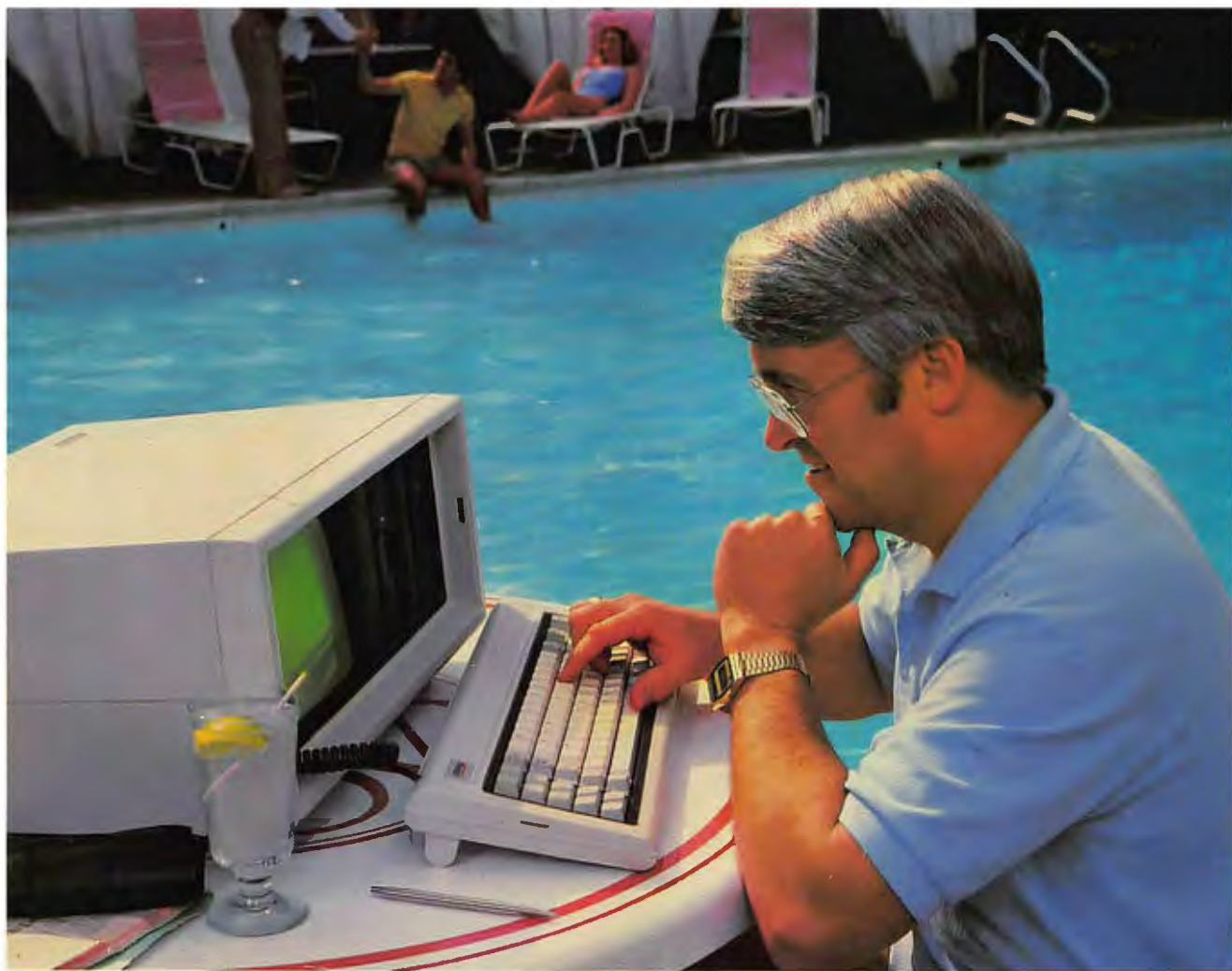


PC WORLD

Volume 1, Number 2
\$3.00

*The Personal Computer Magazine for IBM PCs
and Compatibles*



**Traveling with the
IBM PC's
First Portable
Competitor**

*Win the PC of Your Dreams ◦ VisiCorp Challenges Apple
Microsoft's Multiplan ◦ IBM's Plasma Display
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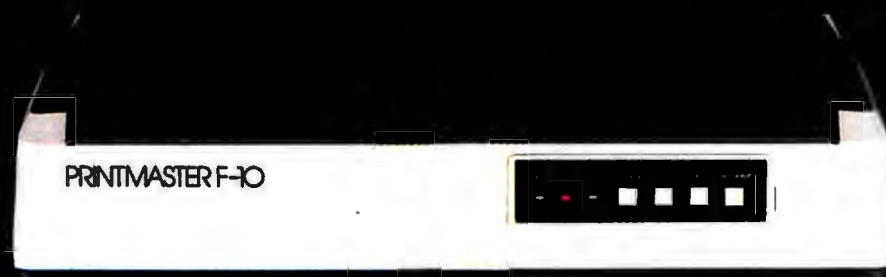
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VISICALC*



INTERACTIVE ELECTRONIC
WORKSHEET

YES

ON-LINE REFERENCE GUIDE

NO

"NAMING" OF CELLS
OR AREAS

NO

PLAIN ENGLISH PROMPTS

NO

INDIVIDUAL COLUMN
WIDTHS

NO

EXTENSIVE FORMATTING
CAPABILITIES

NO

PROTECTED CELLS

NO

MULTIPLE, LINKED
WORKSHEETS

NO

SORTING CAPABILITY

NO

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Compare ease of use. All Multiplan prompts are full length words or phrases. And Multiplan provides "naming," the ability to assign a plain English name to any

cell or area. "Gross Profit = Sales—Cost" rather than "AA44=AZ23—BK154." Which means you can work more intuitively. And faster.

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*Based on features in releases VC-202B0-AP2 and VC-156Y0-IBM of VisiCalc on the Apple II and IBM-PC respectively.

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The command menu offers a choice of commands to get going, you need to:

1. Select an active cell. The direction keys may be used.
2. The same keys and action to move the worksheet of the window.
3. Select a command. There are two ways to do this. You can move the highlight to a command word using the F8 and F10 keys and then press Enter, or type the first letter.

HELP: Resume, Start, Save, Printout, Applications, Commands, Editing, Formulas, Keyboard.

Select option or type command letter. 100% Free. Multiplan PROFIT1

INTERACTIVE ELECTRONIC WORKSHEET

YES

ON-LINE REFERENCE GUIDE

YES

"NAMING" OF CELLS OR AREAS

Region 1 Profit Forecast

| | Jan | Feb | Mar | Apr | May |
|-----------------------|------|-----|-----|-----|-----|
| Region 1 Sales | 2000 | | | | |
| Region 1 Cost | 1300 | | | | |
| Region 1 Gross Profit | 700 | | | | |

FORMATTING: B1:B5 in column 1 starting at B12:B122

Enter reference to cell or group of cells. 86% Free. Multiplan PROFIT1

PLAIN ENGLISH PROMPTS

YES

INDIVIDUAL COLUMN WIDTHS

YES

EXTENSIVE FORMATTING CAPABILITIES

YES

Region 1 Profit Forecast

| | Jan | Feb | Mar | Apr |
|-----------------------|------------|------------|------------|------------|
| Region 1 Sales | \$2,000.00 | \$2,200.00 | \$2,400.00 | \$2,600.00 |
| Region 1 Cost | 1,300.00 | 1,430.00 | 1,570.00 | 1,730.30 |
| Region 1 Gross Profit | \$700.00 | \$770.00 | \$847.00 | \$869.70 |

Growth Rate = 10.0%
Cost Factor = 85.0%

ENTER FORMULAS

Enter 1 to column B12 97% Free. Multiplan PROFIT1

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| Microprocessor 16-bit, 8088* | Operating Systems DOS, UCSD p-System, CP/M-86† | Color/Graphics Text mode: 16 colors* 256 characters and symbols in ROM* |
| Auxiliary Memory 2 optional internal diskette drives, 5¼" 160K bytes or 320K bytes per diskette | Languages BASIC, Pascal, FORTRAN, MACRO Assembler, COBOL | Graphics mode: 4-color resolution: 320h x 200v* Black & white resolution: 640h x 200v* Simultaneous graphics & text capability* |
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PC WORLD

*The Personal Computer Magazine
For Second-Generation IBM PCs and Compatibles*

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Photo shot on location at General Office Equipment, Walnut Creek, California.

VisiCorp Meets the Apple Challenge

The story will soon unfold. Over the course of the past two years a curious, yet monumental marketing struggle has been shaping up between the two companies most responsible for the number-one first-generation personal computer.

This computer is without challenge the Apple II. Love it or hate it, ridicule its 40-column screen and its uppercase-only letters (both shortcomings that can be corrected with add-ons) or its 48K memory, and still the Apple II is number one.

What gave the Apple II the edge, especially when there were many first-generation machines with better specs? Superior marketing is one answer, although an insufficient one. Radio Shack with its huge distribution network and Commodore with its international market are two examples of companies that had functionally equal if not better computers, and they matched Apple ad campaign for ad campaign.

It was *VisiCalc* that made the Apple II blast off. Published in 1978 by a start-up company named Personal Software (later changed to VisiCorp), this revolutionary piece of software initially ran only on the Apple II. It was the first program to penetrate the massive desk-top computing market for business executives and professionals. Thanks to *VisiCalc*, the Apple II stood at the vanguard of this bonanza.

The *VisiCalc*-Apple II train has been running strong for seven years,

which is an amazing feat in a high-rolling, hi-tech market. However, all computers and all computer programs sooner or later become candidates for extinction—a 10-year-old computer is at least a 200-year-old man. Apple Computer and VisiCorp are both in the same perilous position of having their own tough act to follow.

In the world of second-generation PCs, the explosive launching of the IBM Personal Computer has stomped Apple's second-generation PC, the Apple III, into near oblivion. Lotus' 1-2-3 and Microsoft's *Multiplan* (see Edward Rodgers' excellent review, "Multiplan Inherits the Spreadsheet Legacy") have made even *Advanced VisiCalc* seem somewhat dubious.

If Apple Computer's best offering had remained the Apple III and VisiCorp had been content to stay with *Advanced VisiCalc* and the Visi-Series, these companies would be in for trouble. However, Steve Jobs of Apple and Dan Fylstra of VisiCorp are visionaries whose perceptions are not limited to the present.

The major development work at both companies hasn't been focused on the Apple III or *Advanced VisiCalc*. These products were mere side-shows. While milking their first-generation windfalls, Jobs and Fylstra were looking for the next great leap forward.

Enter Xerox. Three or four years ago you could hardly read anything about the future of personal computing without reading about the Xerox

Research Center in Palo Alto. Amazing things were developed in its laboratories.

The new Xerox inventions were based on the concept that man and machine needn't communicate via words alone. Similar to the way that humans enhance oral communication with gestures and tone of voice, communication between humans and machines can be enhanced through the use of graphic symbols and an easily manipulable cursor.

Xerox, not a very good marketer, has never been able to capitalize in a big way on its own research. The Xerox Star, which uses multiple windows and a mouse pointing device, has received a lot of notice, but sales have been scarce due to its high price and the fact that it requires a large and expensive hard disk.

Perhaps because Xerox didn't know what to do with its marvelous discoveries, the company had no qualms about sharing information. In 1979 Steve Jobs visited the Xerox Research Center for a demonstration of Smalltalk, the programming language designed for computer systems that use multiple windows and mice. Shortly thereafter, Jobs hired Larry Tesler, the Xerox specialist who gave him the demonstration, and launched the Lisa project. Some 15 to 20 Xerox engineers followed Tesler to Apple.

Like Xerox, Apple is not a particularly secretive company. When

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David Bunnell

alerted to Apple's plans, VisiCorp responded by developing a software system that would accomplish the very thing Apple was attempting with the Lisa, only on other 16-bit computers.

Somewhere during the course of all this the IBM Personal Computer emerged, which gave VisiCorp the perfect vehicle to run its new software. Unlike both Xerox and Apple, however, VisiCorp kept its project, *Visi/ON*, strictly confidential. When *Visi/ON* was announced, many self-appointed PC experts were stunned. The company they had written off as a one-product flash in the pan was suddenly right back in the thick of the marketplace.

The big question is simply: which is better, the IBM Personal Computer with *Visi/ON* or the Apple Lisa? Unfortunately, we won't know until late summer when both products are readily available. (Speculation is that fearing an announcement from IBM about an advanced Personal Computer, Apple jumped the gun on the Lisa. VisiCorp officials admit that they announced *Visi/ON* ahead of time to preempt Apple.)

In an effort to short-circuit this delay, I contacted Regis McKenna, a PR firm that happens to handle both Apple and VisiCorp. I thought we might be able to get prereleased versions of Lisa and *Visi/ON* to begin our comparison.

The answer I got seemed odd: the people at Apple (unidentified) did not want the marketplace to think that the IBM PC could possibly be an alternative to Lisa. I had thought that Apple would jump at the chance to have Lisa featured in a leading personal computer magazine. Despite assurances that we would conduct our tests in a completely fair and unbiased way, they wouldn't budge.

Of course, we are going to do the comparison anyway. We'll just have to wait for the day when Lisa is available through retail outlets (assuming that day will come).

Meanwhile, without having fired a shot, round one goes to VisiCorp.

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Color Discrimination

A friend of mine was raving about Microsoft's *Flight Simulator*. "For only \$50 you can practically turn your PC into an airplane." I was excited until I discovered that the program, like so many others, requires a graphics card. To turn my monochrome PC into anything requiring graphics would cost several hundred dollars.

That's because IBM is guilty of color discrimination. I'm not talking about its racial policies, but the fact that IBM has segregated its users into two groups: graphics and monochrome. Other companies offer integrated displays, but IBM holds on to the outmoded adage of separate but equal.

As a writer, I use my PC mainly for word processing. For that use I want the clearest and crispest display possible, and the monochrome display fits the bill. But even writers play games and run financial programs that draw pie charts and graphs. Why should we be left out in the drab?

It's not just color. I wouldn't install a color monitor if it came free. I might, on occasion, hook my PC to my TV to play a game, but I've yet to see a color monitor that's crisp enough for my tired and overworked eyes. However, I'm not ready to give up on graphics.

The culprit is not the display screen itself, but the display card stuffed into one of the PC's expan-

sion slots. IBM makes two kinds of cards. The "Monochrome Display and Printer Adapter" supports only the IBM monochrome "Personal Computer Display," while the "Color/Graphics Monitor Adapter" supports any composite video monitor, monochrome or color, as well as black-and-white and color TVs. (TVs require an additional adapter.)

IBM has segregated its users into two groups: graphics and monochrome.

What you see on your screen, be it monochrome or graphics, is a series of meticulously placed dots. Thousands of tiny dots (called pixels) come together to form text or graphics. A standard IBM monochrome screen displays up to 720 pixels across its horizontal axis and up to 350 along its vertical axis. If all those pixels were turned on at once, your display would be bright green. Actually, it would be a 720-by-350-point grid with the 252,000 little dots so close together they would appear as one mass of green light.

Because the monochrome pixels are so dense, the characters they generate look like fully formed letters.

The IBM graphics card has two modes. In its medium-resolution mode it displays 320 by 200 (64,000) pixels, whereas its "hi-res" mode produces 640 by 200 (128,000) pixels. Even the high-resolution graphics display is only half as dense as the monochrome.

Comparing graphics and monochrome text is a little like comparing the quality of a slick magazine with that of a newspaper. If you look closely at a newspaper photograph, you'll see that it's an imperfect screen of closely placed dots. Examine the photos in this magazine and you'll still see dot patterns, but they are so dense that you can barely detect them. You don't expect stunning graphics from your daily newspaper, but you do expect sharp pictures from your slick magazines.

Imagine how you'd feel if *PC World* issued two editions—one for people who like to read and another for those who like to look at pictures. That's what IBM has done with its display system.

This division isn't necessary. Many PC-compatible computers, such as Corona, Eagle, and Compaq, have high-resolution graphics displays that also produce excellent monochrome text. The Eagle, for example, has a 720 by 350 pixel display that handles graphics as well as text.

REMark

Apple's new Lisa may set a standard for the integration of graphics and text. When it introduced its new office computer, Apple bundled the system with a hand-held mouse that can be used to move the cursor from one graphic representation to another. If you want to work with a file, you use the mouse to point to what actually looks like a file folder. Likewise, if you want to calculate, you point to a picture of a calculator.

What Apple did isn't revolutionary. A PC can be made to perform just as admirably. In addition to a plug-in mouse and the right software, it will require a display system that supports both graphics and high-quality text on the same screen.

IBM has learned from Apple in the past; maybe it should take more notes.

Help Is on the Way—Sort of Hercules Computer Technology, a Berkeley, California, company, has produced a card capable of displaying in both graphics and monochrome modes. While I didn't get the opportunity to put the card through a reviewer's scrutiny, I am impressed at how this tiny company is building hardware to remedy an IBM design flaw.

The Hercules board works with IBM's monochrome screen, offering the same crisp text characters as IBM's monochrome board, as well as graphics that are better than those produced by IBM's color/graphics board. Hercules' 720 by 348 (250,560) pixel display is virtually identical to that of IBM's monochrome board, and it displays high-resolution graphics at twice the density of IBM's color/graphics card.

Bar graphs, pie charts, and other illustrations generated with the Hercules board come out as clear, dense, and readable as the letters on a monochrome display. The board also has a parallel printer port, so it can

completely replace the monochrome card. There's only one hitch—standards.

The standards are set by IBM, not by little companies in Berkeley. IBM designed Advanced BASIC and all its assembly language graphics routines to work with the IBM color/graphics card. That card, as indicated earlier,

IBM has learned from
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more notes.

is designed to work with a standard video monitor or TV and produces an image no denser than 640 by 200. As a result, programs written for the IBM graphics card do not necessarily run on Hercules' monochrome/graphics card. Hercules is quick to admit that and claims that it is working with several major software vendors to encourage software that will be compatible with the Hercules board.

Hercules even issues its own version of BASIC. Called HBASIC, it includes the same graphics statements as IBM's Advanced BASIC but can be used with the Hercules monochrome graphics board. Clever as it may be, HBASIC is not likely to become a standard.

As happy as I am to see small companies thrive on the mistakes of giants, I am distressed that it was necessary for Hercules to open up shop. It reminds me of the hundreds of companies that emerged to produce hardware to overcome the design flaws of the Apple II. It's easy to forgive Apple for flaws in a system designed five years ago, but the PC is a much more recent design—segmented displays could have been avoided.

It would be unfair to omit the fact that IBM designed its color/graphics display to work with a TV. There

was some notion back then that lots of people would buy the \$1565 screenless and diskless PC to use like a souped-up Atari on their home TVs. But that market never materialized, and IBM has all but stopped shipping the stripped-down models. In the meantime, those of us with business systems must make difficult choices or clutter our desks (and unclutter our bank accounts) by purchasing extra monitors, display cards, and cables.

Not Too Late

It's not too late. The wonderful thing about the IBM PC is that it can be upgraded. If Hercules catches on, we can expect to see software supporting mixed text and graphics. If Hercules really catches on, we can expect to see other companies, perhaps even IBM, create new and better boards to solve the same problem.

The ultimate solution would be for IBM to issue its own updated display. That would cause havoc in the software industry, sending programmers back to their code sheets to retool their programs to work with the new display card. It would also cause some resentment from consumers, who would have to buy new chips or whole new cards to take advantage of the improved system. But in the long run, it would be a boon for the industry. No longer would "serious" users be barred from playing games, nor would the more powerful business graphics systems like MBA or 1-2-3 require expensive, additional hardware investments.

IBM designed a great computer, and with a little pressure from the user community it can be even better.

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Letters

Counter Confusion

Had to drop you a line in congratulations on *PC World*—a total class act. I was delighted to see familiar names in the by-lines: Larry Jordan, Gene Plantz, Burt Alperson. Looks like you're going to the grass roots for articles. Keep up the good work.

I couldn't find much to criticize in your initial offering, but I'd like to take exception to one of the entries from a contributor in *.*.

Ron Egalka seems to think that *VisiCalc* gets confused if there's more than 288K in memory and says it "defaults to the minimum configuration, leaving only 22K." He couldn't be further from the truth! *VisiCalc* uses every bit of memory in the system. The disparity arises from the fact that the program's memory counter doesn't go high enough to show the total available memory. If you try it, you will see that the 22K counter will decrement towards zero as you fill the sheet, but low and behold, when you think you've hit zero, up pops another 188K or so. It's only the counter that's confused, not the program. Egalka's tip will have a lot of people going to unnecessary trouble.

John O'Boyle
Hartford, Connecticut

Gung-hoism

I enjoyed your first issue a great deal—keep up the good work. At this time, however, while your editorial policies are still in the process of definition, I, as a subscriber, would like to contribute this word of caution.

Whether or not you would care to admit it, it's a fact that magazines like *PC World* partake of a somewhat ambivalent nature because of their necessarily dual function. For while

your stated purpose is to keep your readership informed, it must always be the case that your unstated objective will be to promote the industry that feeds you.

Don't get me wrong, it is not my intention to suggest that your symbiotic relationship with the personal computer industry necessarily implies a conflict of interest. It does not. However, it is obvious to anyone who follows the computer press that its members' natural enthusiasm for computers often causes them to lose track of the critical faculties so vital to good journalism.

In the coming years as computers continue to transform our society, for *PC World* to concentrate only on the benefits of this technological revolution would be—leaving aside the issue of social responsibility—for you to miss half the story.

I would like to see at least one computer magazine that does not fall into this trap of computer gung-hoism. Besides being great liberators in that they free people from unpleasant and mechanical tasks, computers have just as much potential for dehumanization and alienation. Decisions are now being made that will determine whether this will be a country of easy access and free information exchange, or one in which the information poor are controlled by the information rich.

It is perhaps asking too much to look to these pages for direct monitoring of and editorial comment on these important developments—although I don't know why, since such topics would undoubtedly be of much greater interest to your readership than Bob Frankston's high school experiences or other such topics that appeal, for the most part, only to trade insiders (remember that the personal computer business is based on general consumers).

What I do look to you for is an awareness reflected in your articles of the complicated nature of the computer phenomenon.

Juan Nix
Trinidad, Colorado

Global Fix

Karl Koessel's program for creating a perspective image of the globe ("A World for Your PC," Vol. I, No. 1) was very instructive. In some places, however, the image created by the intersection of the longitude and latitude lines is a little sparse. To round out the picture, interested readers can add the following lines, which draw a circle around the globe's perimeter.

```
652 OC = ASP*ZOBs*R/SQR(ZOBs^2-R^2)
654 CIRCLE (XC,YC),OC,3
```

Jim Banta
Teaneck, New Jersey

Fact and Fiction

I want to commend you on your outstanding new publication. I've found it tremendously satisfying and helpful. It seems you've spared no quarter and are unmatched in thoroughness. But at the risk of seeming presumptuous, there is one thing I find lacking.

You see, I've come to think of your staff, with its energy and resourcefulness, as trend setters in home computer publishing. Your magazine definitely shows imagination, which gives me the boldness to suggest a little more daring approach.

Have you ever given thought to slipping some creative fiction in between the pages of nuts and bolts? Perhaps a bit of science fiction to heighten reader entertainment and spark the imagination. With technol-

ogy advancing so rapidly, it is the human imagination that gives the cutting edge to innovation. What we only dreamed of yesterday we are realizing today. Why abandon this corner of the market to *Omni*? Why not amuse your readers as well as informing them?

Dare to stretch the imagination and distinguish your magazine even more.

Mark Middlebrook
San Francisco, California

Send Us More Clones

Thanks for giving us an alternative source of information on the PC. What *PC World* lacks in visual excitement, it makes up for with a

consistent design and high-quality articles. I was especially interested in the articles on the compatibles, or clones. Although your article "Send in the Clones" provided an interesting overview of these various look-alikes, there was not enough in the brief descriptions to separate the wheat from the chaff. What software can the clones run or not run? How does the keyboard feel? What about the display? These are the questions I hope you address more specifically in the future.

Also, why do you call yourself *PC World*? Does this imply an international slant? I would be interested in reading how the PC has or has not affected the rest of the world.

George Camey
Kansas City, Missouri

We're delighted to receive comments and suggestions that go beyond the bits-and-bytes perspective. In response to the above letters: We've been considering publishing some quality fiction and would welcome submissions; and we plan on covering the entire world of IBM PC compatible products, starting with our COMPAQ review in this issue.
—Ed.

Letters should be mailed to Letters, *PC World*, 555 De Haro, San Francisco, CA 94107, or sent electronically to CompuServe 74055,415 or Source STE908.

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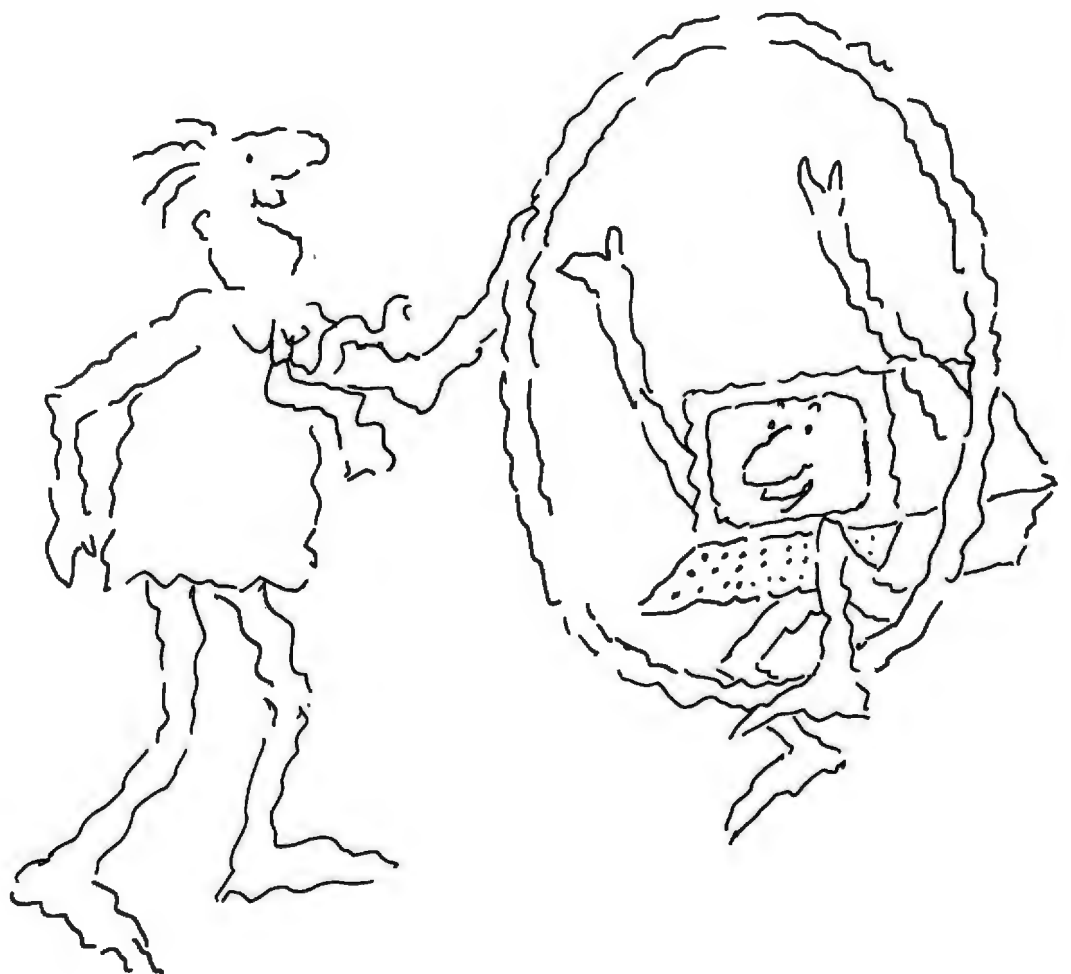
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The spreadsheet function.

If 1-2-3 were just a spreadsheet, you'd want it because it has the largest workspace on the market (2048 rows by 256 columns). To give you a quick idea of 1-2-3's spreadsheet capabilities: VisiCalc's spreadsheet for the IBM PC offers 15 arithmetic, logical and relational operators, 28 functions and 32 spreadsheet-related commands. 1-2-3 has 15 operators, 41 functions and 66 commands. And if you include data base and graphing commands, it actually has 110!

In addition, 1-2-3 is up to 50 times as fast as established spreadsheets. With all the features you've ever seen on spreadsheets. 1-2-3 also gives you the capability to develop customized applications (with 26 macro keys) and lets you perform repetitive tasks automatically with one keystroke. If 1-2-3 were just a spreadsheet, it would be a very powerful tool. But it's much, much more.

The information management function.

