A(K) @ A(K)=A(M) @ A(M)=R
190 NEXT M
200 NEXT K
220 Z2=TIME @ Z3=(Z2-Z1)/60
230 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
240 FOR I=1 TO N
250 PRINT A(I);
260 NEXT I
270 PRINT
280 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR BUBBLE SORT"
290 END
```

```
 10 OPTION BASE 1
 20 DIM A(100)
 30 DISP "HOW MANY NUMBERS";
 40 INPUT N
 50 FOR I=1 TO N
 60 A(I)=N+1-I
 70 NEXT I
 80 Z1=TIME
 90 M=N
100 M=INT(M/2)
110 IF M=0 THEN GOTO 210
120 FOR S=1 TO M
130 I=S @ J=S+M @ Z=0
140 IF A(I)<=A(J) THEN GOTO 160
150 Z=1 @ R=A(I) @ A(I)=A(J) @ A
    (J)=R
160 I=J @ J=J+M
170 IF J<N+1 THEN GOTO 140
180 IF Z=1 THEN GOTO 130
190 NEXT S
200 GOTO 100
210 Z2=TIME @ Z3=(Z2-Z1)/60
220 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
230 FOR I=1 TO N
240 PRINT A(I);
250 NEXT I
260 PRINT
270 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR SHELL-METZNER S
    ORT"
280 END
```

The Shell-Metzner sort is a frequently used, very fast algorithm. Were the number of elements (N) increased, the difference would have been even more dramatic. While the number of comparisons made in the bubble sort goes up exponentially with the number of elements to be sorted, actually (N**2−N)/2 comparisons, the number of comparisons made in the Shell-Metzner sort is a linear function, about 10*N. The number of reversals required in the Shell-Metzner algorithm is also linear, about 5*N for a normal distribution of elements, or about half the time.

Note that the number of reversals actually made in the test programs above would have been quite different were the list originally reversed (change line 60 to A(I)=N+1−I). Execution time would be different still if the array A were comprised of random integers with a normal distribution.

This leads us to the next algorithm. What if the list is already pretty much in order, like a mailing list with a few new additions? A routine published in the September 1980 issue of *BYTE* runs about 7 times faster than the Shell-Metzner sort when the list is ordered to begin with. And the algorithm is just a bubble sort, with a window! "The idea is so simple it cannot be new" says the author, **Paul Brady**. If you have programs that require ordered data in files, you can afford to call this routine even if nothing was done to disturb the order.

```
 10 OPTION BASE 1
 20 DIM A(100)
 30 DISP "HOW MANY NUMBERS";
 40 INPUT N
 60 FOR I=1 TO N
 70 A(I)=I
 80 NEXT I
 90 Z1=TIME
100 W=2 @ X=N
110 FOR I=1 TO N
120 T1=X @ X=0
130 IF W<2 THEN W=2
140 T2=W-1 @ W=0
150 FOR J=T2 TO T1-1
160 IF A(J)<=A(J+1) THEN GOTO 20
    0
170 T=A(J) @ A(J)=A(J+1) @ A(J+1
    )=T
180 X=J
190 IF W=0 THEN W=J
200 NEXT J @ IF X<=1 THEN GOTO 2
    30
220 NEXT I
230 Z2=TIME @ Z3=(Z2-Z1)/60
240 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
250 FOR I=1 TO N
260 PRINT A(I);
270 NEXT I
280 PRINT
290 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR WINDOW SORT"
300 END
```

There are also algorithms that are optimal when the list to be sorted is considerably disordered. For example, the September issue of *CREATIVE COMPUTING* contains a BASIC listing and a discussion of "Heapsort" that meets this contingency. However, with this particular test (i.e., just 100 numbers), the execution times were 2.70 and 4.16 minutes for A(1)=100 and A(1)=1, respectively. The important thing is that you fit the sorting algorithm to your data, and doing this simply involves timing the candidates. ■

Assembler ROM

This Assembler ROM makes it possible to write Assembly-language binary programs for HP-83/85 personal computers. These may be loaded into system RAM along with BASIC programs and will allow you to do such things as mentioned on page 6, where the binary utility routines available through the Users' Library are discussed. A binary program can be used to enrich the built-in BASIC language by providing new statements and system functions. You can tailor statements to your own purposes, using a binary program to take over and redefine built-in BASIC statements and functions. Using binary programs, you can expand I/O control and speed up I/O processes. You can even redefine the system, taking over system "hooks" to gain access to the operating system. This means you can implement languages other than BASIC. It also means that you can defeat the computer's internal safeguards and damage the machine, so you better know what you're doing. The Assembler ROM is primarily intended to help software developers create programs for Series 80 machines. The manual is not tutorial, but assumes a knowledge of programming in assembly language. The manual may be ordered separately (part number 00085-90444; $20.†) Assembler ROM part number 00085-15007; $295.†

The Assembler ROM permits entering and editing source code for binary programs right on the CRT. Automatic line numbering and cursor movement are active, and the source code can be stored on a tape cartridge or disc, listed, and edited in much the same way a BASIC program is stored, listed, and edited. As source statements are entered, they are automatically checked for syntax errors and duplicate labels.

At assembly time, the resulting object code (machine language) is stored on a tape or disc. This object code can also be loaded automatically or on command into the HP-83/85, ready to run.

Included with the Assembler ROM (on both tape and disc) is a global file of HP-83/85 system labels and their memory addresses, providing entry points into many powerful routines that are resident in the operating system. The tape and disc also contain useful sample programs to help illustrate how binary programs are created.

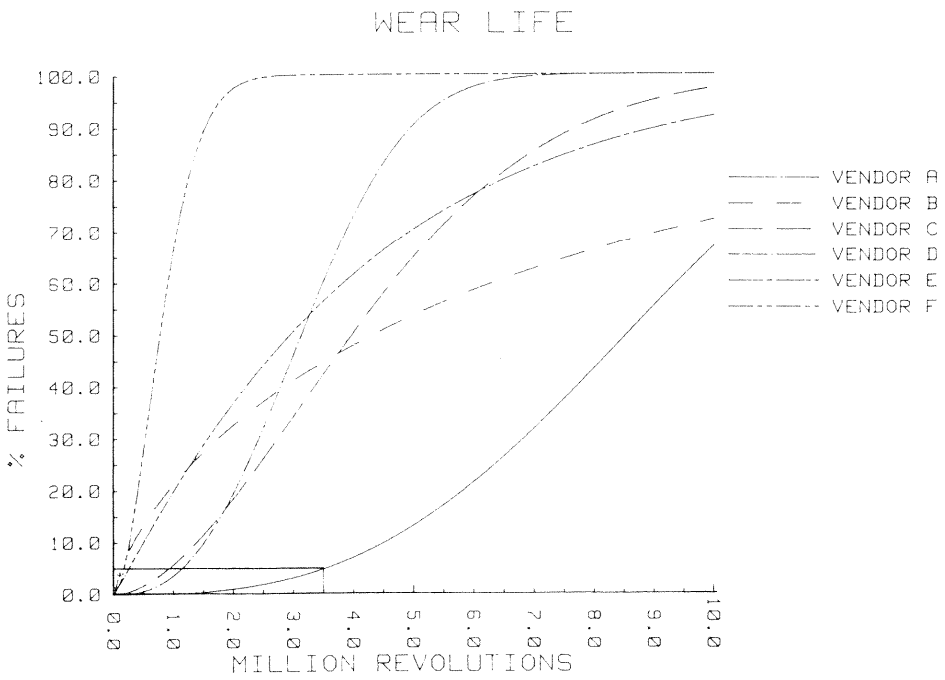
The Assembler ROM also contains all driver routines necessary for using the System Monitor, an optional plug-in module. The System Monitor is NOT required, but it makes debugging binary programs much easier. With it, you can set two breakpoints that interrupt program execution. Once execution has been halted, you can examine and change the contents of memory. You can also execute one instruction at a time, single-stepping through a program; you can even trace program execution, printing the status of the CPU after each instruction. ■

Disc Handling

by Rick Spangler, Manufacturing Engineering Manager
Hewlett-Packard, Greeley Division

The media we supply for use in our flexible disc drives are produced for us by media manufacturers. We have tested more than a dozen different brands over a 3-year period and learned that there is a wide range of performance between brands and that characteristics may vary from one shipment to the next.

The vendor qualification testing for the 5¼-inch disc has been in progress for over a year. We have tested six different brands so far and have only found one that will meet our specifications. The graph shows the results of the wear tests. The curve for each vendor shows the percentage of discs of that type that are likely to fail before a given number of revolutions in the drive. For



acceptance, we require that no more than 5% are likely to fail before 3.5 million revolutions (about 200 hours).

Media wear is critical to the reliability of flexible disc drives. The single most important way to optimize your success with floppies is to treat the disc carefully. The magnetic coating on the surface of the disc is only 100 microinches (.025mm) thick, so the smallest scratch can kill it. And the thickness of a fingerprint or a smoke particle is enough to lift the head off the disc and cause errors. The double-sided drives are much more susceptible to this type of failure than single-sided drives. Here are some specific DO's and DON'T's to protect your disc.

Do

Return the Disc to the Storage Envelope When Not In Use.

The disc is not a frisbee; don't throw it around. If it's laid on a desk unprotected, it will collect dust, which can accumulate under the head and plow away the disc's magnetic coating. This is the most common cause of media failure.

Remove the Disc From the Drive When Not In Use.

This is very important on 8-inch drives because whenever the disc is in the drive, it will rotate even if it is not being accessed. In all drives, this rotation causes wear between the disc and particles trapped in the jacket. In the case of the double-sided drive, the lower head is lightly in contact with the disc, causing "unloaded" wear.

Operate Your System in a Clean Environment

A dirty environment is deadly to a floppy disc, causing both data errors and premature wearout. The most common contaminates are dust, smoke, ashes, erasure crumbs, bread crumbs, and chemical vapors (and occasionally volcanic ash).

Maintain Proper Temperature and Humidity

The proper operating range is 10° to 40° C and 20% to 80% relative humidity. Temperature and humidity variations cause the disc to expand, which moves the head off of the track. High humidity reduces the disc's wear characteristics, and low humidity allows static buildup, which attracts dust. We always see more media failure during the winter in cold climates — the result of low indoor humidity.

Don't

Don't Touch the Magnetic Surface.

Fingerprints are killers, particularly on double-sided discs.

Don't Damage the Disc (obviously).

Label the disc with a soft felt-tip pen. Don't bend, fold, mutilate, etc. (I saw one disc with a label stapled to it!)

Don't Try to Clean a Disc.

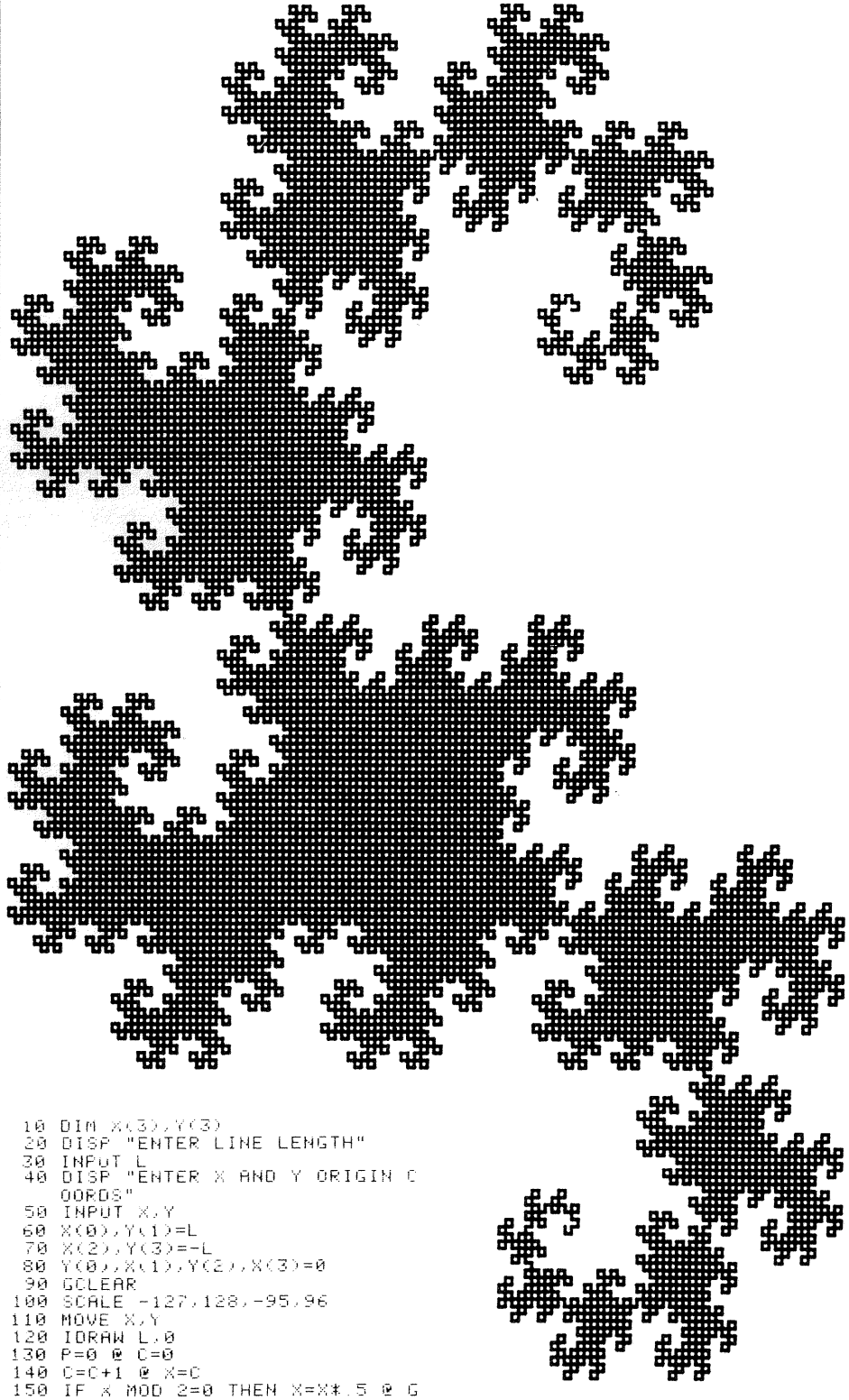
The inside surface of the disc jacket is covered with a special material that cleans the disc as it rotates. Any other cleaning method may cause solvent damage or scratches.

Eventually the disc will wear out. It's bad enough that you lose your disc and its data when it dies, but if left in the drive, an abrasive layer of disc material can build up on the head. This can cause damage to other discs.

Two more procedures are therefore necessary for successful operation. First, always backup critical data. Second, replace discs before they approach wearout. The frequency with which discs should be replaced is difficult to pin down because it is dependent on how much the disc is used. The discs are designed to give several million revolutions of life under normal conditions, but they add up fast. ■

Dragon Curve

Some time ago, **William J. Butler Jr.** of Warwick, Rhode Island, shared a philosophy with me that I tend to agree with. He said he found the first issue interesting, as linear programming is one of his pet topics, but "... an in-place matrix inversion may mean something to a limited number of mathematicians, but virtually everyone seems to be dazzled by the BLINK, FLASH, and TWINKLE of computer graphics. The enclosed program displays a Dragon Curve — the result of repeatedly folding a piece of paper and then partially unfolding it so that the creases form 90° angles. A line length of 1 and an origin of −30,50 is virtually guaranteed to distract the user for quite some time."



```
 10 DIM X(3),Y(3)
 20 DISP "ENTER LINE LENGTH"
 30 INPUT L
 40 DISP "ENTER X AND Y ORIGIN C
    OORDS"
 50 INPUT X,Y
 60 X(0),Y(1)=L
 70 X(2),Y(3)=-L
 80 Y(0),X(1),Y(2),X(3)=0
 90 GCLEAR
100 SCALE -127,128,-95,96
110 MOVE X,Y
120 IDRAW L,0
130 P=0 @ C=0
140 C=C+1 @ X=C
150 IF X MOD 2=0 THEN X=X*.5 @ G
    OTO 150
160 IF  5*(X-1) MOD 2=0 THEN P=(
    P+1) MOD 4 ELSE P=(P-1) MOD
    4
170 IDRAW X(P),Y(P) @ GOTO 140
180 END
```

Questionnaire

On the back page, you'll find some questions that will help us to know who you are and what you want. My first priority is to make *BASIC EXCHANGE* interesting, but what's interesting to you? Bit mechanics? Payroll accounting?

It is important for you to understand that the best newsletter is a two-way medium. The users' newsletter is also your communication channel to us! If we hear from you, not only will the newsletter contain what you want to read about, but our new products will be a reflection of what you want, too.

Now I'm sure you all realize that without hard data *BASIC EXCHANGE* can't be steered by users, but we're all only human, and questionnaires usually don't get returned. So to help ease the pain, we've spiced the deal with a premium—your choice of any program in the Users' Library (listing only). Indicate your choice right on the questionnaire, and return it by May 1st. If you want it recorded on disc or tape (as a binary program must be), you must order another program at the regular Users' Library price to cover the cost of the medium. The program you choose for your premium will be recorded with it free.
If you don't want to tear off the back page, just return a photocopy of the questionnaire. Send it to Curtis Adams, Editor/Hewlett-Packard Co./1000 N.E. Circle Blvd./Corvallis, OR 97330. ■

BASIC EXCHANGE
Spring 1981 Vol. 2 No. 1

Information about new hardware and software, new policies, programming and operating suggestions, further reading, and feature articles. Published four times a year for owners of Hewlett-Packard personal computers.
Reader comments and contributions are welcomed and should be addressed to the editor.

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Palo Alto, CA 94304 U.S.A.

1. Occupation:

2. Professional Affiliations:

3. Age (optional):

4. Level of Computer Expertise:
   1 2 3 4 5 6 7 8 9 10
   beginner expert

5. How many application pacs do you own?

6. Do you modify them? Program at all?

7. What applications would you like to see developed?

8. Do you have
   a plotter?
   a disc?
   any ROM's?
   16K Memory Module?
   other peripherals?

9. Did you purchase your computer or did your company?

10. Do you use it at home or at work? Or both?

11. How many people use your machine?

12. Do you own other computers or programmable calculators?

13. Rank the functions the newsletter serves for you.
   (1 = most important)
   _____ Entertainment
   _____ Increase Efficiency
   _____ Education/Personal Growth
   _____ Exposure to Other Fields
   _____ A Source of Practical Programs
   _____ Improving Programming Techniques
   _____ Information on new products

14. What would be the subject of a special (dedicated) issue you would like to see published?

15. Have you tried using any of the programs published so far?

16. Why do you use an HP-85 computer in particular?

17. What are your primary applications?

18. What would you consider the most desirable improvements to the HP-85?

19. What is your orientation? (check one or more)
   _____ computers
   _____ science
   _____ _____ engineering
   _____ academic
   _____ business
   _____ other

HEWLETT PACKARD

20. What do you read?
   _____ technical journals
   _____ trade journals
   _____ business magazines
   _____ popular sci/tech mags.
   _____ science fiction
   _____ other _____

21. Do you share *BASIC EXCHANGE* with your colleagues?

22. Would you like to see more price information included?

23. Would you like to see articles about unique users' applications?

24. Rate the articles that have appeared in the first three issues (1 = liked best; 3 least)

V1N1	V1N2	
_____	_____	*Software Highlight*
_____	_____	*Hardware Highlight*
_____	_____	*Communique*
_____	_____	*Hardware Domain*
_____	_____	*Software Domain*
_____	_____	*Further Reading*
_____	_____	*Users' Library*
_____	_____	*Quick Routines*

V2N1

   _____ Assembler ROM
   _____ Moon and Stick
   _____ Surveying Pac
   _____ IMPac
   _____ Graphics Pres. Pac
   _____ Sorting
   _____ Disc Handling
   _____ Binary Utilities
   _____ Dynatyper
   _____ Dvorak Keyboard
   _____ Graphics Tablet
   _____ Dragon Curve

25. Please send me the following Users' Library program for my free premium for completing the questionnaire:

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1000 N.E. Circle Blvd.
Corvallis, OR 97330

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inside:

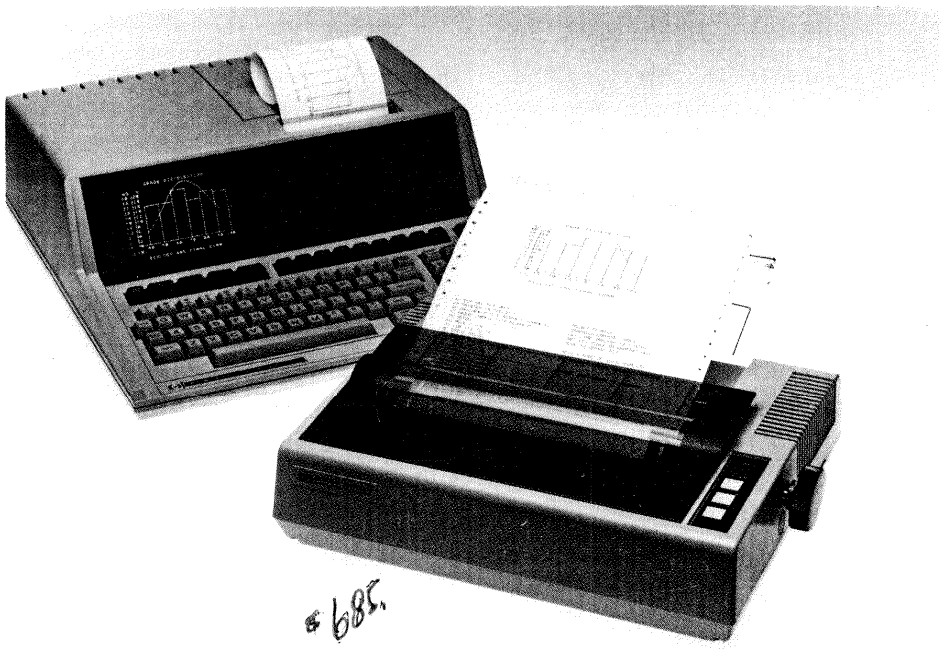
- Feature Article—Communications
- Unique software support
- Data transportability
- Fractals
- Alpha sorting
- Computer-graphics primer

contents

basic EXCHANGE

HEWLETT PACKARD Corvallis Division Summer 1981 Vol. 2 No. 2

HP Series 80—The Total Solution



What do you need today more than a good 5-cent cigar? How about a good, low-cost printer for Series 80 Personal Computers? Announcing the **HP 82905A Printer**! It uses the HP-IB interface — if you already have a disc and/or a plotter in your system, just add the **HP 82905A Printer** to the bus. Part of the beauty of HP-IB is that you can connect all your peripherals on the same

interface, using only one port in the back of the machine.

The HP 82905A fits in well with your Series 80 Personal Computer in many other ways too, like its small size. Measuring only 4.2-inches high by 14.7-inches wide by 12-inches long, it really conserves desk space. Its price is in line with the rest of your Series 80 system—only $945.00†. And it is serviced by the same HP repair centers that handle the rest of the Series 80 product line. Not that it's likely to require service. It incorporates such innovative design concepts as a disposable print head. After printing 50- to 100-million characters, snap it out and throw it away. You can replace it in just a minute with one hand.

Let's look at some other features. **The HP 82905A Printer** prints 80 characters per second and speeds the throughput rate by printing bidirectionally (like the HP-85's built-in thermal printer) and by performing a logical-seeking function to minimize the travel distance between print positions.

Although it is referred to as an 80-column printer, you can get 132 characters across an 8 1/2-inch page using a compressed type style. In fact, you can select densities of 5, 8.25, 10, or 16.5 characters per inch. Multiple type fonts mean you can print bold characters too!

16.5 COMPRESSED PRINT 132/line

10 NORMAL PRINT

3.6 EXPANDED-COMPRESSED PRINT

5 EXPANDED PRINT

Because it is an impact printer, you can print multi-part forms—an original and two copies. A tractor drive (sprockets that engage holes along the sides of the paper) adjusts from 4 to 10 inches to accomodate all manner of forms and mailing labels. The printer also features a form-feed capability.

The 9X9 dot matrix print head prints sharp-as-a-tack characters with true descenders; that is, the tails of letters like "g" and "p" extend below the line. The **HP 82905A Printer** also permits programmable line spacing, so you can print subscripts, superscripts, and special labels.

Last, but most exciting, this printer does raster graphics with either 72×60 or 72×120 dots per inch. It's possible, then, to dump graphics from the CRT to the printer for hard copy output. ■

† For 110-volt systems. Add $50.00 for other power options. All prices in this newsletter are U.S. prices excluding state and local taxes. For information outside the U.S. please contact the sales office or dealer nearest you.

Software Support Services

Now, in addition to hardware service contracts, Hewlett-Packard is offering a new approach to Series 80 software support. It's a program based on past successes in helping customers achieve maximum productivity using other HP desktop computers.

One of the most valuable parts of this new program is the Phone-In Consulting Service (PICS). You can get help by phone from a PICS center as you need it. Each contract designates one customer as a PICS caller and another as an alternate. HP's experience with this type of service has shown that you can realize higher productivity when you receive timely answers to questions; we guarantee a response time of within 4 hours.

Also included in this program is a formalized three-part documentation service. First, HP's *Communicator* magazine, issued quarterly, will keep you updated on current revisions in HP-supported software and firmware. Articles written by HP engineers and programmers will feature application stories, technical articles, and programming tips.

Second, HP's manual update service will send you either new manuals or update sheets as changes occur so that your documentation will reflect the most accurate and clearest information available.

The third part of this service is a formal software bug-reporting system. This system catalogs all known bugs and, when possible, the work-arounds.

These services: phone-in consulting service, *Communicator* magazine, manual updates, and software notes, have been packaged into a new service called **System Information Services (SIS)**. For basic systems you would purchase HP 98090K SIS at $25.00 per month. Products supported include mainframes, enhancement ROMs (except for the I/O and Assembler ROMs), standard peripherals, and selected system-type software. For full I/O support you would purchase HP 98091K SIS at $25.00 per month (you must also purchase HP 98090K SIS). Products supported include all interface modules, the I/O and Assembler ROMs, and the Data Communications Pac. Note that with the exception of selected software pacs, application pacs are not covered. A minimum contract period of 3 months is required, but we recommend a 12-month contract to get maximum benefits from the program.

HP Series 80 Beginner's Course

Designed for the business or technical professional with no BASIC programming experience and little or no knowledge of HP personal computers, this course introduces HP Series 80 Personal Computers with an intense two days on the HP-85. Covering all of the essentials, topics include:

- fundamental operation of the computer, from display editing through using the tape drive;
- BASIC programming tools, from flowcharts, variable assignment, and data input through branching, loops, and subroutines;
- some of the more special features of a Series 80 computer, using the special function keys and graphics;
- and software and peripherals demonstration.

This is an ideal course for the person who wants to discover the fundamentals of operating and programming a computer. The course length is 2 days or 4 evenings, with approximately 70 per cent of the classtime hands-on experience. The price is $260.00. Contact your local dealer or Hewlett-Packard sales office for ordering, availability, and scheduling information.

Computer System Consulting Service

On-site assistance is available through two consulting services: HP 98096A General Purpose Consulting Services and HP 98097A General Interfacing Consulting Services. Prices for these services are based on time and materials. Typical costs run from $600.00 to $800.00 per day.

What you get are recommendations on applications design, suggestions for improving performance, and explanations of system operation. This assistance is specific to your application and need, a personalized approach from an HP systems engineer trained and experienced in that specific area.

Clearly, these are unique services in the personal computer industry. We offer them because we realize you want solutions—not just hardware. A total solution includes hardware, software, and support!

Who can benefit from SIS? Software suppliers; O.E.M.s; those who continually change and develop programs; and those with complex I/O applications. You'll benefit from increased productivity through training in effective programming techniques and conferring with HP systems engineers on specific applications and questions. You'll learn how to successfully use your HP Series 80 Personal Computer and software for solving specific problems and gain insight into new ways of using your system to make your job easier. And, finally, you can minimize down-time due to software reliability problems. ■

Users' Library

Looking over the questionnaires returned from the last issue, we were surprised to discover how many users don't know what the Users' Library is about. The Users' Library is a service we provide to facilitate your getting software; it helps you get the most out of your computer. One of the ways the Library does so is by publishing the *Series 80 Software Catalog*. The Catalog consolidates all of the software we know about for HP Series 80 Personal Computers. The Catalog uses an 8 1/2- by 11-inch, 3-ring binder format to allow for expansion and updating. The pages are color-coded: brown pages for Application Pacs like the Graphics Presentations Pac; yellow pages for third-party software, written and marketed by vendors qualified through our Software Supplier Program; and orange pages for programs developed and contributed by users as well as programs like the binary utilities developed by Hewlett-Packard. (See back page.*)

The Catalog is available to everyone—you can look over a copy at your local HP dealer. To obtain your own copy, join the Users' Library. You then have a reference to consult to find out what's being done with HP Series 80 Personal Computers. It will stimulate your thinking . . . "That's a good idea—I can do that too." If a program doesn't sound like it does exactly what you want, get it to see how the author attacked the problem, and then modify it for your own use. The information included in the Catalog includes program title, abstract, price, memory usage, hardware requirements, and the contributor's name and address. To sum up what the Users' Library is, it is access to lots of programming ideas.

A subscription costs $40.00† in the United States and Canada and $60.00 international. In addition to getting your own copy of the Catalog, you receive a discount on all library programs. Program listings and complete documentation for most contributed programs cost members $6.00†, non-members $10.00. Programs recorded on tape cartridge and disc are also discounted, the first program costs $14.00 and $6.00 respectively for members, $18.00 and $8.00 for non-members. This charge covers the cost of the media; additional programs in your order are recorded at no extra charge.

A program order form appears on the back page of this issue. You can photocopy it and use it to order programs. If you want to join the Users' Library, just say so on that order form and indicate the serial number of your Series 80 computer and the purchase date. Then you can pay member's prices for any programs you order. You'll also get complete new-member information, documentation forms for contributing programs you've written, and your copy of the *Series 80 Software Catalog*. If you're in a hurry, use the charge-by-phone service. Call the Users' Library toll free at (800) 547-3400 (except Alaska, Hawaii, and Oregon call 758-1010).

May Update

Users' Library members and dealers should have received the May update to the *Series 80 Software Catalog*. The update included a new index, about 60 changes, and about 60 additions.

Some of the third-party software in this update includes a data manager and desktop planner from **Scelbi Publications**, general ledger and accounts receivable software from **Business Software, Inc.**, a real estate investment system from **Palmer Berg Company, Inc.** **Northwest Software, Inc.** offers accounts payable, general ledger, accounts receivable, inventory control, and payroll software for both disc-based and tape-based systems. There's a chemical engineering pac available from **KELIX Software Systems**, a number of civil engineering programs from **Northwest Software, Inc.**, including COGO, Bluetopping, Earthwork, and Hardy-Cross analysis. **Robert Vaeth & Associates** offers a word processing system. Whew!

Software Supplier Program

In the way of additional information about these products, let me insert a few words about the Software Supplier Program. The purpose of this program is to help software suppliers develop Series 80 software and to make it available to you. To participate in the program, a supplier must develop, sell, and support his own software. You can obtain this software directly from the supplier or from your local HP Series 80 Personal Computer dealer. If you need help with a supplier's software, you contact the one who knows the software best: the supplier.

As part of the U.S. program, summaries of supplier software are included in the *Series 80 Software Catalog*, alongside Users' Library contributed programs and Application Pacs. This way, you need look in just one place to find a complete list of available Series 80 software.

Since software solutions, support, and language vary by country, implementation of the Software Supplier Program is also by country. Currently, programs have been instituted or are under development in 10 European countries, Australia, Japan, South Africa, and the United States.

Highlights

Here are a few highlights of user-contributed programs that you'll find in the May update:

900-0029 *Command File Binary*, by **Ole Anderson**. This program allows system input to be redirected from the keyboard (normal mode) to a data file containing a sequence of commands stored as strings.

900-0037, 900-0038 *Variable Name Cross-Reference for BASIC Programs*, and *Line Number Cross-Reference for BASIC Programs*, by **James A. Donnelly**. These two programs generate cross-reference tables of all variable names and all statement references in a BASIC program. The tables are generated by reading a program file stored on tape using the "DGTSAV" binary utility (Catalog number 900-0022; $12.00 plus media cost). Cross-references are very useful when developing and debugging large programs and greatly enhance the structural analysis of a program.

Here are some highlights of programs that weren't in time to be included in the May update:

900-0041 *String Arrays and Fast String Manipulation Without Temporary Memory*, by **Mike Steed**. "HANDY" is a binary program that implements six BASIC commands allowing: 1) a string variable to serve as a one-dimensional string array; 2) insertion of characters into or onto a string without using temporary memory; and 3) faster string manipulation.

000-0058 *Print VisiCalc Worksheet to a Plotter with HP-GL*, by **Peter Bock**. This "program" is really a monograph on 14 of the more useful HP-GL instructions (Hewlett-Packard Graphics Language is the "native" language used by all Hewlett-Packard plotters, part of their firmware). It explains how to use the VisiCalc /P print command and HP-GL to transfer your VisiCalc worksheet, or any portion of it, to a Hewlett-Packard plotter, so you can make large-scale copies of your worksheets and slides for overhead projection.

The HP-GL commands are placed directly on the worksheet. You can control plot direction for horizontal or vertical plots, and you can control character size and slant. You can also draw boxes in various linetypes to frame your worksheet or to create tables.

000-0059 *Data File to VisiCalc /SL File*, by **Peter Bock**. This program allows you to take string or simple numeric data from a Series 80 data file and create a VisiCalc /SL file. It saves you from having to key in data to VisiCalc that already exists in a data file. The program will not accept numeric array data but can be modified to do so.

900-0044 *SOURCE COMM*, by **Curtis Adams**. This program makes using networks—The Source in particular—straightforward and convenient. It turns your Series 80 Personal Computer into a "smart" terminal with local file control and full use of the soft keys for accessing program features. You can "download," that is, save incoming information on tape or disc, and "upload," that is, go the other way, sending a file you have on tape or disc out over the network. Incoming text can be printed on the built-in thermal printer or an external printer. And you can transfer programs by first converting them to data files using the "DGTSAV" binary utility.

All you have to do is turn on your machine and dial the phone—the program auto-starts and logs on for you. All the data communications parameters (like parity and handshake protocol) are set to make The Source play. The program listing is annotated to indicate where modifications are required to use CBBS (Community Bulletin-Board Systems). A companion program, "TXTED3", can be chained-in to create text files off-line; that is, while you are not logged onto The Source and not paying for connect-time. The program requires the binary program "IPBIN," the serial interface, the I/O ROM, and a modem.

900-0043 *Screen-Mode Text Editor*, by **Curtis Adams**. "TXTED3" allows you to enter text as you would on a typewriter. When the cursor is within five spaces of the right margin, a "bell" rings.

Pressing [END LINE] drops the cursor down to the next line at the left margin. Any character can be typed, including quotes and commas. You can edit it with the power of a screen-mode text editor—move the cursor to any position in the text and make any changes you like, including deleting or inserting characters. The text can be easily saved on tape or disc and printed on the built-in printer. Files containing up to eight screens of text can be created using this program without a 16K Memory Module. The program was written as a companion to *SOURCE COMM*, but can be used alone. It requires the binary program "IPBIN."

One thing should be obvious at this point. You now have quite an array of software for your Series 80 Personal Computer. The number of applications you have should be taking off now, growing exponentially. ■

Data Exchange Utility Software

Combined with the HP 9895A Flexible Disc Drive, **Data Exchange Utility Software** from Hewlett-Packard provides a means of transferring data between HP Series 80 Personal Computers and systems that use "IBM" 3740 formatted flexible discs. Now, data generated on your HP-85 or HP-83 can be translated into 3740 format for use in larger systems, including HP Systems 35 and 45 Desktop Computers and HP 3000 Series mainframes, as well as IBM and DEC systems.

You can TRANSFER entire discs or specific files from 3740 format data files to HP-format data files, and vice versa. You can PURGE or RENAME any 3740 or HP file. And you can CATALOG on the CRT the file name, file type, number of bytes per record, and number of records per file for HP discs, or the file name, file type, first record address, first unused record address, and last record address for 3740 discs. All these capabilities are provided by a single, easy-to-use program. The program also enables you to initialize a single-sided, 8-inch disc to 3740 format.

The hardware required in your Series 80 system includes a 16K Memory Module, the I/O and Mass Storage ROMs, an HP-IB Interface, and an HP 9895A Flexible Disc Drive. The software is available from your local dealer or HP sales representative for $95.00 (part number 88095A). It can also be ordered for the same price with the HP 9895A by specifying option 185. ■

Vertical Business Applications

Application Pac	Management/ Administration	Marketing/ Sales	Finance/ Investment
VisiCalc™ PLUS $162	Budgets Forecasts	Sales forecasts Contribution analysis Volume pricing Customer qualification	Cash flow planning Targeting R/E worksheets Income tax prep. Variance analysis
Information Management	Personnel lists Mailing lists	Customer activity Price lists Distribution analysis Mailing lists	Chart of accounts Mailing lists Investment offerings
Graphics Presentations	Presentations	Presentations	Presentations
Data Communications	Electronic mail Travel arrangements International and domestic news Computerized-data base access Corporate communications	Electronic mail Order transmittal Airline sched. Business news Field support O.E.M. support On-line marketing	Electronic mail Financial telecommunications Stock and bond prices Multiple listings Financial news and reports
Financial Decisions		Break-even analysis	Capital budgeting Lease vs. buy Loan analysis Bond analysis
Linear Programming	Profit optimization Resource allocation Production planning and sched.	Product mix Advertising media mix Territory assignment	Portfolio selection
Stat Pacs	Trend analysis	Forecasting Variance analysis	Trend analysis Customer Selection (M.L.R.)

Here's a different way to contemplate which application pacs you could use. Look under your business activity for the capabilities you can benefit from having. The application pacs named to the left would provide you with those capabilities.

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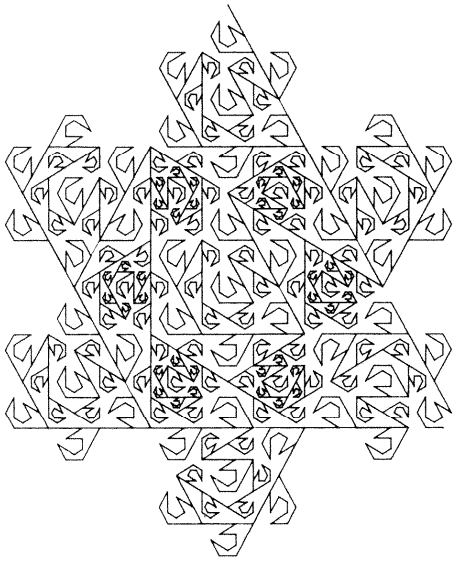
Snowflakes and Flowsnakes

Those of you who read Martin Gardner's "Mathematical Games" in *Scientific American* have run across fractals a couple of times over the last few years (December, 1976 and April, 1978). You may recall that these strange curves have some rather bizarre mathematical properties. One of the most interesting attributes of a fractal is its self-similarity — if you enlarge any portion of it, the pattern still looks the same. This effect is demonstrated by the surface of the moon, which looks pretty much the same from 50 miles above its surface as it does from the Earth.

Many physical phenomena share this property of being statistically self-similar; fractals turn out to be a good device for analyzing such things as the flood levels of the Nile and Brownian Motion. Even some of the best computer-composed music stems from the study of fractals- the degree of unexpectedness or randomness is tempered by the familiarity or repetition that is inherent in fractals.

Well, here's your chance to study some of the properties of fractals right on your CRT. **John Sechrest** has written a program for HP Series 80 Personal Computers that draws an nth order fractal on the graphics screen. When asked `ORDER TO PLOT?`, try `1` first to see the basic curve. The curve shown here has order 3. Higher orders are created by replacing the straight line segments with similar (identical except smaller) curves. The curve generates itself using this completely recursive procedure, until, in the limit, it is infinite in length and completely fills a finite area.