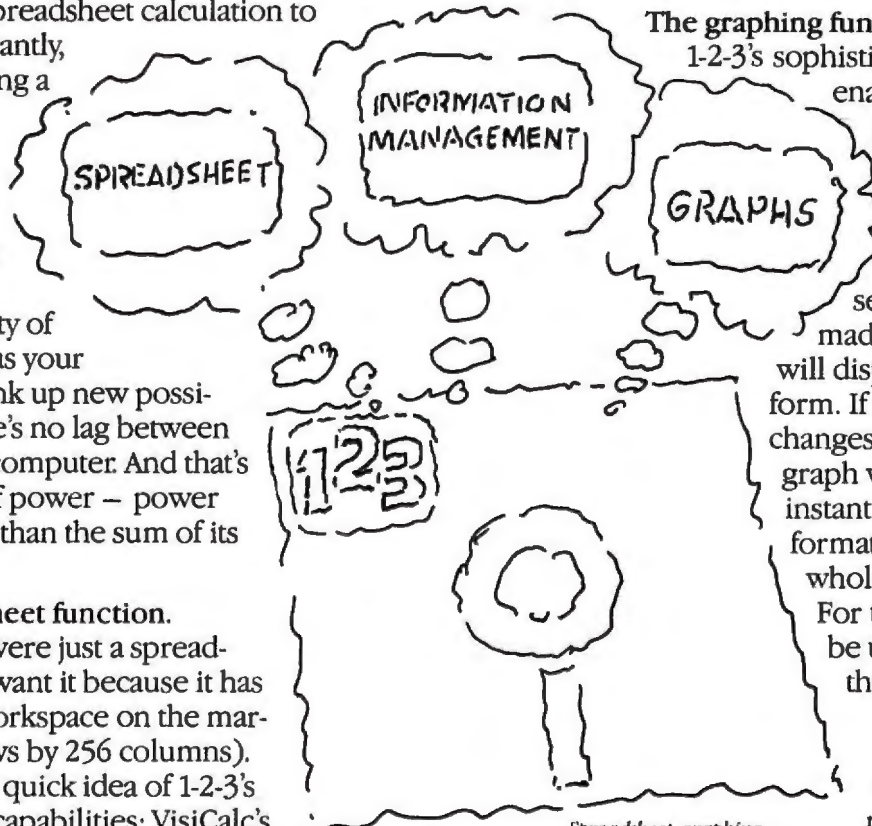
Add to 1-2-3's spreadsheet a selective information management function, and the power curve rises at an awesome rate. Particularly since 1-2-3's information management capability reads files from other programs such as WordStar, VisiCalc and dBase II. So you can accumulate information

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To fully understand just how much power 1-2-3 adds to the personal computer you'll want to go to your nearby 1-2-3 dealer for a full demonstration. For his name and address (and more information if you want it) call 1-800-343-5414.



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| Resident Cache Buffer Hard Disk Storage | 5M/10M | — | ? |
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| CP/M 86 | Yes | Yes | ? |
| MP/M 86 | Yes | — | ? |
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| XENIX | Soon | — | ? |
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| B/W and Color Display Controller | Yes | Yes | ? |
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| Time/Calendar Board | Yes | — | ? |
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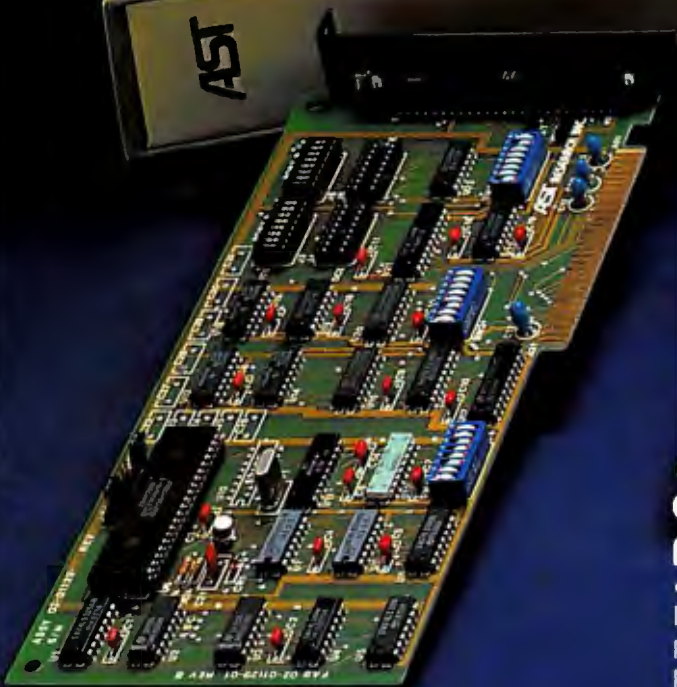
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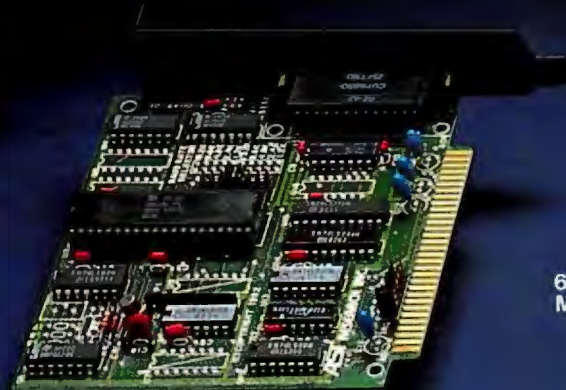
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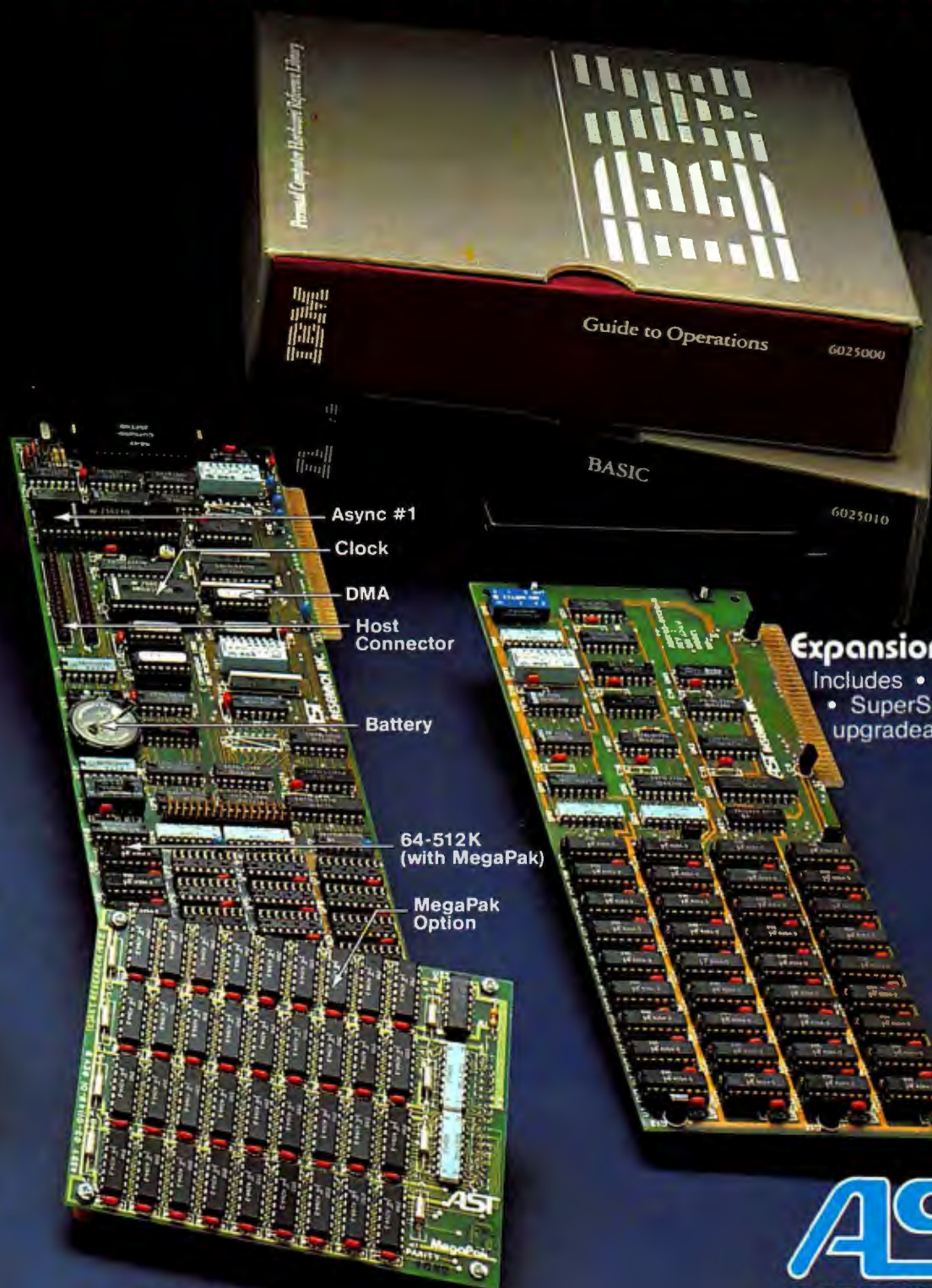
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VisiCorp's Windows on the World

Roy Folk

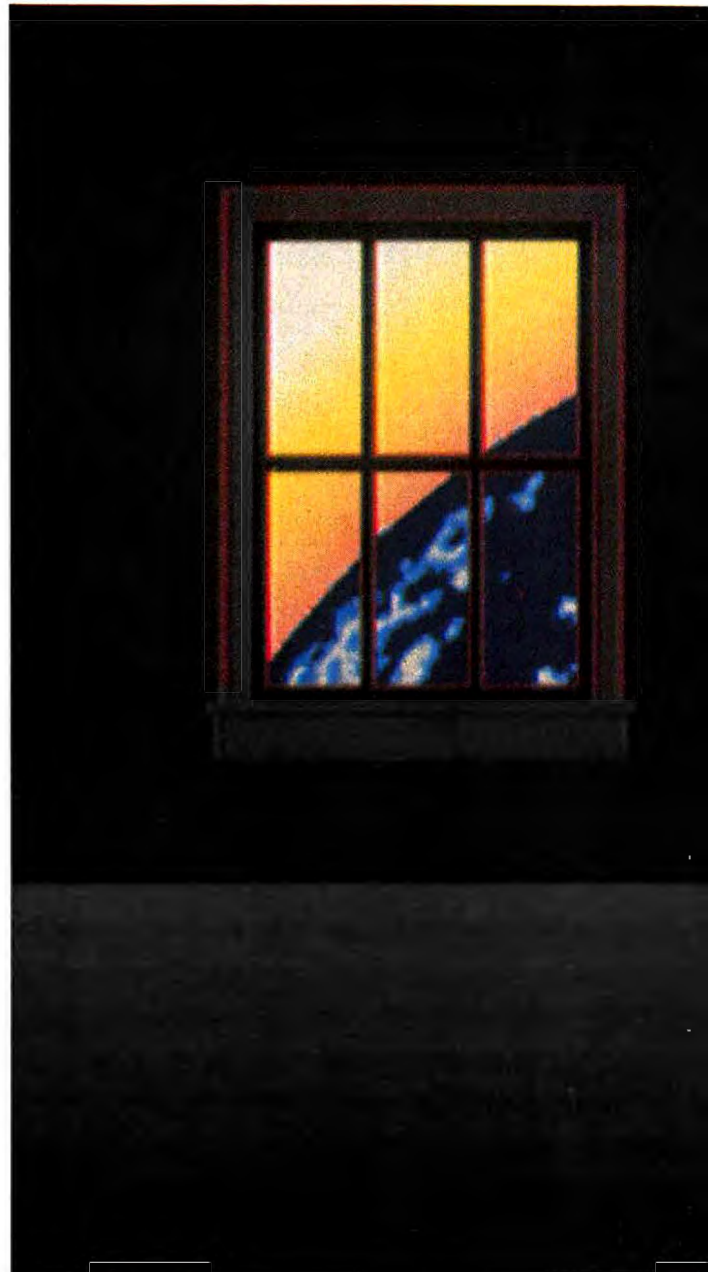
Of all the companies announcing new products at the Winter COMDEX show in November 1982, none attracted crowds as large as those that came to the VisiCorp booth. The product they came to see is the Visi/ON operating environment, a futuristic product that links a wide range of programs and does so in ways that eliminate the need for computer literacy. In this article Roy Folk of VisiCorp describes the new product for those who were not able to see it firsthand.

Visi/ON is a window-oriented software system designed to integrate any number of applications programs in a consistent, easy to use manner. Windows are screens within screens, areas of the video display that appear as if they were separate displays. The window-based design allows the system to represent work as it would appear on a desk top, replacing sheets of paper with video display windows.

Any number of programs may be displayed within these windows and dealt with simultaneously, and data can be transferred between the programs quickly and easily. A mouse pointing device is used to move the cursor about the screen and to select commands. The natural "pointing" technique afforded by the mouse simplifies the learning and use of the Visi/ON commands and, consequently, of the applications programs themselves.

The design effort behind Visi/ON began over two years ago with three major goals: easy use of simultaneously displayed programs, fast and convenient data transfer between programs, and ease of learning and use by office professionals.

The design approach VisiCorp chose is based on work done by the Xerox Corporation. This research, which led to the Xerox Star executive work station, combined the use of a mouse for user interaction with





● State of the Art

user-adjustable, overlapping window displays. [Editor's note: This is the same technology adopted by Apple Computer Corporation for the Lisa product.] The system provides significant integration of programs and management functions in a simple, easy to use, and easy to learn form.

Visi/ON is unique in several ways. It is not another applications program, but a product that unifies the applications environment of the personal computer. *Visi/ON* is open ended; it will support one or more applications programs, and additional programs may be added as necessary. *Visi/ON* also provides extensive help facilities for ease of learning—and ease of relearning programs that are used infrequently.

The *Visi/ON* system provides a high-performance, interactive environment on personal computers and does not require any special hardware except the mouse. The

The nine words at the bottom of the screen represent the complete set of commands required to operate the *Visi/ON* program.

IBM PC version requires the basic system unit with a color/graphics adapter and a graphics monitor. When multiple applications programs are used, at least 256K of main memory and dual, double-sided floppy disk drives are needed; a hard disk drive should be used for optimum performance. A mouse pointing device will be sold by VisiCorp and will plug into a standard RS-232C serial port.

Screen and Mouse

Figure 1 illustrates the *Visi/ON* screen or “desk top.” The nine words at the bottom of the screen represent the complete set of commands required to operate the *Visi/ON* program. These commands are always present and available to the user, regardless of whether an applications program is in use. The upper right corner of the screen shows a list of labels representing the tasks pending. Actually, these are “closed” windows, as we shall see.

The mouse is used to activate commands and to select items and locations. It exploits a natural interaction technique we all learned during childhood: pointing. As the mouse is moved by the user's hand, the arrow-shaped cursor moves correspondingly on the screen. Two buttons on the mouse are used for system

operation; one is pressed to select any point indicated by the tip of the arrow, and the other is used to scroll data within a window.

When the cursor is moved to the command menu line at the bottom of the screen, individual commands change to normal video display as the cursor passes over them, showing that they are indicated for possible selection. Pressing the select button executes the indicated command. For most commands a series of prompt messages are displayed just above the command menu line. These prompts guide the user through the steps necessary to complete the command.

Help and Windows

When the Help command is selected, the help window shown in Figure 2 appears in the middle of the screen. Figure 2 also illustrates the standard window format. The line at the top is called the window identifier. Window identifiers for applications programs are user-definable. Beneath the identifier is the window display area. The bottom two lines of every window are used to display the window's commands. The bottom line contains the individual window commands. Each window command switches from inverse video to normal video when indicated by the cursor. When an individual window command is indicated, a “long prompt” message appears in parentheses on the next to last line of the window. This prompt provides a brief description of the selected command.

Visi/ON provides a comprehensive help facility for itself and for the applications programs in the form of a help network called a hypertext. This network consists of individual pages of text linked together in such a way that, starting with any page, any other page may eventually be reached by following a sequence of interconnecting links. The help window commands provide a convenient way to move from page to page within the network.

The scroll button on the mouse can be used to scroll the contents of any window either side to side or up and down. To scroll the contents of a window the user moves the cursor to any point in the display area, presses and holds the scroll button, and moves the mouse slightly in the direction desired.

Visi/ON supports three scrolling speeds; a reading speed, a scanning speed slow enough to allow key words to be identified, and a paging speed used to move quickly through large documents. Scrolling can also be used to scroll a command menu line, allowing access to more commands than can be displayed within a small window.

Selecting the Quit command will cause a window that is no longer needed to disappear from the screen. The image that was on the screen “under” the window will reappear unchanged.

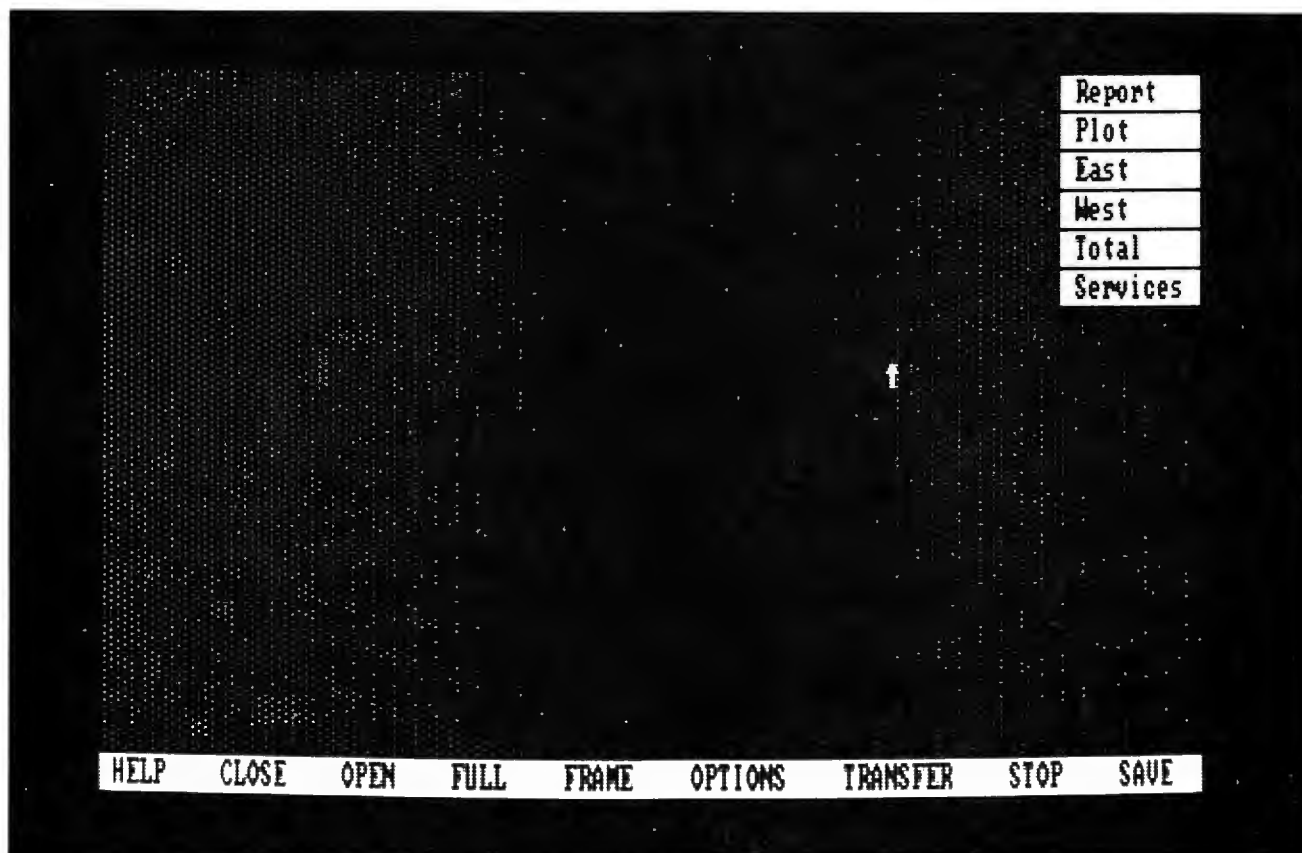


Figure 1: Initial Visi/ON screen display

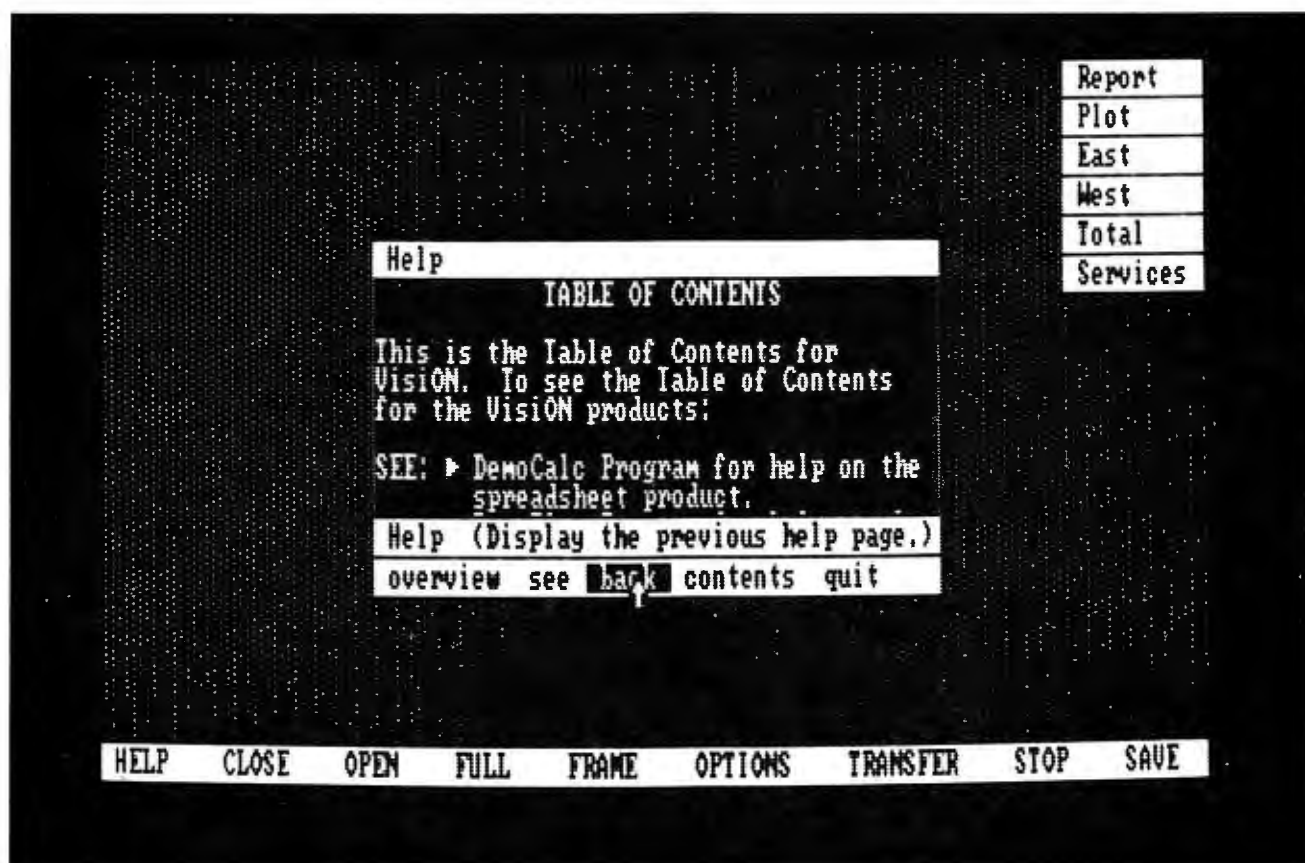


Figure 2: Typical Visi/ON help window

● State of the Art

Close, Open, and Full Commands

Any window may be closed and saved for later reference. The Close command prompts the user to point to and select the window to be closed. A closed window effectively shrinks to the first nine characters of its identifier and is moved to the end of the list in the upper right corner of the screen (see Figure 3). All the labels in that corner represent windows that have been closed.

A closed window can be reopened by selecting the Open command and pointing to the nine-character window identifier. When a closed window is opened, it reappears exactly as it was at the time it was closed, with the same position and size and with the same contents displayed.

Because the Open command is performed frequently in normal operation, an abbreviated form of the command is provided. A closed window may be opened by pointing to it and pressing the select button. In Figure 3 the window labeled East is open. East is a spreadsheet displayed in the standard window format: identifier, display area, and two lines of window command area. This spreadsheet is fully operational in the size displayed.

Whenever the user desires more display space for any window's operation, the Full command may be used to expand that window to fill the entire screen. Only the command menu line remains displayed and accessible to the user. The Open command restores the window to its previous size and position.

Multiple Windows

In Figure 4 two more spreadsheet windows have been opened, removing their labels from the upper right corner of the screen. These windows look like overlapping pages of paper on a desk top. Pointing with the cursor and pressing the select button on the mouse will bring any page to the top of the pile. *Visi/ON's* ability to move a window to the top of the pile quickly makes moving back and forth among several windows on a desk top convenient. Fast window switching makes it convenient to manage multiple overlapping windows, and even to transfer data among them.

The number of windows that can be opened and overlapped on the simulated desk top is limited only by the computer's disk storage capacity. If the windows on top completely obscure the desired window, they must be closed or moved to reveal some part of the hidden window before it can be selected.

When it is more convenient to display two or more windows simultaneously, the Frame command may be used to rearrange the simulated desk top by repositioning and resizing any window. Once selected, the Frame command guides the user with a sequence of simple prompt messages:

Frame which window? The cursor and select button are used to indicate the desired window.

Upper left corner of new frame? The cursor is used to indicate the first point of a diagonal that will define the new window frame.

Lower right corner of new frame? As the cursor is moved down and to the right, a flashing rectangle is displayed to indicate the boundaries of the new window. When this second point is selected, the window is redrawn within the new borders.

Figure 5 shows the screen after the Frame command has been used to rearrange the three spreadsheet windows for simultaneous data viewing.

Transfer

One of *Visi/ON's* most powerful features is its ability to transfer data between any two windows. The use of simultaneous window display and the mouse pointing capability are significant factors in accomplishing data transfer quickly and simply. No typed commands, file names, arguments, or use of the keyboard are needed to complete the transfer.

When the Transfer command is selected, a series of prompt messages appears that guides the user through each step. The prompts and their functions are described in Figure 6.

Options, Stop, and Save

Figure 7 shows a simulated desk top with three applications displayed concurrently: word processing, spreadsheet, and plotting programs. The plot window displays a bar graph reflecting data that has just been transferred from the total line of the spreadsheet. It is possible to specify that the transfer is either "one time" or "linked."

One of *Visi/ON's* most powerful features is its ability to transfer data between any two windows.

In a linked transfer a permanent connection is maintained between the source window data and the destination window data. When changes are made in data that has been the source of a linked transfer, the data in the destination window will change correspondingly the next time the destination window is selected.

The Options command may be used to change the properties of individual applications programs. For example, the graphics display of the plot shown in Figure 7 could be enhanced by adding grid lines or changing the shading pattern.