```
10 DIM S(13,7),D(13),L(13),F(13
   )
20 DEG
30 CLEAR
40 DISP "ORDER TO PLOT";
50 INPUT N
60 CLEAR
70 SCALE -1.14,.74,-11,1
80 H0=10
90 RESTORE
100 FOR I=1 TO 13 @ READ D(I),L(
   I),F(I)@ NEXT I
110 L0=H0
120 X0=H0*SQR(3)/2
130 Y0=0 @ X=X0 @ Y=Y0 @ K=1
140 MOVE X,Y
150 S(1,1)=N
160 S(1,2)=90
170 S(1,3)=L0
180 S(1,4)=1
190 GOSUB 220
200 BEEP @ DISP "DONE !"
210 STOP
220 IF S(K,1)=0 THEN 360
230 J=1
240 IF J>13 THEN 340
250 S(K,5)=J
260 S(K+1,1)=S(K,1)-1
270 S(K+1,2)=S(K,2)+D(J)*S(K,4)
280 S(K+1,3)=S(K,3)*L(J)
290 S(K+1,4)=S(K,4)*F(J)
300 K=K+1
310 GOSUB 220
320 J=S(K,5)+1
330 GOTO 240
340 K=K-1
350 RETURN
360 D1=S(K,2)+120
370 X=X+S(K,3)*COS(D1)
380 Y=Y+S(K,3)*SIN(D1)
390 PLOT X,Y
400 K=K-1
410 RETURN
420 DATA 60,.3333,-1
430 DATA 60,.3333,1
440 DATA 0,.3333,1
450 DATA 300,.3333,1
460 DATA 150,.19245,1
470 DATA 150,.19245,-1
480 DATA 210,.19245,-1
490 DATA 270,.19245,-1
500 DATA 0,.3333,1
510 DATA 210,.19245,1
520 DATA 210,.19245,-1
530 DATA 0,.3333,-1
540 DATA 0,.3333,1
550 END
```



Personal Data Communications -Part 1

by Curtis Adams, Editor

Your HP Series 80 Personal Computer opens the world of personal data communications to you. If this new world is unfamiliar landscape, you should read this two-part series. Part 1 provides background information and covers computerized data bases in some detail. Part 2 will focus on computer conferencing and electronic mail. All three main features are available to you now, if you're ready.

Networking—The Concept

Computer networking involves linking together computers via telephone. It also involves linking individuals with information and, as we shall see, has the potential to substantially impact society. By way of getting started, I'll just list some of the functions that networking can provide:

- Electronic mail—less expensive, faster, and easier than conventional mail.
- Electronic bulletin-boards—to maximize the awareness of products, services, and events.
- On-line conferencing—to develop and exchange ideas.
- Bartering—to save taxes and stimulate business.
- On-line newsletters—timely, convenient, comprehensive, and focused.
- On-line marketing—including on-line product data bases, on-line order processing, and electronic funds transfer.
- Computerized data bases that can be searched to provide personalized news and information.
- Entertainment unique to the media—including interactive novels.
- Educational resources—for example, management simulation games.

All of these features are available now. You can access them with your HP Series 80 Personal Computer equipped with the serial interface, an I/O ROM, a Bell-103-compatible modem, and the software that makes it all play. In this article we'll look at a few of the above functions and exactly how you would set up your HP Series 80 Personal Computer to access them. But first, let's look briefly at the significance of the medium.

Computer networking will affect the way we interact, the way we're informed, educated, and entertained. Lets just list some effects first and then go on to consider how they arise by looking at specific examples.

- Fewer middlemen and retailers, with accompanying lower retail prices.
- Lower white-collar overhead, with lower cost of manufactured goods.
- Increased cottage industry and self employment.
- Reduction in automobile/truck use, with lower energy consumption.
- An increased rate of change; an increased need for continuing education; increased personal communications.
- Changes in advertising, controlling copyrights, and enforcing taxes.

Imagine the potential effects on our culture, on time, on entertainment.

Let me illustrate some of these points. Imagine that you're a retailer, and that computer networks are firmly in place. You don't need a store-front, because customers won't be getting in their cars to go shopping. You don't need advertising or salespeople because customers' computers can find goods without either. Customers will fill out their own orders on your computerized order blanks, and electronic transfer of funds completes the picture.

Or consider this: when it doesn't take four days to transmit a letter across the country, or five tries to reach a person on the telephone, network members should be able to keep in touch with four or five times as many people.

Imagine the possibilities for new kinds of games. At Xerox's Palo Alto research center, there's a version of computerized Star Trek that never starts or ends. People join in from their desk terminals and search around the simulated universe for another player to engage in battle.

Networks take employees out of the office (they decentralize things in general), making commuting more than once or twice a week unnecessary. Ultimately, many of the details of society will be handled by networks. Then, people will belong to half a dozen or more networks to fill their needs; anyone not participating in networks would be shut out.

The Medium

What we're talking about here is a new medium. When you sit down in front of your HP Series 80 Personal Computer and log onto a network, something strange happens. You lose track of your physical surroundings and move inside one point. Inside that point you have all your files, your entire office, and all the space you need to meet with other people. [1] You enter the domain of pure thought. It is in this regard that networks are so profound—they are a thinking-prosthetic. Computer networks are tremendously useful for organizing and formalizing your thoughts.

This is why electronic mail really shines. It's as fast and more efficient than the telephone, but because it's a written medium, people have more time to spend refining their thoughts than they do in oral conversation. The material they transmit is more highly developed. On the receiving end you can digest the information much faster because you can zoom in on what you want or need to focus on. You're not encumbered by the pauses and hesitations that occur in oral conversation.

The computer-network medium provides two things: information and communications. Let's look first at information, at its value in our society, and how information is affected by the medium. **Alvin Toffler** has presented in *The Third Wave* [2], compelling arguments that we're on the threshold of a post-industrial society. Like capital in an industrial society, information is the working fluid of the post-industrial society. Those who have information will be in control, and the gap between those with information and those without it will be as significant as the gap between rich and poor in an industrial society.

Here's an example. Suppose that you're an investor with a lead on what you feel is a brilliant technique for desalinating water, but before you sink much money into it, you want to feel more confident that it's technically feasible. Even though you are technically competent in recombinant DNA, what you require is expert knowledge in biophysics. An expert, who guards that special knowledge and, in a sense, controls that information, is likely to be very expensive. But knowing your way around computerized-data bases, you can pull together dozens of reports, gathering enough information to assess the state of the art, the feasibility, what technology exists, and what technology remains to be developed. Your search might also point you in new directions and generate new and better ideas.

What we have here is not just information but information reshaped by the computer network medium. Networks are a way of bringing together all the knowledge in all the highly-specialized fields and branches within fields. They give us a handle on all this information and they save us from having to re-invent things. They will prove to be the exponent of the information implosion.

Scientists have been among the first to establish networks. Instead of having to spend great chunks of their time combing journals for relevant research reports, scientists can now have their own customized electronic journals that present only the information they require. No wading through scores of journal articles for tidbits. And, the information is more current.

Because data are being obtained at such a phenomenal rate, it is no longer even practical to publish data in journals. Now there are many publicly available data bases that allow machine searching of that huge body of scientific and technical data. It is now possible for scientists to automatically search several data bases and create their own personalized information base organized for their needs. Since data obtained over the network is already in machine form, it can be analyzed without having to be re-entered. And these data bases can be accessed from anywhere in the world, making us one worldwide community. You can read about the **Dialog™ Information Retrieval Service**, one of the largest technical data bases in the world, in the June, 1981 issue of *BYTE* magazine.

™—Dialog is a registered trademark of the **Lockheed Missile and Space Co, Inc.**

Available Networks

All networks have their own specialties. Costs also vary; some are even free. The information utilities are aware of the great potential they have and are scrambling to bring new data bases on their systems. They're working with reservation agencies, real estate listing services, press services, and libraries. They're all experiencing growing pains too. The most common problem is that capacity is not growing fast enough to keep up with demand, and systems become unresponsive. Users are annoyed by delays and have to endure slow systems. Another problem is that there is no standard protocol — commands on one network generally are not the same as commands on another.

CBBS (Community Bulletin-Board System)

As the name implies, these systems mostly contain information of interest to the community—want ads, greetings, and general graffiti. Some contain data bases on special topics like medicine, aviation, and ham radio. It is a grass roots electronic mail movement. Anyone who wants to can get on the system and leave or read a message. They can search for messages from a certain individual or about a certain subject. Roaming around on a Los Angeles CBBS network, I ran across a message from someone I'd lost contact with years ago.

At first, I couldn't understand why people operated these networks at no charge. The resounding answer — they do it for fun! There are no operating expenses beyond the initial hardware purchase. Someone with a personal computer and an auto-answer modem simply makes his system available to anyone who wants to call up and use it. The software is such that the protocol for using all CBBS networks is the same and is hardware independent.

Current CBBS phone number directories are available from several sources. Try the **MAG-MEDIA-80 CBBS** (415) 573-8768 or contact me on The Source.

The Source

There are many networks; the one we'll review in this issue is The Source. Subscribers can dial one of 300 local phone numbers in North America and throughout the world and gain access to scores of data bases and can communicate with each other via electronic mail and on-line conferencing. The Source qualifies as a consumer data base on two counts—it's affordable and it's easy to use. Using the SOURCE COMM program in the Users' Library (page 3), all you have to do is turn on your HP Series 80 Personal Computer and dial the phone. The program turns your machine into a smart terminal with local file control. That is, you can create, edit, and save files off-line (no connect time charges), log onto The Source, and transfer these files out (called uploading). You can also capture information displayed on your screen and save it in local files (called downloading). These files may be letters, reports, orders, application programs, etc.

The Source offers access to several data bases, including the following business and financial information: stock market quotations, commodity reports, bond prices, exchange rates, stock market averages, closing statistics, news, quotations, and summaries.

There are daily news features including UPI wire service, Washington hotline, sports news, a daily news summary, and business and financial news. The New York Times Consumer Data Base is also on line, one of the world's largest data bases. There's a customized information research service, a discount buying service, and a travel club for electronic reservation and confirmation services. Subscribers planning a trip can learn about special events at their destination or the local restaurants and can often make advance reservations.

Entertainment hasn't been neglected. There's a complete computer games library, wine-tasting information, gourmet meal recipes, syndicated features on home entertainment, chess club, bridge, and a restaurant guide.

We'll use The Source to look at computer networking from a very practical, user's point of view.

Located in McLean, Virginia, five-interconnected mainframe computers are silently churning, transferring packets of information in short bursts. Just pick up the phone, dial a local number, and place the receiver in an acoustic coupler, and your HP Series 80 Personal Computer is plugged into a vast network. Now you can maneuver through the corridors of information looking for treasures. In this greatest of all adventure games, you're armed with some extraordinary weapons, like HELP and key-word searching. HELP is the resident wizard. Whenever you don't know what to do next, type HELP and the rules and your options are explained. There are very few ground rules, and knowing these, brand new users can get where they want to be in just a few minutes. Suppose, for example, that you want to know what is going on with the space shuttle, and you've never used The Source before. In fact, I'll assume that all you know is that the master index of all The Source's data bases can be accessed by typing DATA LIBALL. Type it and here is what you get

A few libraries look promising but you decide to try United Press International first and type DATA UPI for the instructions on how to use that data base. You'll learn that the data base is divided into National, Regional, or State news or Features, and further classified as General, Business, or Sports. Type UPI N G hoping that space shuttle news is filed in the National, General section.

Now, one of the most powerful features of computerized-data bases is at your disposal, key-word searching. Type space shuttle and every article in the UPI wire service that mentions space shuttle will be presented to you. There you have the information you were after. I must admit that key-word searching is something you have to learn to use. The first time I tried this, I typed shuttle and got an article on *shuttle* diplomacy. (See next page.)

Roaming around The Source is a lot of fun, and proficiency comes very quickly. But data base access is only half the story. The other half is communicating with others, electronic mail, and computer conferencing. We'll talk about them in the next issue.

It's Here Now

Why don't you get a Source account and send a "letter" to me? My Source address is TCX248. I'll send you salutations, a warm welcome, and a copy of "TXTED3" and the documentation over the wire. (The program is reviewed on page 4.) What you need in the way of equipment in addition to your HP Series 80 Personal Computer is the HP 82939A Serial Interface ($395.00), the I/O ROM (part number 00085-15003; $295.00), and any of the commercially available Bell-103-compatible modems (costing $100 to $300). If you don't already have a ROM drawer, you'll need it too. The software required is available from the Users' Library. You can order it using the Users' Library order form on the back cover. *SOURCE COMM* and "IPBIN" are necessary; "TXTED3" and "DGTSAV" are highly desirable (Catalog numbers 900-0044, 900-0024, 900-0043, and 900-0022; $6.00, $12.00, $6.00, and $12.00, respectively).

The last expense is a one-time, $100.00 fee to subscribe to The Source. More information on The Source can be obtained by writing to Source Telecomputing Corportion/ 1616 Anderson Road/ McLean, Virginia 22102. Their phone number is (703) 821-6660.

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>data liball

                    *** THE SOURCE ***

ADVANCED APPLICATIONS & PROGRAMS.....DATA ADAPPR
ADVICE COLUMN.....DATA LORE
AIRSCHEDULES.....DATA AIRSCHED
ANNOUNCEMENTS (UPDATED FREQUENTLY).....DATA ANNOUN
ASTROLOGY LIBRARY .....DATA ASTRO-LIB
AWARE FINANCIAL SERVICE GLOSSARY.....DATA GLOSS
BARTER-TRADE NETWORK.....BARTER
BRIDGE ACCORDING TO THROOP.....DATA BRIDGE
BUSINESS & FINANCE.....DATA BIZDEX
CALCULATOR.....DATA CALCUL
CAREER NETWORK.....EMPLOY
CLASSIFIED ADS.....DATA CLASSI
CONSUMER INFORMATION.....DATA CONSUM
CROSS X-ASSEMBLERS.....INFO X-ASSEMBLERS
DINING OUT:  WASHINGTON, D.C.....RESTGD
             NEW YORK CITY.....NYRESTGD
             CONTINENTAL U.S. & CANADA.....USREST
DISCOUNT SHOPPING SERVICE (MONEY SAVERS).....DATA BUCKS
EDUCATION.....DATA EDUCAT
ENERGY SAVING NEWS & TIPS.....ENERGY
FINANCIAL NEWS.....DATA BIZDEX
GAMES.....DATA GAMES
HOME ENTERTAINMENT.....DATA HOMENT
INFORMATION ON DEMAND.....DATA IOD
MAILCALL.....DATA MAILCALL
MAIL DELIVERY.....INFO DATAPOST
MOVIES REVIEWS BY JAY A. BROWN.....MOVIES
MUSIC TO ORDER.....MUSICSOURCE
NEW YORK TIMES NEWS SUMMARY.....DATA NYTNS
NEW YORK TIMES CONSUMER DATA BASE.....NYTCDB
PERSONAL CALENDAR & NOTEBOOK.....DATA PERSON
PERSONAL FINANCE.....DATA PERSFI
POLITICAL ACTION REPORT.....DATA PAR
PORTFOLIO MANAGEMENT.....DATA FOLDEX
RADIO PROGRAMS TO ORDER.....RADIOSOURCE
RAYLUX FINANCIAL SERVICES.....DATA FINANCIAL
SCIENCE & ENGINEERING.....DATA SCIENG
SELF-PERCEPTION.....PLAY ICHING
SMITHSONIAN EXHIBITS AND TOURING EXHIBITS.....DATA MUSEUM
SPECIAL APPLICATIONS.....DATA COMPUDEX
SPORTS.....DATA SPORTS
STUDENT AID.....COLLEGECASH
SUGGESTION BOX.....DATA SUGBOX
TRAVEL CLUB.....DATA TRAVEL
UNISTOX.....UNISTOX
UNITED PRESS INTERNATIONAL (UPI).....DATA DANEWS, DATA UPI
VOICEGRAM.....DATA VOICEGRAM
WEATHER.....DATA WEATHR
WINE.....WINE
WISDOM OF THE AGES.....WISDOM
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>UPI N G

KEY WORDS (PRESS RETURN FOR ALL STORIES):
SPACE SHUTTLE

ENTER STARTING & ENDING DATE - OR PRESS RETURN FOR TODAY
3/20/81-

PICK A STARTING STORY NUMBER - FROM 1 (THE EARLIEST)
TO   35 (THE LATEST).
35

READ FORWARD IN TIME (RF), READ BACKWARD (RB),
SCAN FORWARD (SF) OR SCAN BACKWARD (SB)?
RB


  35 -02-81 10:19 aes
By AL ROSSITER JR.
UPI Science Editor
   CAPE CANAVERAL, Fla. (UPI) _ Space shuttle astronauts John Young
and Robert Crippen enter medical quarantine tonight to minimize their
exposure to contagious diseases during the final week before launch
April 10.
   The astronauts will remain in Houston until they fly to the Kennedy
Space Center Tuesday and take up lodging in remodeled quarters where
Young twice stayed before flying to the moon.
   Doctors say the spacemen must stay 30 feet away from anyone not on
a special list of people who have been checked to make sure they do not
have any infectious diseases. More than 700 people, including the
pilots' families, are on that list.
   After surmounting one technical problem after another during the
past few years, project officials want to make sure the shuttle's maiden
54 ( hour orbital test flight is not delayed by a sick crewman.
   NASA acting administrator Alan Lovelace said Wednesday that weather
appears to be the factor most likely to interfere with the launch of the
```

With this equipment and software, you can also access hundreds of free Community Bulletin-Board System networks.

If you can't afford to invest several hundred dollars to improve your information access, be patient; the entry fee will be dropping rapidly in the near future. The number of networks suited to your needs will also be increasing dramatically as information access is integrated into a much broader system for entertainment, education, and commerce. Unlike the long time it took for telephone and television networks to get in place, computer networks could explode into place almost overnight; they can just ride "piggyback" on these earlier-established networks.

Even though the telephone has been around for a hundred years, telecommunications is something in which you can still pioneer. It is my feeling that, if you can, you should jump in with both feet right now and learn the in's and out's of the medium—the first to enter will develop the most effectiveness.

You probably didn't realize it when you bought your machine, but over the next few years, communications will become your most important application. For many of you it could be your most important application right now. ■

1. Art Kleiner. NCC '80 Personal Computing Digest. *AFIPS Press; Box 9657; Arlington, Virginia 22209*

2. Toffler, Alvin. The Third Wave. *New York: Morrow 1980*

Questions and Answers

As a result of the questionnaire in the last issue, along with some good data I received hundreds of questions. Fortunately for me, most of them were the same; I'll answer them here. If you have further questions, ask them, and look for the answers in the next issue.

Q. Other languages?

A. Now that the Assembler ROM is available, some among you will use it to develop languages beyond BASIC for Series 80 computers. In fact, in the May update to the Series 80 Software Catalog, you'll find *HP-83/85 FORTH* (Catalog no. 900-0040; $50.00 including 5-1/4" flexible disc). FORTH is a computer language that is used for controllers and anywhere else relatively high-speed and dense code is required. This version is adapted from the FORTH Interest Group's (FIG) FORTH Model. Included are an assembler, a FORTH decompiler, a string handling package, and alpha and graphics CRT control. The program is not designed to teach programming in FORTH, but a manual entitled "*Using FORTH*" is available for purchase through an order form included in the program documentation. A 16K Memory Module, Mass Storage ROM, and HP Series 82900 Flexible Disc Drive are required. This software was contributed to the Users' Library by **Larry Woestman** and **Tom Houser**. Please note that user-contributed programs are not supported by Hewlett-Packard.

Q. Terminal emulator?

A. By far the most frequently asked question concerned data communcations. Not so coincidentally, the subject is one of the main themes of this issue. It is one of the applications that crosses the business/technical user boundary. If you aren't aware of what is happening in this area, you owe it to yourself to read the "Personal Data Communications" article. If you're ready to do it, the software is available from the Users' Library—*SOURCE COMM* allows you to use The Source and the free Community Bulletin Board Systems for access to a wealth of information and electronic mail. Refer to the Users' Library column for a complete discussion of this software. The only hardware required is an I/O ROM, the serial interface, and any of the commercially available Bell-103-compatible modems.

Q. Merge programs?

A. A column in the first issue of *BASIC EXCHANGE* discusses a technique for merging two programs or inserting part of one program into another, using the CRT memory as a buffer.

The binary program "DGTSAV" (Catalog no. 900-0022; $12.00 plus media cost) can also be used for this purpose. If you didn't pick that up from the last issue, please re-read the Binary Utilities discussion (V2N1, page 6)—there's a lot of hidden gold in those binary programs.

Q. Back issues?

A. All three back issues of *BASIC EXCHANGE* are available and presently free. Just send us your request, attention **Curtis Adams, Editor**.

Q. Keyboard masking?

A. The I/O ROM adds keyboard masking to your system's capabilities. With the ENABLE KBD command, you can disable certain keys while a program is running to prevent inexperienced operators from unwittingly crashing the program, destroying data, or otherwise having a hard time. The binary program "IPBIN" (Catalog no. 900-0024; $12.00 plus media cost) also provides this capability.

Q. Accessories/Prices?

A. Your local HP dealer has two brochures in particular that are real jewels. The *HP Series 80 Hardware brochure* (5953-1969) and the *HP Series 80 Software brochure* (5953-1966) are 16-pages each, containing detailed descriptions of current Series 80 peripherals, firmware, interfacing, and application pacs, with technical specifications. Your dealer also has current price lists.

Q. The disc stops?

A. The motor that spins the disc in the Series 82900 Flexible Disc Drive stops when the disc is not being accessed. This is done for two good reasons—it eliminates media wear and it extends the life of the bearings and brushes in the motor. The system waits for 2.5-seconds after an access before stopping, so that during frequent accesses the disc spins continuously with no time spent stopping and starting the motor. The inertia of the disc and motor is low, so the disc is up to speed quickly, and operations like head positioning overlap motor start up. Access time can be computed from the following table:

Track to track	5	milliseconds per track
Head settle	15	milliseconds
Latency (the time for the desired sector to rotate to the head)	200	milliseconds maximum
	100	milliseconds average
Motor start up	250	milliseconds

Q. Error 19: MEMORY OVERFLOW ?

A. When using string variables on the HP-85, some operations require a temporary memory space for processing. Therefore, it is possible to have a memory overflow even though the program with dimensioned string variables seems to be well within memory limits. String concatenation using "&", READ#, PRINT#, and OUTPUT all require this "scratchpad" memory. The problem arises when the operand is a very long string variable, because the scratchpad memory is required in addition to the dimensioned variable space. Here are some tricks that can be used to minimize temporary memory requirements:

1. Concatenating strings without "&".
   Use substring operations instead; for example, to add a string to the end of A$ whose length is 10,000:

```
A$[10001,10013]= "END OF STRING"
```

   When accessing data files using READ# and PRINT#, break the string into pieces and concatenate with substring notation. For example, the following routine will read a 25,000-character string (broken into 250-byte pieces) and will require only 595 bytes of temporary memory, including the buffer.

```
10 DIM Z$[25000]
20 ASSIGN# 1 TO "DATA"
30 FOR X=1 TO 100
40 READ# 1,X ; Z$[X*250-249,X*250]
50 NEXT X
60 ASSIGN# 1 TO *
```

2. PRINTing or OUTPUTing substrings.
   Rather than attempt to OUTPUT the whole string, OUTPUT segments, as follows:

```
OUTPUT 702 USING "#,K"; A$[1,250]
OUTPUT 702 USING "K"; A$[251,500]
```

   Or, use SEND instead of OUTPUT; SEND does not use temporary memory.

3. Deleting characters in mid-string. Use substring notation as follows:

```
Z$[1500, 2499] = Z$[1501, 2500]
Z$ = Z$[1,2499]
```

   The second statement is necessary to adjust LEN (Z$).

4. Inserting characters in mid-string: There is no way to avoid using "&" here, except by using the binary program "HANDY". "HANDY" includes several commands for string manipulation and string arrays, and is available from the Series 80 Users' Library.

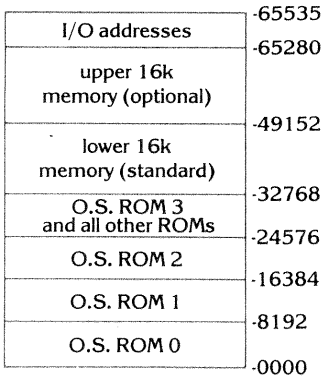
Q. Black-printing thermal paper?

A. You have a choice of thermal papers for your HP-85, one that prints blue and one that prints black. Because some photocopiers don't pick up blue tones, you may require the latter. Order HP 82951A Paper (6-rolls, 120-meters each); $90.00.

Q. 112K bytes of memory?

A. In the CPU architecture article (V1N2), I said that two bytes of address information could be sent on the bus. This limits the addressing to 64K bytes, yet Series 80 machines can have up to 32K of RAM and up to 48K (6 * 8K) of option ROMs in addition to the 32K operating system. This all adds up to 112K bytes of memory space. How is this achieved?

The CPU architecture supports block-switching of memory segments. The map below illustrates where everything is located in the 64K memory space.



Note that the upper 16K does not get a full 16,384 bytes. 256 bytes are "stolen" from this address range for all I/O addresses. The internal and external I/O is memory mapped and resides in this range.

The main operating system ROM number 3 and all option ROMs share the address range of 24576 to 32767. Only one of the ROMs is selected at a time. When the main system wishes to access a particular ROM in the block switch range of addresses, it writes a select byte into reserved I/O address. This reserved address is recognized by all the ROM chips that reside in the 24,576 to 32,767 range.

Q. Need to duplicate data files?

A. **J. H. Randall** of Stellenbosch, South Africa, has written a data file editor and contributed it to the Users' Library: GENFED (Catalog no. 9000-0039; $15.00 plus media cost) allows you to examine the contents of a file, modify it, and create a copy. Note that the binary program "VFYTYB" (Catalog no. 900-0007; $12.00 plus media cost) is required by the program.

Q. Alpha mode cursor control?

A. You can move the cursor to any location on the CRT with MOVE CURSOR, a BASIC command supported by the binary utility program, "LINKEY". MOVE CURSOR *column, row* makes full use of the 32 columns and 16 rows of the CRT, allowing you to do fast graphics in alpha mode.

If you require something fancier still, a second program, "IPBIN", provides the following BASIC commands:

CCURSOR *numeric expression* positions where the next character will be written. The numeric expression can evaluate to a number from 0 to 2047; that is, the cursor can be positioned anywhere in CRT memory (four screens). CCURSOR does not affect where the current display window is.

CLINE *numeric expression* positions where the CRT display window starts, with the numeric expression ranging from 0 to 63.

CCLEAR clears the entire CRT (CLEAR only clears the current window) and positions the window and the cursor position to the start of display memory.

CCPOS is a function that returns a numeric value indicating the current cursor position from 0 to 2047. This function allows relative cursor positioning.

CLPOS is a function that returns a numeric value that indicates the current window position (which line is the first line displayed on the screen, from 0 to 63). It allows you to establish a reference point for the current display window.

The binary program "IPBIN" is Catalog no. 900-0024 and costs $12.00 plus media cost.

Q. String arrays?

A. Another binary utility program, "HANDY" (Catalog no. 900-0041; $12.00 plus media cost), allows a string variable to serve as a one-dimensional string array. "HANDY" is described in the Users' Library column on page 3. ■

More On Sorting

After reading the sorting article in the last issue, a couple of readers wrote letters expounding on the virtues of using the Matrix ROM (part number 00085-15004; $145.00) for sorting applications. Professor **Bruce Liebert** of the University of Hawaii compared his four-line sort routine (below) with the Shell-Metzner routine with these results:

No. of elements (N)	Time (minutes)	
	Matrix	Shell-Metzner
100	0.44	0.68
200	1.73	2.21
500	10.65	5.81
1000	42.33	14.27

The sorting speed is the same regardless of the order of the data. Also, a second array is available that may be useful when the routine is used as part of a larger program. The Matrix ROM makes loading the data quick and easy and accesses stored data quickly.

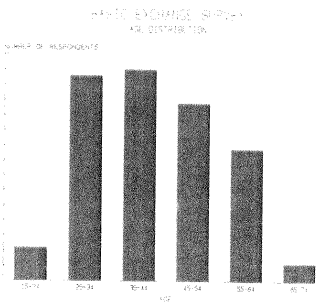
```
 10 OPTION BASE 1
 20 DIM A(1000),B(1000)
 30 DISP "HOW MANY NUMBERS (MAX=
    1000)";
 40 INPUT N
 50 REDIM A(N),B(N)
 60 RANDOMIZE
 70 FOR I=1 TO N
 80 A(I)=IP(100*RND+1)
 90 NEXT I
100 Z1=TIME
110 FOR I=1 TO N
120 B(I)=AMIN(A)
130 A(AMINROW)=INF
140 NEXT I
150 Z2=TIME
160 Z3=(Z2-Z1)/60
170 MAT DISP B
180 PRINT
190 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR";N;"RANDOM NUMB
    ERS USING MARTIX ROM FUNCTIO
    NS."
200 END
```

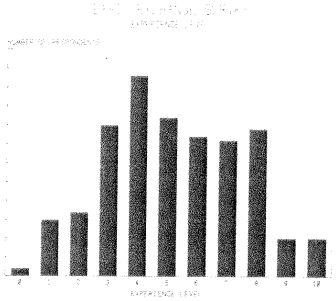
Here is a program that uses the Shell-Metzner sort to alphabetize a list of names. To do so, the program puts alpha strings into a numeric array by converting the string characters into their decimal codes, an idea developed by **Wesley Lindsay** of San Jose, California. Note that a maximum of six characters can be converted into a 12-digit number, but six characters so converted require only eight bytes of storage. The program uses an interleaved storage technique (which can be extended further) to accomodate strings of up to 18 characters.

You'll find this routine limited, but useful for simple things like distribution lists. To use the program, after you've entered all the names, just type "SORT", and they will be displayed in alphabetical order (based on the first six characters). The binary program, "LINKEY", permits commas to be used. Just delete lines 30 and 40 and change "LINPUT" to "INPUT" if you don't have the binary.

```
 10 OPTION BASE 1
 20 DIM A$[32],C$[2],A(600)
 30 ON ERROR GOTO 50
 40 LOADBIN "LINKEY"
 50 ON ERROR GOSUB 270
 60 FOR I=1 TO 200
 70 DISP "NAME(LAST, FIRST)";
 80 LINPUT A$
 90 A$=A$[1,18]
100 IF A$[1,4]="SORT" THEN GOTO
    280
110 B=0
120 FOR J=1 TO 6
130 B=B+NUM(A$[J,J])*10^(12-2*J)
140 NEXT J
150 A(I)=B
160 B=0
170 FOR J=7 TO 12
180 B=B+NUM(A$[J,J])*10^(24-2*J)
190 NEXT J
200 A(I+200)=B
210 B=0
220 FOR J=13 TO 18
230 B=B+NUM(A$[J,J])*10^(36-2*J)
240 NEXT J
250 A(I+400)=B
260 NEXT I
270 IF ERRN=56 THEN RETURN ELSE
    DISP "ERROR";ERRN;"ON LINE";
    ERRL @ STOP
280 ! SORT ROUTINE
290 OFF ERROR
300 N=I-1
310 M=N
320 M=INT(M/2)
330 IF M=0 THEN GOTO 440
340 FOR S=1 TO M
350 I=S @ J=S+M @ Z=0
360 IF A(I)<=A(J) THEN GOTO 390
370 Z=1 @ R=A(I) @ A(I)=A(J) @ A
    (J)=R @ R1=A(I+200) @ A(I+20
    0)=A(J+200) @ A(J+200)=R1
380 R2=A(I+400) @ A(I+400)=A(J+4
    00) @ A(J+400)=R2
390 I=J @ J=J+M
400 IF J<N+1 THEN GOTO 360
410 IF Z THEN GOTO 350
420 NEXT S
430 GOTO 320
440 ! CONVERT A(I) TO C$
450 FOR I=1 TO N
460 A$=""
470 B=A(I)*10^-10
480 GOSUB 540
490 B=A(I+200)*10^-10
500 GOSUB 540
510 B=A(I+400)*10^-10
520 GOSUB 540
530 GOTO 610
540 FOR J=1 TO 6
550 IF NOT IP(B) THEN GOTO 610
560 C$=CHR$(IP(B))
570 B=FP(B)*100
580 A$=A$&C$
590 NEXT J
600 RETURN
610 PRINT A$
620 NEXT I
630 END
```

Survey Results





Thanks! The survey in the last issue drew a 10-percent response. That's more than enough data to get a statistically-significant picture of BASIC EXCHANGE readers. Above you'll find some histograms that will give you an idea of the company you're keeping.

There were some surprises. A lot of you program (85-percent), and according to your self-evaluations, you're good at it. And even though 82-percent of you use it either at work or both at work and at home, 18-percent use it exclusively at home!

Excerpts From "On the Uncertainty of Science"

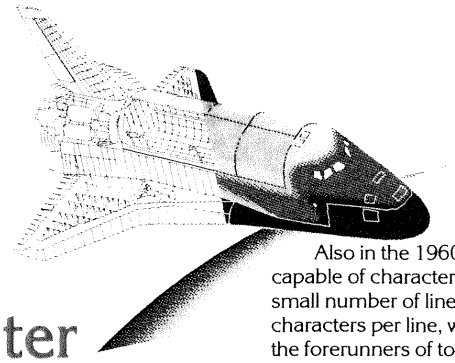
by Lewis Thomas

"What I would like to know most about the developing earth is: Does it already have a mind? Or will it someday gain a mind, and are we part of that? Are we a tissue for the earth's awareness? . . .

"I would like to think that we are on our way to becoming an embryonic central nervous system for the whole system [the planet earth]. I even like the notion that our cities, still primitive, archaic, fragile structures, could turn into the precursors of ganglia, to be ultimately linked in a network around the planet . . .

"But I do worry, from time to time, about that other possibility: that we are a transient tissue, replaceable, biologically representing a try at something needing better means of perfection, and therefore on our way down under the hill, interesting fossils for contemplation by some other kind of creature . . . [Perhaps a silicon-based life-form?] The great successes in evolution, the mutants who have, so to speak, made it, have done so by fitting in with, and sustaining, the rest of life. Up to now we might be counted among the brilliant successes, but flashy and perhaps unstable. We should go warily into the future, looking for ways to be more useful, listening more carefully for the signals, watching our step, and having an eye out for partners. [Computers?]"

Lewis Thomas is chancellor of the Memorial Sloan-Kettering Cancer Center in New York. "On the Uncertainty of Science" was presented in June, 1980 as the Harvard Phi Beta Kappa Oration. Excerpts from *Harvard Magazine* are reprinted with permission.



What is Computer Graphics? Part 1

by Craig Schmidt, Product Marketing Engineer, and Virginia Pollack, Senior Technical Writer, Hewlett-Packard, San Diego Division

This is the first in a four-part series of articles written to familiarize you with computer graphics. We will look into what computer graphics is, its origin, the various types of computer graphic devices and their uses, and most importantly, what computer graphics can do for YOU! You don't have to be a computer whiz to read this; you don't even have to like computers; just sit back, take a few minutes, and enjoy.

Let's start by saying that computer graphics is a pictorial or graphic representation, displayed or produced by a computer . . . a clear and lively, artistic rendition of numbers, images, or pictures. How many times, when trying to discuss a complex problem, have you drawn a picture, a graph, or a chart to get your point across? There you have it, graphics at work!

To get clear and lively artistic images, we need some way to draw or display the graph—a CRT, a line printer, or a graphics plotter. The computer converts numeric information into graphic format, modifies existing graphic information, or simply retrieves any graphic information previously stored. With these two elements, we can enter, anaylze, save, and display, in many forms, various types of charts, graphs, pictures, or artistic representations of simple or complex data.

A Brief History

Like many of the new technologies of recent years, computer graphics were first developed for U.S. military applications. In the mid- and late fifties, the SAGE (Semi-Automatic Ground Environment) air defense system used a display screen to give visual indication of the positions of aircraft. Following this, in the early 1960s, **Ivan Sutherland**, in a federally funded project at MIT's Lincoln Labs called Sketchpad, pioneered the areas of data structure and software necessary for today's high-performance graphics systems.

Computer graphics at that time required the largest and most expensive computers, and only universities, governments, and large industries could afford the high price tag. Several computer-aided design (CAD) systems for automobile, aircraft, and missile design came about independently during the 1960s. These systems allowed engineers to alter design parameters and then see the effects displayed on the screen. Data on how the new parameters would affect such areas as cost, strength, and aerodynamic efficiency were also immediately obtainable.

Also in the 1960s, a variety of display screens capable of character generation, but limited to a small number of lines with a fixed number of characters per line, were developed. These were the forerunners of today's high-resolution raster graphics devices. (We'll get to "raster" later). In the late 1960s a new type of display appeared on the market place, the storage tube display. This was the first low-cost terminal priced between $4,000 and $15,000. Its introduction stimulated the development of other technologies, such as lower-cost stroke writing refresh tubes and raster scan converters, the two main types of display devices used today.

Hewlett-Packard's efforts during this time centered on medical displays, the first of which appeared in 1966. These small-screen, high-resolution displays, which used analog input, were the forerunners of today's medical monitors and were used for such things as fetal monitoring. In 1970 HP entered the large-screen display area with a high-resolution radar display. HP introduced its first graphics terminal for commercial data processing in 1978. A small color vector display was introduced in 1979 and a desktop computer with color CRT in 1980.

New applications of computer graphics continue to be found. In fact, business applications of computer graphics first became significant in the late 1970s. The growth of computer graphics has been made possible by both the expansion of available software and advances in technology. Software ranges from packages that simplify the generation of plots to complete turnkey systems. Hewlett-Packard has developed graphics software, graphics peripherals, and graphics systems for OEMs (original equipment manufacturers) and end users. Programming languages and subsets of languages have been developed specifically to plot graphics. Hewlett-Packard has made a significant contribution in this area with the development of Hewlett-Packard Graphics Language (HP-GL).

Microprocessor technology and the drastic price reductions for computer memory have made possible dramatic reductions in the cost of computer graphics. Use is no longer limited to governmental agencies, large corporations, and universities. Graphics displays and plotters are both available for under $3000. Computer games and electronic toys, as well as commercial systems, use forms of computer graphics unimagined 25 years ago.

Raster vs Vector

Computer graphic output devices are of two main types, raster and vector. A vector device creates graphics by drawing continuous lines from one defined point to another. In general, vector devices provide high-quality output with high resolution. On a vector display, lines are drawn on the CRT by an electron beam moving directly from one point to the next. The beam excites phosphors on the face of the CRT so the lines become visible. A vector display is sometimes called a stroke writer. They are found in the most expensive turnkey systems.

A vector display has a limit to the total length of lines that can be drawn without flicker becoming a problem. Unless all lines can be redrawn within the refresh cycle (normally 1/60 of a second), the plotted data will appear to flicker on the screen.

On a vector plotter, lines are drawn with a pen just as when you write with a pen. Pen speed on a vector plotter is sacrificed somewhat for line quality. **The HP 7225 Graphics Plotter** is an example of a vector plotter.

A raster device has a fixed number of dots or locations, arranged in a fixed number of rows and columns. You can think of raster as being a two-dimensional matrix or as an area divided into smaller areas, like a sheet of postage stamps. A raster is sometimes described by the number of rows and columns. Thus, a sheet of one hundred postage stamps is a 10 × 10 raster. The resolution of a raster device depends on, and increases with, the number of rows and columns per unit area. Imagine a giant sheet of postage stamps spread over a section of a college football stadium. This sheet of postage stamps has greater resolution than the card cheering section located in the same area (where each student sitting in the section holds a large "card" over his head to produce a picture) because there are more stamps than cards per unit area.

A raster device creates graphics by selectively turning dots on or off. On a raster graphics printer, dots that are "on" are printed on paper; dots that are "off" result in blank paper. On a raster display, dots correspond to screen locations that are either on or off (illuminated or not illuminated). To determine if a dot is on, a raster device "scans" or examines an area of computer memory many times each second. A raster is usually scanned from top to bottom, one row at a time, left to right in each row. The larger the print or display area, the greater the resolution.

Because a location in computer memory can change value instantaneously, raster graphics on the CRT can be updated in real time. In fact, the image could change every refresh cycle. Raster devices can create filled areas quickly; there is no limit to the amount of a screen's area that can be illuminated. Flicker is not a problem.

Raster printers generally can plot complex graphs more quickly than vector plotters, but with less resolution. The **HP 82905A** Printer is a raster device. It can print the contents of the graphics display in HP Series 80 Personal Computers.

What's Next? Part 2

In the next article, we will be looking into the many applications for computer graphics in business, engineering, scientific applications, and in the home. Line charting, bar graphing, and pie charting will be discussed in light of their various uses with "Good Graphic Form." Single color versus multiple colors graphic impacts will be evaluated, and also the multi-dimensional aspects of current computer graphics. ■

SERIES 80 USERS' LIBRARY ORDER FORM

Series 80 Library programs with documentation and complete program listing are priced from $10.00 each ($6.00 each to members when you include your member number). Consult your *SERIES 80 SOFTWARE CATALOG* for program numbers. Always use the correct Library identification number when ordering programs. *Hewlett-Packard offers no warranty, expressed or implied and assumes no responsibility in connection with the program material listed. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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Your credit card account will be billed when your order is shipped.