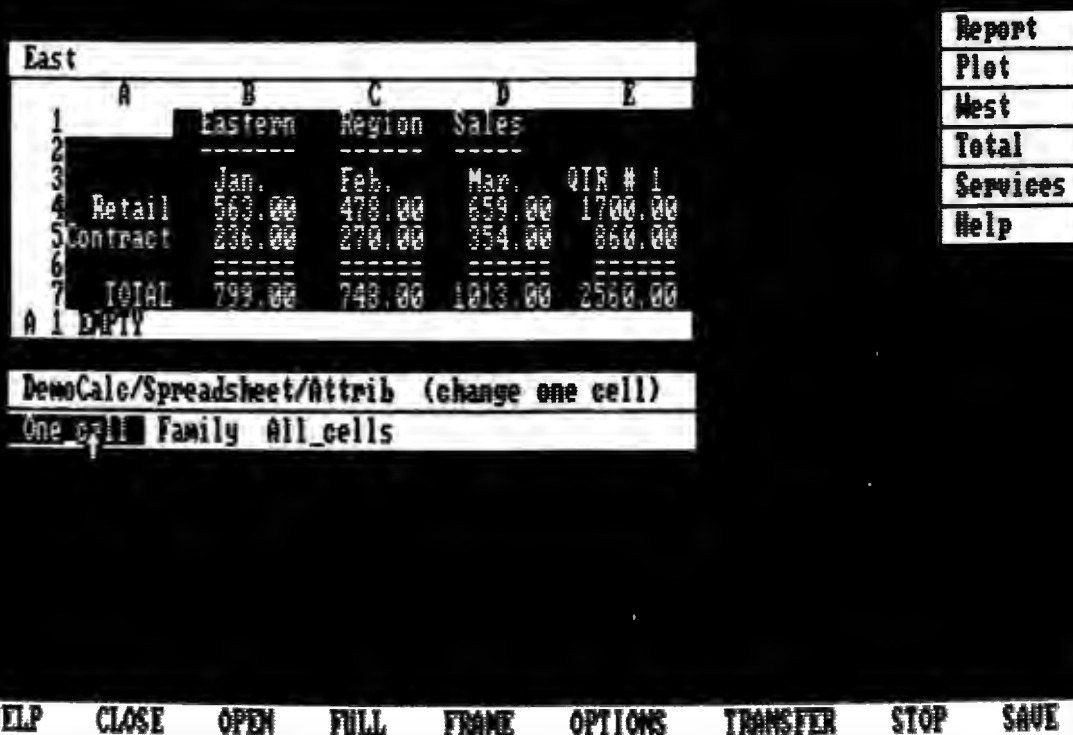


Figure 3: Help window is closed and spreadsheet window East is opened

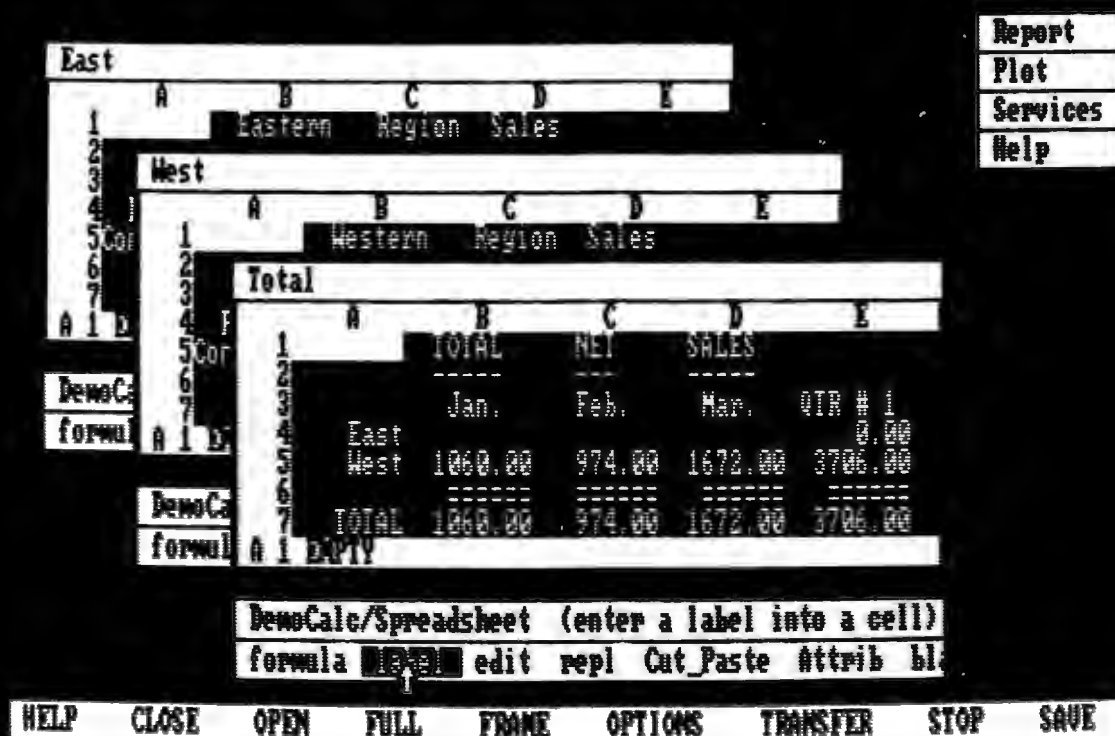


Figure 4: Three windows open simultaneously

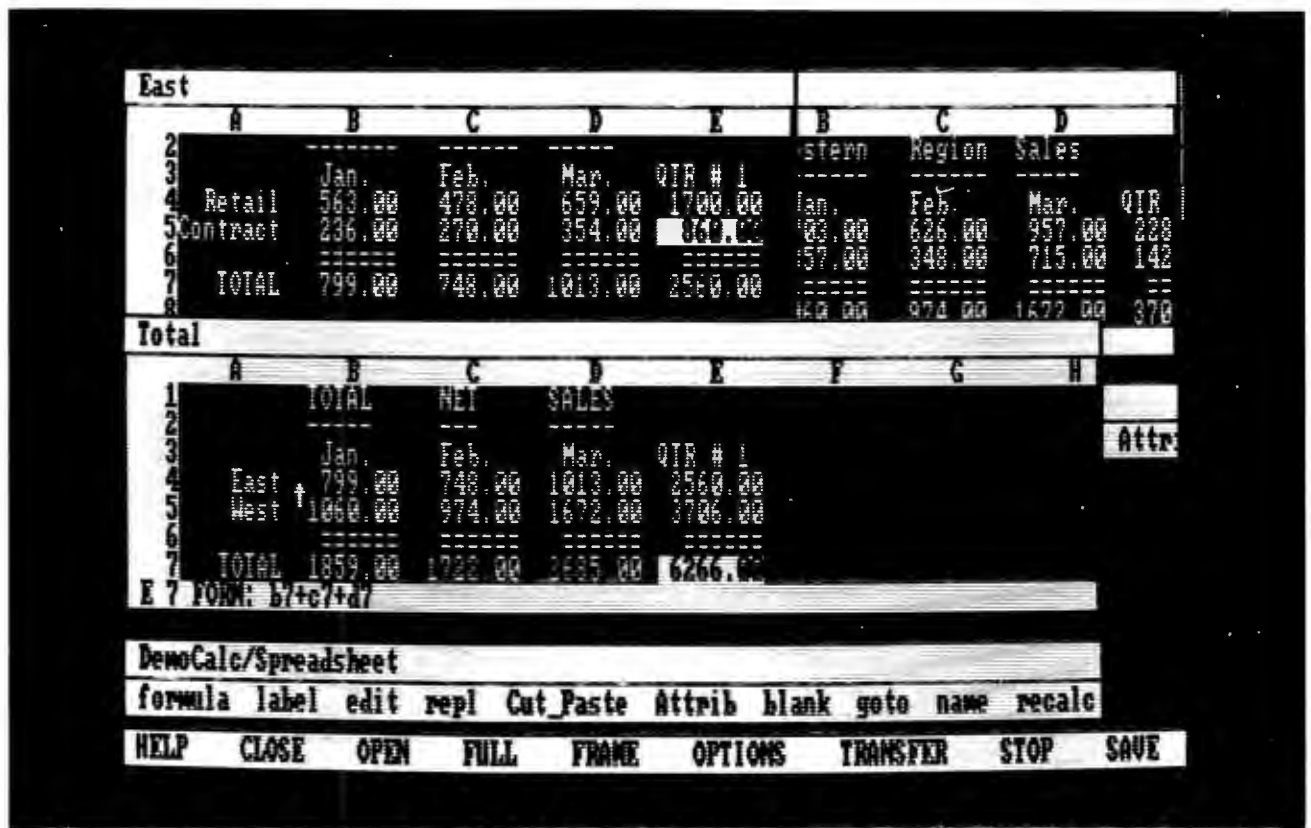


Figure 5: Windows rearranged by the Frame command

| | |
|----------------------------------|---|
| Transfer from which window? | The user selects the source window by pointing to it with the mouse. |
| Start of region to transfer? | The user points with the mouse to the first item in a sequence of items to be transferred. In the case of a spreadsheet, the user would point to the upper left cell in a rectangle of row and column data. |
| End of region to transfer? | To transfer data from a spreadsheet, the user would select the lower right cell in a rectangular group of cells to be transferred. The mouse scroll button can be used to move the cursor or the display to the desired end cell before this selection is made. |
| Transfer to which window? | The cursor is used to select any destination window. If the desired window is partially overlapped, it will move to the top of the pile. |
| Where to put transferred region? | If the destination window were a spreadsheet, the user would point to the first cell (upper left) to receive the transferred data. |

Figure 6: Prompts and operation of the Transfer command

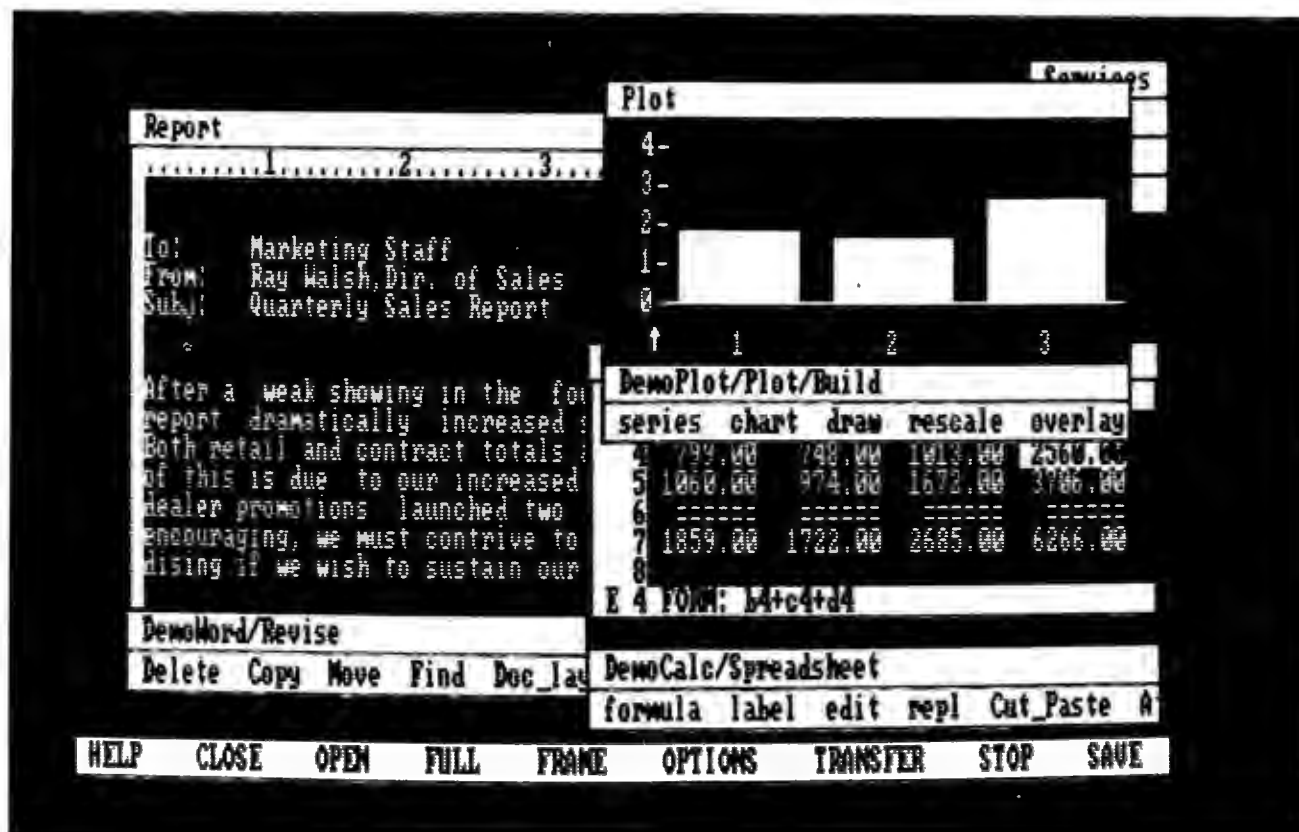


Figure 7: Word processing, plotting, and spreadsheet windows

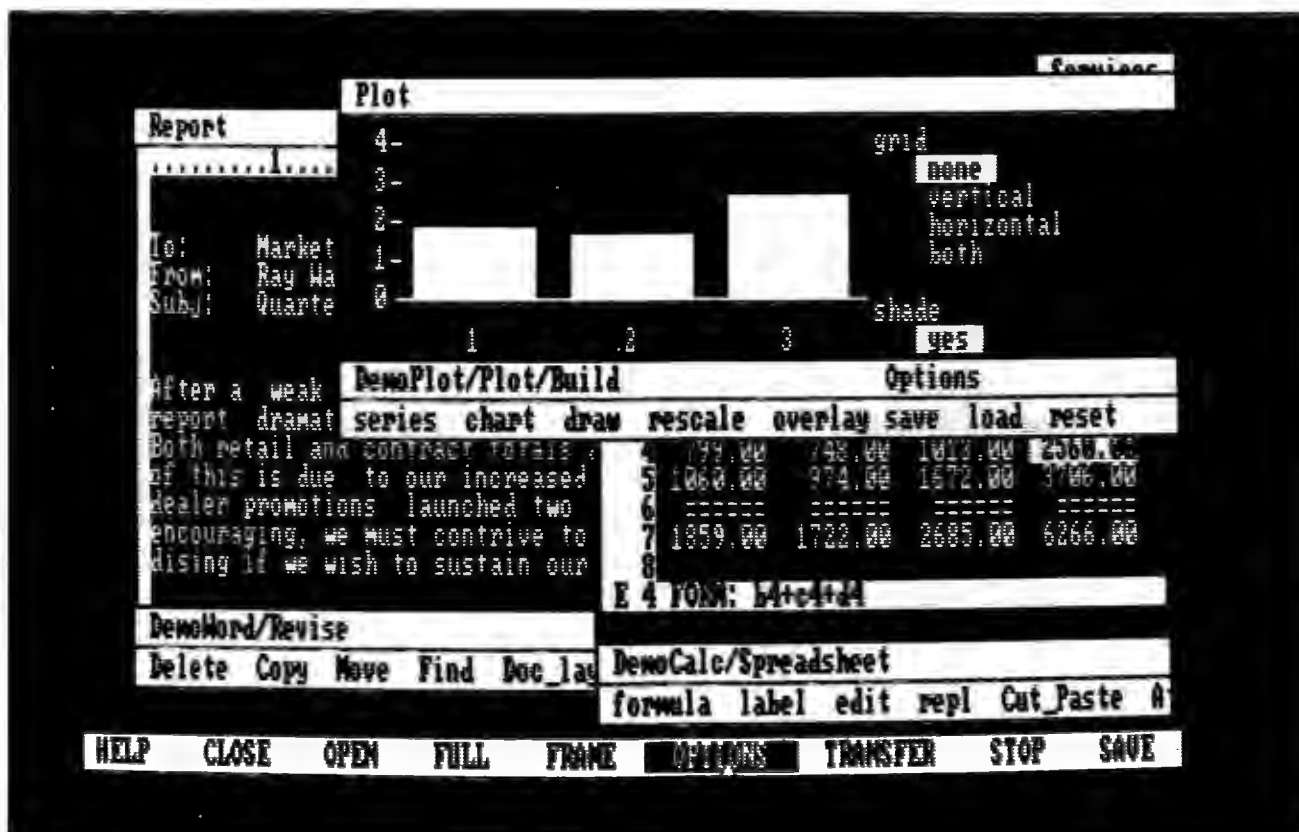


Figure 8: Option pane added to the plot window

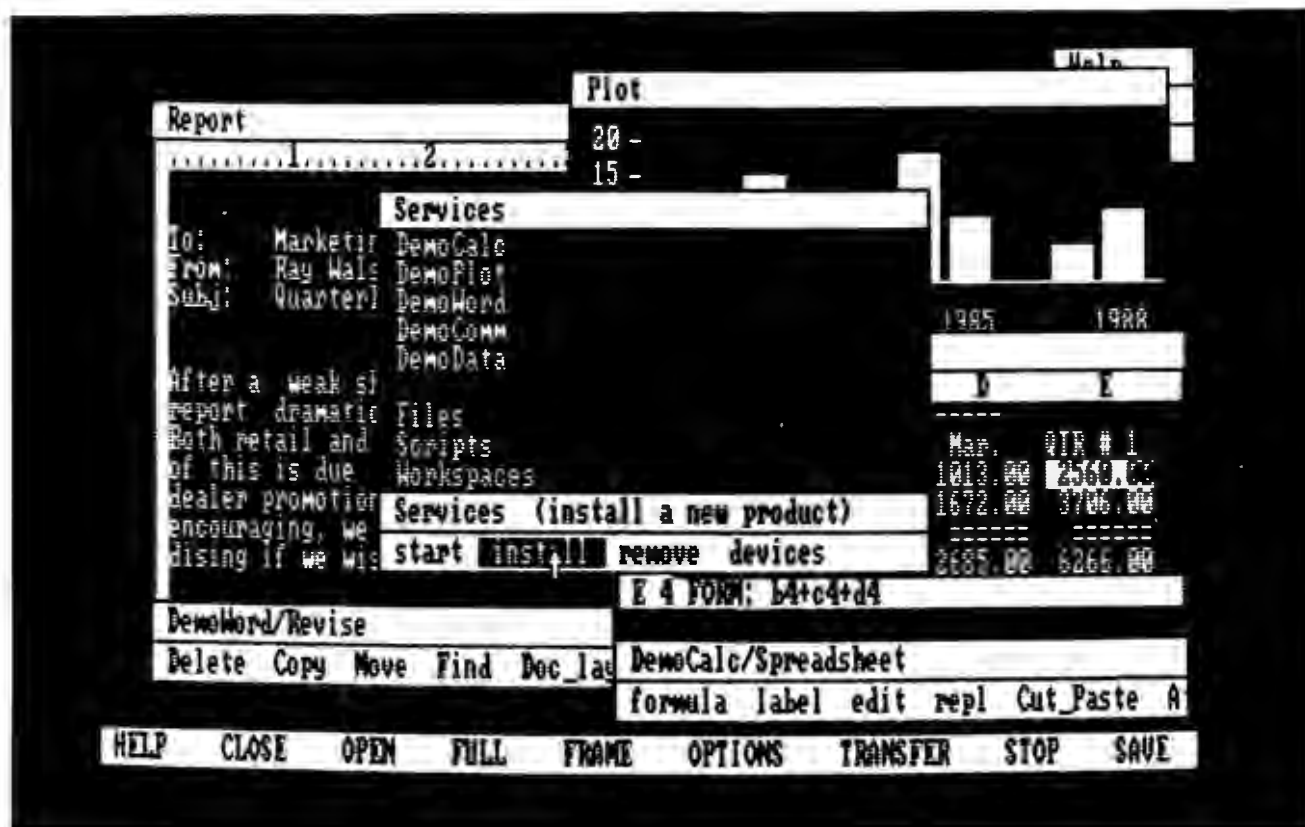


Figure 9: Services window selected to start a new window

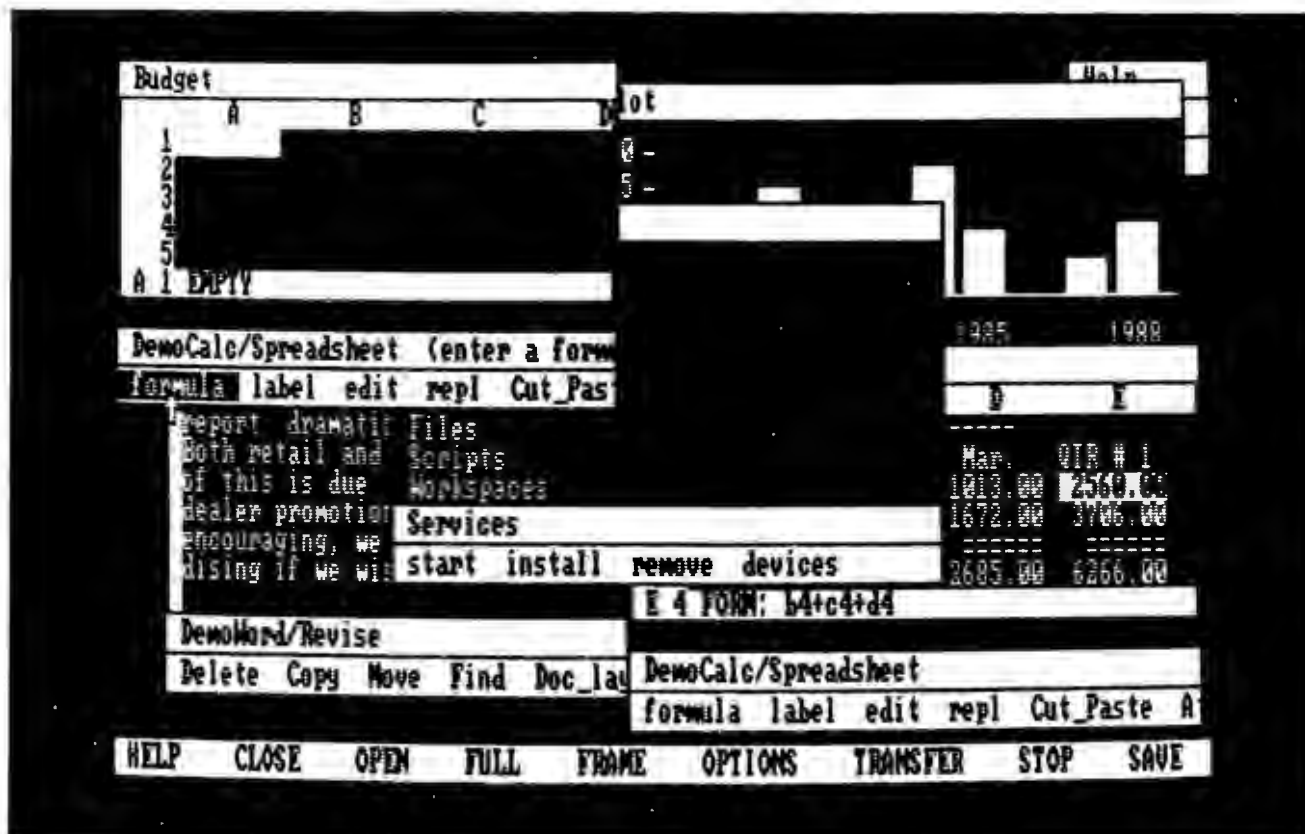


Figure 10: Window called budget appears after use of the Start command

When the user requests Options for a selected applications program, *Visi/ON* "glues" a pane onto the side of the original window. The new area displays the options and alternatives that are appropriate for the particular program (Figure 8). This area can be scrolled with the mouse. The possible values for each option are displayed within the pane, and the current value is highlighted. The mouse can be used to change a value to any alternative in the list; any changes in the display of the main window will appear immediately. When the user is through changing or inspecting options, selecting the Options command a second time will remove the options pane from the window.

Visi/ON is written in the C language to facilitate portability to a broad range of personal computer systems.

The Stop command discontinues any command in progress. Both *Visi/ON* commands and individual applications program commands can be halted any time the system is waiting for user input.

The Save command stores the entire contents of the display for later retrieval. It retains the size, position, program, and data file contents of each window on the simulated desk top. This information is stored as a "work space" file, which can be retrieved at any time to continue the work where it was left off.

Services

Figure 9 shows the Services window for a typical *Visi/ON* system. The five entries represent all the applications programs installed in this particular system. The Start command is used to define a new use of an already installed program—a new sheet of paper for the desk top. After selecting the Start command, the user moves the cursor to indicate which applications program will control the new sheet, and then types in an identifier that will appear on the top line of its windows. A new window appears in the upper left corner of the screen, and the user can begin operation by entering data or loading a data file (Figure 10).

The Services window includes an Install command that allows the user to install additional applications programs that are compatible with the *Visi/ON* system. The install command copies a new program from the

default floppy disk drive to the system disk and adds the program name to the Services window. The newly installed program can then be started from the Services window as described above. This facility allows users to start with only one or two applications programs, adding others as desired. Installable programs will include future VisiCorp products as they are developed, as well as applications programs developed by independent software vendors licensed through VisiCorp.

Files, Scripts, and Work Spaces

The three remaining entries in the Services window are the system utilities. When the Files entry is selected, a Files window is created that lists all the data files created by the applications programs, along with standard file maintenance functions such as Copy, Rename, and Delete. These functions are available using the standard command format, so there is no need to access the host operating system to perform these tasks.

Scripts is a powerful facility that enables the system to remember and repeat any sequence of commands and operations, including cursor selections. Turning on the Scripts facility causes *Visi/ON* to memorize whatever commands are performed until the Scripts facility is turned off. The command sequence is stored as a named Scripts file. The next time a repetition of the same task is required, that script can be invoked to perform the process automatically.

The Workspaces entry in the Services window is used to restore any screen image or work space created with the Save command.

VisiCorp hopes that *Visi/ON* will become a standard user interface for integrating applications programs and is supporting this goal by licensing *Visi/ON* to hardware manufacturers and independent software vendors who wish to develop applications for it.

Visi/ON is written in the C language to facilitate portability to a broad range of personal computer systems, and to allow a wide range of applications products to be designed or easily modified to run under it.

The program will be available on the IBM PC this summer with core applications products for the office professional: spreadsheet, word processing, data base, communications, and graphics. This system will also be available on the DEC personal computer.

Roy Folk is marketing manager of Systems Products for VisiCorp. He has been involved in software development, design, and management with several companies including Versatec, Digital Equipment Corporation, Applicon, and Amcomp.

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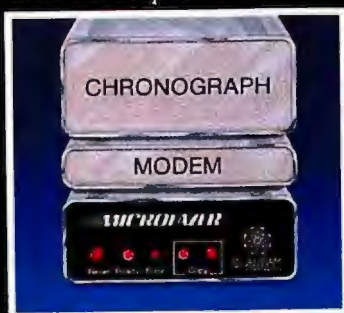
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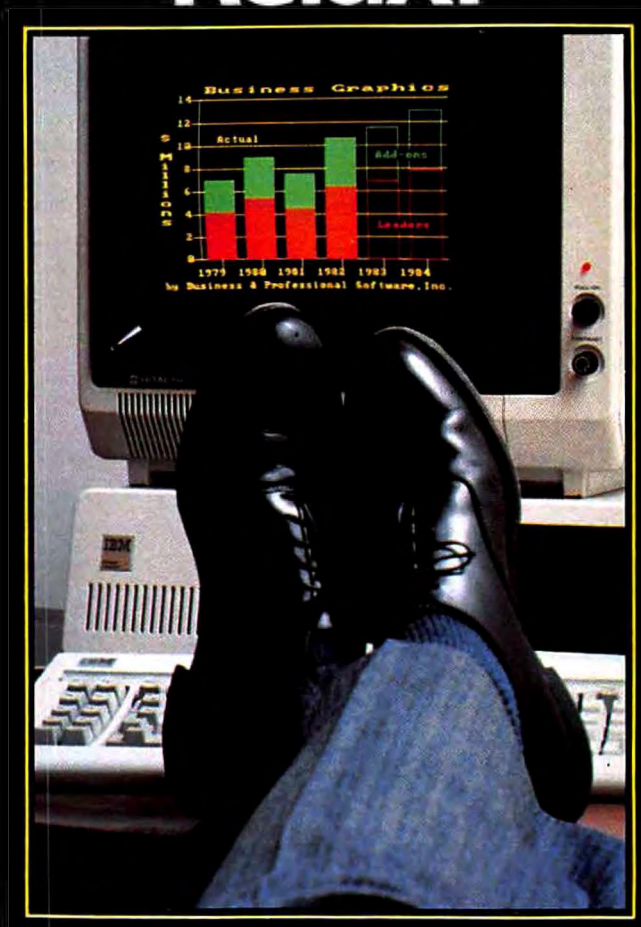
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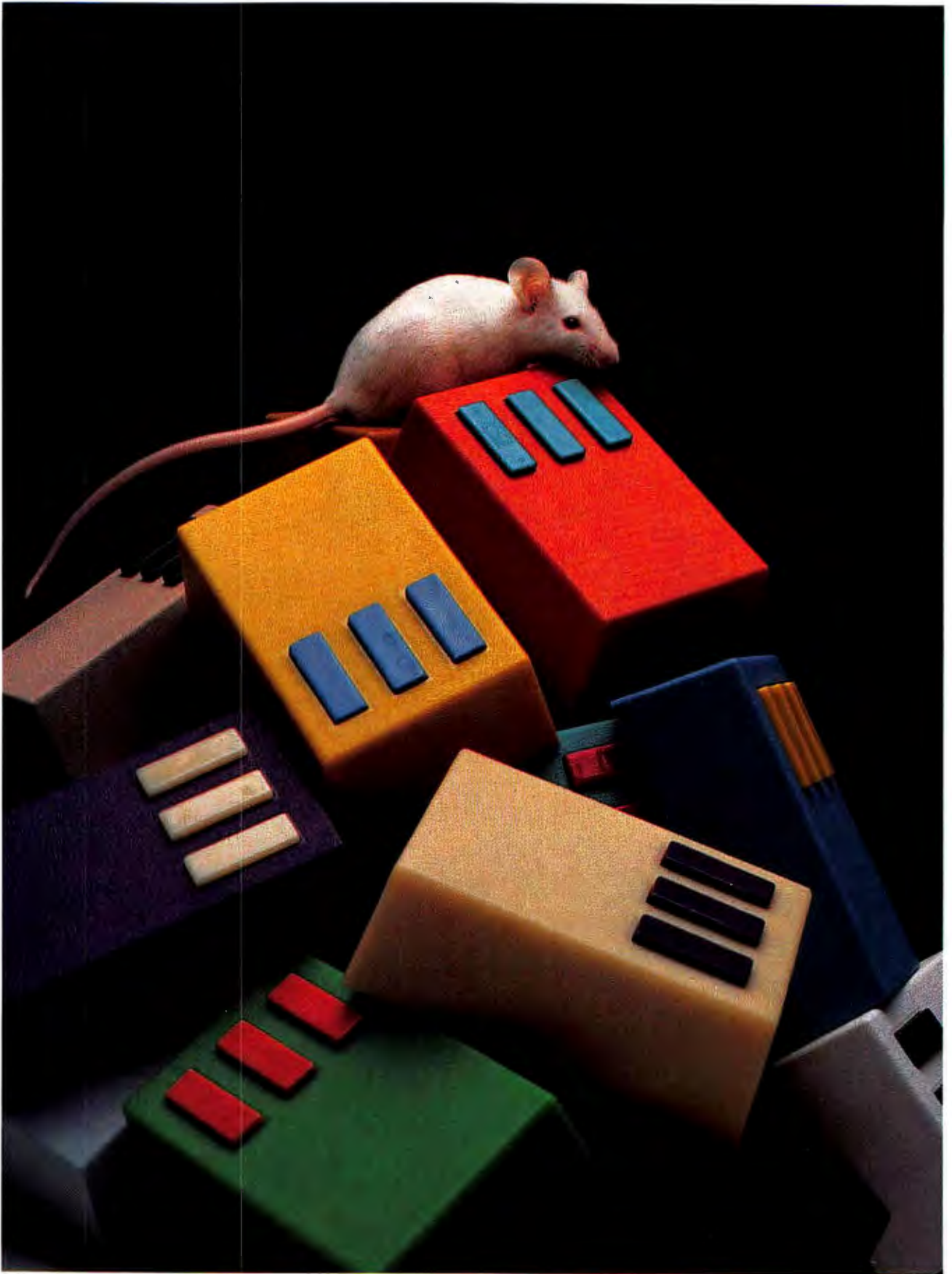
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To Build a Better Mouse

Mouse competition is turning into a real rat race.

Lisa B. Stahr

The mouse first went public with Xerox's \$20,000 professional computer. Then Apple saw the Star shining in the east and used this state-of-the-art cursor controller to run Lisa, a system similar to the Xerox Star but costing only half the price. Today, with the help of these two computers, the mouse has broken out of the research and development labs and into the personal computer world—and the excitement it's generating is reminiscent of the days when *VisiCalc* was new. Manufacturers predict that the mouse will be standard equipment on personal computers by 1985.

Designed as a supplement rather than an alternative to the omnipotent keyboard, the mouse is a small hand-operated device with buttons on top that look like ears and a long taillike cord that connects it to the computer. When moved across a flat surface (such as a desk top) or a special pad, the mouse electronically signals the cursor to move in the same direction on the computer screen.