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BASIC EXCHANGE
Summer 1981 Vol. 2 No. 2

Information about new hardware and software, new policies, programming and operating suggestions, further reading, and feature articles. Published four times a year for owners of Hewlett-Packard personal computers.
Reader comments and contributions are welcomed and should be addressed to the editor.

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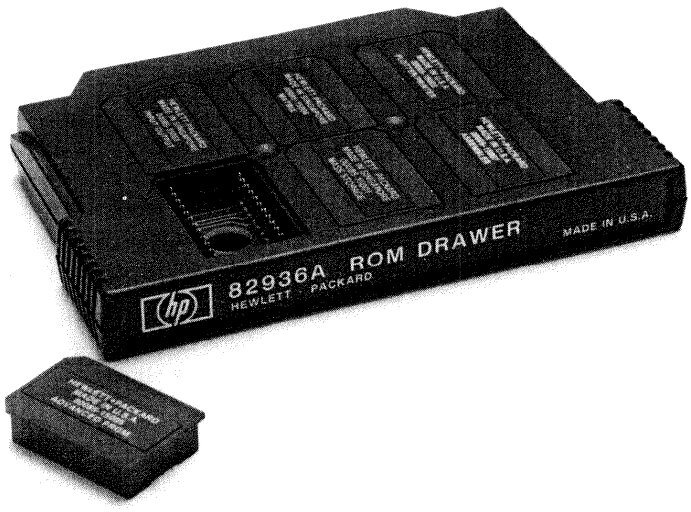
- Ultra-Fast Sorting
- Program Transportability

HEWLETT PACKARD

basic EXCHANGE

PERSONAL COMPUTER DIVISION WINTER 1981 VOL. 2 NO. 3

A Complete ROM Complement



While it will be the first ROM for some, others will be removing the last protective cap in the ROM Drawer to make room for the **Advanced Programming ROM**. This ROM is loaded with advanced features that will please beginning and experienced programmers alike. Take for example the command that lets you turn off the CRT. In itself, that may not sound very exciting.

But turning off the CRT during mass storage operations can cut the execution time of those operations in half!

The Advanced Programming ROM provides several other features that make a running program more friendly. And there's another class of features that makes writing programs easier. Of these, SCAN is a favorite. SCAN"A$",102 locates and displays the first program line after line 102 that contains A$. You can use SCAN to quickly find where in a program you used ON ERROR GOTO or ASSIGN#, etc.

Or suppose you want to merge part of another program into the one you're writing, and both programs use the variable B1. To prevent the value of B1 from being clobbered, just type "REPLACEVAR B1 BY B2" to rename the variable B2 before merging.

Speaking about variables being unintentionally overwritten, XREF V can be used to generate a cross-reference table that shows every program line in which a variable occurs (*figure 1*). You can consult the variable cross reference when you're writing a program to see which variable names you've already used and thus avoid potential conflicts.

```
VAR     OCCURS IN LINE
A ()    20 ,60 ,100 ,100 ,150
        160 ,160 ,190 ,200
        210 ,210 ,250 ,260
        270 ,270 ,330 ,340
        350 ,350 ,380 ,380
S (,)   20 ,420 ,430 ,470 ,480
        510 ,520
N       40 ,50 ,90 ,100 ,110
        560 ,570
I       50 ,60 ,70 ,130 ,200
        200 ,210 ,220 ,220
        240 ,240 ,250 ,260
        260 ,270 ,300 ,300
        320 ,340 ,350 ,350
        360 ,360 ,370 ,380
        420 ,440 ,480 ,490
        570 ,580 ,590
T1      80 ,560
Q       90 ,120
L       110 ,120 ,130 ,140
        160 ,300 ,310 ,470
        490 ,510
R       110 ,120 ,130 ,140
        300 ,310 ,430 ,440
        520
T       110 ,400 ,410 ,410
        420 ,430 ,460 ,460
        470 ,480 ,510 ,520
        530 ,530
```

Figure 1

The XREF L command generates a line-number cross-reference table (*figure 2*). This table becomes very useful when you start to clean-up a program. Say, for example, you want to delete a few lines of a program. A quick glance at the line number cross reference will show you whether these lines are referred to elsewhere in the program.

Both tables become particularly valuable when you want to analyze someone else's program (or a program you wrote a while ago and didn't document).

```
LINE#   OCCURS IN LINE
120     450 ,500 ,540
180     190
190     170 ,290
240     250
250     230
300     200 ,260
310     120
340     370
380     340
410     300
460     300
510     400
550     400
```

Figure 2

There is a third class of features provided by the Advanced Programming ROM, features that significantly extend the power of your computer. One feature is subprogramming, which allows you to build a library of independent routines. These routines can then be called as required in other programs or even other subroutines.

If you have a 16K Memory Module and you're still bumping up against the end of memory, subprograms offer a way out. Here's how. A "main" program resides in the top of system memory (*figure 3*). One or more of the program lines in it may CALL a subprogram, whereupon the subprogram is loaded into system memory and executed, and control is returned to the next line in the main program. If another program line CALL's another subprogram, it will be loaded at the beginning of the remaining memory. If there isn't enough room, the previous subprogram can be deleted using SCRATCHSUB without destroying the main program.

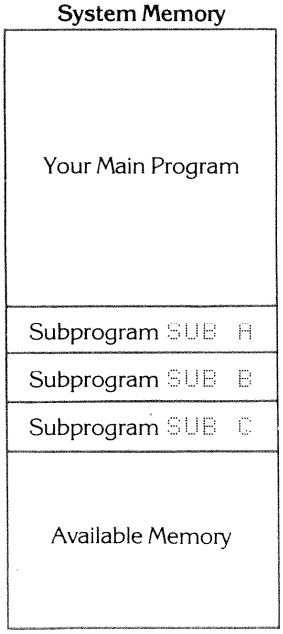


Figure 3

Now let's consider a second very powerful feature—string arrays. As implemented in the AP ROM, these have the form A$(I), where A$(1) may be "HI" and A$(2), "GOODBYE." That is, the string elements can be as long or as short as necessary and aren't constrained to be the same length. Once again this permits efficient memory utilization. In fact, you can use string arrays to conserve mass storage, too. If you have data you need to get at randomly, but it varies considerably in length, you can have a lot of wasted mass storage space because random access files have a fixed record length. With string arrays you can store your data in a serial file. Then, when you read the data back in, you can make each record an element of a string array and so access it at random (*figure 4*).

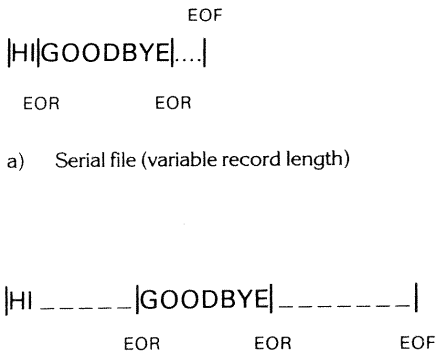


Figure 4

You'll find that having string arrays will allow you to do things that are otherwise awkward or impossible. When you need them, you'll be glad you have them.

Many of the capabilities the binary utility programs offer are provided by the Advanced Programming ROM, with the advantage that they're at your disposal as soon as you turn on your machine. Of course, you can still use binary utility programs, too. In fact, the Advanced Programming ROM provides the SCRATCHBIN command to scratch one binary program from memory so that another may be loaded. (Only one binary program can be present in system memory at a time.)

The bow on the package is the very well done 90-page manual written by **Bill Yoder**. Bill is a Senior Technical Writer here and has contributed the next article to convey his enthusiasm for the ROM. I'd just like to add that whether you're a beginner or an expert, you'll be very pleased with the new-found power this little $145† ROM can add to your system. ■

† *All prices in this newsletter are U.S. prices excluding state and local taxes. For information outside the U.S. please contact the sales office or dealer nearest you.*

The Advanced Programming ROM

by Bill Yoder, Senior Technical Writer
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The HP-83/85 operating system resides in 32K bytes of read-only memory, that is, in the four system ROMs. When you type a system instruction such as AUTO and press (END LINE), the instruction is interpreted and executed by one or more of the system ROMs. Each of the HP Series 80 Enhancement ROMs adds 8K of read-only memory to your HP-83/85 to enlarge the computer's instruction set (vocabulary) and capabilities.

The Advanced Programming ROM equips your HP Series 80 Personal Computer with 51 new instructions. These commands, statements, and functions fall into seven main groups:

- Program editing.
- String-handling.
- Subprograms.
- Alpha cursor control.
- Keyboard interrupts.
- Program flags.
- Clock and calendar functions.

Among the ROM's editing features are search and replace capabilities. A SCAN command allows you to specify search strings and variable names so that you can quickly locate specific lines of long programs. A REPLACEVAR command replaces one variable name by any other throughout a whole program.

There's a new renumbering command that allows you to renumber selected portions of a program in lieu of the whole program. The current LIST command is redefined so that a listing begins from where a program is halted for quick editing. A powerful MERGE command causes all or any portion of program from mass storage to be merged into the current BASIC program. A SCRATCHBIN command erases the current binary program in memory so that you can replace one binary program with another without affecting the resident BASIC program.

The AP ROM enables you to create and use one-dimensional string arrays, convenient for manipulating large groups of character strings. After declaring a string variable to be a string array, you may enter string elements of varying lengths and reference them by their indices. The LINPUT statement, a variation of the current INPUT statement, allows you to enter commas, quotes, and leading and trailing blanks in string variables. In addition, a half-dozen string functions allow you to reverse strings, repeat strings, rotate strings, underline strings and so on.

The ROM has built-in subprogramming capabilities, enabling a program to call, or bring into memory, a subprogram from a mass storage device, transfer control to that subprogram, and afterwards return control to the calling program. Similar to FORTRAN subroutines and PASCAL procedures, subprograms can receive parameter values from the calling program either by address or by value. Subprograms are a step forward in bringing structured programming to the BASIC language.

The alpha cursor control capabilities of the AP ROM open a variety of possibilities. You can determine the cursor's location, turn the cursor on and off, move the cursor to any of the four display screens, and read information from or display information at any cursor location.

In short, you can turn the CRT into a four-screen circus. Applications include generating forms, setting margins and tabs, creating protected fields, toggling between screens, even producing (limited) animated sequences.

The ON KYBD statement allows a program to "take over" the entire keyboard. Unshifted, shifted, and control keys can be defined in much the same way that the soft keys, (k1) – (k8), can be defined. That is, any key or keystroke combination can interrupt execution and cause a branch to any subroutine or program operation. You're given the opportunity to entirely redefine the keyboard during program execution.

The AP ROM is equipped with 64 flags that can be individually set, cleared, and tested. The flags can be controlled by program execution and can themselves control execution, expanding the decision-making scope of the HP-83/85.

There are seven AP ROM clock and calendar functions. Among them are functions for converting date and time information from string to numeric formats, and vice versa. These functions enable you to calculate date-to-date intervals and day-of-week information. They also enable system clock readings to be printed in readable formats. Another clock function returns the number of seconds registered on a system timer after that timer has been set in a running program, allowing you to control timer interrupts efficiently.

There a number of other AP ROM capabilities, such as KEYLAG, which sets the amount of delay before a key starts repeating its output, and PAGE, which sets the number of lines that are printed on the HP-85 thermal printer before a page break occurs. The owner's manual also includes the listings for three pieces of software—an alpha sort program that uses string arrays, a Shell sort subprogram, and a musical keyboard program that uses key interrupts—available on tape or disc from the Series 80 Users' Library.

The AP ROM offers a variety of programming enhancements to the HP-83/85. You'll find it versatile, useful, and, incidentally, a great deal of fun. ■

ROM/Interface Table

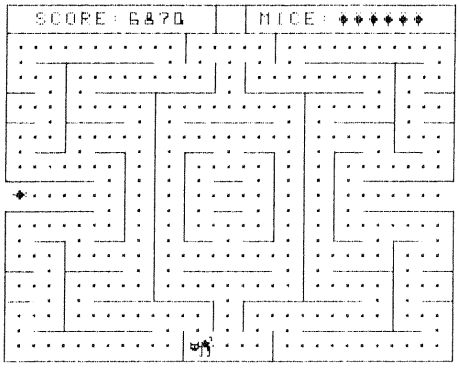
In case you've lost track, here's a complete list of the ROMs and interfaces available for HP Series 80 Personal Computers. With Christmas right around the corner, this is a good "wish-list" to leave on the coffee table. And, don't forget, most of these products are probably tax-deductible! ■

ROM/Interface	Part Number	Price†
Mass Storage ROM	00085-15001	$145
Plotter/Printer ROM	00085-15002	$145
I/O ROM	00085-15003	$295
Matrix ROM	00085-15004	$145
Advanced Programming ROM	00085-15005	$145
Assembler ROM	00085-15007	$295
HP-IB Interface	HP 82937A	$395
Serial Interface	HP 82939A	$395
GPIO Interface	HP 82940A	$495
BCD Interface	HP 82941A	$495
Printer Interface	HP 82949A	$295

The Games II Pac

The **Games II Pac** is clearly a second generation product. The pac authors have pushed the limits of HP Series 80 Personal Computers to achieve some fast, very detailed games. Most of the games in the pac use binary programs. If you want to see what binary programs can do, what kind of speed they can provide, take a look at *BATS*. There are so many things going on and happening so fast, you'll be amazed. The games in the Games II Pac are mostly arcade style, featuring good graphics. You'll notice that the graphics in *DODGE* are done in alpha mode. It uses alpha cursor control to accomplish this feat with the advantage that while there is only one graphics screen, there are four alpha screens.

Here are descriptions of the games.



Fatcat

You control the direction of a mouse in a series of mazes. The object of the game is to have the mouse eat each piece of cheese in the maze without letting the cat, which is constantly aware of the mouse's location, catch him. Each piece of cheese is worth five points. You start the game with three mice. For each maze that you complete, you receive a *bonus* mouse. Your main controls are to turn left or right. An additional capability which you have is to burrow once with each mouse, but only once. Each maze also is set up with a mouse hole on the sides that only the mouse can go through.

The game offers you a variety of skill levels and 35 different mazes to keep you challenged indefinitely. You may also specify whether or not you want sound effects. The sound effects provide you another means of determining how close the cat is to the mouse. The audible tones act much like a Geiger counter.

As an added feature, it is possible, if the timing is perfect, to run between the cat's legs. The consequences of bad timing in this maneuver is the loss of one mouse, so you should be prepared to lose a few mice if you try this. It is worth trying though, if you are trapped in a dead end.

Dodge

This game is an electronic dodge game where you have to work your way through a moving maze. You earn points by moving over targets in the maze. The complexity and the movement of the course are options for you to specify before beginning play. There are three playing fields and 10 levels of barrier density and field motion. A secondary consideration is the time required to remove all of the 100 targets. The strategy is quite simple and is reduced to quick hand-eye coordination.

Ratpak

You are alone, roaming the deserted streets of the city in your ratmobile, when a pack of rabid, hunger-crazed rats pours from the mouth of a filthy alley. Because of an overloaded city budget, your ratmobile is very poorly equipped, to say the least. The ratmobile has no engine, so you must push it along (there's a hole in the floor board for your feet). Because of this, you are in constant danger of being bitten by a rabid rat. Your only weapon is a vintage muzzleloading rifle.

Space Wars

The object of this game is to destroy an invasionary force in a specific amount of time. To accomplish this task, you have two different weapons systems, phasers and photons, and can move relatively freely in the eight-by-eight quadrant space. You must be aware of your energy level and the remaining time for your mission. Energy is used when you fire phasers, move, make repairs, or obtain scans.

The display provides you with most of the information that you need. As you play, you will probably want to keep track of the locations of the starbases and "Lubachs" that you detect using your long-range scan. The quadrant locations of bases and Lubachs are fixed during a game. The sector locations are generated each time you enter a quadrant. During play, you will receive messages about your status on the CRT. You will also be informed of the damage sustained by you and the Lubachs.

Bats

In this game, bat-like objects swoop down and around in various patterns. As they descend, they drop bombs. You have three ships that operate in two modes, conventional and warp. In conventional mode, your ship will be destroyed if it is struck by a bat or a bomb. You can destroy the bats and score points by hitting them with your own shots. There are three different bat-like objects that take from 1 to 4 hits to destroy. You score 10, 50, or 100 points for destroying an object, depending on the required number of shots. In warp mode, you destroy the bats and score points by ramming your ship into them. Your ship is not affected by their missiles when you are in warp mode. You can only be in warp mode for a limited time and once for each ship. Some of the patterns contain a bomber that scatters bombs on its descent. The bomber will only appear once. If you destroy a bomber, you score 200 points. If you lose a ship, the current pattern will be repeated.

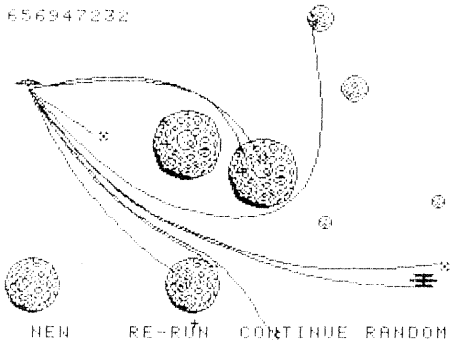
The complexity of the game can be altered by changing the number of bats on the screen. Increasing the number of bats provides more targets and more bombs to be avoided. The combination of these two factors is well balanced. As the number of objects on the CRT is reduced, the remaining objects speed up. As with other games in Games II, the sound effects can be either on or off.

Gnome

GNOME is a game in which you must search through vast caverns in order to find the Gnome's hidden treasure. In this game, you enter a cave and maneuver about by six commands: NORTH, SOUTH, EAST, WEST, UP and DOWN. There are a variety of other commands that can be used for manipulation of objects, etc. A discussion of these manipulative commands is not provided because it is up to you, the treasure-seeker, to determine and initiate the action required to get the treasure and get out safely.

Tank

In this game, you control the turret of a tank that is trying to knock off moving targets on the screen while being fired upon by guns on the left and right. There are 10 skill levels. For every target that you hit, you score five points. For each shot that you fire and miss you lose one point.



Asteroids

This program simulates a sector of space on the graphics screen. The space contains a random arrangement of eight asteroids, each of which has a mass proportional to the cube of its diameter. There is, also, a spaceship in the upper left of the CRT and a space station in the lower right. The object is to launch a supply capsule and cause it to dock at the station. You control the

capsule's initial speed and direction. The initial velocity is proportional to the distance from the cursor to the spaceship. The initial direction is toward the cursor position. After launch, only the asteroids' gravity can change the capsule's path.

Bullpen

The object of this game is to trap from one to three bulls in a bullpen that you create by moving blocks to form a pen around the bull(s). The game ends when either you succeed in containing the bulls or a bull catches you. There are five skill options that change the speed of the bulls. You also have the option of specifying on the screen the number of blocks that you can use to pen the bull(s).

Moon Lander

As pilot of the lunar lander, you are to land successfully on the moon. You control left/right motion and vertical thrust. You start with 500 units of fuel. Each left/right motion uses one unit of fuel. Thrust uses five units. There is also an Abort button that uses 100 units of fuel and should recover you from most high-speed falls.

An audible warning signals when your fuel drops below 100 units and increases in pitch as you deplete remaining fuel. You can land on any flat terrain and, once landed, take off again by applying thrust. Your score depends on the width of the flat spot on which you land —a narrow zone landing is worth more than a wide zone.

Barrage

A barrage of aliens descends on you and you must defend the planet. You can temporarily hide behind barriers, but the aliens will quickly destroy these, so you must keep moving. After you destroy all of the aliens in one wave, another set will appear on the CRT. You get three tanks at the start of the game and an extra tank for each new screen of aliens. Before play begins, you get to select the skill level, type of bombs, and sound option. Smart bombs follow you as you move, and you must take evasive action to avoid them. As you might expect, dumb bombs fall straight down.

Golfer

Holly Pines is a par 35 course for nine holes. Each hole is stored on tape and is loaded and displayed as needed. When you get on the green or very close to the green, the display will be changed to show the green, the pin placement, and your current position. To take a stroke, specify the club, direction, and the strength of the swing. The course of your ball will be shown on the display and then your final position.

This game should test your golfing judgment and sharpen your game. Hopefully, Holly Pines Golf Course will bring you back for many more rounds of golf at the Series 80 Open.

The Games II Pac; part number 00085-13057, is $95.00.† ■

Data Structures and Data Management —Part 1

by Charles L. Pack, Los Altos, California

In this first installment, we'll define some terms associated with data bases and go on to discuss sequential files, indexed sequential files, and random access to sequential (serial) files. In part 2 we'll discuss linked lists, circular buffers, on-line versus batch updating techniques, and backups. Hopefully, when we're done, you'll be able to write programs using file structures that suit your problems. At least you'll be able to appreciate the fine points of data base managers and list managers.

A data base is commonly thought of as a collection of homogeneous data. Some examples of data bases are a personal check register, client accounts receivable, and an auto parts inventory. Data base management is simply the process of controlling the collection, arrangement, and use of a data base. A data base management system (commonly abbreviated DBMS) is a computer program that performs the collection, maintenance, and retrieval of data on a data base.

Suppose you had a client name and address card file with 500 names, each on a 3 x 5 index card. Would you throw the cards in a file box at random, or arrange them neatly in a particular sequence so any given name in the file can be easily found? Now, assume you are a photography buff who just returned from vacation with 600 slides. Would you put them in a big pile in a shoe box, or arrange them in slide trays in order by subject matter or by the place where they were taken? The need to retrieve specific data would, in either instance, dictate the use of a logical, ordered system of access.

Each of the above two cases illustrates the need for proper design and management of a data base. The way a data base is stored and maintained by a computer can have a profound effect on the time it takes to retrieve the required items and the ease and accuracy with which the information is updated. Another important aspect of data base management is the capacity of the media on which the data is recorded. What happens when your index card cabinet gets full—do you throw away some data to make room, or get another cabinet?

At this point let me define some terms. A *volume* is a single unit of media on which data is stored. Examples of volumes are a slide tray, a tape cartridge, and a floppy disc. A *file* is a homogeneous collection of data about a particular subject. Examples of files are a personal Christmas-card list, this article (done on a word processing system), and the latest 300 days of Dow Jones statistics. A *data base* may consist of one or more files. A data base might be analogous to a collection of financial periodicals. A volume might be analogous to a file cabinet drawer. And a file might be a grouping of *The Wall Street Journal*s.

A *record* is a number of data items that make up an element of a file. The data items within a record are called *fields*. For example, a file could be a box containing a number of index cards on which names and addresses are written. The index card would then be analogous to a field on that record. The *sort key* is a field or group of fields on each record that is used to determine the sequence of the records in the file. For example, the name and address file might be sorted in ascending sequence by last name, thus the last name would be the sort key. A *search key* (or just a key) is a field or group of fields that can be used to uniquely identify any individual record in the file.

There are actually two types of records used by a computer. The previous definition refers to a *logical* record, because it is *logically* defined by the applicant that it serves. A *physical* record is a fixed-length record, the length of which is defined by the computer's hardware design. A logical record can occupy any contiguous part of one or more physical records. Normally the concept of a physical record is transparent to the computer user or casual programmer; however, a properly designed data base will make the most efficient use of the available physical record length.

The *structure* of a file embodies the way the file is updated, the way data is retrieved from it, and the way records are defined and organized within it. A file structure can exist in the HP-85 internal memory, on a tape cartridge, or on a flexible disc. A file structure can also embody more than one type of organization or data access at the same time, as we shall see.

Sequential File Organization

A sequential file is simply a group of records written in some particular sequence, one after the other. An example of a sequential file would be a personal checkbook in which checks are written in numerical sequence. The second record cannot be written until the first is written; the third record cannot be written until the second is written; and so on. Adding or deleting a record other than at the end of the file poses a problem, the solution to which depends on the media on which the file is written.

If the entire file is small enough to fit in computer memory, a new record can be inserted by moving all existing records after the insertion point up one record position, and then inserting the new record in the position vacated by the move. (*See diagram 1.*) This is analogous to

A	B	D	E
1	2	3	4

a) Before inserting "C"

A	B	D	D	E
1	2	3	4	5

b) File is "opened up" by moving E to 5 and D to 4 (D still exists at 3)

A	B	C	D	E
1	2	3	4	5

c) C is inserted at 3 (replacing original copy of D)

Diagram 1. Inserting a record into a sequential file.

adding an index card to the name and address file. Conversely, an existing record can be deleted by moving all records after it down one position, thus overwriting the deleted record.

A large file on disc or tape poses a different problem because it is not practical or efficient to open-up the file for record insertion; that would require a lot of searching from one part of the file to another, which would be costly in time and in media wear. The best solution, one not limited by internal memory capacity, would be a sequential batch update.

A batch update is called such because all the update records are collected together in a separate sequential file. The update program then reads the old file one record at a time, merges the old records with the updates, and writes out a new file sequentially, one record at a time. (*See diagram 2.*) Old records are deleted by not copying them onto the new file; corrections are made by matching the corrected update with an old record, copying the corrected record onto the new file, and deleting the old record. The entire update is done all at one time in a batch, without operator intervention. This is opposed to an on-line file update, in which records are processed one at a time by the computer as the data is entered by the operator.

The advantages to sequential file organization are: First, reading and writing is fast because the records are contiguous. Second, relatively little programming effort is required because there is no search for a key. Third, the file can occupy multiple volumes, and records can vary in length. The major disadvantage is the lack of direct access, because to get to any particular record, all records existing before that record must be read first, which can be costly in time. Another disadvantage is that a large file must be updated by the batch method described above. This would be impractical using a single tape cartridge, because of the time it takes to search the tape from one file to another and because of increased media wear. A single disc could be used if the update, old, and new files will fit. But the use of a dual disc system, with the old file and updates on one drive and the new file on the other, would be very desirable and much more efficient.

NEW C	NEW D	DELETE E
1	2	3

a) Update file

A	B	OLD D	E	F
1	2	3	4	5

b) Old master file

A	B	NEW C	NEW D	F
1	2	3	4	5

c) New master file (after update)

Step 1. copy A from old to new
Step 2. copy B from old to new
Step 3. copy C from update to new
Step 4. copy D from update to new
Step 5. read past D on old
Step 6. read past E on old
Step 7. copy F from old to new

Diagram 2. Sequential batch update.

Some examples of appropriate usage for a sequential file are a personal check register, a transaction journal for an accounting system, and a text file, such as this article (the entire file resides in memory, allowing an on-line sequential update).

Indexed Sequential Files

An indexed sequential file is an ordinary sequential file with a special feature that allows direct access to certain records. To do this, a separate index file is created in which each record contains a search key and a corresponding record number. Each search key on the index file exists on one or more contiguous records on the master data file, and each record number is a "pointer" to the first (or only) record that has the corresponding search key. The index file, which is analogous to the table of contents in a book, is usually a small file that can reside in the computer's internal memory. Although there can be one index record for each master data file record, for large files, each index record may "point" to the first of several contiguous master records that represent a particular category of data.

An indexed sequential file is created just like a sequential file. Usually the index file, or table, is created simultaneously because the record number for each record is known at the same time. The index file itself is a simple sequential file. To find a particular record in the master data file, its key is looked up in the index; then the corresponding record number is used to directly access the required record in the master data file. This record might be the first of several contiguous records of a specific category, in which case a sequential search of these records would be a much lesser evil than having to search the entire file sequentially. (*See diagram 3.*)

On the HP-85 an indexed sequential file can be on tape or disc, but would work more efficiently on disc because of the reduced search time between records, which may be logically far apart. An indexed sequential file is more efficient when its records are long compared to those of its index. If the index file is nearly as large as the master data file, the reason for the indexed access method is nullified.

The advantages of the indexed sequential access method are relatively fast access to indexed record groups and very fast sequential access to the whole file. The disadvantages are still that a large sequential file may have to be copied to add or delete records, and more programming effort is required to set up the index file. Also, if the file requires more volumes than the number of disc drives available, repeated changing of discs (or tapes) may be required to access widely separated parts of the file. In this case the file should be broken up into two or more separate parts.

a) Index file, also serves as "chart of accounts"

901 DIVIDENDS	913 INTEREST	984 GAIN-LOSS
1	3	5

901 3-26-81	901 6-25-81	913 1-1-81	913 7-1-81	984 7-31-81
1	2	3	4	5

b) Transaction file (in order by transaction date within each account)

Diagram 3. Indexed sequential data base.

An example of an application for an indexed sequential file would be a general ledger data base. The data would be organized by category (assets, liabilities, etc.) and account number, with each account having one or more transactions. The index file would have one record for each account number; transactions within each account would not need index entries because they would be accessed in sequential order to compute the balance of the account. Furthermore, the index file could, with the addition of a couple of extra fields, double as the chart of accounts!

Random Access To Sequential Files

There are ways in which individual records in a sequential file can be accessed at random. The search key must be known and must match that of an existing record. One way is to use the indexed sequential access method described previously, except an index record must exist for every master file record. First, find the search key in the index, then use the corresponding record number to directly access the master record. The problem is, the bigger the master file gets, the bigger the index gets, and looking up the required key takes longer and longer. Therefore, this method works poorly for large files.

A way to get around this problem is to eliminate the index file and calculate the record number directly from the search key. This technique employs what are known as "hash codes." There are a number of mathematical algorithms available for this purpose, but a discussion of these algorithms is beyond the scope of this article. The reader who wishes to pursue this further may consult a good reference such as one by Donald Knuth.

The advantages to this method are rapid random access to individual records while retaining rapid sequential access, and the ability to access the master file using differently defined search keys. For example, a client name and address file could be accessed by either last name or zip code. One disadvantage is that if all records in the master file are to be accessed non-sequentially, processing time would be increased because of the time required to search between records that are logically far apart (especially on a tape file). In that case it might be better to sort the records in the required sequence and use straight sequential access. Another disadvantage is the extra programming effort for calculating hash codes. Furthermore, care must be taken to minimize the possibility of calculating the wrong record number.

An example of a use for a sequential file with random access would be an inventory file with one record for each stock number. Inventory status reports could be prepared by accessing the file sequentially. Yet, an operator could, interactively, find out the status of a particular stock number by using a program that can randomly access the file.

(Mr. Pack is a software consultant with 11 years of business programming experience on IBM 370-type equipment and 5 years experience on personal computer systems. His current line of work is business programming for stock market analysis, investment analysis, and other accounting applications. He also does free-lance writing in the computer fields. His is the first of hopefully many user-contributed articles to appear in *BASIC EXCHANGE*—Ed.) ■

Accounting Software for HP Series 80 Systems

Now, in addition to doing analysis and other computational tasks, you can keep complete business records on your HP Series 80 system with new accounting software. All functions necessary for small business accounting—general ledger, accounts receivable, accounts payable, job costing, and payroll—are available with pacs offered by several HP Series 80 software suppliers and sold through HP dealers. So an HP-85 or HP-83 being used for other jobs can double as an accounting machine with the addition of easy-to-use software.

HP Series 80 software suppliers offering accounting programs are **Golden State Business Systems, Business Software Inc., Northwest Software Inc., Profit Management Systems**, and **Racing Services Inc.** All these companies have met HP's standards for professionalism, documentation, and customer support.

Golden State Business Systems, supplier of one of the most complete and easy-to-use accounting software pacs, provides excellent documentation and support. Its "The Accounts Journal (TAJ)"* software comes with an extensive manual that explains and gives examples of all the English commands the programs recognize and all the reports that can be printed. And phone and mail consulting are offered to TAJ owners.

TAJ's most important feature is the integration of all four journals: general ledger, accounts receivable, accounts payable, and payroll are all stored on the same disc, so when a transaction is entered, all relevant journals are updated. Other accounting software requires the user to enter the transaction into one journal, and then change storage media and enter it again for other journals. The multiple-entry mode means that entries may be miskeyed, resulting in the books being out of balance. TAJ can never be out of balance.

The English command structure of TAJ makes it very easy to learn. Because the commands are all English words (such as "LIST"), little training is needed. (Most accounting packages for other personal computers are driven by complex menus requiring multiple inputs and commands.)

TAJ was designed to match the way small businesses already conduct accounting, so most users will have to make only minor changes in accounting procedures to use the software. For instance, TAJ provides all of the reports a small business needs for consistent, well-presented financial statements and analyses.

Accounts and employee information can be printed on the HP-85's internal printer, but an external printer, such as the HP 82905A, is required for standard financial reports. A single or dual disc drive, a 16K Memory Module, and a Mass Storage ROM and Plotter/Printer ROM are required to run TAJ.

There are many other suppliers providing quality software, documentation, and support. The number of packages available (more than 50 now) is increasing rapidly, letting HP Series 80 owners extend their computing capabilities into fields such as real estate investment analysis, and civil, electrical, and chemical engineering.

The Real Estate Investment Analysis Pac offered by **The Palmer Berge Company** is one of the best on the market and features an easy-to-use approach to four major types of real estate analysis: income property, raw land, leasing, and exchange.

Your authorized HP personal computer dealer can show you more about all the solutions provided by HP Series 80 software suppliers. For the location of the dealer nearest you, phone, toll-free, (800) 547-3400. In Alaska, Hawaii, and Oregon, call (503) 758-1010.

TTY users with hearing or speech impairments, please dial (503) 758-5566.

The *Series 80 Software Catalog*

The latest update to the *Series 80 Software Catalog* was distributed in early November. There are 53 new contributed programs included in the update. Also included are 25 new packages available from Series 80 Software Suppliers. Among them are some valuable technical and business solutions, including chemical, civil, and electrical engineering packages, as well as the real estate and accounting software discussed above. ■

* *"The Accounts Journal" and "TAJ" are trademarks of Production Data Systems, Sacramento, CA.*

Questions & Answers

Q. Program Transportability?

A. In order to load a program, you must have the same ROM configuration as the system on which the program was developed. If the same ROMs aren't present, the loading process will abort the first time a BASIC statement that requires a missing ROM is encountered. What may be confusing is that the statement may look from the program listing like a mainframe statement. Here's what's happening. Some mainframe statements and ROM statements *are* identical. When the program is translated from BASIC syntax into machine code, the ROMs have first crack—if one of the ROMs recognizes a BASIC keyword, that program line will specify the code contained in the ROM for use when the program is running, not the code in the operating system ROMs.

Binary programs can also "hook" themselves into a program this way. In fact they have the highest priority of all. If a binary program uses a key word that is identical to one supported by a ROM or the operating system, its code will be executed, not the ROM's or the operating system's. This allows you to completely redefine or take over the operating system.

The phenomenon works the other way too. If, for example, you have a program that was written without a Mass Storage ROM and you want to use disc storage instead of tape, just plugging the Mass Storage ROM in won't do it. You must first translate the program. The `TRANSLATE` command is provided by the Mass Storage ROM and simply tells the system to use the Mass Storage ROM storage and retrieval statements rather than the corresponding mainframe statements.

The `UNTRANSLATE` statement provided by the binary utility program "*UNTRAN*" (Catalog No. 900-0009) performs the opposite function. If a program was written with an optional ROM plugged in, `UNTRANSLATE` translates ROM program statements into program statements that are compatible with the mainframe.

It is up to the supplier to untranslate his programs, because using "*UNTRAN*" requires the ROMs in question to be present. Another solution is for the supplier to, rather than store his program, save it as an ASCII data file using the `OSAV` command provided by the binary utility program "*DGETSAV*" (Catalog No. 900-0022). The user can convert the data file to a BASIC program with statements compatible with the mainframe using the corresponding `OGET` command. Any statements not understood because of a missing ROM are commented out (!), making the user aware of the problem. The missing ROMs can be identified and obtained or the program modified to run without the ROM.

Q. String Manipulations?

A. **J. H. Randall**, of Stellenbosch, South Africa, offers the following tips for working with strings: "There are two aspects to setting a string to zero. Unlike `V=0`, the effect of `Q$=""` is only to set the length of `Q$` to zero. Two alternative methods for blanking out a string are `Q$,Q$[2]=""` and `Q$[2],Q$=""`. The first statement leaves the length of `Q$` at 1 while the second causes the length to be the dimensioned length of `Q$`. If it is necessary to set the length of the string, use `"Q$[1,L]"` for `"Q$"`, in which L is the desired length, in conjunction with the second statement.

Joe Pehoushek of Cincinnati, Ohio, suggests another variation of concatenating long strings using substring notation to avoid a memory overflow: `A = LEN(A$) @ B = LEN (B$) @ A$[A+1,A+B] = B$.`

Q. Efficient Tape Use?

A. A tape cartridge has two tape tracks with a variable number of records available in consecutively numbered files on each track. The first file on track A and the first file on track B are both at the same end of the tape. This can cause a situation in which one file spans two tracks, making access to this file both time-consuming and wearing to the tape. When this happens, it is a good idea to first label the file spanning both tracks as a dummy and then store the program or data again, using the following procedure:

```
LOAD "filename"
RENAME "filename" TO "DUMMY"
STORE "filename"
```

The file named *DUMMY* will then span both tracks and will not be accessed. However, the `STORE` command causes the same program or data to be stored under the desired file name on the second track immediately after the end of file *DUMMY*. Now, when accessing the program or data material in this file, the time loss and additional wear to the tape cartridge caused by running back and forth between tape tracks is avoided.

Q. More Columns per Line?

A. You'll find the table below useful if you want to change the number of columns the HP 82905A Printer prints on a line. The table assumes that the HP-IB Interface select code is 7 and that the address of the printer is 01.

If you want to print:	Then enter:
40 columns per line	`PRINTER IS 701,40` `PRINT CHR$(14)&"string"`
48 columns per line	`PRINTER IS 701,48` `PRINT CHR$(27)&"M"&CHR$(14)&"string"`
66 columns per line	`PRINTER IS 701,66` `PRINT CHR$(15)&CHR$(14)&"string"`
80 columns per line	`PRINTER IS 701,80` `PRINT "string"`
96 columns per line	`PRINTER IS 701,96` `PRINT CHR$(27)&"Mstring"`
132 columns per line	`PRINTER IS 701,132` `PRINT CHR$(15)&"string"`

Q. RAM Stolen?

A. The number of bytes of RAM reserved by the enhancement ROMs for their own use are given in the table below:

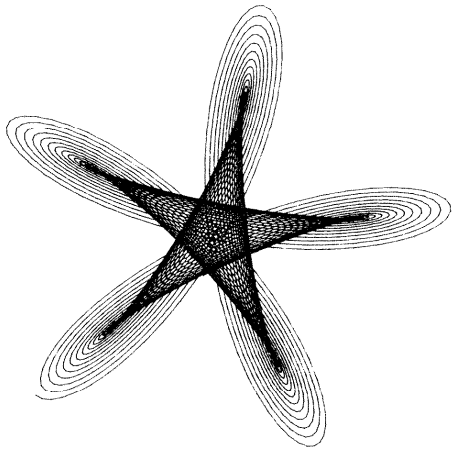
Plotter/Printer (alone)	373
Input/Output (alone)	416
Plotter/Printer and Input/Output	556
Mass Storage	150
Matrix	69
Assembler	124
Advanced Programming	91

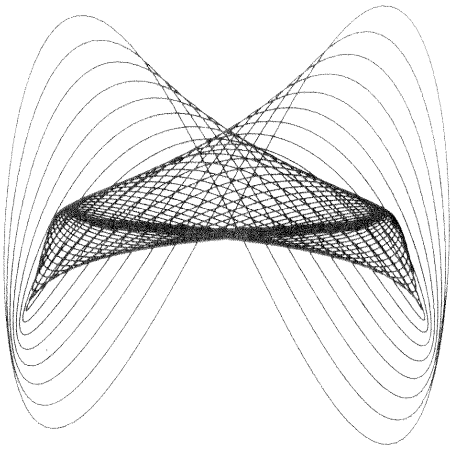
Q. *SOURCE COMM* and Dow Jones?