The mouse is one of the easiest and perhaps the fastest cursor controllers currently available. Unlike the pesky rodent, this mouse is a welcome companion to anyone who, in frustration, has almost pushed a cursor key through the keyboard while waiting for the cursor to get to its destination.

With the help of the function buttons, you can even use the mouse to do word processing and graphics. Without putting your hands on the keyboard or taking your eyes off the screen, you can select menus, edit text, draw charts and graphs, or even find, replace, and delete files.

"The mouse is ideal for any human interaction with a computer," according to Steve Kirsch, president of Mouse Systems Corporation in Santa Clara, California. Novices will be happy to make its acquaintance since it can shorten computer learning time from hours to minutes. By lessening keyboard dependence the mouse also makes computers more accessible to inexperienced typists such as business executives and engineers.

"Originally engineers used the mouse for computer-aided design and manufacturing," says Dan Robinson, vice-president of operations for another mouse manufacturer, USI International in Brisbane, California. "But now it will be used for business, word processing, graphics, and games."

Mechanical and Optical Mice

Two types of mice are available today, although one has been around much longer than the other. The first mouse, designed in 1967 by Douglas

Engelbart at the Stanford Research Institute, was mechanical. It controlled cursor movement with two wheels placed perpendicularly. As one wheel rolled freely on a flat surface, the other dragged along without moving. The wheel's rotation was translated into electronic signals that the computer used to duplicate the mouse's movement on screen. For diagonal movement each wheel moved in proportionate horizontal and vertical motion.

Modern mechanical mice follow this basic principle but feature some improvements. The Micromouse from 3G Company in Gaston, Oregon, for example, has two wheels made of a special foam rubber for greater traction and durability. The Hawley X063X mouse, made by Jack Hawley, who designed the Xerox Star mouse, has a small stainless steel ball instead of wheels. Both feature a less expensive movement detection design than the original.

Unlike the mechanical mouse, the optical mouse requires a specially designed pad to communicate movement to the cursor. The mouse travels over the pad, which is marked with a pattern of dots or lines. As it moves, the optical mouse compares the "before" and "after" images on the pad, translating the image changes into spatial and directional movement.



Micromouse, 3G Company

LogiMouse, Logitech

X063X mouse, Hawley Laboratories

One of the key issues in comparing an optical mouse to a mechanical one is reliability. Proponents of optical mice claim that these cursor controllers are more reliable than their mechanical counterparts.

"The wheels or ball bearings [of a mechanical mouse] can get dirty and refuse to roll, and the communicators are prone to contamination," according to a USI International report. In addition, the mechanical mouse's tiny, precision-machined parts make it more expensive to manufacture than the optical variety.

In defense of mechanical mice, Jack Hawley, now president of The Mouse House in Berkeley, California, says an optical mouse's grid pad will wear out long before any part fails in the mechanical mouse.

"There's a lot of abrasion in moving an optical mouse over its pad," says the self-proclaimed Big Cheese. "The pad will have to be replaced long before a mechanical mouse's rollers."

The grid pad required for an optical mouse also restricts its freedom of movement, Hawley says. The optical mouse moves in relation to the lines on the pad; the mechanical mouse is more flexible because it is not restricted to following lines on a pad.

The mouse is a cursor positioner primarily, but it can be used for

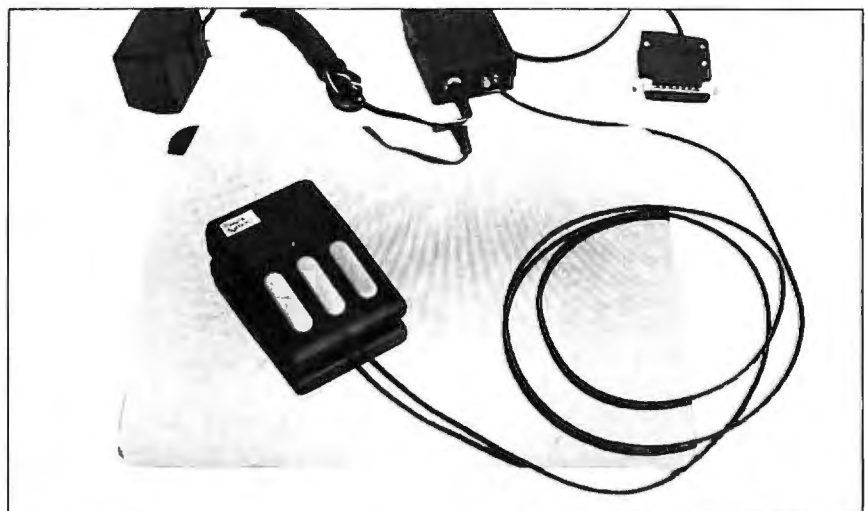
drawing. In this application the grid can work in the optical mouse's favor, according to (surprisingly enough) a mechanical mouse advocate.

"A mechanical mouse can't be used for freehand drawing without an extremely steady hand," explains Richard Wolf, senior design engineer for Random Access, Inc., a manufacturer of mouse interfaces. "The optical mouse's exact grid coordinates could make it better for drawing and tracing." Wolf warns that the IBM PC's microprocessor probably isn't fast enough to handle the information coming in from a mouse in this graphics activity.

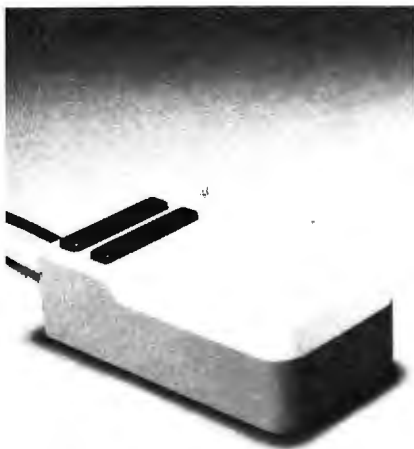
Resolution

New strengths and weaknesses continue to be found in both optical and mechanical mice. The mechanical mouse's higher resolution means that less mouse movement is required to move the cursor across the screen. An optical mouse typically has a resolution of 100 parts per inch (parts are quantifiable events, such as lines or dots that a mouse can count and transmit to the computer), while a mechanical mouse has 200 parts per inch or more.

The LogiMouse, an optical-mechanical hybrid made by Logitech, Inc. of Palo Alto, California, has one of the highest resolutions of both



M-1 optical mouse with grid pad and RS-232C interface box, Mouse Systems Corporation



OptoMouse, USI International

kinds of mice, with 380 parts per inch. As Pierluigi Zappacosta, vice-president of Logitech explains, "the resolution of an optical mouse isn't limited so much by its grid as it is by its optical sensor. A grid with finer lines isn't difficult to make, but a more sensitive optical sensor is."

USI's Dan Robinson is quick to point out, however, that the movement scale to which an optical mouse relates can be increased with one of its buttons. This may not be an ideal solution, however, since assigning a scale function to a button leaves the button with one less function capability. As with a keyboard's function key, the interpretation of a mouse's button depends on the software. This is one reason several manufacturers stress that a mouse's resolution can be misleading—so much depends on the speed of the system and its software.

Buttons

The commercial immaturity of the mouse keeps debates like the optical-mechanical issue alive. Another issue that must be resolved before the ideal mouse is created is the number of buttons in its design.

One-button mice are too confusing for the operator to use, as too many operations must be assigned to that button. Xerox offers a two-button mouse for its Star because the com-

puter operates in a way most naturally handled by two buttons. Jim Golts, vice-president of software for 3G Company, says its Micromouse uses two buttons, because three buttons cause the user to look away from the screen and lose valuable time.

Xerox says that most untrained operators have little dexterity with their ring fingers. Several studies have indicated that the easiest method for operation is to move the index finger from button to button; having a different finger on each button is less natural for the user.

Logitech's Zappacosta says that with the LogiMouse having three buttons is not a problem. Originally designed and distributed in Europe as the DePratz mouse, the LogiMouse is hemispherical in shape and has three buttons in front rather than on top. The mouse rests comfortably in the palm of the hand while the user's three middle fingers lay across the buttons. This method of holding the mouse also helps prevent any movement while a function button is being pressed.

Jack Hawley, whose mice also sport three buttons, says that a third button can make the mouse capable of three-dimensional graphics by using it to select a third axis for Z coordinates.

A Japanese company is reportedly working on a five-button mouse. Five buttons may eventually be optimum, Zappacosta says, but that's a long way from becoming a reality.

The mouse was originally designed to be a pointing and positioning device, but it has developed new function capabilities. Software permitting, the mouse's buttons determine and activate functions such as scrolling and deleting. As a result, the more buttons a mouse has, the more functions a mouse can perform. Using the mouse you can select an operation with the standard menu format or by marking an icon, or symbol, that appears on the screen.

"The cursor is moved to a symbol [icon] or location [menu] and the button is pressed to select the opera-



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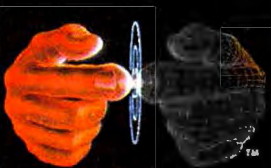
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Movers and Pointers

For those of you who decide that your PC just can't live without a pet for companionship, we've included this list of compatible mice and products that will allow a mouse to operate.

When considering a mouse, make sure you know how you want to use it. It isn't likely that the mouse will be able to operate by itself. A mouse will usually require a hardware interface, and attaching a mouse to a serial or parallel port requires software. Some manu-

facturers include everything required to run their mouse while others don't.

Software applications designed to allow a mouse to make menu selections are not yet available; you will either have to wait for them or write your own. But if you want to use a mouse for simple cursor positioning or limited button function selection, you should be able to find what you need.

Mice

Executive Mouse

A mechanical mouse with three buttons and 200 parts-per-inch resolution. List price: mouse \$150, interface box \$200. Product Associates, 465 Convention Way, Redwood City, CA 94063, 415/364-3121.

LogiMouse

A mechanical mouse with an optical sensing device, three buttons, and 380 parts-per-inch resolution. List price: \$350 including mouse, interface box, and game on disk. Logitech, Inc., 165 University Ave., Palo Alto, CA 94301, 415/326-3885.

Micromouse

A mechanical mouse with two buttons and 235 parts-per-inch resolution. This mouse requires interface development and is sold only to OEMs. List price: \$180. 3G Company, Inc., Route 3, Box 28A, Gaston, OR 97119, 503/627-1792.

M-1

An optical mouse with three buttons and 100 parts-per-inch resolution. List price: \$286, power supply interface box \$26. Mouse Systems Corporation, 2336H Walsh Ave., Santa Clara, CA 95051, 408/988-0211.

OptoMouse

An optical mouse with two rocker-switch-like buttons (creating four circuit selections) and 100 parts-per-inch resolution. List price: \$300, power supply interface box \$15. USI International, 71 Park Ln., Brisbane, CA 94005, 415/468-4900.

X063X

A mechanical mouse with three buttons and 200 parts-per-inch resolution. This mouse requires an interface box at additional cost. List price: \$415; \$300 after April 1. The Mouse House, A Division of Hawley Laboratories, 1741 Eighth St., Berkeley, CA 94710, 415/525-5533.

Hardware Interfaces

Mouse Trap

A small boxlike device that stands outside the PC and allows the Hawley X063X mouse to be used without serial interface. Both the mouse and keyboard plug into the box, which then plugs into the keyboard outlet on the system unit. List price: \$345. Corman Custom Electronics, 38 Bridgeport Road East, Waterloo, Ontario N2J 2J5 Canada, 519/884-4430.

MU-1 and MM-1

Two interfaces that are used with the Hawley X063X mouse. Each interface requires the development of a software driver, examples of which are provided in the docu-

mentation. The MU-1 requires a serial interface and the MM-1 requires a parallel interface. List price: \$295. Random Access, Inc., 246 Highland Rd., Pittsburgh, PA 15235, 412/247-7472.

Software

Visi/ON

A program that will serve as an integrated applications software environment and has been designed for use with the mouse. Visi/ON will use replaceable windows that can be viewed and manipulated. Initially VisiCorp plans to package Visi/ON with its own mouse used for cursor positioning and item selection. Visi/ON will be available this summer. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134, 408/946-9000.

Quantum System

A software package based around a UNIX-like operating system called QUNIX, or QNX. It requires 96K and one disk drive. The source code for the shell (the definable user interface) is provided and allows development of software applications that can communicate with a mouse. The Quantum System also includes a C compiler, 8086/8087 assembler, link editor, full-screen editor, and communications program. List price: \$650. Quantum Software Systems, Inc., 7219 Shea Ct., San Jose, CA 95139, 408/629-9402.

tion identified with that symbol or location," explains Syd Geraghty, president of Quantum Software Systems, Inc. of San Jose. With Apple's Lisa, for example, you can point to a trash can that appears on the screen and press the button to throw a document away.

Another option, button reassignment, allows a button's function to be reassigned for easier use with a particular application.

"In an interactive program with different applications, assigning functions like scrolling, deleting, or changing windows to the mouse buttons could save operation time," Geraghty says. Button reassignment could occur automatically as the user selects an application, or the user could select a button's function from a Button Reassignment mode in the program's menu.

Usually communication from the mouse to the computer is one way only. In order to effect button reassignment, the system must support two-way communication, meaning that the system must have a hardware interface that can receive data on its way back to the mouse. Hardware interfaces that connect to an RS-232C port are capable of this two-way operation, as are a few other types of interfaces.

Hardware Interfaces

Hardware interfaces, while important to button reassignment, are integral to the entire operation of the mouse. Without the proper interface, a mouse will, at best, have limited communication with the computer.

"There are several ways for a mouse to interface with its host system," explains John Corman, president of Corman Custom Electronics in Waterloo, Ontario. "One is through an expansion slot with a parallel or RS-232C port, another by plugging the mouse and the keyboard cable into a box, which, in turn, plugs into the back of the system."

Corman Custom Electronics' Mouse Trap is just such a box. "The

Mouse Trap translates the mouse's movements into cursor control codes," Corman says, "and it doesn't need an expansion slot or its own power supply." The Mouse Trap was designed for use with the Hawley mouse, as were the MM-1/Parallel and MU-1/Serial interface boxes from Random Access, Inc. of Pittsburgh. The MM-1/PC, designed for the IBM Personal Computer, uses eight consecutive I/O addresses on the PC.

If an RS-232C port is used to connect a mouse to a PC, the computer will require more power to run the device. USI sells a \$15 power box with its \$300 OptoMouse. The mouse plugs into the box, which plugs into the RS-232C port in the system.

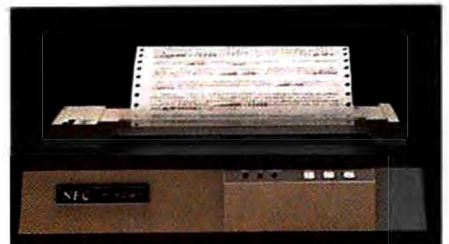
In a similar arrangement, Logitech offers an optional interface box with each of its mice, including its IBM LogiMouse, made especially for the PC. The mouse and keyboard cable simply plug into the box, which plugs into either the RS-232C port or keyboard jack in the back of the computer.

"With this box the LogiMouse provides cursor movement with existing software," Zappacosta explains.

Software

Using a mouse with existing software isn't as simple as it may seem. Sometimes the software doesn't behave as it should. With *WordStar*, for instance, the cursor movement might be reversed, or, if it doesn't follow in the right direction, it might be too slow for the user's needs. Logitech is planning to develop mouse software, including a text editor, free of these shortcomings.

Some mice, such as the Executive Mouse from Product Associates, Inc. of Redwood City, California, can be used as a joystick replacement for PCs with game boards. To take advantage of a mouse's pointing and selecting capabilities, special symbols must be written into the program to which the mouse can point to activate the function. To do this with an existing application, a programmer would have to access the source



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code, which is usually protected by the manufacturer.

Some companies, like Quantum Software Systems, Inc. of San Jose, makers of the QUNIX operating system, supply the source code to mouse users for just this reason.

"Although QUNIX is an operating system, having the source code makes it ideal for programming mouse software," according to Geraghty. Quantum has used the Hawley mouse with a Corman Mouse Trap for screen editing and window management applications.

For people interested in learning to write mouse programs, 3G Company has some simple how-to examples, including an *Etch-A-Sketch* graphics program. These programs and the 3G mouse are available to OEMs only.

While companies like Quantum and 3G offer some assistance in making or modifying applications software, most mouse users will have to wait for mouse-designed software to be developed before taking full advantage of the device. Special engineering programs for computer-aided design and manufacturing are currently available, but spreadsheet, word processing, and business management software is just now being written.

The best known of these programs is *Visi/ON*, which VisiCorp will release this summer. *Visi/ON* will initially appear with its own mouse, although a software-only version will be available in the future. VisiCorp is contracting hardware manufacturers to provide the mouse, which will probably feature an optical design with two buttons for scrolling and selecting. The mouse will also plug into a system's serial interface without taking up an expansion slot.

In addition to the mouse, *Visi/ON* will come with a complement of applications products, according to Roy Folk, marketing manager for the *Visi/ON* line.

"The products will include word processing, spreadsheet, data base, communications, and graphics, and all will be enhanced versions of the present VisiSeries software," Folk says. He hints that an enhanced version of *Visi/ON* will eventually be available.

Software Directions

The favorable reception of Apple's mouse-driven machine makes it likely that future mouse software will be modeled after Lisa's, including the use of overlapping windows.

"The desk-top-like screen layout is easier for beginners and experienced users," Random Access' Richard

Mice initially serve a need: they educate novice users and help them overcome the fear of computers.

Wolf says. "You don't have to remember commands because the symbols remind you."

One of the problems with this desk-top design is that to be effective it requires a high-resolution display. "The PC's 640 by 200 color/graphics adapter offers the bare minimum resolution you'd want for this software," Wolf says.

USI will adapt existing software but will soon write programs for graphics and menu selection. Digital Research, in the meantime, is reportedly working on a standard C/P/M package for the mouse.

Future Mice

With improvements for the mouse in mind, manufacturers are preparing for a long and prolific future. Logitech, Inc. anticipates a need for many types of mice and will make

both optical and mechanical versions in the near future. Mouse Systems Corp. will soon be coming out with an improved version of its M-1, including one with a microprocessor to track translation and movement. For its Executive Mouse, Product Associates, Inc. has developed a complete computer system, the Z-Disk, which comes with specialized word processing and optional spreadsheet software.

Devices based on the mouse cursor control principle are already being introduced. The Koala, by Koala Technologies in Los Altos, California, is a touch tablet, or video sketchpad, that is presently used for video games only. Similar to the mouse, the small, 4-inch by 4-inch portable tablet has two function buttons. Unlike the mouse, the Koala is stationary; it reacts to the touch of a fingertip to move the cursor. By the end of 1983 the device and its applications software will be available for personal computers.

Although the mouse is generating excitement, some people don't share the optimism. Research analyst Alex Stein of Dataquest, Inc., a market research firm in San Jose, believes the mouse is a passing trend. "Mice initially serve a need: they educate novice users and help them overcome the fear of computers," Stein says.

The mouse's problem is that it increases the likelihood of system failure. "Mouse software requires dot-pinpointing techniques that increase the possibility of software crash." It's only a matter of time, Stein thinks, before touchscreens become a suitable replacement.

Meanwhile, the mouse will bask in the computer world limelight, enjoying popularity while its usefulness lasts. Like the joystick before it, though, the mouse will someday fade into familiarity. And with the dynamism of this industry, it shouldn't be too long.

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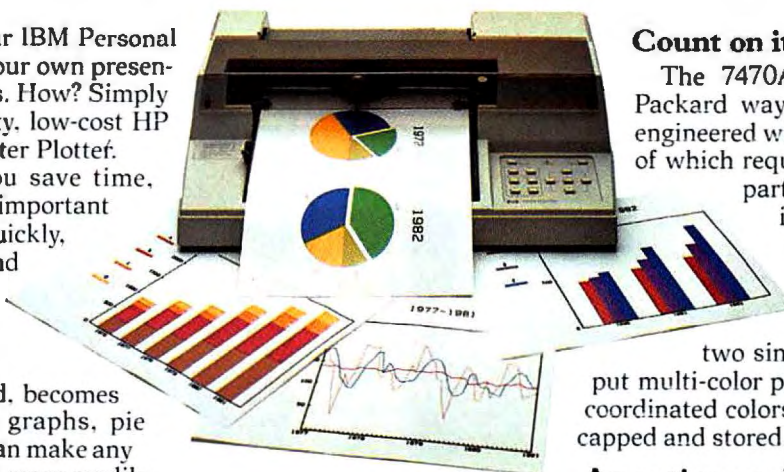
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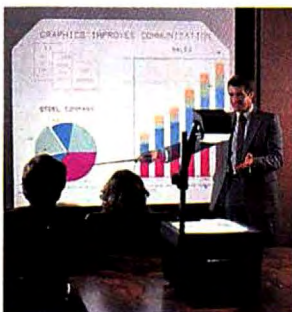
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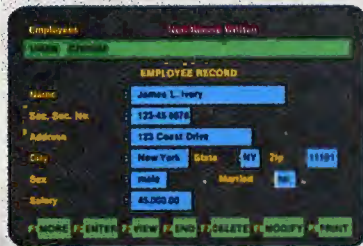
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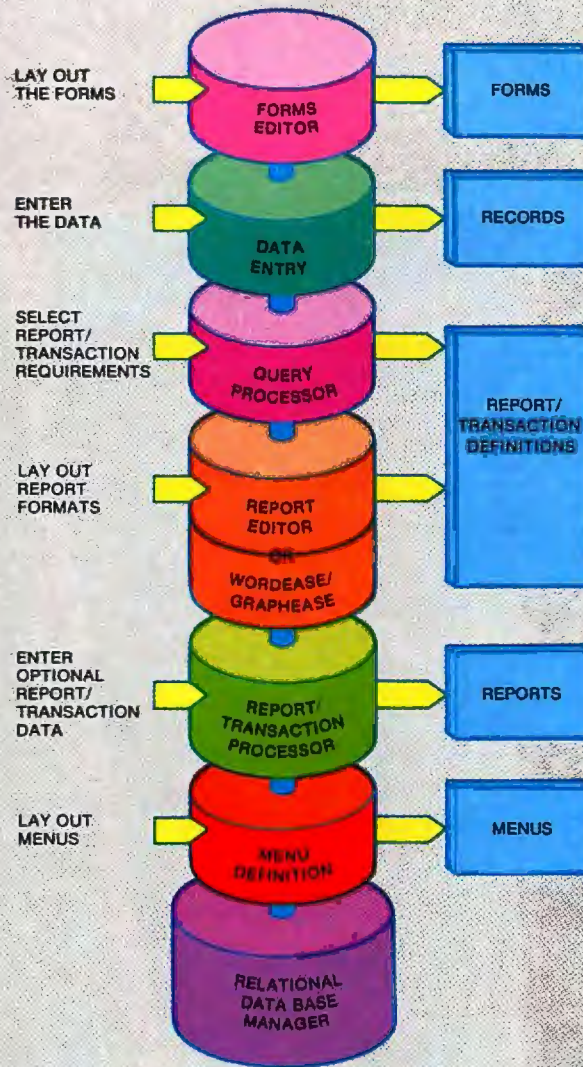
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High Interest in Home Banking

PC users can look forward to the convenience of home banking and other electronic services.

Catherine Kent

The new era of deregulated banking and the revolution in microelectronics will combine to bring banking home in the not too distant future.

In anticipation of this event, nearly 50 banks are conducting small-scale home banking studies designed to identify services consumers want and will pay for, and the best way to deliver those services. A few banks already offer commercial home banking to customers in limited geographical areas.

The experiments afoot offer a selection of home banking services chosen for their predicted consumer appeal and ease of implementation. Table 1 shows a list of services grouped into three stages in order of probable appearance. Most experiments include Stage I services, and a few include Stage II services; Stage III services are predictable but await hardware and software developments in system compatibility.

Banking services arrive in the home via two-way (interactive) communication carried by telephone line or cable from a remote data base to a terminal equipped with a modem and keyboard. Users sign on the system, enter passwords and other identification, and receive a menu of services. Banks either provide services directly from their own data bases or through third-party systems such as information networks that



provide an assortment of additional services—algebra courses, shopping information, news, games, and even jokes.

Today the PC user can receive Stage I home banking services from Huntington National Bank of Columbus, Ohio, and Shawmut Bank of Boston via the CompuServe network. This summer, Chemical Bank of New York will make home banking available to PC customers. Widespread service availability depends on the results of experiments and the development of new communications technologies.

The next few years will witness a revolution in the delivery of electronic information to the home, and banking services will be part of this revolution.

Home Branch Office

The stages of home banking development in Table 1 are not hard and fast. They suggest a likely sequence, but applications of new technology often follow a leapfrog course. Stage I home banking promises the convenience of being able to pay bills without writing checks or licking stamps (see Figure 1). This stage will allow review of account balances and comparative interest rates, and electronic transfer of funds among accounts to maximize yield. Account status and balances are always accessible, regardless of whether it's midnight Thursday or Sunday at seven.

In addition to providing payment records, posted bank card transactions, and current statements, Stage II services allow consumers to open new accounts, apply for loans, buy Certificates of Deposit (CDs), and buy and sell stocks and bonds if banks receive legal clearance to offer this service.

As electronic banking progresses, banks will design services specifically for the PC. These services will include automatic loading of programs from the bank's data base and downloading of bank-supplied programs for off-line use. Downloading is the

Stage I: Included in most experiments

1. Electronic bill payment
2. Internal funds transfer
3. Balance inquiry
4. Bank product and service information
5. Comparative interest rates
6. Itemized check clearings
7. Electronic mail to bank

Stage II: Planned but not widely tested

1. Month-to-date statements
2. Applications for new accounts and loans
3. Posted bank card transactions
4. Historical payment record
5. Integrated account statements
6. Securities transactions

Stage III: Predicted

1. Program downloading: personal budgeting, graphics, cash management, account reconciliation, statistical forecasting, portfolio management and analysis, retirement planning
2. Automatic program loading

Table 1: Home Banking Service Development

transmission of a program from a large computer to a smaller one. For dedicated home accountants, Stage III will be seventh heaven.

It appears likely that home banking will be offered in combination with other electronic services. Subscribers will be able to access local real estate listings and look at floor plans of interesting houses. By switching to the banking service, potential buyers will then review their overall financial position to determine how much money is available for a down payment. The push of a button will display comparative mortgage rates, and a simple accounting program will calculate monthly mortgage payments based

on the best available rates and various payout periods. Later the buyer could apply for a loan electronically.

While home banking is not widely available to PC owners today, powerful incentives in the banking and communications industries assure that it will soon become popular.

The Paper Chase

Costs, consumer clout, and competition steadily propel banking into the electronic age. The expense of service delivery to perform a given function from brick and mortar offices is increasing wildly while the cost of using new technology declines steadily. Paper processing is becoming prohibitive.

Consider that in 1980 the cost to commercial banks of handling and processing more than 47 billion paper items (checks, sales drafts, deposit and withdrawal slips, loan payment stubs) amounted to over 37 cents each, or about \$17.8 billion. If trends observed between 1971 and 1980 continue, the number of items processed will reach 81.6 billion by 1990 and will cost 75 cents each—a total of \$61.2 billion. In contrast, Don Long, finance industry consultant with IBM, estimates that the cost of performing and storing a given computation in mainframe computers has declined at a compound rate of over 20 percent a year since 1962.

To put it another way, the net cost to the payer, biller, and bank of a payment made by conventional check and voucher exceeded 65 cents in 1982, while the net cost of bill payment by push-button telephone directly to the bank's computer amounted to less than 30 cents. Interactive home banking may be able to keep transaction costs somewhere between the extremes. John Farnsworth, senior vice-president of Chemical Bank, New York, is emphatic: "If financial institutions don't find alternatives to paper checking and banking procedures, they aren't going to be around."

● State of the Art

Bolstering the cost argument for home banking is the increasing stature of the consumer in the financial marketplace. In April 1982 consumers accounted for an average of 41 percent of commercial bank loan portfolios and 58 percent of deposits. Basing his calculations on projections in the FDIC's *Bank Operation Statistics*, Don Long estimates that consumers could account for 66 percent of bank loans and a staggering 90 percent of deposits by 1990. The banks have set their sights on winning consumers; they have given consumers more branches, drive-up windows, and automated teller machines. Home banking is the next logical step in the evolution of consumer convenience.

Increasing competition for customers also spurs banks to develop services for the home. Deregulation of the banking industry, set in motion by the Monetary Control Act of 1980, jostled financial institutions out of their traditional strongholds. Fueled by high interest rates and recession, the upshot has been sharpened competition among commercial banks, between these banks and the savings and loans, and between banks and nondepository competitors such as Merrill Lynch and Sears. All these institutions are now free to offer similar services, and all are vying for a larger percentage of the consumer dollar.

The tremendous success of direct mail and statement-stuffer advertising has shown the rewards of bringing products into the consumer's home. In a major effort to defend their territory and achieve a competitive edge, banks have pioneered delivery of financial services to the home.