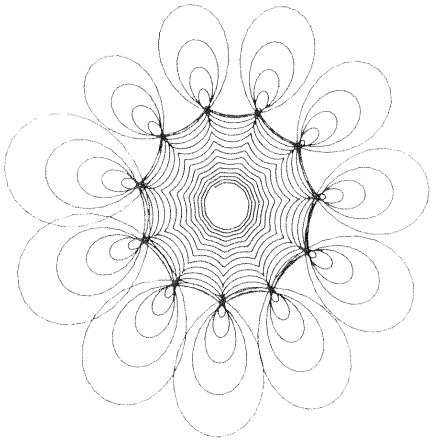
A. The *SOURCE COMM* program in the Users' Library (Catalog No. 900-0044) also works with the **Dow Jones News/Retrieval Service** and **Compuserve**. The log-on procedure is slightly different if you use **TYMENET** instead of **TELENET**; if you aren't able to get the auto-log-on feature of *SOURCE COMM* working, just delete lines 550 through 630 and log on by hand. Look for a feature article about the **Dow Jones News/Retrieval Service** in the next issue! ■

The Pendulum Swings

What do all these designs have in common? They're all solutions of the equation that describes the harmonic oscillation of a conical pendulum. The equation is x'' + 2px' + (p**2+w**2)x = 0. It has the solution x = (e**(−p))*(Bsin(wt) + Ccos(wt)).



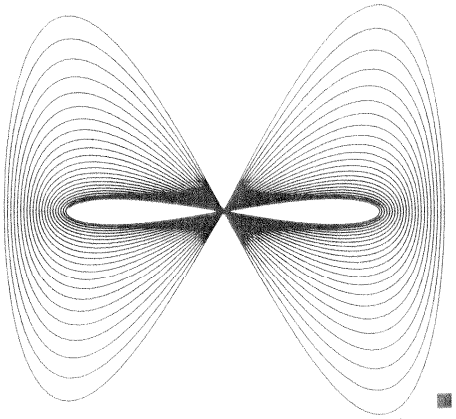




Eugene Hungate of Elkhart, Indiana, sent the first pattern. Then, while walking through the lab, I spied the other designs on **Tom Houser's** bookshelf. I was surprised to learn that they were all generated with the same program (below) using different coefficients. The variety of patterns is endless; these were generated using the following coefficients:

.4. 1. 1.4, −1.5, 1.4, 1.5, −1.4, 1.5, 1.4, 1.5, 2, 3
.25, 2, 4, 0, 0, 0, 0, 4, 0, 0, 1, 2.03
1, 3, 2, −1, 2, 1, 2, −1, −2, −1, .5, 5
.25, 2, 4, 0, 0, 0, 0, 4, 0, 0, 1, 2

```
 10 DISP "A1,A2,B1,B2,C1,C2,D1,D
    2,E1,E2,F1,F2"
 20 INPUT A1,A2,B1,B2,C1,C2,D1,D
    2,E1,E2,F1,F2
 30 GCLEAR
 40 F=0
 50 SCALE 0,1000,1,1000
 60 FOR T=0 TO 200 STEP .05
 70 R1=100*EXP(-A1*.01*T)
 80 R2=100*EXP(-A2*.01*T)
 90 S1=R1*SIN(F1*T)
100 S2=R2*SIN(F2*T)
110 T1=R1*COS(F1*T)
120 T2=R2*COS(F2*T)
130 X=511+B1*S1+B2*S2+C1*T1+C2*T
    2
140 Y=511+D1*S1+D2*S2+E1*T1+E2*T
    2
150 IF NOT F THEN F=1 @ MOVE X,Y
     @ GOTO 170
160 DRAW X,Y
170 NEXT T
180 END
```



Personal Data Communications —Part 2

by Curtis Adams, Editor

In part 1 we talked about networking in general and using data bases in particular. If that three-page article can be summarized, it's by a thought that appeared in the October, 1981, issue of *Omni*[1] in an article by physicist **Lewis Branscomb.** "What can a medium that is selectively accessible under computer control do for us? The new electronic media have the capability to individualize information, to make the acquisition of knowledge a matter of private choice. The notion of user-controlled selectivity is not new. There has always been an audience that demanded information of a specific nature, to be delivered according to individual choice from a large aggregate of knowledge. The system that has provided that service for 3,000 years is called a library.

"Electronics has shrunk that library's archives dramatically and has extended its reading room to all the people within reach of antennas, cables, or fibers. It has also reduced the cost of storage so that in the future large parts of the library can be replicated economically at the user's location. But the most revolutionary change of all is the reduction in time from book stacks to retrieval. The electronic book stacks can be searched with the speed of light."

Here in part 2 we'll look at the other half of what the computer network medium provides—electonics mail and computer conferencing. Electronic mail is discussed later from a very practical standpoint, as it is implemented on **The Source**. We'll talk about computer conferencing more generically here. Keep in mind that, procedurally, computer conferencing is the same as electronic mail, with the addresses being the conference participants.

A complete treatment of computer conferencing is given in *The Network Nation*[2], including an interesting history of how it developed. Originally it was modeled after face-to-face conferences, complete with a chairman who assigned the floor to a "speaker." It was soon learned, though, that this medium doesn't require a floor, because people can enter text simultaneously. This property also makes it possible for multiple streams of thought to form and flow in parallel, with some people following the main stream, others following a new branch, and many following both.

This is possible because computer conferencing not only implies remote in space but also remote in time. That is, computer conferencing doesn't have to occur in real time. Members can do their writing when they have the

opportunity, follow what has transpired on their own time, and reply to or address whatever they want. Non-real-time computer conferencing also gets around the usual problems involved in arranging a meeting time for a group of busy people, even people in different time zones around the world.

Art Kleiner, in a paper[3] presented at WESCON last year, warned that computer conferencing is not only effective but addictive, with addicts signing on at least several times a day ("maybe something is writing"), irritated when the system is inaccessible, reluctant to compose thoughts and write offline, reluctant to conduct collegial relationships offline, "signing on just one more time" before going to sleep, and dreaming about the network. Kleiner has hypothesized why some are susceptible to becoming addicts:

"Computer conferencing provides a continuous, content-rich stream of useful INFORMATION. Traditionally, people who receive a lot of information receive it in chunks: conferences, seminars, journals, papers, magazines, books, correspondence, and occasional conversations. Users of computer networks, on the other hand, receive a steady stream of information, directed specifically at their interest, and often referred their way by peers or colleagues.

"People who enter computer networks to keep contact with a small circle of people often find their CONNECTIVITY expanding exponentially after a brief time on the system. Continuous participation intensifies relationships, new contacts proliferate, individuals become members of new networks or subnetworks, and linkages are formed with diverse people whom the user might meet no other way. Those who find their horizons expanded suddenly may become addicted to the increasingly diverse and rich conversation they find through this medium.

"Typically, people who work with paper (writers, managers, scientists for a few) must spend hours dealing with the DRUDGERY of communications. Computer networks, which incorporate electronic mail, message systems, word processing, and automatic documentation of experiments between people, make the work much easier. Addicts are often people who have become impatient with their 'normal' typewriter, which doesn't backspace to correct errors or pick up the mail on its own.

"In conventional media we send many messages through many channels, but only in the best of relationships are we guaranteed full FEEDBACK in return. Computer networks and conferencing systems offer instantaneous response: a notification by the system when someone receives a message, and in many cases a much quicker reply from the participant. People who like to see ideas blossom quickly among a group, or who feel good when others reply quickly to their messages, get spoiled by the first response they get using the system.

"Computer conferencing is a verbal medium, which often allows for ANONYMITY: both the functional anonymity of communicating without nonverbal cues, and deliberate anonymity on occasion when a user's identity is deliberately masked. To varying extents, these forms of anonymity lead to the judgement of ideas uncolored by prior judgement of the people who generate them. This reverses conventional processes where people often tend to judge first the person and then the ideas. Many addicts find this new type of freedom to be judged by their ideas alone at first refreshing and later indispensible."

Such, very generally, are the dynamics of computer conferencing. Now let's get very specific and examine electronic mail as it is implemented on **The Source.**

In addition to your present circle of friends and associates, you can find others to "talk" to on **The Source** by reading or posting a message on the BULLETIN-BOARD or by looking through a data base called DISEARCH, which contains information users enter about themselves.

During prime time, connect time on **The Source** costs $18 an hour. Between 6:00 p.m. and midnight it costs $5.75 an hour, and from midnight to 7:00 a.m. (and all day on weekends and holidays) it costs $4.25 an hour. Transferring information at 300 baud corresponds to about six words per second, so depending on when you send your mail and the length of the message, it can be more or less economical.

The Source also has 1200-baud lines to make transferring large volumes of information more economical. You're charged for the time it takes you to send your message over the network, and the recipient is charged for the time it takes him to display the message. Network transmission is free within the continental United States, but elsewhere in the world there's an additional charge.

What do you get for your money? Source mail includes automatic filing, retrieval, and forwarding of mail. Filing and retrieval can be done by key words as well as by date, subject, and name. The system also has full text editing capabilities, allowing you to add to or modify your text. **The Source**'s electronic mail system also provides for multiple distribution, and provides you with a scanning capability when reading mail.

```
     To:  TCX248
   From:  TCX248                  Pos
ted:  Mon  14-Sep-81  17:04  Sys
 12  (12)
Subject:          WELCOME
--More--
Hi, just wanted to keep in
touch.  A couple of people have
reported problems with a "MODEM
CARRIER LOST" error.  Delete
lines 500 and 1550 of SOURCE
COMM and the problem won't
occur.  If you discover any
other bugs, please let me know.


     To:  TCX248
   From:  TCX809                  Pos
ted:  Mon  21-Sep-81  2:10  Sys
12  (19)
Subject:  SALUTATIONS
--More--
HI CURTIS,
THANKS FOR THE FRIDAY PHONE CALL
S AND SOURCE COMM LINE 500--1550
 DELETION INFO.
IN ALL OTHER RESPECTS THE HP-85/
82905A COMBINATION IS PERFORMING
VERY WELL.
WILL TRY THE OTHER SYSTEM NETWOR
KS TOMORROW NIGHT.  YOU WERE RIG
HT----
COMMUNICATIONS VIA THE HP-85 IS
G R E A T.
REGARDS,
MAXIMILIAN
```

Source mail is one of the three most popular features on The Source. The concept is well thought out. What follows is an overview that will give you an idea of the versatility and power this medium can provide.

When sending mail, you are prompted "To:", "Subject:", and "Text:". In response to "To:" you may specify an address or a file containing a list of addresses. Similarly, in response to "Text:" you can enter the text or specify the name of a previously created, edited, and stored file. Then type ".SEND" and the letter is sent instantly. If you send the letter express, "EXPRESS MAIL CALL" instantly flashes on the addressee's screen and the letter goes to the top of his stack instead of the bottom. You will be advised when your addressee reads it if you send it "AR" (acknowledgement requested). You can send a letter "for so-and-so's-eyes-only" by requiring a password before the letter can be read. You can even use the system clock to deliver mail on a specified date and time.

That just about covers sending mail. What kind of creative things can be done with reading mail? When presenting mail, the display shows who it is from, when it was sent, the subject, and then pauses. At that point, you can either read the letter or go on to the next one. The latter is similar to scanning mail, but if you're serious about scanning, there is more power in the SCAN command. For example, you can scan by sender (if you're expecting something from so-and-so) or scan by subject, with up to two key words that can be AND'ed or OR'ed.

Back to creative dispositions when reading mail: you can REPLY to the letter, read it again, delete it from your mailbox, or save it in a file. You can even forward the letter along with your reply or comments. There's more, but hopefully this is enough to give you an idea of the capabilities inherent in electronic mail.

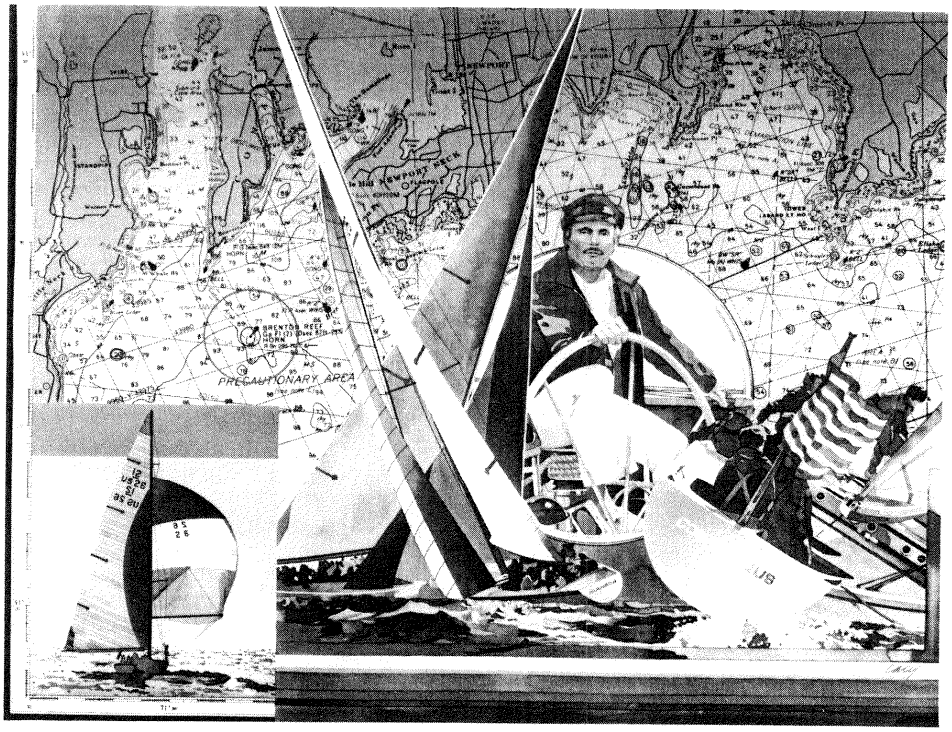
If you want to send me some mail, my Source address is **TCX248**. The hardware you'll need in addition to your HP Series 80 Personal Computer includes the HP 82939A Serial Interface (option 001), the I/O ROM, and any of the commercially available Bell-103-compatible modems. You can get the necessary software from the Users' Library—just order the *SOURCE COMM* package at the special price of $30.00 plus media cost, $18.00 for tape, $8.00 for disc (or $14.00 for tape, $6.00 for disc for Series 80 Users' Library members).[1]

What's next? Coming in the next issue—a feature article on the **Dow Jones News/Retrieval Service**. Also, some special announcements! ■

1. Copyright 1981 by OMNI Publications International, Ltd. *and reprinted with permission of the copyright owner.*

2. Hiltz, Starr Roxanne and Turoff, Murray. The Network Nation. *Reading, Massachusetts: Addison-Wesley 1978.*

3. Excerpts from NCC '80 Personal Computing Digest *are reprinted with permission of the publisher, AFIPS Press; Box 9657; Arlington, Virginia 22209; U.S.A.*



Tenth Anniversary Calendar

Yes, 10 years have passed since Hewlett-Packard introduced the famous HP-35. To celebrate this anniversary, we are producing a Hewlett-Packard Personal Computing Products Tenth Anniversary Calandar.

Hewlett-Packard has commissioned **Michael Cacy** to create 12 original scenes that depict unusual events and places in which HP Personal Computing Products have been used. Among the events selected for the calendar are: on-board the space shuttle *Columbia*; across the Atlantic Ocean in a balloon; in the pits at a Grand Prix race; and winning the America's Cup race, twice.

Opened, the calendar measures 45.7 by 76.2 cm, and the scenes are illustrated in full color, using mixed media. It's a real beauty. To order one, send your name, address, and payment to:

HP CALENDAR
Attn: Darlene Johnson
Hewlett-Packard Company
1000 N.E. Circle Blvd.
Corvallis, OR 97330 U.S.A.

The purchase price is $5.00+ postpaid in the United States and $8.50+ postpaid elsewhere. All overseas orders will be sent by air mail. You should allow 4 to 6 weeks for delivery. ■

Take Your HP-85 To Sea

If you'ld like to sail through the South Seas but just can't imagine getting away for that long, maybe you can! Communications technology is already to the point where sailors armed with an HP Series 80 Personal Computer and The Source can have daily mailcall.

COMSAT General Corporation of Washington, DC, presently operates three satellites in geosynchronous orbit in support of their MARISAT (Maritime Satellite Communications) service. The MARISAT satellites provide instant interactive communications with shoreside computer networks and databases. This global maritime communications system allows ships at sea to dial any telephone number in the United States at a charge of $10 a minute with a 3-minute minimum. Further land transmission charges away from receptor dishes are added on to the

tolls when communications come down to earth and start to travel beyond prescribed major land areas.

Thomas McCarthy at COMSAT Maritime Services points out that "ships at sea, in relatively isolated circumstances for prolonged periods of time, can now communicate anywhere for more than urgent data exchange about supplies and logistics. They can have a daily mailcall, for example, maintaining communication bonds with families and friends through The Source. The MARISAT communications toll set at $10 a minute is most reasonable for the global telephone access capability; adding on 25 cents a minute for prime time access to The Source is really negligible."

Jean-Michel Cousteau likes it. "We have had MARISAT on board the *Calypso* for 1 1/2 years, and it has changed our life on board ship. It has enabled us to keep in contact with the Cousteau Society as well as scientific organizations even in the most difficult of sea conditions." ■

Excerpts from SOURCEWORLD *magazine, Volume 2, Issue 2, are reprinted by permission.* SOURCEWORLD *is published by* THE SOURCE (SM), *a subsidiary of* ***The Reader's Digest Association, Inc.***

The Last Word on Sorting?

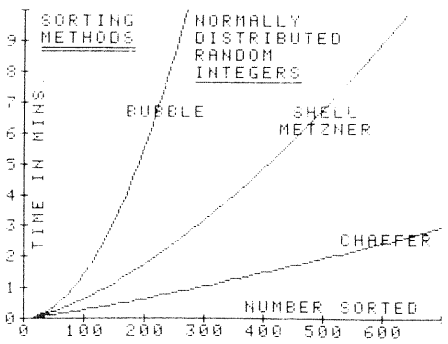
Ever since we published the first article on sorting, better and better routines have surfaced. One of the consequences of publishing problems together with possible solutions in *BASIC EXCHANGE* is that it provides a focus that yields significantly better solutions.

Two inputs in this third iteration come to us from Europe. It takes longer to exchange information between Oregon, Germany, and England, but the Europeans' contribution was worth waiting for.

Let's consider first an algorithm known as "Quicksort". **Christopher Sandy** of Berlin, West Germany, sent in the BASIC version listed below.

```
 10 OPTION BASE 0
 20 DIM A(1001),S(7,2)
 30 DISP "HOW MANY NUMBERS";
 40 INPUT N
 50 FOR I=1 TO N
 60 A(I)=RND*1000
 70 NEXT I
 80 T1=TIME
 90 Q=INT(LOG(N)/LOG(2))+2
100 A(0)=-INF @ A(N+1)=INF
110 L=1 @ R=N @ T=0
120 IF R-L<=0 THEN 310
130 I=L @ J=R
140 M=INT((L+R)/2+.5)
150 K=A(M)
160 A(M)=A(L)
170 GOTO 190
180 J=J-1
190 IF K<A(J) THEN 180
200 IF J<=I THEN A(I)=K @ GOTO 3
    00
210 A(I)=A(J)
220 I=I+1
230 GOTO 250
240 I=I+1
250 IF A(I)<K THEN 240
260 IF J<=I THEN A(J)=K @ I=J @
    GOTO 300
270 A(J)=A(I)
280 J=J-1
290 GOTO 190
300 IF R-I>=I-L THEN 410 ELSE 46
    0
310 FOR J=L+1 TO R+1
320 I=J-1
330 K=A(J)
340 IF K>=A(I) THEN 380
350 A(I+1)=A(I)
360 I=I-1
370 IF I>0 THEN 340
380 A(I+1)=K
390 NEXT J
400 IF T#0 THEN 510 ELSE 550
410 T=T+1
420 S(T,1)=I+1
430 S(T,2)=R
440 R=I-1
450 GOTO 120
460 T=T+1
470 S(T,1)=L
480 S(T,2)=I-1
490 L=I+1
500 GOTO 120
510 L=S(T,1)
520 R=S(T,2)
530 T=T-1
540 GOTO 120
550 T2=TIME
560 PRINT "SORTING TIME WAS";(T2
    -T1)/60;"MINUTES FOR";N;"RAN
    DOM NUMBERS."
570 FOR I=1 TO N
580 DISP A(I)
590 NEXT I
600 END
```

Mr. R. Chaffer of North Yorkshire, England, wrote a similar program and used his HP-85 to analyze his program's performance and produce the graph you see here.



Mike Boich here at Hewlett-Packard is well versed in sorting algorithms and had the following comments to share.

"Quicksort was invented by **Charles Anthony Richard Hoare**, now a professor at Oxford University. Interestingly, Hoare was employed as a programmer by a computer firm in England and was charged with the task of implementing the newly invented Shellsort when he invented his faster algorithm.