Getting the Picture

The banks' desire to provide attractive home services will soon be abetted by a new videotex system that provides excellent graphics and has powerful industry support. Coined by the French, *videotex* is the generic term for terminal-based inter-

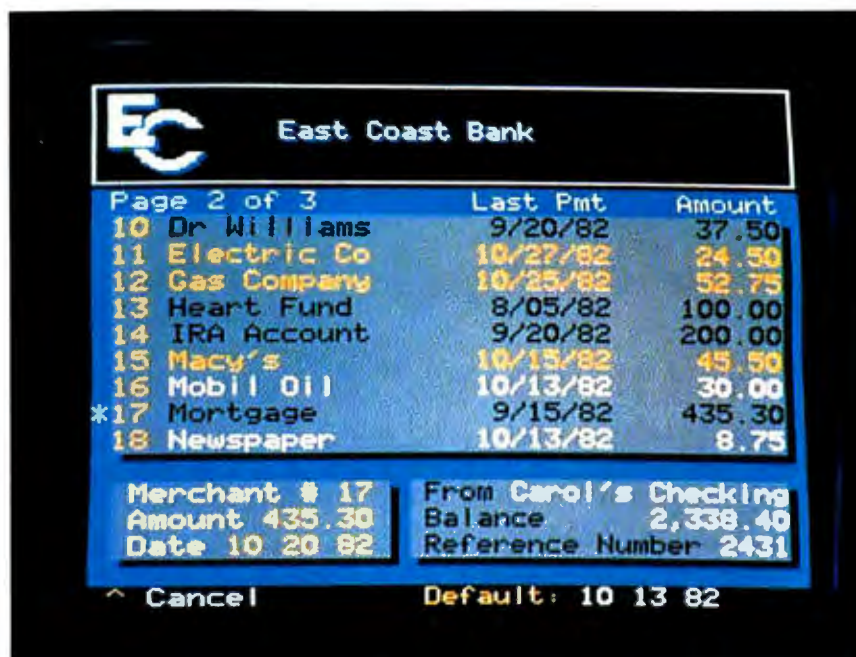
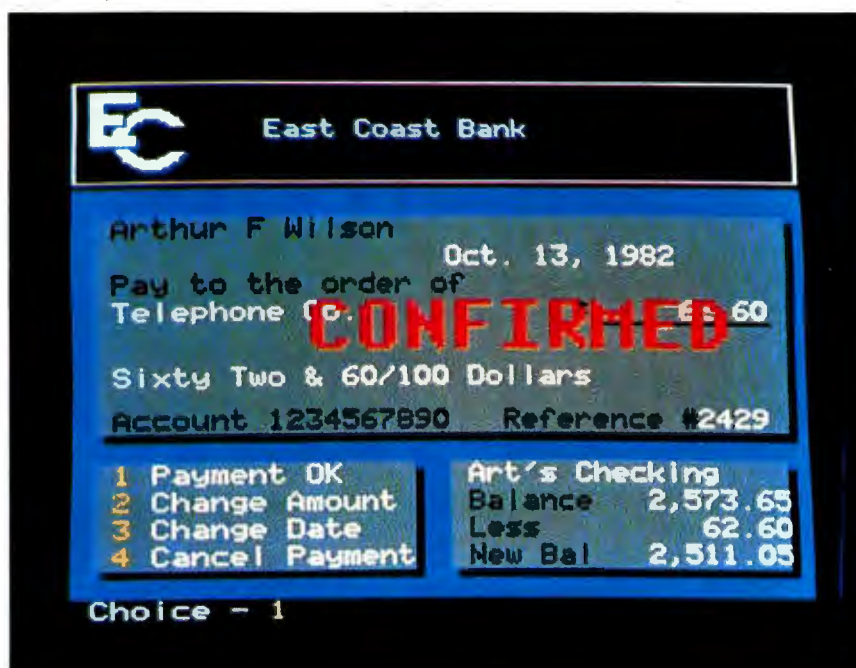


Figure 1: Two Screens from the Home Banking Interchange (HBI) System

active communications that include color graphics displays. The color graphics distinguish second-generation videotex from traditional communications between a central computer and remote terminals.

Whether the screen shows a picture of an account statement or a chinchilla coat, the display quality depends on the protocol governing the coding of information at the

originating data base. Protocols are ordered in ascending levels, one through seven, each level providing the functions of all lower levels while adding embellishments of its own. ASCII, used for traditional data base-to-terminal communications, is a low-level protocol capable of delivering text in black and white. It is fine for stock quotations and bank statements, but not for floor plans and fur coats. CompuServe, The Source,

Dow Jones News/Retrieval service, and other information retrieval services currently transmit in ASCII.

The first commercial videotex system, now called Prestel, was developed by the British Post Office in the early 1970s. Prestel provides color and a graphics display grid of 5760 resolvable dots (compared to about 300,000 for a typical television picture). At Prestel resolution the bank statement looks fine, but the chin-chilla coat appears to be made of Lego blocks. Similar in capacity to Teletel, the French videotex system (see Figure 2), Prestel in this country is limited to use in private networks. (See "Networking in Color," *PC World*, Vol. I, No. 1.)

In 1978 the Canadian Communication Research Center unveiled the Cadillac of videotex, Telidon, a level 6, or presentation level protocol. A new form of compressed coding allows Telidon to deliver outstanding graphics at astonishing speed. With Telidon, graphics are stored in the central computer in the form of picture description instructions (PDIs) such as "arc" or "circle," along with color and screen location instructions. Any terminal that can decode the PDIs can present a display up to the terminal's maximum resolution capacity. With the PC's standard color/graphics board, Telidon's resolution is 200 by 320 picture elements; with a higher resolution board the resolution will be better (see Figure 3).

Telidon can paint a full frame display in 15 seconds at 300 baud or in 5 seconds at 1200 baud, although detailed pictures take longer. Telidon's most important strength may be its ability to store information locally in the home terminal to enhance transmission speed. Compared to Prestel or Teletel, Telidon allows a greater variety of ways to format screen displays that are user-friendly. This is a big advantage for consumer-oriented services such as home banking.

The virtues of Telidon were recognized early in the United States. AT&T made a few modifications to



Figure 2: Teletel Resolution Graphics

Photo courtesy of Viewdata Corporation

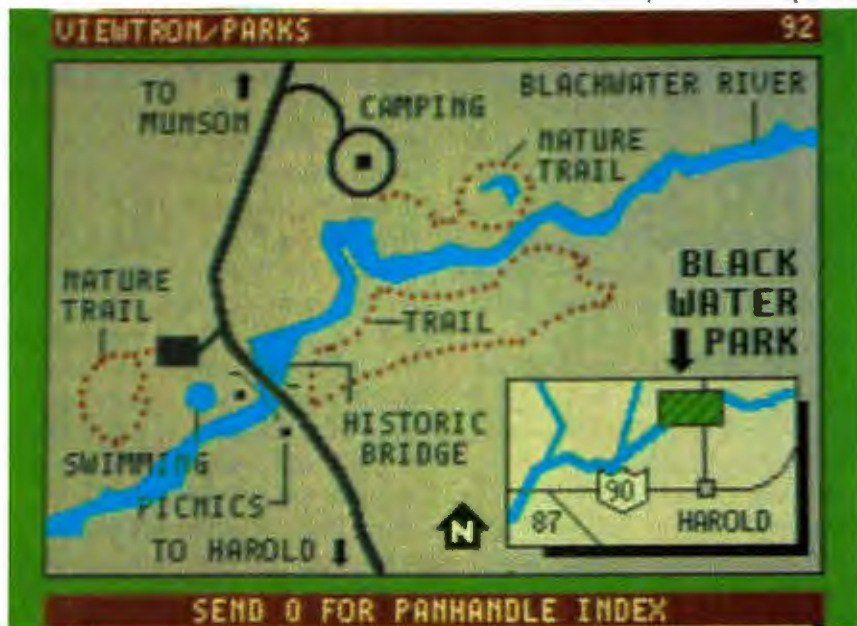


Figure 3: PLP Resolution Graphics

the system, named the result North American Presentation Level Protocol Syntax (PLP), and the American National Standards Institute approved it as the United States' videotex standard. Canadian Telidon kept its name but included AT&T's modifications, so Telidon is now fully compatible with PLP.

Electronic Yellow Pages

While speed and formatting flexibility recommend PLP for home banking, its color graphics make it attractive to advertisers. When the first commercial videotex network goes into operation later this year (see Figure 4), it will carry advertisements for everything from gourmet foods to Alaskan cruises.

● State of the Art

Network videotex will provide still-frame advertising "pages" organized by subject, such as food or travel, the way the Yellow Pages are organized in the phone book. They are far less expensive to advertisers than television ads and can be changed almost instantly to reflect new merchandise or a special sale. Soon consumers at home will be able to order the chinchilla coat at the push of a button and charge it to their bank card account.

Advertising revenues will support the spread of videotex networks, and home banking will be among the services offered. Banking will benefit from the electronic proximity of other network services in much the same way that merchants in a shopping center benefit from physical proximity.

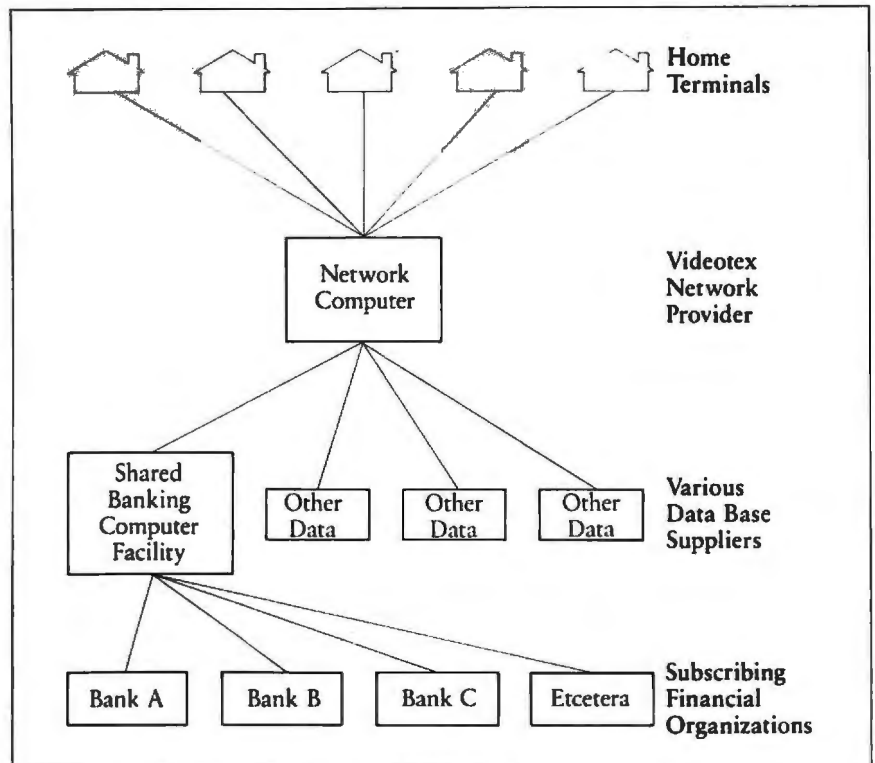


Figure 4: Schematic of Videotex Network

PLP Availability

At the moment only one package allows the PC to receive and transmit PLP videotex: TELIgraph, manufactured by Microtaure, Inc. of Ottawa, is a full implementation of PLP in software designed for graphics applications such as animated cartoons, architectural models, and medical information.

TELIgraph costs about \$400 and requires one disk drive and 256K. It also requires both a monochrome and a color monitor, one for the menu and instructions and the other to create the display. TELIgraph can receive or transmit at 300 or 1200 baud and can print in up to five sizes on any Epson printer. It provides eight colors, seven shades of gray, and seven character sizes. In the context of PLP videotex, TELIgraph is ideal for creating advertising pages that could be uploaded to the network computer and transmitted to subscribers.

Commercially available PLP decoder boards for the PC require the development of Very Large Scale

Integrated (VLSI) circuit chips. These chips may be available later this year from Texas Instruments of France, which demonstrated a prototype chip in 1981, or from Intel, IBM's major chip supplier, which publicly endorsed PLP last June. Significantly, AT&T's new subsidiary, American Bell, Inc. (ABI), plans to market PLP terminals in late summer to receive the first commercial videotex network in the United States. ABI Division Manager Sam Berkman says the terminal will probably retail for about \$800. Whether ABI plans to market its own VLSI chips remains to be seen.

Wolfdelta, Inc. of Ithaca, New York, maker of the Prestel board for the PC, promises to make a PLP board as soon as the VLSI chips are available. The board may not be cheap. It requires a minimum of 16K (and probably more) to decode the picture description instructions. Wolfdelta's Prestel board, which requires considerably less memory, costs \$600 plus \$250 for the minimum software. Whatever the initial cost of the PLP boards, however, the price will come down as the technology matures. Larry Pfister, chairman

of the U.S. Videotex Industry Association, foresees the day PLP decoder chips will be standard equipment in TVs as well as PCs.

The Winning Combination

With their current home banking experiments, financial institutions seek answers to these questions: Which home banking services are both attractive to the consumer and feasible for the institution? How should the services be delivered? What should the services cost?

Most of the experiments (see Table 2) provide menu-driven Stage I services, with plans to introduce Stage II later this year. The following are examples of attempts to find the combination of services that will satisfy consumers.

Channel 2000: The first interactive home banking experiment in the world was conducted in 1980 by Bank One of Columbus, Ohio. The Channel 2000 system linked 200 home TVs equipped with homemade communications gear to a central computer via a dial-up library catalog

| System | Operator | Participants |
|---|--|---|
| BancShare | CompuServe | Huntington National Bank, Columbus, OH |
| Channel 2000 | OCLC, Columbus, OH | Bank One, Columbus, OH |
| Chase Home Banking | Chase Manhattan Bank | Chase Manhattan Bank, New York, NY |
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| PRONTO | Chemical Bank | Security Pacific National Bank, Los Angeles, CA |
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| | | Citizens First National Bank, Ridgewood, NJ |
| Versatel | Videotex America Corp. Times Mirror | Fidelity Union Bank, Newark, NJ |
| VideoFinancial Services via Viewtron | Viewdata Corporation Knight-Ridder/AT&T | Bank of America, San Francisco, CA |
| | | Southeast Bancorp., Miami, FL |

Table 2: Recent Home Banking Experiments

service. Channel 2000's results suggest that the chief drawing card of Stage I home banking is transactions services such as bill paying.

Exclaimed one participant, "It [home banking] was like my microwave oven. Once I started using it, I couldn't live without it."

John Fisher, senior vice-president of Bank One, refers to Channel 2000 as "the Kitty Hawk of home banking." He believes that fully shared joint ventures among groups of banks will eventually provide home

banking to the mass market. Bank One plans to offer commercial services with such a group by mid-decade.

Microbanc: An opportunity to provide direct bank-to-consumer home services at relatively low cost is offered by Microbanc, Inc. of San Francisco. The company offers a menu-driven system that interfaces the bank's home service package with customers' computers.

According to President Philip Burkett, "Microbanc offers banks a turnkey system customized to each

bank's specifications, providing security, control, and technical requirements. The system is linked with the bank's mainframe on-line applications while communicating with multiple microprocessors. Almost any microprocessor with a modem and TTY software can talk to the bank via the Microbanc system." The system allows banks to break even on home services with only a few hundred customers.

● State of the Art

FirstHand: The concept of combining home banking services with other services aimed at a specific market segment is under test by First Bank System of Minneapolis. The system, FirstHand, delivers Teletel videotex banking and agricultural information to members of the ranching community of Fargo, North Dakota. FirstHand has its roots in a 1975 videotex experiment by the University of Nebraska that provided farmers with cultivation and livestock information via such programs as Soilloss and Ewesale.

"We came to realize," writes Senior Vice-president Stuart MacIntire, "that our services needed to be structured to the individual needs of particular market segments rather than to the market as a whole. We also found that home cannot stand alone. By itself, it does not provide sufficient value to warrant the development of the system to put it into the home."

Viewtron and Gateway: Two large newspaper chains plan to introduce a panoply of consumer services with PLP videotex in the near future. Besides home banking, the networks will offer frame after color frame of ads, consumer service information, and local news including weather, health, taxes, gardening, travel, entertainment, auto repair, education, and recipes.

Viewdata Corporation of America, a subsidiary of Knight-Ridder Newspapers, will introduce its Viewtron service in southern Florida in September. So far, 12 financial institutions—including banks, credit unions, and savings and loans—have contracted to deliver home banking via Viewtron. The system will transmit to the PLP terminals forthcoming from Viewdata's joint venture partner, American Bell. It will also transmit to any other terminals that can decode PLP by that time. Viewtron's subscription fee is \$15 per month plus communications charges.

The other newspaper network in the offing is Gateway, developed by Times Mirror's subsidiary, Videotex America Corporation. Gateway's recently concluded market test in the Los Angeles area suggests that the most popular videotex services will be electronic mail, games, news, and transaction services such as shopping and banking.

Telephone Computing Service (TCS), a subsidiary of Seattle's Automatic Data Processing, will provide the banking package for the next Gateway experiment through Home

Home banking promises the convenience of paying bills without writing checks and licking stamps.

Banking Interchange (HBI). HBI serves about 15 banks offering Stage I and Stage II services. Videotex America's PLP system will switch (gateway) to HBI in Seattle, and then HBI will transmit banking services in ASCII protocol.

"You don't need PLP for banking," observes TCS Vice-president Bill Koenig. "But perhaps other services will make banking go. Then you need PLP for the graphics." Koenig believes that consumer videotex needs advertisers to help bear the cost. "Publishers go into videotex on the strength of their experience with packaging the three major elements: the information, the consumer, and the advertiser."

PRONTO: Banks, on the other hand, bring their own specialized skill to videotex financial services. PRONTO, the first videotex banking system to go into production, was developed by Chemical Bank of New York. "Our real strength," says Vice-president Mark Holthouse, "is transactions processing. Our whole system is almost completely automated. With direct access to our accounts,

we can process more efficiently than banks that clear through other banks."

PRONTO provides 350 customers with Stage I and Stage II services for about \$10 a month and holds licenses to run pilot tests for six other banks. A test license allows the franchisee bank to conduct a pilot study of services using PRONTO's processing equipment and central computers. With a production license, the franchisee brings all the processing in-house while PRONTO provides network software development and coordinates the addition of services.

Initially delivering services with a modified PLP to Atari computers equipped with special software cartridges, PRONTO plans to support the PC with similar but expanded software sometime this summer. As PLP boards and terminals become commercially available, PRONTO will provide full PLP implementation. Mark Holthouse foresees two developments: investment services offering stock and bond transactions, and the downloading of programs and data to the PC. Downloading will be accomplished with the help of a remote control program that allows PRONTO to tailor programs to the characteristics of the PC keyboard. The remote control program itself is downloaded and stored in memory.

When it introduces a variety of electronic shopping services later this year, PRONTO will begin to look like a consumer videotex network. "We'll come up with a little bit of everything," says Holthouse. Banking services, however, will underpin the system. PRONTO looks forward to the day when subscribers will shop electronically. The bank will process payments through the customer's account and pay merchants via electronic funds transfer. "What would it be worth to the merchant," muses Doug Kirk, senior vice-president of Affiliated Computer Systems of Dallas, "to have the money automatically transferred the same or next day? Enough to lower the retail price of the goods?"

Problems Ahead

The security of electronic transactions may be a cause of concern, and the shortcomings of the funds transfer mechanism for electronic bill paying must be resolved before home banking becomes widespread. Bank One's John Russell declares, "It's easy to write software to communicate financial information. It's much more complicated to write software that will keep the information confidential and prevent it from being compromised."

Michael Nye with Marketing Consultants International of Hagerstown, Maryland, puts it differently: "It's easy to tap data transmitted in the clear via common telephone lines. People must realize that when they transmit information, it's like taking an important memorandum and flashing it on a neon sign in Times Square."

Banks are unwilling to outline their precautions in detail, but most

Perhaps the most formidable obstacle to the development of home banking concerns the processing of electronic bill payments.

secure electronic banking transmissions with encryption devices and multilevel password and identification checks. They protect against fraud by processing electronic payments to pre-authorized merchants only. It is a closed system: the bank verifies the authenticity of both payor and payee before completing the transaction. Whether these efforts suffice to fend off electronic thieves remains to be seen.

Perhaps the most formidable obstacle to the development of home banking concerns the processing of electronic bill payments. When PC

owners press a button on the keyboard to indicate a payment to Finnegan's Hardware, the bank must complete the transaction by delivering two items to Finnegan's: the money and the account identification information Finnegan's posts to accounts receivable. The bank can pay Finnegan's by crediting its account if it is a bank customer, or by transferring the funds to Finnegan's bank via the Automated Clearing House. But as yet there is no convenient, standardized way to deliver the accompanying account data. Most of the merchants who receive the majority of payments have invested millions in equipment to process paper checks and vouchers and post them automatically to accounts receivable. Account data arriving any other way creates the nuisance, expense, and high error rate of exception processing.

For the bank, filling out volumes of vouchers or preparing computer tapes customized for each vendor's system is tremendously expensive. It's the chicken or the egg problem: at current low transactions volumes, it does not profit merchants to develop special computer-to-computer programs to accept accounts receivable data and run them in addition to the established check and voucher system.

But it is difficult for banks, with many merchants to pay in as many different ways, to increase electronic transactions volumes substantially until a standardized system is in place. Because electronic bill payment is the most popular home banking service, the solution to this problem bears directly on the future of home banking.

Getting Your Arms Around It

Reporting from the trenches, TCS's Bill Koenig explains, "It's very tough to get your arms around home banking in the abstract." Home Banking Interchange plans to study the human engineering aspects of home banking during its upcoming test with Vid-

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eotex America. Meanwhile, what has all the money and the study produced so far? No firm conclusions can be drawn as yet, but reasonable assumptions can be made.

Most popular services: Transactions services—bill payment and funds transfers—have proved most popular with consumers since the first test. This suggests that the most popular Stage II services may include transactions such as CD purchases and securities purchase and sale.

Best service mix: The consensus is that home banking is best offered in combination with other videotex services, particularly shopping, electronic mail, news, and games. The combination enhances the appeal of home banking, and advertising sponsors share delivery costs with networks and consumers.

Delivery of service: On balance, the banks participating in home service experiments favor some sort of joint venture—groups of banks sharing the same network software, licensing arrangements such as PRONTO, or hookup with a commercial videotex network.

Service availability: Commercial availability of home banking on even a modest scale appears unlikely before 1985.

Service costs: Banks are studying their test results to determine what the market will bear and what their own costs of delivering home services will be. Many believe charges will consist of a monthly rate plus transaction fees.

Audience: The average home banking customer will probably be between 25 and 45 and will command a family income of \$35,000 or more. He or she will be interested in saving time and money, open to new products, and comfortable with computers. The arrival of relatively inexpensive videotex terminals can be expected to broaden the home audience base.

Screen design: Clarity and friendliness are essential in home banking displays. When participants in one study expressed doubt that bills could really be paid at the touch of a button, test designers added the display of a filled-out check for each transaction. Speed is important; viewers become fidgety watching screens that take 30 seconds to complete. Screens will probably use relatively simple designs that display quickly.

Electronic Banking for the PC

The home banking vanguard is experimenting with the technology and marketing of Stage I and Stage II services. Attractively presented and easy to use, they offer convenience to owners of both TV-based terminals and PCs. Personal computer owners are widely considered ideal candidates for home banking, and the PC, with its strength in the small-business and professional market as well as at home, will become the natural target of increasingly sophisticated services.

Banks will develop the software to exploit what TCS's Koenig calls "the real power" of the personal computer, its capacity to access remote data bases and store the information for later processing. The PC will receive Stage III services in the form of programs downloaded from the bank's data base. Software-by-wire will deliver personal budgeting, graphics, statistical forecasting, tax accounting, and investment analysis—a palette of programs to put the PC to work on home finance.

To make personal financial management even easier, Don Kretz, applications manager of HBI, predicts the development of software that will enable the PC to capture bank-stored data automatically and use it to load financial applications programs. The PC will automatically dial up the data base, sign on, extract the relevant information, and load it as the program continues to run. Loading a 1040 tax form or a financial forecasting spreadsheet are possibilities.

Automatic data retrieval is particularly intriguing when the contents of a data base are many and varied, like those of a large videotex network. It makes possible what Alan Brighish of Information Systems Marketing, Wilton, Connecticut, calls personalized service. Subscribers can build personal interest profiles that include items of regular interest stored in the data base, such as account balances, check postings, assorted interest and currency exchange rates, the prices of selected stocks and commodities, oriental rug auctions, or the network bulletin board. The PC can be set to dial up the data base during hours when rates are low and extract the information called for in the profile.

Electronic home banking is the focal point of forces in the financial community that guide its development, advances in computer technology that foster its imaginative use, and new developments in the videotex industry that shape its delivery. Mort Goldstrom, marketing director of Viewdata Corporation, makes the optimistic prediction that videotex will be in 30 percent of United States' households by 1990. If so, electronic banking will be there too.

Catherine Kent is a technical publications consultant in the San Francisco Bay Area specializing in user software documentation.

J.L. Pullen of Home Banking Interchange invites PC owners who wish to participate in a study of the PC market for home banking services to write to him at the following address: ADP/Telephone Computing Services, Inc., Attention: J.L. Pullen, Home Banking Interchange, 1020 John St., Seattle, WA 98109. Please include an expression of interest in the study, your name and address, and the name of your bank.

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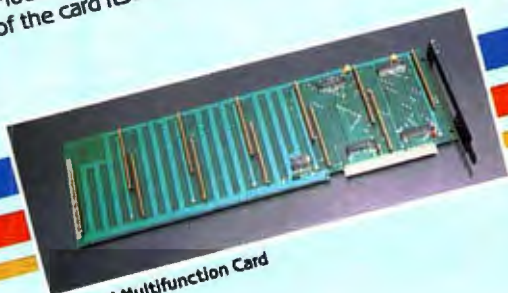
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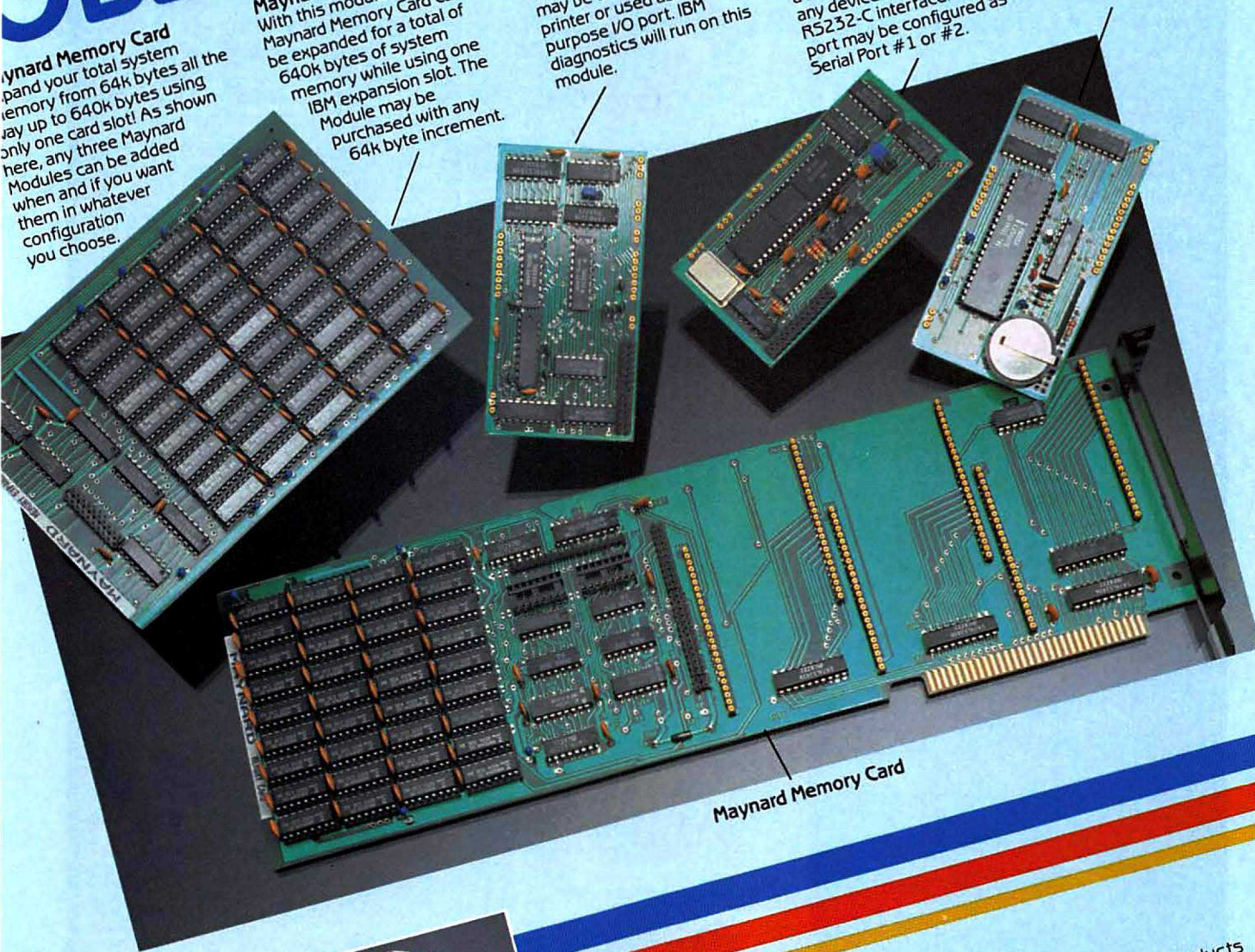
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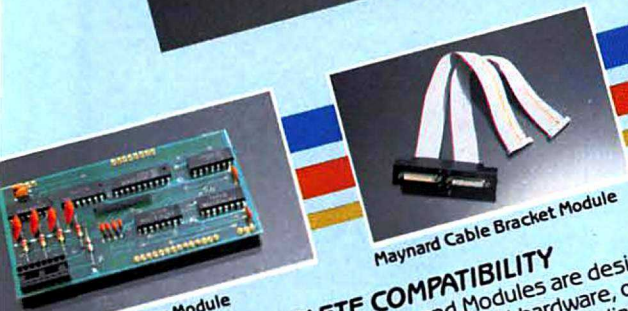
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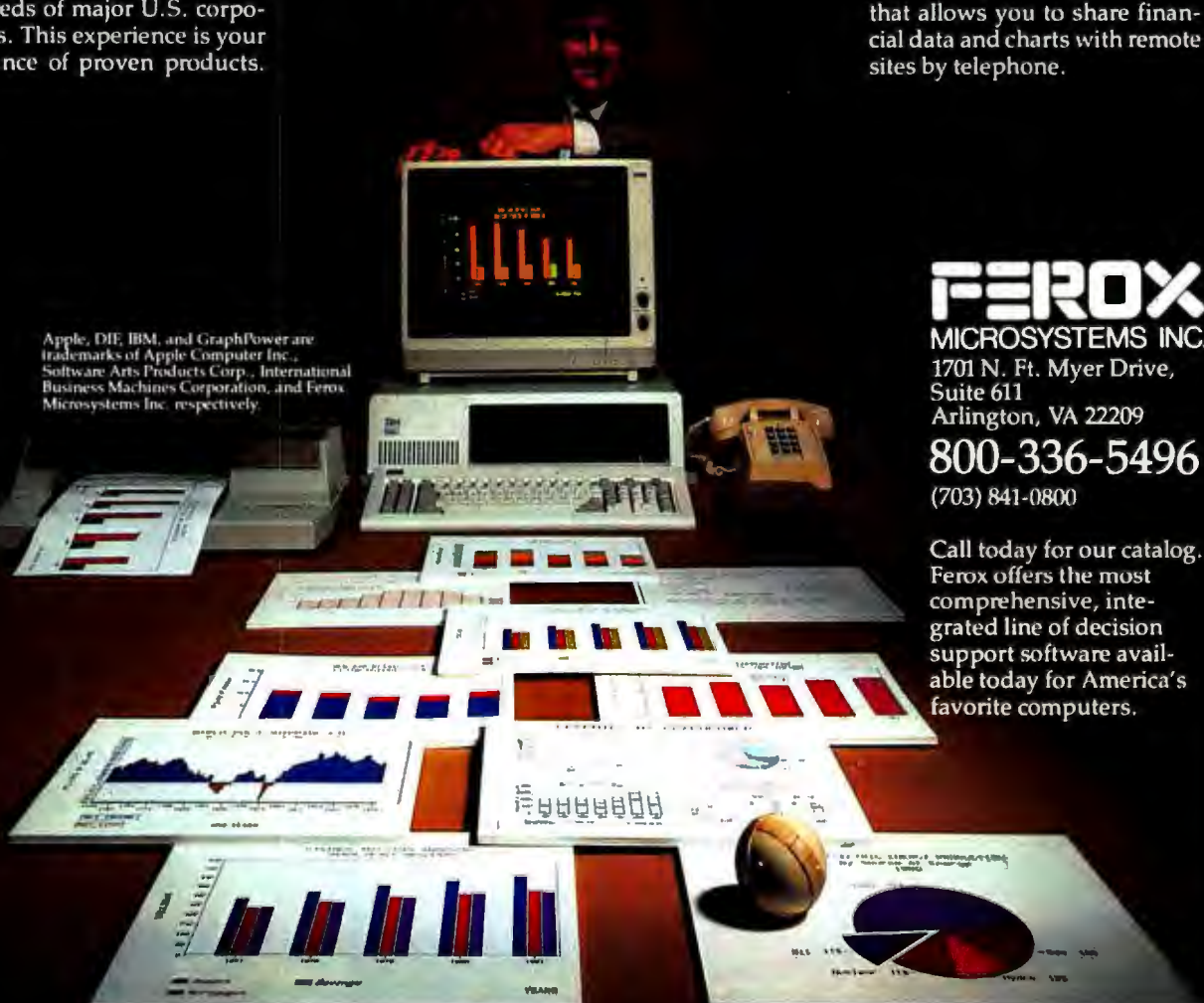
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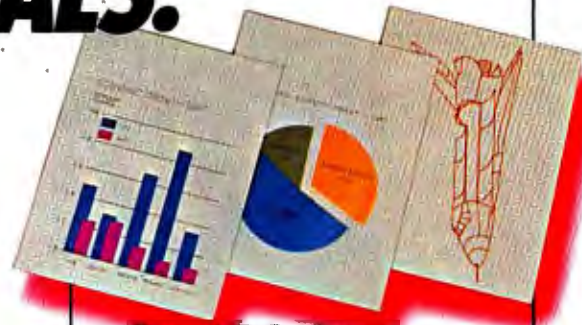
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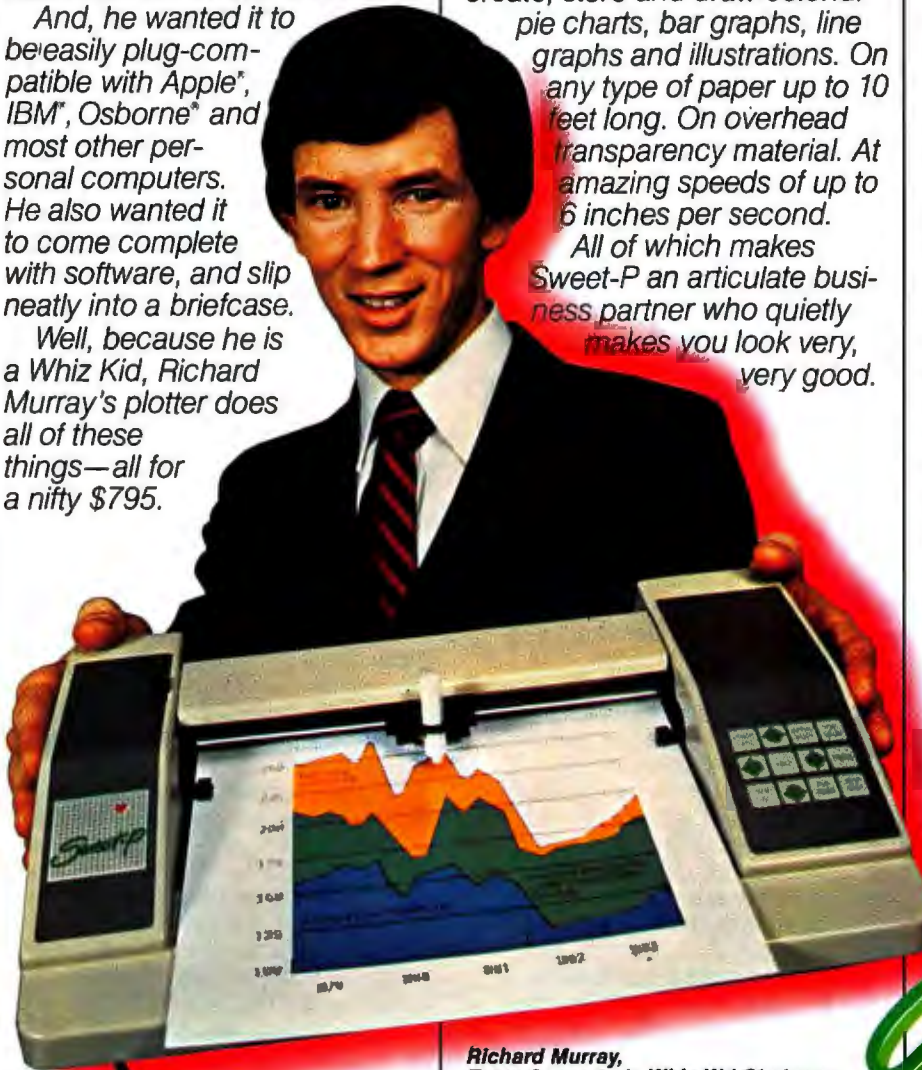


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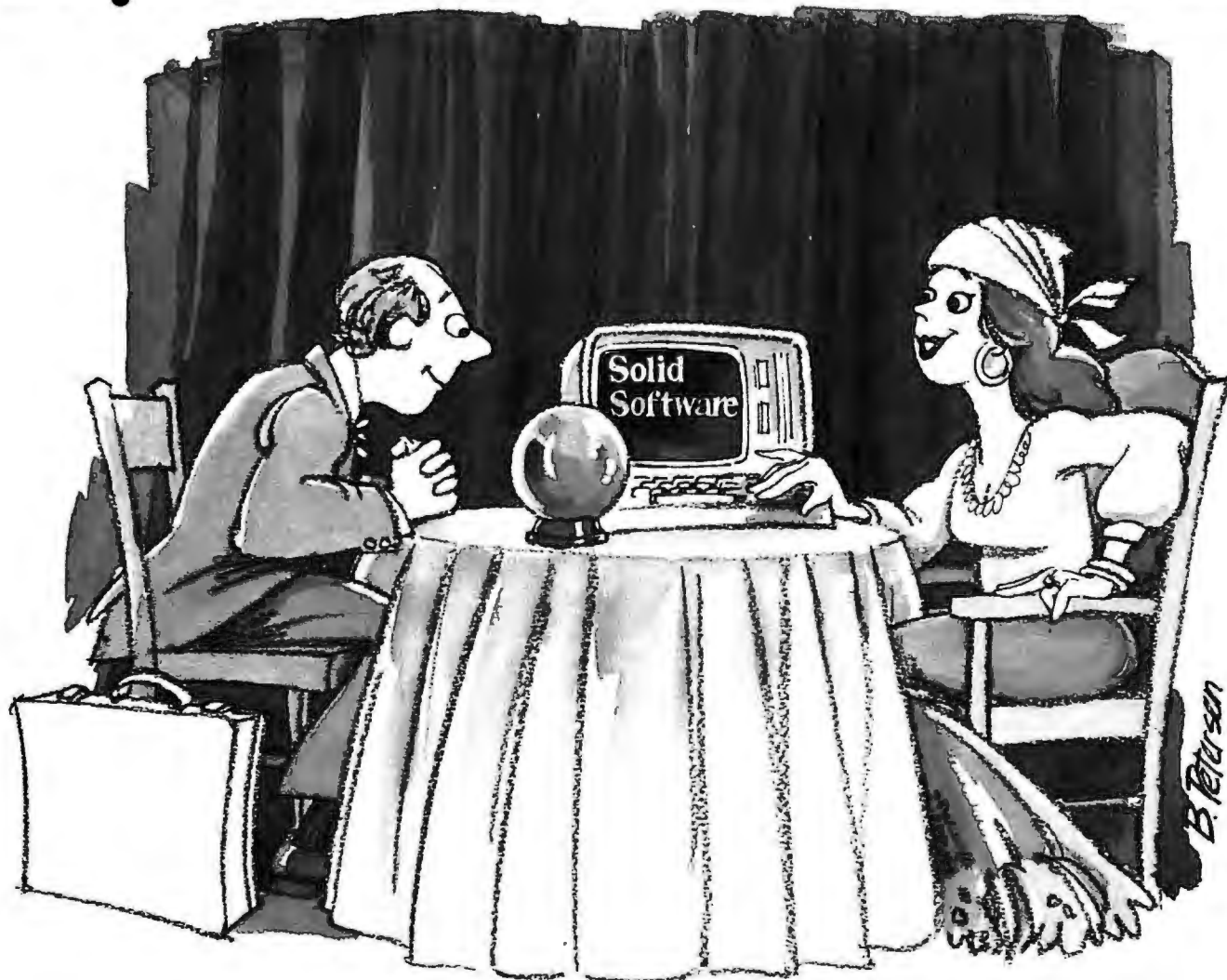
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Displaying the Future

IBM's new development, a plasma display subassembly announced at COMDEX/Fall '82, may change the way you look at your PC.

Lisa B. Stahr

When IBM representatives brought the 581 Plasma Display Subassembly to COMDEX/Fall '82, they didn't think it would steal the show. But crowds gathered constantly, watching in amazement as the orange and black screen created an endless variety of clear, high-resolution images. Intricate geometric designs, a beautiful dark-haired woman, even a house in a pastoral setting were displayed with almost photographic accuracy. All this appeared on a large, 17 1/4-inch diagonal screen only 3 inches thick.

Hooked up to an IBM PC, the 581 can display alphanumeric and graphic information with sharp, undistorted precision on its nonreflective screen. The 581 can display up to 69 lines of 160 characters, twice the standard cathode-ray tube (CRT) screen width. Its unique plasma technology allows full or partial images to be added, deleted, moved, or altered anywhere on the screen, much like an electronic blackboard.

Plasma Technology

The composition of the 581 is not difficult to understand. The plasma (or alternating current gas discharge) panel is made up of a grid of conductors, less than 1/70 of an inch apart, sealed between two flat plates of glass. The space between the glass is filled with neon/argon gas, which, when excited at an intersection in the



A photographic-quality image on the plasma display

grid, creates an image. (The gas mixture also gives the display its characteristic orange color.) The greater the number of these intersections in a display the higher the resolution of the graphics. In the 581 more than 737,000 of these picture elements, or pixels, are used to create the very high-resolution images. In comparison, the raster CRT, the most common kind of personal computer

display, usually has from 280,000 to 307,000 pixels; the IBM PC monochrome display, also a raster CRT, employs more than 350,000 pixels for greater resolution. These monitors still offer much lower resolution graphics per screen image than the 581.

Each of the intersections in IBM's plasma display subassembly can be turned on (lighted) or off (erased) individually, which enables the panel

to display a variety of character fonts and sizes. The phosphor on a CRT screen has to be constantly reactivated, or refreshed, in order to remain illuminated, whereas the intersections of the plasma display are charged simultaneously and the charges stored, so no external refresh is required. This "all-points-addressable" feature creates a display that is flicker free, eliminating eye strain and other annoyances common with CRTs.

Radiation exposure, another common complaint against CRTs, is not a concern with plasma displays. Images on CRTs are created by an electronic beam that is swept across the phosphor-coated surface of the video tube 50 or 60 times per second, causing dots of the phosphor to glow at the proper time to produce an image. This electronic beam is not blocked by the glass of the display and, consequently, reaches the user's face. (The same method of display is used in consumer television sets.) In the plasma display the electronic charge that excites the gas is wholly contained within the unit; rather than sweep across the screen, the charge travels through the grid of conductors and never leaves the surface of the display.

IBM officials are quick to point out that the 581 is not designed to be competitive with the CRT, apparently in response to CRT manufac-

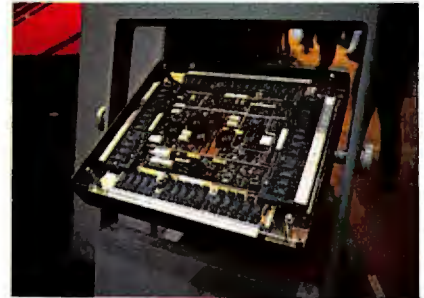
turers who have shown some resistance to plasma displays. Other smaller display manufacturers, however, believe that several of the plasma display's features, like stored image and flicker-free display, are vast improvements over the CRT. In addition, plasma technology is expected to become even more important in display design as the need for thinner, lighter monitors increases.

The Plasma Past

Plasma technology, although not new, has received little commercial attention since its development 13 years ago. In the mid-1970s IBM delivered its first small plasma panels to banks and to Goodyear and Goodrich tire manufacturers. Since that time over 100,000 of the IBM 3600 Series displays have been sold each year, mostly to European banks. In this country, IBM has just announced an optional plasma display for its popular 3278 terminal.

Its durability and high-resolution graphics have made the plasma display a favorite of the military for many years. Companies that once dabbled in plasma display technology for commercial uses now concentrate research and development on the more profitable military market. One such company, Magnavox, spent \$25 million over 10 years to develop a commercial market for its small (15-

by-15-inch) but thick (7-inch) display. Instead of using integrated circuitry as the 581 does, the Magnavox Blue Box had discrete, resistor-diode electronics. It also sold for almost twice the price of the IBM 581. Magnavox and the others soon found that the



The interior of the 581

military was the only buyer willing to pay the high price for plasma displays.

Finding A Market

The introduction of the 581 marks the first large-scale effort to develop a commercial need for alternating current gas discharge panels. Armed with a reported \$100 to \$200 million marketing budget, IBM is hoping to develop a significant commercial market by selling the 581 subassemblies to original equipment manufacturers (OEMs) who will in turn package and sell them to businesses and individual users. If the market takes hold, other display manufacturers who were once involved in commercial research are expected to return to the competition.

One OEM, Photonics Technology, Inc. of Northwood, Ohio, believes that only IBM has the muscle to develop a commercial market for plasma displays. Photonics, which has supplied the military with alternating current gas discharge (plasma) panels since 1978, will purchase the 581 subassembly from IBM and package it for a variety of business and personal applications. According to Donald K. Wedding, vice president of marketing for Photonics, the 581 is ideal for airlines, stock exchanges,



COMDEX participants gather around the 581 Plasma Display

● State of the Art

legal and medical offices, and executive work stations. "An image like a map or a medical form can be projected onto the 581, and the panel's images can be displayed over that," Wedding adds.

Photonics will begin selling a complete line of plasma displays during the first quarter of 1983, including the packaged 581 for \$3,000 to \$3,500.

PC Compatibility

The 581 subassembly is not PC-compatible as delivered from IBM, even though IBM used a PC to demonstrate the display at COMDEX. The cost of the display, as much as what many PC users paid for their computers, will limit individual user purchases, an IBM official explains. But for those interested OEMs, IBM will publish an interface kit. Loaned out to OEMs for 6 months, the kit includes a card that plugs into the PC, a power supply, a 5 1/4-inch floppy disk using PC-DOS, some basic subroutines, and documentation on how to make the two products compatible.

Plasma displays can be made in a variety of sizes. The viewing area on the 581, for example, has a diagonal measurement of approximately 17 1/4 inches; Photonics has made some as large as 6 1/2 feet and others as small as 4 1/2 inches. Wedding believes the 12 1/2-inch diagonal with about 405,000 pixels will be popular for PC displays, and that the smaller 9 1/2-inch or 6-inch diagonal panels with 131,000 and 65,000 pixels, respectively, will be suitable for portables.

Plasma Portables

Plasma technology, which can be used to create very small, thin, and durable displays, is seemingly ideal for portable computers. The 1/2-inch glass plates on the 581, for example, can be pared down to a thin 1/4 inch. One portable computer, the COM-PASS by Grid Systems Corp. of



IBM representatives show off the 581 Plasma Display at COMDEX.

Mountain View, California, uses electro-illuminiscent technology, a close relative of plasma technology, in its design.

While CRT manufacturers aren't in any immediate danger of losing the display market to plasma technology, the introduction of the IBM 581 could be an omen. Judging from the overwhelming response that the IBM 581 received from PC users at COMDEX, it might not be long before plasma displays break into the personal computer market.

Lisa B. Stahr is an assistant editor at PC World. She was formerly a staff writer for Microwave Systems News

and Defense Electronics magazines in Silicon Valley.

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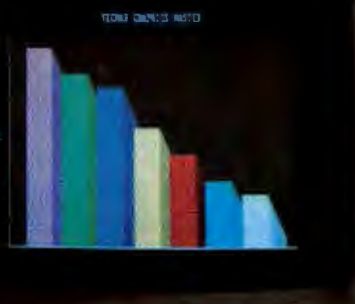
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PC WORLD View

News and Notes for the Computing Community

The *PC World View* staff is avidly attuned to new developments in computer technology, and we hear lots of rumors, speculation, and advance news that interests us. We want to share the most promising and unusual of these developments. We've reserved the "Grapevine" section of this column for industry reports, speculation, and rumors that we find especially enticing.

Grapevine

Several recent industry reports have stated that IBM is acquiring hard disks for an upgraded PC and other small computers. Among the reported vendors of these 5- and 10-megabyte hard disks are Seagate and Miniscribe. At least one supplier of hard disk controller cards for the PC will be Xebec Corporation.

Another industry source reports that IBM has agreed to a 1-year contract with Qume Corporation to buy that firm's half-height 5¼-inch floppy disk drives. Our source states that these drives are slated for use in a low-cost—and as yet unannounced—version of the PC.

Because they are just half as high as the standard floppy disk drives, two of the Qume drives can be installed in the slot occupied by a single 5¼-inch drive in current systems. This would allow greater variation in storage configurations in the PC, such as two half-height floppy drives in one slot and a hard disk in the other. (This is an unlikely mix for a low-cost PC, however, since hard disks cost well over \$1000 from suppliers with the lowest prices and are likely to cost well over \$2000 from IBM.) The Qume drive, by the way, is double-sided, has 48 tracks per inch, and can store 500K of data.



To encourage its employees to use their PCs and write programs for the computer, IBM has established a companywide software network. This is strictly an internal affair, but one or two good programs have slipped into public use via the wide-open bulletin board systems (BBS) maintained by PC users throughout the country. So if you've downloaded any programs from one of the public BBSs, you may be sharing in one of IBM's little secrets.

Next month, according to a report in an industry newspaper, Durango Systems of San Jose, California, will announce a PC-compatible computer available in a single-user model that will use MS-DOS, and a multiuser model that will use a version of UNIX.

Sorbus Supports PCs

If your PC or one of its peripherals is ailing, you no longer have to wait in line for the dealer's technician or ship it off to IBM's service center in Illinois. The newest alternative in PC repair is offered by Sorbus Service, a division of Management Assistance of Frazer, Pennsylvania. *PC World*

View correspondent Emil Flock provided the following report about this promising new service.

Has the itty-bitty machine company let you down? Has your highest priority project been put on the back burner because of a glitch in your equipment? Perhaps it's time to check out Sorbus. This company provides on-site and depot service in 160 centers around the country and even has the temerity to mention same-day service. Sorbus employs 1200 field service technicians and will send one of them to you if you can't take your misbehaving equipment to one of its centers.

Sorbus offers three basic types of service: contract mail-in or carry-in repair; per-incident mail-in or carry-in repair; and on-site repair. Selected rates for a yearly contract for carry-in or mail-in repair are:

System unit/keyboard, \$148
Single-sided disk drive, \$50
Double-sided disk drive, \$78.50
Monochrome display, \$53
Dot matrix printer, \$143

Rates for per-incident carry-in service are somewhat higher and are billed at an hourly rate. Monthly rates for on-site service are:

System unit/keyboard, \$15.50
Single-sided disk drive, \$5.25
Double-sided disk drive, \$8.25
Monochrome display, \$5.50
Dot matrix printer, \$15

The most convenient aspect of Sorbus' service policy is that it will repair third-party hardware such as an AST memory board or a Diablo printer. The firm promises 5-day turnaround for mail-in or carry-in repairs, and an on-site technician "within a few hours," according to Sorbus President Ronald Wallace. Staff members at two Sorbus centers

in the San Francisco area estimated that their typical carry-in repair time was 48 hours.

For more information about Sorbus Service call 800/423-2797.

Big Blue's News

Sweet Sixteen Colors

IBM has announced a color monitor for the PC, which you can see in its latest television ad (Charlie Chaplin and the Hat-of-the-Month Club) even if your dealer doesn't have one yet. A spokesperson at our local IBM Product Center promises to have the new display in April, adding that the price will be approximately \$680.

This monitor is a high-resolution device driven directly from the Color/Graphics Adapter for the PC. The screen measures 13 inches diagonally and can display 16 colors at a resolution of up to 640 by 200 pixels. Like the monochrome display, the color monitor has brightness and contrast controls on the front of the cabinet. The IBM product number of the color display is 5153.

Power to Insurance Agents

Two firms have recently signed agreements with IBM to sell the PC and custom-designed software to the insurance industry. IBM recently opened distribution of the PC to such firms, which operate as value-added remarketers of the computer—they buy machines from IBM at wholesale, add their own components such as custom software, and sell the



systems at retail to specialized markets. Computone, an Atlanta firm, and Informatics General of Dallas expect to be putting PCs on the desks of several thousand insurance agents soon.

64K Chips in Europe

With its introduction of a European version of the PC, IBM has improved upon the computer in an important way. Instead of using 16K memory chips on the motherboard as was done in the original PC design, IBM designers have recircuited the European PC for 64K chips so that the basic system configuration is 64K, with main memory expandable to 512K. (This half-megabyte of memory is only half the address range of the Intel 8088 microprocessor in the PC, however.) Purchasers of the PC abroad can specify single- or double-sided disk drives. Some of the European PCs are being assembled at home base in Boca Raton, Florida, and others are being manufactured at an IBM plant in Greenock, Scotland.

Bare Bones Clone

Micromint, Inc. of Cedarhurst, New York, has announced a stripped-down, single-board computer claimed to be PC compatible. Micromint states that its MPX-16 computer is fully compatible with applications software and hardware peripherals now used with the PC and offers support for several peripherals without the addition of extra boards (as the PC requires).

The MPX-16 is supplied with an Intel 8088 processor and has space for later addition of an 8087 processor, and has a hard disk controller; the single-board computer includes 256K of RAM plus two serial ports and three parallel ports. It is designed for CP/M-86; MS-DOS and other operating systems will be added later. This bare bones clone consists of the computer on the motherboard without a cabinet or other accessories.

The MPX-16 costs \$1200 if ordered in quantities of 100 or more. It's just the thing for anyone who wants to start a computer company and ride the PC's wave.

The Ultimate Processor

In a marvelous new book called *Blue Highways*, author William Least Heat Moon recounts his travels across America and the people he discovered by sticking to the back roads. At a Baptist college in Mississippi, Moon encountered a young woman named Sally, who believes in using computers to "send up" prayers. She describes an outfit (not

identified, unfortunately) in California that will “run your prayer through” its computer twice a week for a month for \$2. She says that computers can be prayer machines just like rosaries and prayer wheels, explaining that all these devices are used by “people just trying to maximize the prayer function.”

This may be the strangest story you’ve read about computers (Moon asked Sally if God understands FORTRAN), but the book is full of singular people and offbeat places that are well worth a few hours away from the keyboard and screen.

Doctor LOGO Arrives

In a departure from its concentration on operating systems and other technically oriented software, Digital Research of Pacific Grove, California, has announced that it will market a version of LOGO for the PC. Named DR LOGO—and quickly dubbed Doctor LOGO—this widely used educational language will be ready for the PC in the third quarter of 1983. It will require a color/graphics adapter. The price of DR LOGO is estimated to be between \$100 and \$200.

A Welcome Warranty

FriendlySoft, Inc. of Arlington, Texas, has announced a lifetime guarantee for its FriendlyWare programs, which include education, entertainment, and business software. The firm calls its new policy the “No Fine Print” guarantee, and its staff is prepared to support this offer with a 24-hour hot line as well as a promise of repair or replacement of defective

disks within 48 hours of receipt. If the damage to a disk results from misuse—FriendlySoft’s example is “mustard on the hub ring”—a replacement will be provided if the customer sends the original program disk with a blank one. Company Chairman Michael Yaw says that this new policy is designed to “offset any fears that may exist about copy-protected software.”



Mystery of the Month

Anyone who has used a computer for very long is likely to have experienced some kind of mysterious event. It may have been a temporary glitch that caused a program to behave strangely, an unexplained flickering of the image on the screen, or an electronically stuck key that sent a stream of the same letter or number squirting across the screen.

It may be an axiom of computing that many of these mysteries cannot be explained, even by the most knowledgeable micro detectives. As

part of our continuing effort to delve into the depths of the unexplained, we will relate tales of these mysteries in *PC World View* and offer a forum for speculation on their causes. We’d like to hear about your computer mysteries—explained or unexplained—so that at least we can all take comfort in the fact that these things happen to other people as well.

This month’s mystery concerns a power supply that seems to have a mind of its own. An acquaintance of ours was happily working away at her PC one Sunday morning (being an avid computer user, she rarely sleeps in). It was a cold, rainy Sunday, and she had wrapped herself in an electric blanket to keep warm.

After she had gotten a few paragraphs into an article she was writing about computers, the phone rang. She answered it and simultaneously gave the command for her word processing program to save the work she had just done; she left the computer on as usual, with the cursor blinking unobtrusively at the beginning of her file. As she talked, the storm outside grew more blustery and her none-too-cozy home office grew colder, so she turned up the electric blanket to its highest setting—something she’d never had occasion to do before.

About this time her dog decided to make a bed out of the extra part of the electric blanket piled at her feet. Now this leftover portion of the blanket was right next to the power supply (bet you thought we’d never get to the part about the power

supply) for the hard disk that she had installed in her PC. Just after the dog finished pawing around among the folds of the blanket and settling into his warm little nest, the hard disk's power supply shut off spontaneously. The noise from its fan ended abruptly, and the hard disk itself, located in the PC's cabinet, slowly whirled to a stop.

Nothing else had changed. The cursor was still blinking encouragingly, and the first two paragraphs of her article glowed in green phosphor on the screen. The dog was sleeping contentedly at least a foot away from the now-silent power supply. The power supply's switch was still turned on, and the cord was still attached to the front of its small metal cabinet. The electric blanket was still putting out enough BTUs to keep our acquaintance warm.

Puzzled but not panicked, she excused herself from the telephone conversation and proceeded to make an orderly assessment of the situation. First she turned the electric blanket down to a lower setting. Then she tried to activate the computer, but because her program and file were both on the hard disk, she could do nothing but turn off the machine. She also turned off the power supply's switch and then checked all her system's plugs and connections. Finally, she moved the hard disk's power supply to a more sheltered position behind a table leg.

Having taken every precaution she could think of, she turned on the power supply and was immediately greeted by the drone of its fan. Next she turned on the computer, and after a few seconds, saw the cursor appear on the screen and heard the machine's beep and the disk drive's

little groan as it loaded DOS. Everything was behaving normally. She entered the word processing program and gave the command to edit the file she'd been working on that morning; her article was intact.

What had gone wrong? Had the electric blanket sucked so much juice that it caused the power supply to fail? Or was the dog the culprit, having wagged his tail too close to the small metal box? And why did the computer itself stay on and—phew!—the files on its hard disk remain undisturbed? We don't know. This is not a we'll-tell-you-next-month story; we'd like to know your theories about this event. And we'd

also like to know about your computer mysteries. (They need not involve the family pet or peripheral heating devices.)