"The algorithm appears to deserve its rather immodest name. The program submitted by **Christopher Sandy** sorted 1000 random numbers in just over 3 minutes, compared to 14.27 minutes for the Shellsort featured in the Spring 1981 *BASIC EXCHANGE* (V2N1).

"The performance advantage of Quicksort should become even more obvious for larger arrays, since its average time to sort grows more slowly than that of most other algorithms. The chart submitted by **Mr. R. Chaffer** illustrates this nicely. The literature of computer science (D.E. Knuth, The Art of Computer Programming, Vol. 3), reveals that, on the average, Quicksort requires a time proportional to N*log(N), while Shell-Metzner requires a time proportional to $N^{(3/2)}$, and Bubblesort, a time proportional to N^2.

"Why not just use Quicksort everywhere then? Glad you asked! The formulae noted above report rates of growth, not absolute quantities. For smaller arrays, the 'overhead' of Quicksort may actually render it slower than a simpler method such as Shell-Metzner. In fact, most implementations of Quicksort utilize a simpler sort for dealing with partitions of less than some predetermined size. Also, the most common implementation of Quicksort has the interesting property that its worst case occurs when the data to be sorted is already in order! Thus, Quicksort may not be appropriate for data that is only slightly out of order".

That leads us to Heapsort. You'll recall that in the Spring 1981 issue I mentioned it but said its execution times were slow. Well, **Richard Falk** of Berkeley, California, has submitted a version (below) optimized for HP Series 80 Personal Computers, together with some informative words. "Heapsort is one of only a few sorts where the worst-case sort is not much slower than the average case. I have found that for the enclosed modified version, the time for sorting N numbers (N>20) is .0528N*logN + .073N seconds. In fact, Heapsort is faster than the Shell-Metzner sort and even faster than Quicksort, though I believe that if one were sorting more than 1000 records, the theoretical order of Quicksort, Shell-Metzner, Heapsort would emerge.

```
 10 OPTION BASE 1
 20 DIM A(1000)
 30 DISP "HOW MANY NUMBERS (MAX=
    1000)";
 40 INPUT N
 60 RANDOMIZE
 70 FOR I=1 TO N
 80 A(I)=IP(100*RND+1)
 90 NEXT I
100 Z1=TIME
110 N1=N
120 FOR L=N\2 TO 1 STEP -1
130 A=A(L)
```

```
140 GOSUB 230
150 NEXT L
160 L=1 @ A=A(N1) @ A(N1)=A(1)
170 FOR N1=N-1 TO 2 STEP -1
180 GOSUB 230
190 A=A(N1) @ A(N1)=A(1)
200 NEXT N1
210 A(1)=A
220 GOTO 320
230 J=L
240 I=J @ J=J+J
250 IF J<N1 THEN 280
260 IF J>N1 THEN 300
270 GOTO 290
280 IF A(J)<A(J+1) THEN J=J+1
290 IF A<A(J) THEN A(I)=A(J) @ G
    OTO 240
300 A(I)=A
310 RETURN
320 Z2=TIME
330 Z3=(Z2-Z1)/60
340 FOR I=1 TO N
342 DISP A(I)
344 NEXT I
350 PRINT
360 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR";N;"RANDOM NUMB
    ERS USING HEAPSORT."
370 END
```

■

What Is Computer Graphics? —Part 2

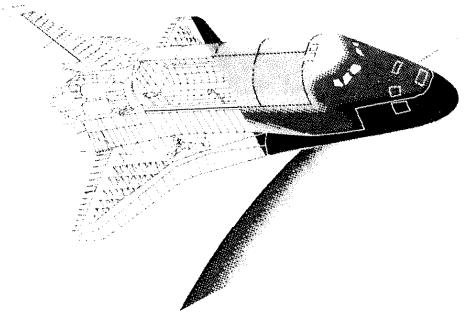
by Craig Schmidt, Product Marketing Engineer and Virginia Pollack, Senior Technical Writer Hewlett-Packard, San Diego Division

This is the second in a four-part series of articles written to familiarize you with computer graphics. In the first article we reviewed the history of computer graphics and then defined the similarities and differences between vector and raster graphics devices. In this article we will look into the use of computer graphics, good graphics form, line graphs, bar graphs, and pie charts.

Uses of Computer Graphics

The field of computer graphics is growing at the rate of 25 percent per year (measured in sales $s). This growth can also be seen in the increasing number and kinds of graphics systems available, the number of installations using graphics and the variety of applications that have developed. Applications of computer graphics are sometimes broken down into two classifications. One is data display or data presentation graphics; the other is design and image graphics.

Data display graphics provide symbolic representation of numerical data. This data can be from scientific investigation, industrial monitoring and testing, or management statistics. Most of Hewlett-Packard's graphics customers use graphics for data display applications. The common forms of display graphics are bar graphs, line graphs and pie charts. Such graphics are designed for human appeal and clarity.



Design graphics, on the other hand, represent actual physical or geographical data. The form of the graphics depends entirely on the application. Generally speaking, design graphics require higher resolution devices than data display graphics and have a high degree of interactiveness. Design graphics include computer-aided design (CAD), computer-aided manufacturing (CAM), image processing, and mapping. Historically, the first computer graphics users fell under the design category and used graphics in military and computer-aided design applications. CAD has now spread well beyond the automotive and aircraft industries where it had its beginnings. Design graphics play an important part in the manufacture of printed-circuit boards, and in electronic design. Other design applications include apparel graphics (pattern and fabric cutting), structural engineering (finite element analysis), and mechanical drafting.

Another group of design graphics applications can be classified as image processing. Image processing started with the analysis of satellite photos. Computer-aided tomography (CAT) is a recent addition to the list of image processing applications. Closely related to image processing is mapping. Mapping includes construction of maps from census data, maps for business planning (store locations and demographics), surveying and civil engineering maps, and maps to monitor utilities and natural resources. As you can see, the uses of computer graphics are varied and widespread.

Good Graphic Form

In the previous section we divided computer graphics into two types: design graphics, which are used interactively to create pictures; and data display graphics, which usually produce graphs from stored data. In this section we will discuss the three common types of graphs used in data display graphics: line graphs, bar graphs, and pie charts. The object is to give you (including you mathophobics) some insight into the variety of graphs than can be created to convey numerical information, and to give you some principles of good graphic form. Please do not be concerned, at this point in time, that you do not know enough about graphic programming to write the program to actually draw the graph. Just try to understand each form so you can judge which one is best suited to a particular application and what makes the form effective.

What is good graphics form? There is no easy answer. From graphics, the viewer should gain some information about mathematical or numerical relationships between data. To measure the success of a graphic presentation, you would need to test whether the information was correctly conveyed in less time than could have been done verbally or in text.

In designing a graph you need to consider the nature of the data, the medium of presentation (CRT, slides, paper, in color or black and white), the purpose of the chart, the audience (size and type), and the time available for preparation and presentation. Some of these concerns are more important than others. The ideas presented here are not absolutes; they are suggestions, not limitations. The only absolute you need remember is this: if your graphics convey your idea with speed and accuracy, they are "good" graphics.

Line Graphs

Let us first consider the line graph. Line graphs are used in both business and scientific applications. The points in a data set are connected, in order, by a single line, sometimes curved and sometimes straight. More than one set of data points can be represented on a single graph, with each line differentiated by color or line type (dotted, dashed or solid). While line graphs usually have linearly scaled perpendicular axes, one or both axes may be scaled logarithmically. These graphs are called semi-log and log-log graphs, respectively. Logarithmic scaling is used where data extends over a wide range of values and appears most frequently in scientific, as opposed to business, applications. A line chart is frequently used to plot some variable versus time; the X-axis usually denotes time. Other uses of line charts include frequency distributions and any charts where data is a function of two variables.

Figure 1

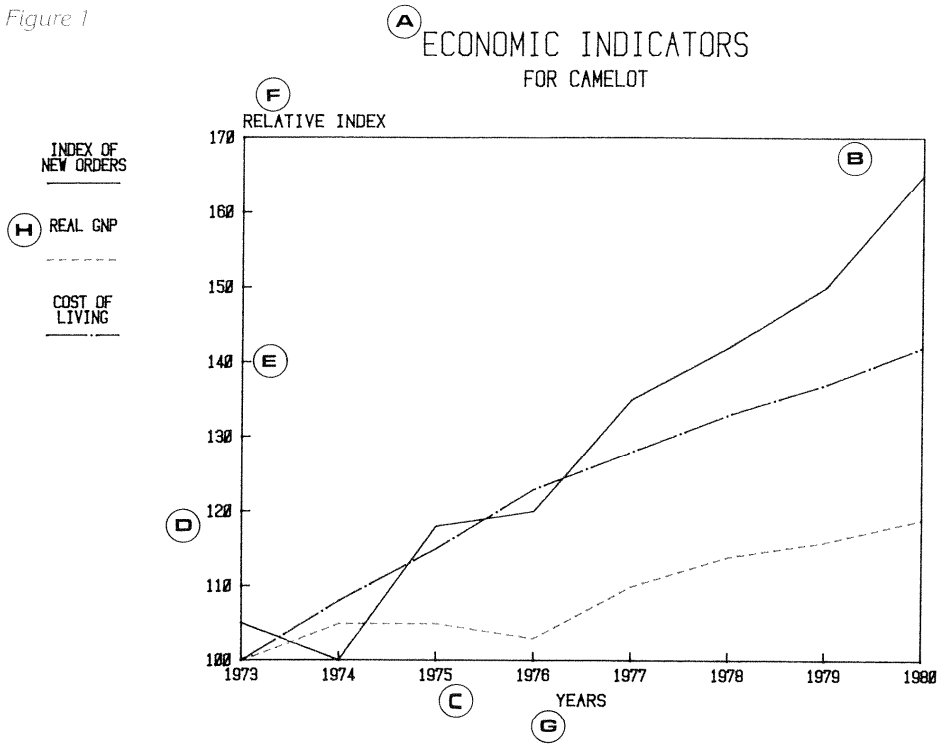
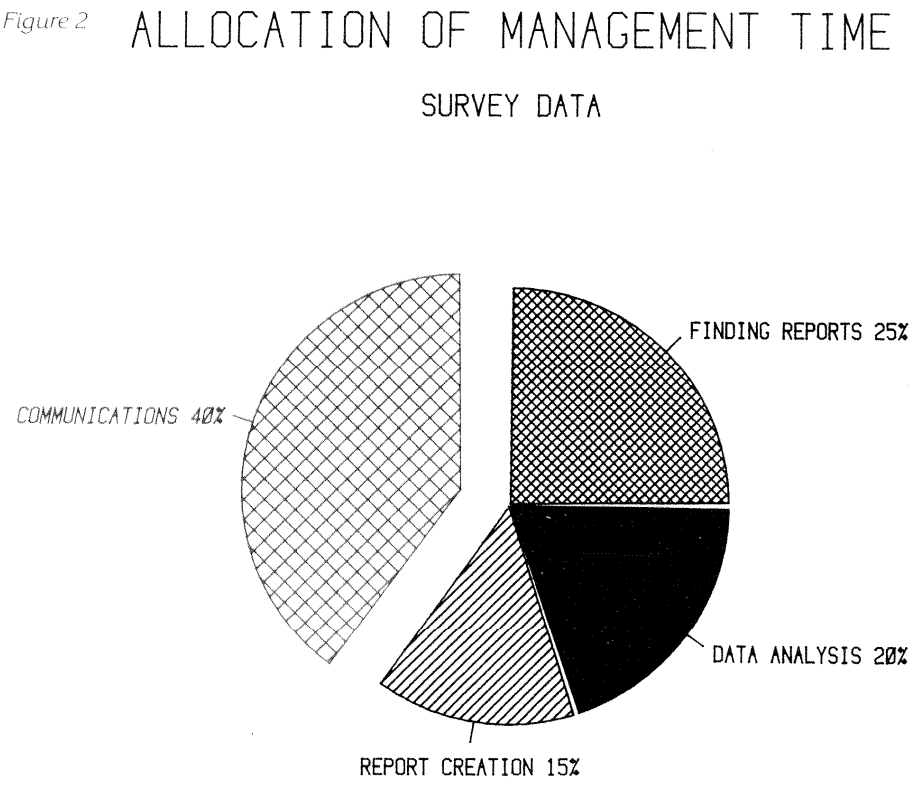


Figure 1 is a sample line chart that we will use to illustrate the essential parts of graphic form. Every graph should have a title (A) that states what, where, and how. The title is best placed above the picture. The area covered by the graph is usually framed (outlined) (B) and that area scaled to fit the data. The axes are marked using this scale (C), (D) and tic marks (small lines at regular intervals) (E). Axes are labeled and titled, (F), (G) usually with horizontal labels. When there are multiple lines on a graph, each line should be identified with either a horizontal label near the line or a legend placed away from all lines (H). The legend is often placed to the left of the Y-axis label or below the title. The most important point to remember when annotating a graph is that nothing should detract from the plotted data.

Figure 2



Pie Charts

Pie charts show parts of a whole entity. The slices of the pie are the component parts. There are two variations on the pie chart. First one or more slices may be "exploded," that is, offset slightly from the center as if partially removed from the pie plate. Second, a third dimension can be added to the pie so that it resembles a coin or disc.

To construct a pie chart the data is computed as a percentage of the total, and each data value (percent) is converted to its appropriate segment of a full 360-degree circle. Sections are usually arranged according to size and differentiated by color or hatching. Each segment is labeled; the labels are best placed outside the pie; labels placed inside tend to distort the information. Percentage values are sometimes included with the labels and may be placed inside the pie.

The pie chart is not well suited to graphs with many segments (more than six) or with several segments of small size (3 degrees or less). It is often advisable to group these small segments as "other" and, if necessary, show a breakdown of "other" in a separate segmented bar or in the accompanying text. Pie charts have great appeal with non-technical audiences, perhaps because they are frequently found in the general press, and there is no necessity for the viewer to calculate the coordinate position of a point or bar.

Bar Graphs

The bar graph is a popular chart especially appropriate for comparing size or parts of a total. The length of each bar is proportional to the quantity or amount of each category represented. We will make no distinction between bars that are horizontal and bars that are vertical. However, some people call graphs with vertical bars column graphs. There are many variations of the simple bar graph.

Figure 3 is a simple bar graph consisting of seven bars representing sales volume for each of seven items. Five is sometimes cited as the upper limit for the number of items represented on one chart. This, however, depends on the data; for instance, there is no reason why 10 years of sales data showing a trend could not be represented on a graph of total sales. Five is probably a valid limit if the sales graph shows a year's sales by region and is to be used to compare regions with one another.

Figure 3

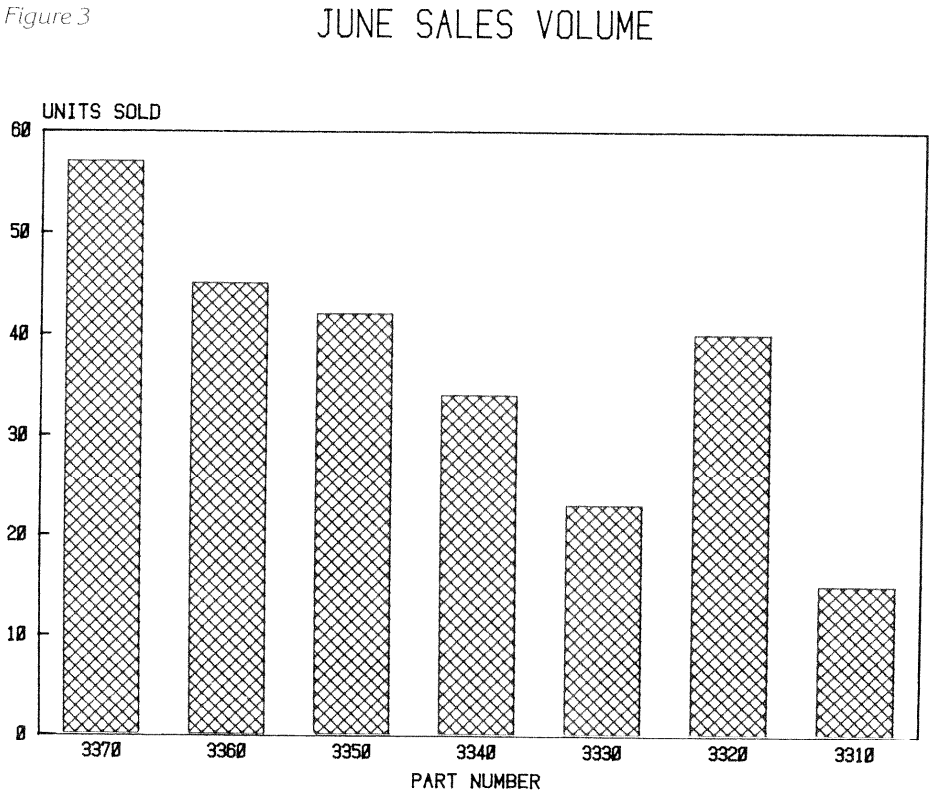
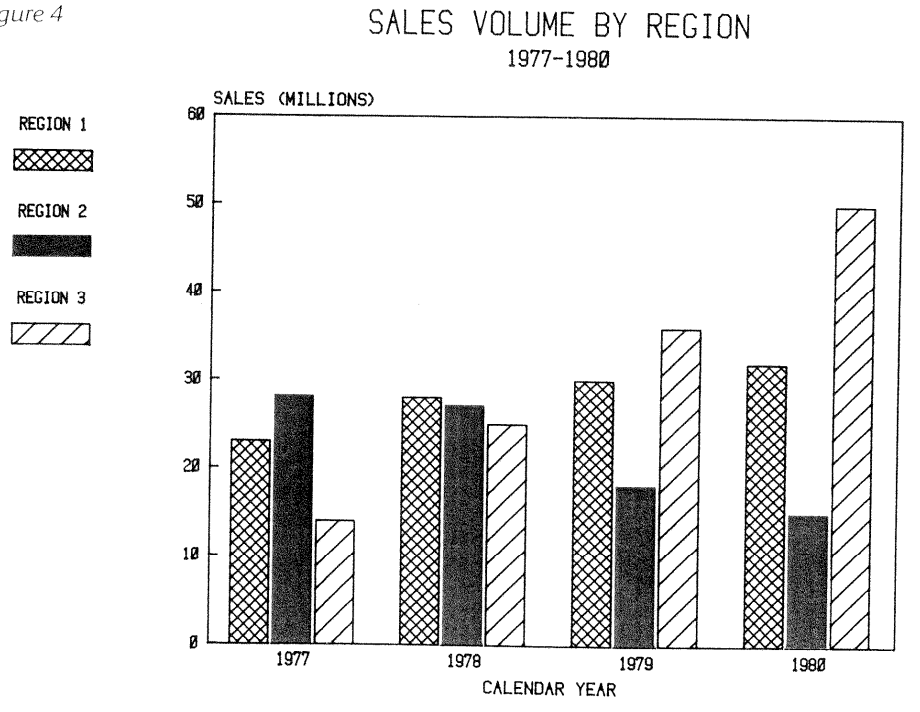


Figure 4 shows sales by region for three divisions over a 4-year period. When more than one bar refers to the same X-axis value and the bars for that value are close together or touching, we call the graph a clustered or comparative bar chart. Again there is an upper limit to the number of bars that can be "clustered" and still be an effective graph. Each bar of the cluster is usually a different color or is hatched using a distinct pattern. This means a four-color plotter can produce a graph with four shaded bars per cluster. A monochromatic graph can also have four; one solid bar, two with hatching (narrow and wide), and one clear area. The solid shading should be in the smallest segment because it is easiest to interpret the value of a shaded area. For easy pattern recognition a large hatch pattern should be reserved for large areas. You seldom put large patterned wallpaper in a 9 × 10 foot room!

Certain practices should be followed when creating bar charts. The bars should be of uniform width with evenly spaced bars. Minimum spacing is half the width of the bars and maximum spacing should still enable the eye to move from one bar or cluster to the next. The scale should always include the zero value.

A good practice is not to cluster values that are widely different in value. The eye probably cannot evaluate both columns in one glance. ■

Figure 4



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BASIC EXCHANGE
Winter 1981 Vol. 2 No. 3

Information about new hardware and software, new policies, programming and operating suggestions, further reading, and feature articles. Published four times a year for owners of Hewlett-Packard personal computers.

Reader comments and contributions are welcomed and should be addressed to the editor.

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