Miriam Medom

PC World View *welcomes contributions from readers, and we'll pay up to \$50 for the items we use. Please include your name, address, and phone number with your contributions. Send them to PC World View, PC World, 555 DeHaro St., San Francisco, CA 94107.*

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Other spelling checkers "borrow" their words from printed dictionaries—or copy them from old word lists. Or give a programmer who can't spell "programmer" a chance to write his first dictionary. And as though all this wasn't bad enough, a lot of these

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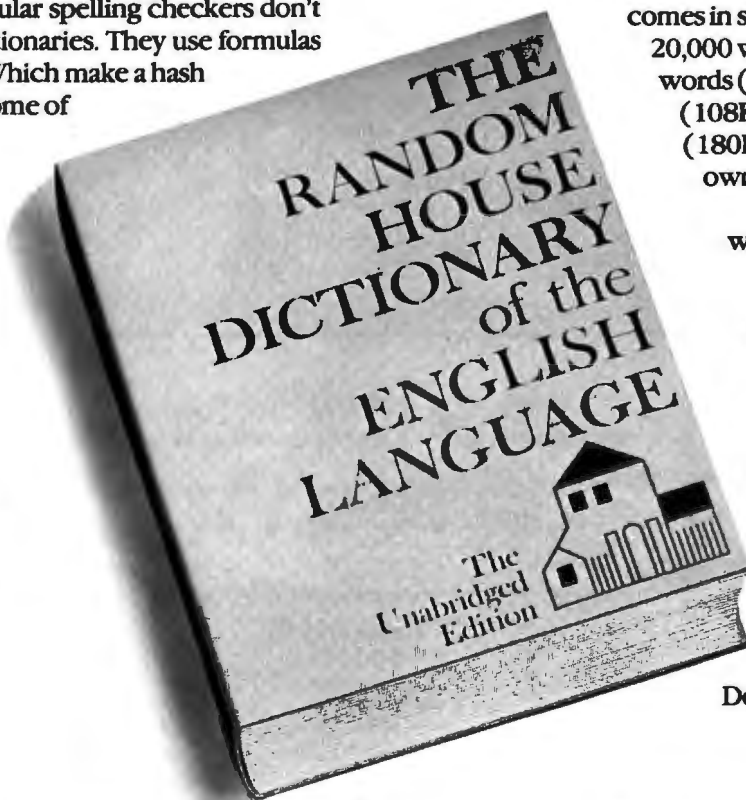
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WHY WE CREATED THE FIRST DOESN'T MAKE YOU WORK

by JIM EDLIN, PRESIDENT—BRUCE



A "writing tool" is what we call our improvement on conventional word processing. My company has just created a writing tool program for the IBM Personal Computer — WORDVISION™ — that breaks new ground in two directions. First, WORDVISION is far easier to use than earlier programs. Second, WORDVISION'S suggested retail price is far lower than prevailing levels. I'd like to tell you how and why we accomplished this.



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WORDVISION was designed from scratch for the IBM PC.

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nates need for any terminal — either the teletypewriter or newer video kind. The PC's display can be changed from top to bottom in an instant, allowing program features not possible on computers using terminals. Also, the PC screen can show details like underlining and bold printing, either directly or using colors. Another assist is the array of useful keys found on the PC keyboard but not on old-fashioned terminals; these provide easy ways to control a program's operation. And the PC is designed to have plenty of memory which also encourages easy-to-use program design. To use all this power, we began WORDVISION'S design with a clean slate. The result is a program that, unlike

its predecessors, won't ask you to memorize arcane codes or keep track of disorienting modes.

WORDVISION includes a set of handsome, full-color key legends that affix to your keyboard and show you the available controls. (Optional replacement keycaps will also be available.) Where other programs suggest you read their manual when you get stumped, WORDVISION is so easy you can usually just read the keyboard instead.

WORDVISION is designed for your personal writing.

Early word processing programs were designed either for computer programmers or secretaries. But programmers are used to dealing with computer idiosyncracies, and the secretarial process is a linear, static incorporation of someone else's requested changes in how a document looks or what it says. Our writing tool is specifically designed for the more fluid, dynamic process of interacting with your own words — where each new thought may inspire changes anywhere in your text, and you want to see easily how a change would look or sound.




If you understand traffic lights, you already know one of WORDVISION'S main operating principles.

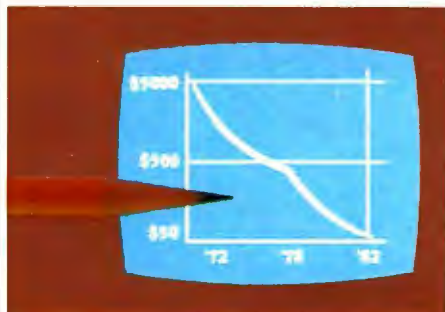
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WORDVISION will be on sale soon both at major bookstores and at selected program retailers. Reserve a copy now for early delivery, or if your favorite store hasn't yet arranged to carry WORDVISION, ask them to order you a copy by calling our toll-free number below.

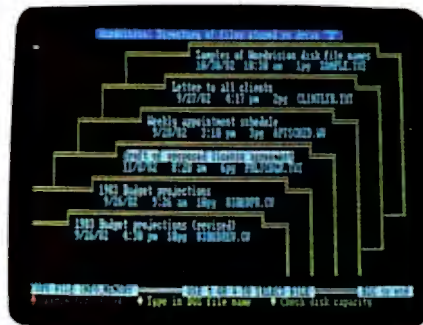
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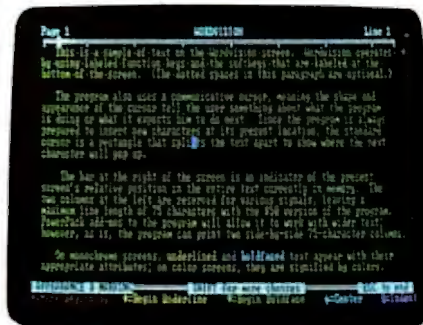
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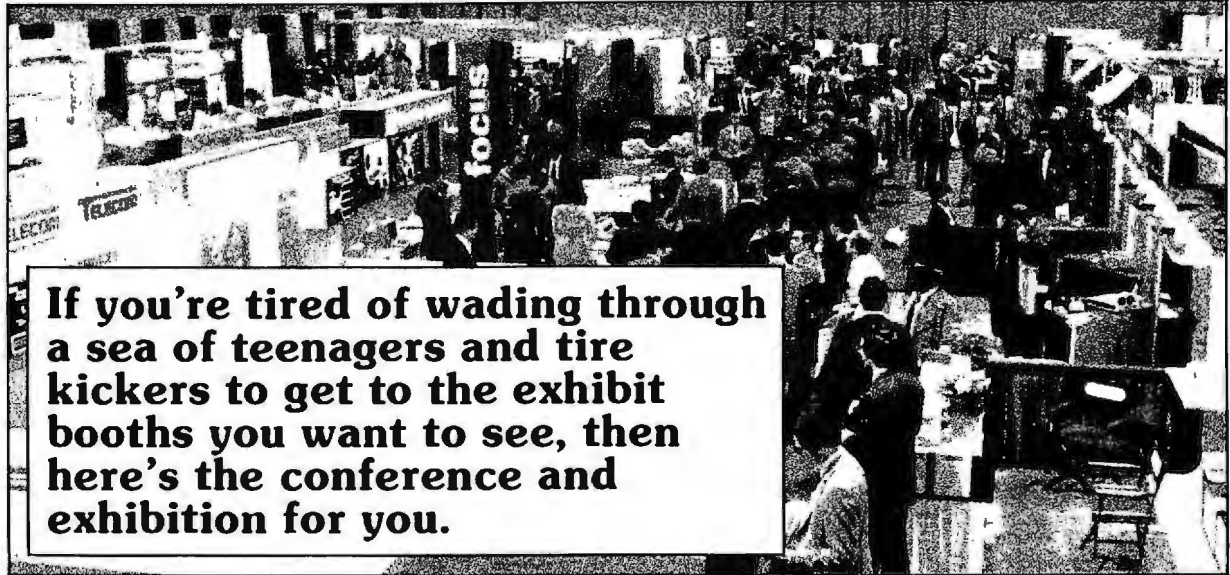


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Travels with COMPAQ

Andrew Fluegelman



The unassuming beige box couldn't have arrived at a more perfect time. I had arranged to fly to Dallas for Future Computing's three-day conference on IBM PC compatibility, then on to Boca Raton to see whether the Big Blue Oracle might be speaking any wisdom, and finally to New York for some publishing business and a family visit before returning to San Francisco. I was going to be on the road for a week and was lamenting having to be separated from my trusty PC.

Then it arrived—the COMPAQ Portable Computer from COMPAQ Computer Corporation of Houston, Texas. This machine had distinguished itself from the moment it was announced. It was claimed to be as PC compatible as any machine can get without violating the routines in IBM's copyrighted ROM chips.

But the COMPAQ has features that take it beyond copycat compatibility: a standard 128K of random access memory on the system board upgradeable to 256K without using additional slots, an 8-inch green screen monitor capable of displaying both the PC's monochrome character set and graphics, and—the crowning glory—an integrated carrying-case housing that includes keyboard and monitor and makes the computer completely portable.

Packing My Bags

I had barely 24 hours from the moment the machine was uncrated until I was due to hit the road, so my first task was to assemble a functioning hardware/software system. If I were to duplicate the system I'm used to working with on my desk-bound IBM PC, a number of important factors would have to be considered.

For one, I'm a RAM addict. My regular machine has 576K of memory, and I use every bit of it. Using electronic disk emulation software, I reserve 128K of the RAM as system memory; that is, I make the PC act as though it were a 128K machine. I use the remainder of

the memory to create an electronic disk, which the system treats as though I had a C drive with about 448K of storage.

The standard COMPAQ model comes with 128K installed on the system board, but this model came configured with an additional 128K. This system board memory capacity is one of the COMPAQ's design enhancements over the PC, which accepts a maximum of

One taste of computer portability and I was hooked.

only 64K on the system board. The practical value of COMPAQ's extra capacity is that you don't have to use up additional slots to add memory.

But even 256K wasn't going to be enough to satisfy my voracious RAM appetite. I fished inside my PC and pulled out my combo board, manufactured by AST. In addition to another 256K of memory, the combo board provides a clock/calendar and a serial port that I could use for asynchronous communications. I assumed that the board would function normally in the COMPAQ, which was reputed to accept whatever expansion boards work with the PC.

Under the Hood

Getting inside the COMPAQ was not easy. A fairly thorough review of the well-produced operating manual revealed no instructions as to how—or even where—to open the cover. I finally worked up enough courage to squeeze and pry the side panel of the case until it popped

● Review

off. It is held in place by beveled tabs that snap into recesses on the main system case (see Figure 1). Once you know where to press, you can get the panel off, but it's not a very well-designed casing, particularly in the absence of instructions.

Once inside, I found another obstacle in getting to the system board slots: a metal cover with Swiss cheese holes was held in place by six small phillips-head screws. Again, I was forced to operate on intuition, for the



Figure 1: The insides of the COMPAQ are accessed by prying off the side panel on the case

manual did not describe the inside of the machine. Even though I am rather intrepid when it comes to poking into mechanical things, I didn't want to start messing with those screws until I had Technical Editor Steve Cook at my side.

As it turned out, the screws should not be removed—you have to loosen them only a bit to slide off the system board cover (see Figure 2). The system board cover has additional guides that hold installed boards in place and make the system more secure for traveling.

Finally, the system board was revealed. Of the five available slots, one was occupied by a disk controller board and another by a large combination monochrome/graphics display board (see Figure 3). Sliding the AST combo board into one of the empty slots was a tight squeeze but posed no special problems. Once the board was installed, I replaced the system board cover and the side panel.

I've gone to some length describing these operations because I'm frankly amazed that the manuals, which are otherwise well produced and comprehensive, do not include instructions for doing anything inside the machine.

Big Boot Bombs

The next step was to boot the system and see whether the installed memory could be configured as an electronic drive. The software I regularly use for doing this is the *JEL* program from Tall Tree Systems. I have one of my disks configured with that program, plus my word processing, communications, and various utility programs and batch files. I call it my "Big Boot" disk, and I use it to start all my work sessions.

Big Boot wouldn't. The *JEL* program that sets up the electronic disk evidently looked for something in ROM that it didn't find in the COMPAQ. (John Henderson of Tall Trees Systems has acknowledged this problem and now claims to have solved it in a new version of *JEL*.)

With *JEL* out of the running and time ticking away, I turned to the *Superdrive* electronic disk program produced by AST. I had not used this software before, because it requires that the system board switches be set



Figure 2: Removal of the system-board retaining cover

to reflect the amount of memory you want to use and the number of drives (including electronic drives) you want to install. I had considered this a bit of a nuisance and for that reason had been using *JEL*, which doesn't require any special switch settings.

Now it was indeed a nuisance. I had to pry off the side panel and remove the system board cover again to get at the switches. I also had to work by intuition again to set the switches, as the COMPAQ documentation does not provide any information about switch settings. Instead, I consulted the *IBM PC Guide to Operations*, assuming that switches 1 and 2 performed the same functions on the COMPAQ.

My insecurity was heightened by a notice in the COMPAQ manual stating that the COMPAQ, unlike the PC, does not support more than two disk drives. But what about electronic drives? On faith, I set the switches and once again put together the machine.

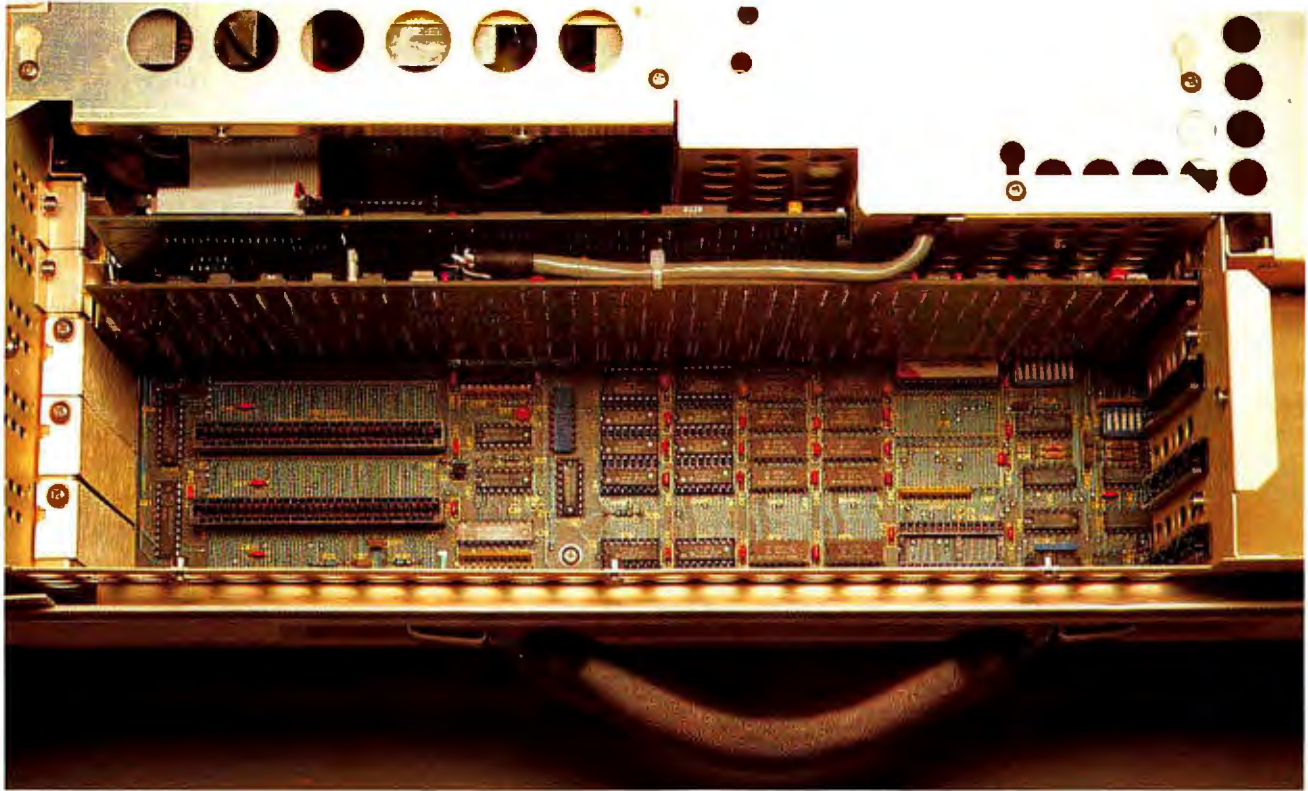


Figure 3: A look inside the COMPAQ reveals the system board with 256K of installed RAM, the monochrome/graphics card, the disk drive controller, and three available slots.

I booted, this time with *Superdrive*. I'm not a believer in praying to machines or computer code, but I considered it. *Superdrive* and COMPAQ greeted each other and shook hands.

Some inquisitive fumbling was required, but I now had a computer with 128K of system memory, two 320K floppy drives, an electronic drive (drive C) with 320K capacity, and another one (drive D) with 64K. I also had a parallel port (on the COMPAQ's monochrome/graphics board), a serial port (on the combo board), and a battery-run system clock—not too shabby for a machine that I was going to carry around the country.

The rest of my pre-trip setup involved making a new version of Big Boot with *Superdrive* and the supporting programs. One of the cornerstones of my working system is the *Keynote* keyboard enhancer utility. I tested it in conjunction with *WordStar* and both worked on the COMPAQ without any problems.

Several of my Big Boot programs and utilities run in BASIC, and here I ran into another consideration. The COMPAQ cannot run the BASIC.COM and BASICA.COM programs supplied on the PC-DOS disk because a good chunk of IBM's BASIC resides in the PC's ROM chip, and this could not be duplicated in the COMPAQ.

Instead, COMPAQ provides a DOS disk with three programs: BASIC.COM and BASICA.COM are relatively small programs (500K), each of which activates a program called BASICA.EXE, a large (53,760K) file that does all the work of interpreting BASIC.

BASICA.EXE is supposed to be functionally equivalent to IBM BASIC. However, the additional size of the file does cause a larger memory overhead when you want to store BASIC on a disk. The practical result was that I couldn't fit all the programs I normally include on Big Boot within the 320K capacity of the disk. It was not too much trouble to prepare a second disk, but configuring my regular system on the COMPAQ did take

I was forced to operate on intuition for the manual did not describe the inside of the machine.

some planning. I was relieved that I had not just thrown some disks in a plastic case and taken off.

Finally, I made a quick check of my Hayes Smartmodem 1200 and the serial port on the AST board by running *PC-TALK*. The communications system worked fine.

My first hands-on experience with a PC-compatible computer left me with two somewhat disparate conclusions. On one hand, despite COMPAQ's 99 44/100-percent-pure compatibility claim, I discovered that achieving that compatibility took some thought and preparation at the user's end. My PC system could not be transported intact.

● Review

On the other hand, I had pulled a new and unfamiliar computer out of a box and reproduced my PC working software on it in a couple of hours without having to make a single trip to a computer store (and with only one brief prayer). I consider that a rare and impressive occurrence in the computer world.

Maiden Flight

It was 7 a.m. Monday morning. The clothes, papers, disks, modem, and assorted support items I had stuffed into one suitcase just about balanced the 28 pounds of portable computer I was carrying in my other hand. I dashed into San Francisco International Airport and hadn't quite gotten to the American Airlines check-in counter when I was intercepted by a ticket agent.

"Do you have any bags to check?"

"Just this one."

"And how about *that*?"

"It's a computer. I'd like to carry it on board."

The agent grimaced just slightly as she offered her opinion that the computer wouldn't fit under the seat.

"I really would like to carry it on board," I repeated. "It's a delicate piece of machinery."

We consulted another agent, who had me set the COMPAQ next to the carry-on size limit markings at the counter. The COMPAQ flunked the test.

We both managed to remain cordial as I pleasantly made my carry-on request a third time. A short conference between the two agents ensued and a phone call was made to a supervisor. The only snatch of the

I was thrilled to be sitting deep in the heart of Texas writing on my portable computer.

conversation I caught was "sewing machine." I was to hear those words at least 50 times during my trip—a sewing machine is exactly how the COMPAQ appears when it is folded up.

About 4 minutes later the agent hung up, gave me detailed instructions on how to proceed if I couldn't cram the COMPAQ into the passenger compartment, and wished me luck with a smile.

In contrast to my grilling at the check-in counter, I had no problem requesting that the security people make a hand search of both the COMPAQ and a box of floppy

disks. I was surprised almost as much as the security agent when he laid this portable "sewing machine" on its side, flipped two latches, and revealed a computer screen, keyboard, and two disk drives. From there it was a relatively short walk to the gate, and by the time I got there my shoulders were thankful.

For all the foreboding about getting the COMPAQ on the plane, I managed to be among the first to board and slipped the computer into the carry-on luggage closet where others were stowing their hanging suit bags. With the COMPAQ safely tucked away, I enjoyed a spectacular flight over a snow-covered Nevada desert.

Once on the ground in Dallas, I pursued some scientific investigations and tried to fit the COMPAQ under the seat. After some fussing, I did prove that the computer could slide under the middle seat, leaving about an inch and a half for what would have been my rather cramped legs.

After a short walk to the baggage claim, I located the airport bus that was to take me to my hotel. I was content to let the COMPAQ ride in the bus' underbelly en route to the hotel. So much for the COMPAQ's maiden flight. It had not been a major hassle, but I could not have kept pace with O.J. Simpson.

Tabletop Computing in Big D

A few beads of perspiration were on my brow by the time I set the COMPAQ down in Room 712 at Dallas' Anatole Hotel. Conveniently, there was a good-sized table and a three-pronged electrical outlet handy. I flipped down the keyboard and booted the machine, just to make sure it had survived the trip. The COMPAQ blinked, burped a few times, and a few batch commands later greeted me with *WordStar*'s No-File Menu. I had set up shop at the Anatole.

After dinner I spent a few hours recording my experiences with my electronic traveling companion and found the COMPAQ to be a very serviceable writing tool.

Although the keyboard layout is identical to the PC's, it does not have the same feel. The COMPAQ keys offer more resistance, do not click, and do not hit bottom with the same hard stop that the PC keys do. The adjective that first came to mind in describing the COMPAQ keyboard was *mushy*. At first, the different keyboard feel caused me to make many typing mistakes, but after a while I got used to it and my writing proceeded at my normal pace.

Well into the evening, I discovered that the keys will activate with minimal pressure, at about the first 10 percent of the total keystroke throw. Just tapping the tops of the keys will elicit a response. A ten-finger touch typist (which I'm not) might put this phenomenon to efficient use. Keyboard feel is a subjective factor. Personally, I don't think the keyboard is one of the COMPAQ's strong points.



The COMPAQ flies Microsoft's Flight Simulator

There were a couple of other minor disappointments. The fan that circulates air through the machine is noticeably noisier than the PC's. The COMPAQ's screen is smaller, and although it produces perfectly legible characters, it's not the ideal display for a long work session. The legibility situation is definitely improved, however, by the fact that the COMPAQ's normal text display reproduces the PC's monochrome adapter characters, which have higher resolution than the graphics adapter characters.

Nevertheless, I was thrilled to be sitting deep in the heart of Texas writing on my portable computer. Once one becomes accustomed to the computer as an essential professional tool, it's difficult to work without it. By the same token, when the right tool is available, work comes easily. It was satisfying to have a word processor—and a powerful one at that—available for a couple of hours of writing each evening. One taste of computer portability and I was hooked.

I was conscious once again of applying two judgmental standards. If I compared the COMPAQ with the PC, I could come up with a list of features that didn't quite measure up. But I never could have carted my PC system in one hand through two airports and into my hotel room. All in all, I had gained in portability much more than I might have given up in terms of physical preferences.

How BASIC Is BASIC?

The second day of the conference I ran into Rod Canion, the president of COMPAQ Computer Corporation. He doggedly and good-naturedly resisted my attempts to pry some projected sales figures from him, but he didn't express any fears that his production lines would be idle during 1983. COMPAQ plans to capture a significant

share of the still-growing IBM PC market. Based on my experiences with the machine to that point, I tended to agree.

I asked Canion about some of the technical problems in trying to produce a PC lookalike. He stated that the COMPAQ ROM chip was created from scratch and was not a physical copy of the PC chip. What the COMPAQ's designers did was reproduce every function of the PC ROM chip, except for the stored BASIC routines. Canion was confident that his company had done a perfect job in that regard.

The same claim couldn't be made for the COMPAQ's BASIC. Canion acknowledged that getting a PC lookalike version of BASIC running on the COMPAQ had been one of his company's major hurdles in developing the product.

The BASIC supplied on the COMPAQ DOS disk is actually the current advanced version of Microsoft's GW BASIC, and this version is not identical to IBM BASIC. The source of the differences are those stored routines on the PC ROM chip, subsequent revisions to IBM BASIC as issued by IBM in DOS 1.10, and subsequent improvements to Microsoft's version of BASIC.

One example of such an improvement is that COMPAQ's (Microsoft) BASIC makes use of dynamic file buffering, in contrast to IBM BASIC's static file buffering. That means that in IBM BASIC the contents of a file created with an OPEN # statement remain in memory—even after the file is closed—until a new file is opened with the same number. This is not the case with BASIC as implemented on the COMPAQ, which stores files in memory only while they are open.

If the foregoing paragraph is beyond the level of your technical understanding, you're not likely to encounter the difference as a problem. But if a programmer relied on the static file feature of IBM BASIC (not generally good programming practice), he or she would find that the program wouldn't run properly on the COMPAQ.

Probing technical details such as these led Canion and me into a general discussion of who is responsible for program compatibility—the computer manufacturer or the programmer? Without making sweeping accusations, Canion felt that most of the incompatibility problems he's encountered so far have been the result of questionable programming techniques and shortcuts.

That evening I spent a few hours working on a BASIC program that I've been developing and discovered a strange quirk in connection with COMPAQ's BASIC editor. If I saved a program in progress with the SAVE command and kept adding lines, each new line entered caused some disk activity on the drive to which the program had been saved. No actual writing to disk appeared to be involved—just whirring every time I pressed the ENTER key. The solution to this annoyance, I discovered, was to give a dummy load command in the form LOAD "" ENTER, which caused the disk activity to stop.

COMPAQ-Tested Software

The following is a listing of currently available software programs that have been tested by COMPAQ Computer Corporation for use on the COMPAQ Portable Computer. This list in no way constitutes endorsement of any particular software program, for any particular purpose, by the COMPAQ Computer Corporation. This listing is effective February 1, 1983, is updated monthly, and is subject to change without notice. The listing was created by the COMPAQ Computer Corporation and is published with its approval.

Available software programs that have been tested and run without any alteration on the COMPAQ Portable Computer:

| Program | Publisher | Program | Publisher |
|--|--------------------------------------|----------------------------------|--------------------------------------|
| 1-2-3 | Lotus | EasyWriter II | Information Unlimited Software, Inc. |
| Accounts Receivable | IBM (BPI Systems, Inc.) | EDIX | Emerging Technology |
| Adventure | IBM (Microsoft) | Fact/Trac | IBM (Science Research) |
| Adventure In Serenia | IBM (On Line Systems, Inc.) | Flight Simulator | Microsoft |
| Arithmetic Set 1 | IBM (Science Research) | FORTRAN 77 (Ref UCSD p-System) | IBM (SofTech Microsystems Inc.) |
| Arithmetic Set 2 | IBM (Science Research) | FORTRAN Compiler | IBM (Microsoft) |
| Astro-Dodge | Digital Marketing | FriendlyWare PC Introductory Set | FriendlySoft, Inc. |
| Asynchronous Communications Support 2.0 ¹ | IBM | General Accounting | IBM (BPI Systems, Inc.) |
| Basic Compiler | IBM (Microsoft) | General Ledger | IBM (Peachtree Software Inc.) |
| Blingsplatz! | OMRIC Corporation | Graph'n'Calc | DeskTop Computer Software Inc. |
| BPS Business Graphics | Business & Professional SW | The Home Accountant Plus | Continental Software |
| COBOL Compiler | IBM (Microsoft) | IBM Pascal | IBM (Microsoft) |
| Communicator/Text Ed | Electronic Data Systems | Inventory | IBM (BPI Systems, Inc.) |
| Concurrent CP/M-86 | Digital Research Inc. | Las Vegas Blackjack | Quala |
| CP/M-86 | IBM (Digital Research) | Macro Assembler | IBM (Microsoft) |
| Crosstalk | Microstuf, Inc. | Mailing List | Alpha Software Corp. |
| Datatest | Datatek Inc. | MailMerge | MicroPro |
| dBASE II | Ashton-Tate | MBA | Context Management Systems |
| DEADLINE | Infocom, Inc. | Microsoft Decathlon | IBM (Microsoft) |
| Desktop/Plan PC | VisiCorp | Midway Campaign | Microcomputer Games |
| Dow Jones Reporter | IBM | Money Decisions | Eagle Software Publishing, Inc. |
| EasyFiler | Information Unlimited Software, Inc. | Multiplan | IBM (Microsoft) |
| Easy Speller | Information Unlimited Software, Inc. | Pascal Compiler | IBM (Microsoft) |
| EasyWriter 1.1 | IBM (IUS) | | |

¹ Requires a minimum of 192K of RAM with COMPAQ DOS 1.10. Use of COMPAQ DOS 1.10 Rev. B or later does not have this requirement.

| | | | |
|------------------|---------------------------------|---------------------------------|-----------------------------------|
| PC Crayon | PCsoftware | Total Information Management | Innovative Software |
| PC-DOS | IBM | Type Faces | Alpha Software Corp. |
| PFS File | IBM (Software Publishing Corp.) | Typing Tutor | IBM (Microsoft) |
| PFS Report | IBM (Software Publishing Corp.) | UCSD Pascal (Ref USCD p-System) | IBM (SoftTech Microsystems, Inc.) |
| Pig Pen | Datamost | VisiCalc | VisiCorp |
| Question | Alpha Software Corp. | VisiDex | VisiCorp |
| Space Guardian | OMRIC Corporation | VisiFile ² | VisiCorp |
| Space Strike | Datamost | VisiSchedule | VisiCorp |
| SpellStar | MicroPro | VisiTrend/Plot | VisiCorp |
| Startrek | Zeta Products | Volkswriter | Lifetree Software, Inc. |
| SuperCalc | SORCIM Corporation | WORKIX | Emerging Technology |
| Temple of Apshai | Automated Simulation | The Word Plus | Oasis Systems |
| The Benchmark | Metasoft Corporation | WordStar | MicroPro |
| The Ledger | Westware | Zork I | Infocom, Inc. |
| Time Manager | Microsoft Inc. | Zork II | Infocom, Inc. |
| | | Zork III | Infocom, Inc. |

² Requires a minimum of 192K of RAM and COMPAQ DOS 1.10 Rev. B or later.

Available software programs that have been tested and do not completely run on the COMPAQ Portable Computer. Some of these software programs do run with modifications (if noted). COMPAQ Computer Corporation has a continuing effort to amend problem areas through modifications by either COMPAQ or a cooperative effort with the software publisher.

| Program | Publisher |
|-----------------|------------------|
| Casino Games | IBM |
| Data Capture/PC | South Eastern SW |
| Word Challenge | Proximity |

Available software programs that are currently undergoing extensive review and testing for use on the COMPAQ Portable Computer. Final results of these efforts will be published periodically upon completion of testing.

| Program | Publisher | Program | Publisher |
|---------------------|-------------------------------|--------------------------|-------------------------------|
| Accounts Payable | IBM (Peachtree Software Inc.) | Micronet | ABTEX Computer, Ltd. |
| Accounts Receivable | IBM (Peachtree Software Inc.) | Move It | Full Comm. System |
| Disk Magic | Norell Data Systems | Payroll | IBM (Peachtree Software Inc.) |
| Disk saver | ABM Inc. | Perfect Filer | Perfect Software |
| FORTH/Level 2 | FORTH, Inc. | Perfect Speller | Perfect Software |
| Inventory Control | IBM (Peachtree Software Inc.) | Perfect Writer | Perfect Software |
| Loadcalc | Micro Decision System | Real Estate Investor | Simple Soft |
| MBA Converter | Context Management Systems | The Apple IBM Connection | Alpha Software Corp. |
| Mergecalc | Micro Decision System | Video Graph 88 | Windmill Software Inc. |
| | | Word Processing | Designer Software |

● Review

This might be the appropriate time to mention that the COMPAQ's disk drives, manufactured by Control Data Corp., are the quietest, smoothest drives I've ever used.

I also noticed that the Ctrl-ScrollLock key combination would not cause a break from a DOS operation such as halting screen scrolling during a TYPE command. When I tried pressing Ctrl-C, the break command worked. Oddly though, Ctrl-ScrollLock worked as advertised from within BASIC.

Although I was keeping an eye out for just these types of differences and incompatibilities, the only ones I ran across were the two described above, and I quickly stumbled upon remedies. However, there might well be other quirks in the COMPAQ that I didn't find.

By the end of that evening, I had successfully created and tested a major new chunk of the program. Once again, I was impressed by the novelty and utility of being able to do meaningful computer work far from my office.

Flying into Boca

The next morning, my traveling computer center was turned into a portable sewing machine once again as I headed for the airport. On the way I ran into Tom Meadows of BPI systems, who was traveling with his COMPAQ, encased in the optional padded nylon cover for the carrying case.

The COMPAQ's optional nylon cover serves vital functions. It protects the computer somewhat from bangs, scrapes, and scuffs and provides a measure of weatherproofing. I was especially conscious of my computer not having this protection because it was raining heavily, and several slots were exposed where the COMPAQ's sectional plastic case joins.

The nylon cover also provides loops for connecting a shoulder strap. (Two days later, I was to dream about having those loops available on my machine.) I would strongly advise purchasing the COMPAQ traveling case; it is a useful accessory and a good investment for extending the life of the machine.

Because of a scheduling change, I was forced to fly standby and was the last one to board a crowded plane. I was, nevertheless, able to paw through a forest of garment bags and stow the COMPAQ on a shelf in the passenger section closet.

My destination that day was the Boca Raton, Florida, headquarters of IBM's Personal Computer division, and I was well aware that I had Big Blue's first bona fide competitor in the trunk of my rented car as I drove into the parking lot. The purpose of my visit was an interview about IBM's software submission program and a tour of the IBM PC manufacturing facility. To be honest though, I was looking forward to getting some reaction to the COMPAQ.

My host at IBM was Information Manager Jeannette Maher. In the madcap 1½ years since the introduction of the PC, she had proven to be one of the most helpful, gracious, and professional people I had encountered in the computer industry. I was pleased to finally meet her in person. We conducted our interview and drove to lunch with Jeannette's ever-jocular assistant Dan Scherer. On the way back to the IBM building I casually mentioned that I had a COMPAQ computer in the trunk.

My bombshell announcement completely fizzled. Jeannette and Dan both acknowledged having seen the machine, though neither of them had used one. They were interested in the fact that I was actually making use of one on my trip. But they were not so taken aback that they suddenly blurted out IBM's plans for new personal computer products. As a matter of fact, not a single bean was spilled.

But when I mentioned that I also had a copy of Microsoft's *Flight Simulator* with me, two sets of eyebrows raised in unison. Neither Jeannette nor Dan had seen the program run on any computer, and they were very interested. And that's how I managed to walk into the IBM building with the COMPAQ in hand, feeling like I was smuggling a Greek Cypriot into a Turkish bath.

The demo was an unqualified hit. I unpacked the machine on Jeannette's desk, booted *Flight Simulator*, and in a minute the COMPAQ's screen was displaying an aerial tour of Chicago. A half-dozen employees passed by, stopped in, and ogled. A few tried their hands at simulated aerobatics. The crowning glory was when I managed a perfect landing back at Meigs Field, which thrilled me much more than my audience.



Assistant Editor Lisa Stahr tries out the COMPAQ's optional nylon cover. Her evaluation: "The shoulder strap keeps one arm from getting longer than the other."

It's been generally speculated that IBM has several new personal computers in the works, but is one of them a portable PC? I never got a clue from anyone at Boca.

I was loaded with extra baggage when I boarded Eastern Flight 756 from Ft. Lauderdale to New York, which unfortunately did not have a carry-on closet available. Still not willing to ride with the COMPAQ under the seat, I discovered that it would fit in the overhead rack and convinced the flight attendant that its weight did not violate the 40-pound overhead storage limit.

With the computer safely tucked away, I vowed that I would never be forced to store the COMPAQ under my seat, and formulated my First Law of Portability. Simply stated, it postulates that the stowage space for computers on an airplane is directly proportional to one's resourcefulness and determination.

Schlepping in the Big Apple

The word *schlep* is of Yiddish origin, but it has worked itself firmly into the New York colloquial tongue. Its German root is the word *schleppen*, meaning to haul or drag. As used on the New York streets, it takes on an additional burdensome connotation, with overtones of complaint and victimization. I was to feel the full weight of all those meanings as I schlepped the COMPAQ around New York City.

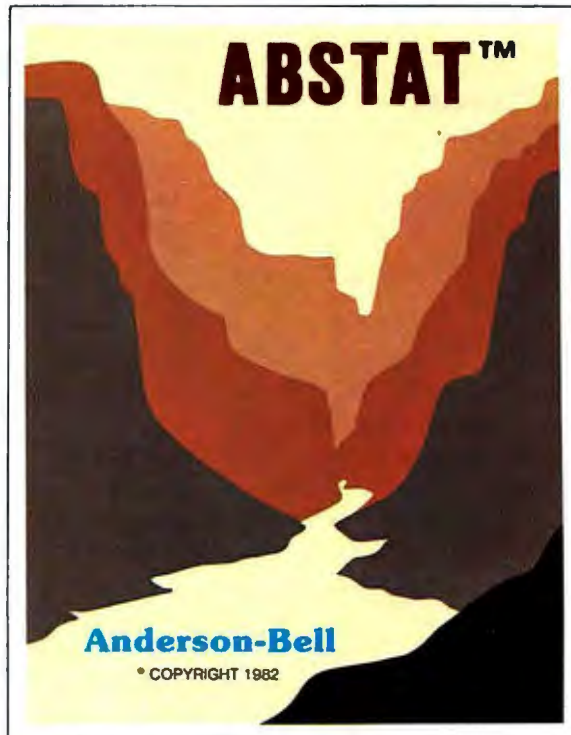
My day's itinerary in the Big Apple was typical for a business day in Manhattan: a subway ride to Midtown for a 9 a.m. meeting, a five-block walk to a 10:30 meeting, a subway ride to Wall Street for lunch, another trip underground back to Midtown for an afternoon meeting, and a taxi to the Upper West Side for dinner. It was during this day that I formulated the Second Law of Portability, which states that a 28-pound computer increases in weight exponentially with the distance carried.

I'm having some fun writing about these street words and mythical laws, but the fact is that carrying the COMPAQ for a whole business day is not easy. I am fairly strong, thanks to a regular routine of kayaking. Still, I had to set the computer down and switch hands every city block or so. By the time I arrived at a business appointment, my shoulders and forearms felt the strain and my hands were aching and cramped. Thankfully, the handle on the machine is comfortable and well padded.

Could my burden have been lessened? A few people suggested one of those rolling luggage carts, but I feared that the vibrations and curb pounding might loosen or damage the disk drives, boards, or monitor. Suspending the computer on a shoulder strap would make carrying it easier. Nevertheless, the COMPAQ is not for 98-pound weaklings—and probably not for 120-pound persons in fair shape either.

I discovered in New York that the COMPAQ is a *transportable* computer, not a real portable. It's superb for moving from place to place and setting up for work.

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● Review

It's easy to move it in the back seat of a car. I can attest that it can be carried without problems on an airplane.

But a roving reporter would not want to carry a COMPAQ the way he or she might pack along an Olivetti typewriter, and a sales rep probably wouldn't want to use the COMPAQ for demonstrations when making calls on foot. I'm not being critical of the machine—it packs an amazing amount of computing power in a convenient package. But before you conjure up grandiose plans for hauling the COMPAQ around, you should load a suitcase with 28 pounds and carry it around for a day.

Family Reunion

The last segment of my trip was the highlight. I drove upstate to join my family and celebrate my father's eightieth birthday, and the COMPAQ traveled with me. As it turned out, it may have been the high point for the computer as well.

My father was born ten months before the Wright brothers' first flight. No lifespan has ever witnessed more technical innovation. And now I was able to bring a computer into his house for him to sample firsthand the beginnings of the computer age.

Together we wrote some BASIC programs and played graphics and word games. My father is used to receiving information from large computers at work, but he was amazed at what he could do with a computer in his lap. Computers still amaze me too. We swapped amazements for a while, and then my mother had to try her hand for a first taste of computer antics.

My nieces, age 10 and 12 and no strangers to computers, stepped in and immediately racked up record high scores on the games. Then they showed off their programming proficiency by writing some simple guessing games and stringing together notes until they had the computer playing tunes. We couldn't have come up with a more special entertainer for a special birthday party.

I finally got a chance that evening to use the COMPAQ for some telecommunicating. Finding modular phone jacks in any of the hotel rooms or offices I had visited had been impossible, which had frustrated my desire to send an electronic communique from the road. (I should also mention that it was inconvenient to cart around a modem, an AC adapter, and a connection cable. If I were going to use the COMPAQ for regular travel, I would outfit it with a modem card that could fit into one of the system board slots.)

For all their computing experience, my nieces had never talked with anyone over a phone line via computer. We called cross-country to Associate Editor Jeremy Hewes, aka "Modem Mama," who served up her inimitable brand of keyboard repartee. For almost an hour Amy and Melissa were enchanted and Modem Mama was enchanted in return.

I've painted a picture of a computer age family reunion, with three generations gathered in the cool green glow of a CRT display. I know that there are many other, more traditional ways for families to come together. But I'm also aware that the portable computer that I had carried from California had allowed me to share a part of my world and had helped me broaden others' views of what is possible in the world. It is clear to me now that the portable PC will be an energetic and powerful missionary in the spread of computer gospel.

Welcome Home

The COMPAQ survived a blizzard and a full-to-the-gills transcontinental flight and made a glorious entrance at *PC World* headquarters in San Francisco. Immediately, Harry Miller made arrangements to take it home for some work, Jeremy Hewes reserved it for use during a week-long house sitting stint, Patricia Navone and Cindy Hamburger grabbed it for some emergency additions to the data base, and Steve Cook wanted it for some program testing.

We had to fight to keep the machine in the Editorial Department, because David Bunnell wants to create a spreadsheet file for a special project, Cheryl Woodard would like to play with her advertising data, Jackie Poitier has to keep track of her print runs, and Janet McGinnis wants to learn word processing, and....

The Third Law of Portability became apparent in an instant: A computer will be put to use in proportion to its transportability. That is the appeal and value of the COMPAQ, and I predict that it will be a successful machine for precisely that reason.

Before I set out on my trip, I wrote down four questions that I would try to answer by the time this somewhat unconventional review went to press. I now have positive answers to all of them.

Is the COMPAQ computer a viable alternative to an IBM PC? Yes. I have a high degree of confidence in its ability to take advantage of most major PC hardware and software.

Would I buy one as my first computer? Possibly. I'd want to make sure that it were comfortable enough to use for my daily work.

Would I buy one as my second computer? Definitely.

Will we see more portable and transportable computers? The market will explode with them.

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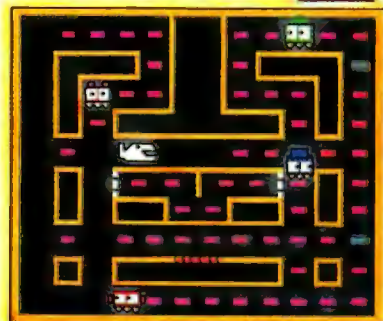
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| Daily Transactions Report | Departmental Income Statement(s) with prior year comparison |
| Itemized Monthly Transactions | Detail report for individual accounts |
| Balance Sheet | Trial Balance Statement |
| Balance Sheet with prior year comparison | |

Accounts Receivable

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| Statements (with or without pre-printed forms) | Itemized Monthly Transactions |
| | Customer Account Report |
| | Customer Activity Report |

Accounts Payable

- | | |
|----------------------|----------------------|
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| Daily Credit Report | Open Voucher Report |
| Check Printing | Aging Report |
| Check Register | List of Vendors |
| Vendor Status Report | |

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|-------------------------|---|
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| Tax Table Listing | Quarterly Summary Report (State unemployment info.) |
| Payroll Check Register | 941 Worksheet |
| Paycheck Printing | W-2 Printing |
| Monthly Summary Report | |

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| | | Transaction Capacities per month | | |
|----------------|----------------------|----------------------------------|-----------------------|------------------|
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| AR | 400 Customers | 800 | 1,600 | 7,000 |
| AP | 400 Vendors | 800 | 1,200 | 7,000 |
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DOS; 64K RAM; two disk drives; 132 column printer (an Epson MX-80 or similar type printer with compressed mode will work fine)

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11:00–12:00 p.m.
"The PC Phenomenon"

Panel members: David Bunnell, President and Publisher, *PC World*; Cheryl Woodard, Associate Publisher, *PC World*; Ron Posner, Chairman, National Training Systems; Portia Isaacson, President, Future Computing; Martin Alpert, President, Tecmar.

12:30–2:00 p.m.
"Second Generation Software"

Panel members: Mitchell Kapor, President, Lotus Development Corp.; Jeff Harbers, Associate Manager, End-User Division, Microsoft; Gilbert Hoxie, President, Context Management Corp.; Roy Folk, Division Marketing Manager, VisiCorp; Harry Miller, Associate Editor, *PC World*.

2:30–4:00 p.m.
"PC Multiprocessing, Networking,
and Communications"

Panel members: Drew Major, Software Systems Manager, Novell Data Systems; Steve Pomeroy, Product Marketing Manager, 3COM; Steven Cook, Technical Editor, *PC World*; Phil Belanger, Omni Project Manager, Corvus.

4:30–6:00 p.m.
"PC Add-Ons—What Is
Compatibility?"

Panel members: Rod Canion, President, COMPAQ Computer Corp.; Andrew Fluegelman, Editor, *PC World*; Dr. Robert Harp, Chairman of the Board, Corona Data Systems; Karl Koessel, Programming Editor, *PC World*; Steven Cook, Technical Editor, *PC World*; Martin Alpert, President, Tecmar.

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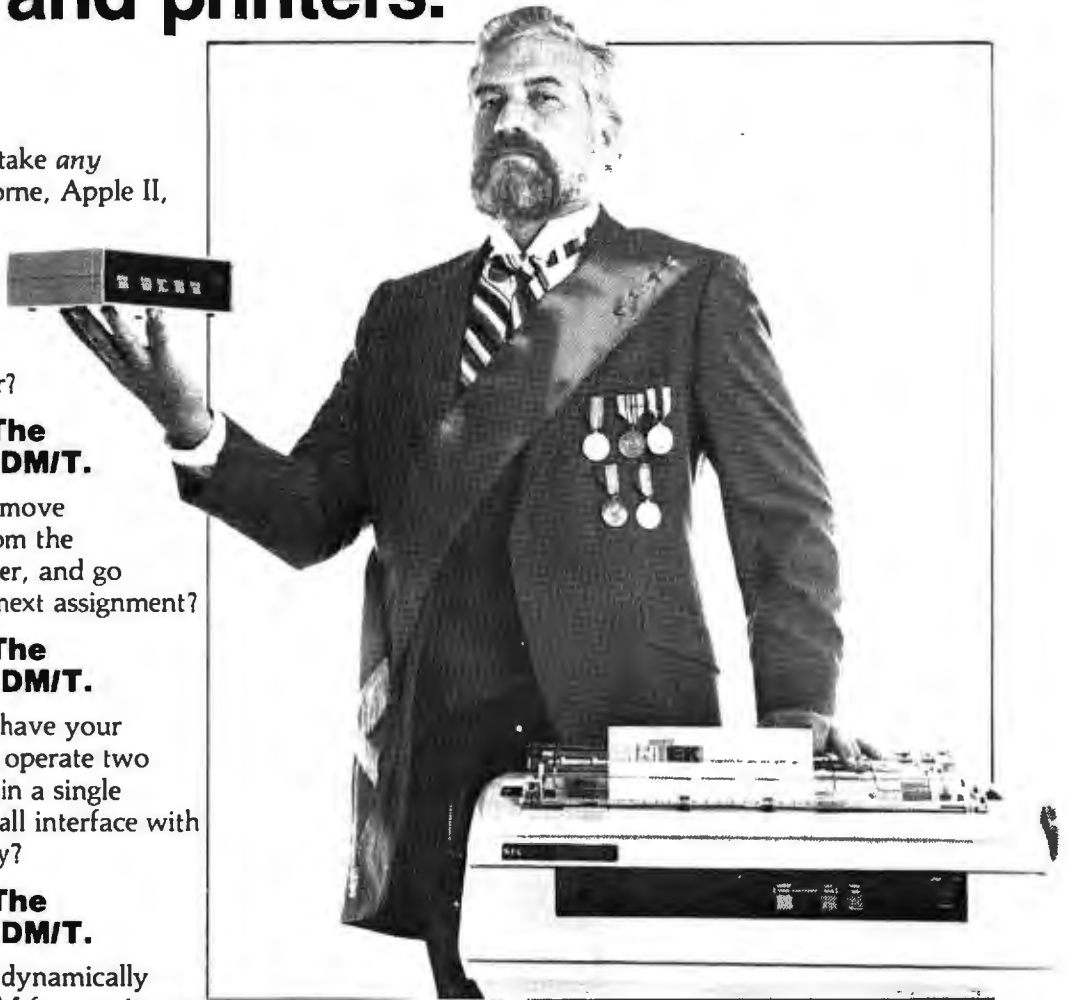
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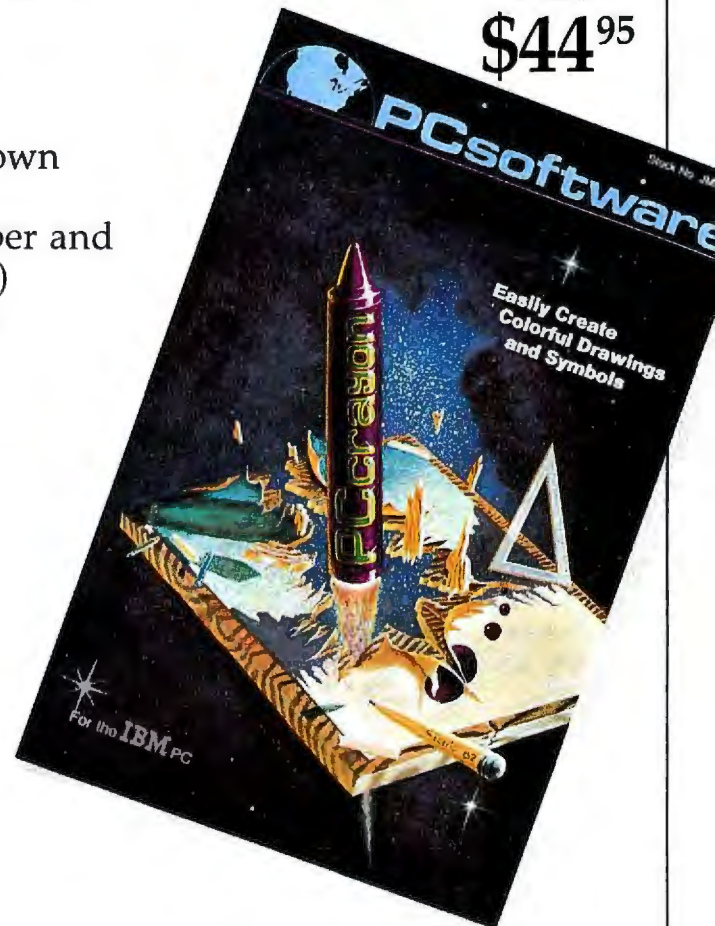
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Multiplan Inherits the Spreadsheet Legacy

The latest in the new breed of electronic spreadsheets that combine advanced features with a superior user interface

Edward Rodgers

Consider for a moment the evolution of personal computing. Advances in microprocessor technology have resulted in a rapid progression from 8-bit to 16-bit, and most recently, to 32-bit microprocessors. Consequently, new or variant operating systems have evolved to utilize the increased performance capabilities of each successive microprocessor generation. The CP/M operating system demonstrates this evolution: CP/M-80 to CP/M-86 to Concurrent CP/M and beyond.

Applications software is not exempt from this evolutionary process, which occasionally yields a new breed of software better adapted and more refined than its predecessors. *Multiplan* is one of the new breed, the second generation of electronic spreadsheets.

Spreadsheet Genetics

To understand the significance of *Multiplan* we must first look to its predecessors. *VisiCalc*, introduced in 1978 by Personal Software (now VisiCorp), defined the concept of electronic spreadsheets. An extremely popular program (with an estimated 250,000 copies sold), *VisiCalc* expanded the market for personal computers.

VisiCalc's success did not go unnoticed by other software developers. Soon a number of spreadsheet programs flooded the market, each bearing a resemblance to *VisiCalc*. Some of these "visiclones" even improved on the concept.

Multiplan is equally resourceful in presenting a spreadsheet as it is in calculating it.

If we consider *VisiCalc* the original expression of the idea, recognition for the most significant enhancement should go to *SuperCalc* for its particular contribution—speed. As benchmark tests have shown, *SuperCalc* can add and multiply nearly twice as fast as *VisiCalc*. In addition to speed, *SuperCalc* provides the ability to lock cells, control recalculation, and substantially lower the time required to load or save a spreadsheet.

While these enhancements are useful, *SuperCalc* still lacks a user interface that could extend the benefits of electronic spreadsheets to the least technical of users. *Multiplan* addresses this deficiency with a powerful user interface as well as advanced spreadsheet features.

The Anatomy of Multiplan

The amount of command information displayed on the *Multiplan* screen is the most evident feature of the program's user interface. Unlike *VisiCalc* or *SuperCalc*, both of which require users to memorize command names, *Multiplan* sports a full list of commands near the bottom of the screen (see Figure 1 and Table 1).

Users new to electronic spreadsheets should find this command line helpful, while experienced users will be pleased to note that this feature was not provided at the expense of the number of rows displayed on the screen. Although one column narrower than either *VisiCalc* or *SuperCalc*, *Multiplan*'s largest viewing window (20 rows by 7 columns) is adequate for most applications.

After the desired command is selected, the command line displays a number of options (such as defining decimal places or changing the size of cells) related to the selected command. For some commands, such as *FORMAT*, the options are predefined and easily selected with the Tab key or the Space bar followed by ENTER.

For commands, such as *MOVE*, *COPY*, or *GOTO*, that have user-definable fields *Multiplan* uses a routine that provides proposed responses. This routine monitors what you are doing on the spreadsheet and tries to anticipate what you are going

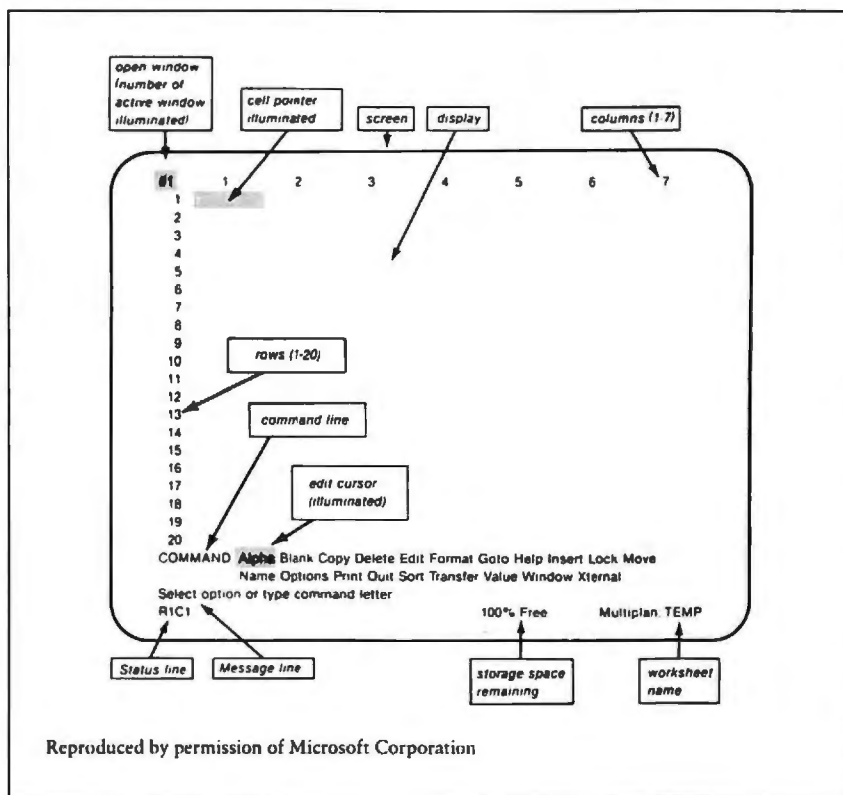


Figure 1: A Multiplan Screen

to do next. If you copy the contents of one cell into one or more columns, for example, *Multiplan* will propose the same number of target columns on subsequent rows for the next Copy Cell operation by filling in the target field.

If the proposed response is incorrect, you can Tab to the field, type in the correct response, and press ENTER. This feature proved to be quite intelligent and useful—*Multiplan* correctly anticipated my responses nearly 80 percent of the time.

A related convenience is the scheme used to identify rows and columns within the spreadsheet. Unlike *VisiCalc* and *SuperCalc*, which use numbers and letters to designate rows and columns, *Multiplan* uses numbers only.

If you've ever worked with large spreadsheets and wanted to jump to a location, such as row 3, column 47 on the far right side of the sheet, you'll appreciate the simplicity of keying R3C47 instead of translating this coordinate to its alphabetic equivalent (AU3) in *VisiCalc* or *SuperCalc*.

Cell Biology

Fundamental to the electronic spreadsheet concept is the ability to calculate a value for a cell or group of cells based on the value(s) contained in one or more other cells. The problem that follows is how to indicate the relationships and dependencies among the cells. *Multiplan* answers this question with three cell-referencing techniques.

The first technique, the explicit reference, is common to *VisiCalc*, *SuperCalc*, and *Multiplan*. It defines the value of a cell or group of cells based on the value(s) located at the specific coordinates of any other cell or cells.

If you want to add the contents of three cells, for example, and place the result in a fourth cell, the formula contained in the fourth cell could read either 'R1C1 + R1C2 + R1C3' or 'SUM(R1C1:3)' [the formulas are equivalent]. R and C designate row and column, respectively, with the colon in the second formula denoting the column range.

| Multiplan | VisiCalc |
|--------------------|----------|
| Blank | /B |
| Transfer Clear | /C |
| Delete Columns, | /D |
| Delete Rows | |
| Edit, Alpha | /E |
| Format Cells | /F |
| Format Width | /GC |
| Format Default | /GF |
| not needed; see | /GO |
| text | |
| Option | /GR |
| Insert Columns, | /I |
| Insert Rows | |
| Move Columns, | /M |
| Move Rows | |
| Print | /P |
| Copy | /R |
| Transfer Load | /SL |
| Quit | /SQ |
| Transfer Save | /SS |
| Window Split | /T |
| Titles | |
| Option | /V |
| Window Open, | /W |
| Window Split, etc. | |
| Window Link | /WS, /WU |
| Goto Row-col | > |
| Next Window key | ; |
| Recalc key | ! |
| use references | # |
| see Table 2, REPT | /- |
| function | |

Note: You type only the capitalized characters of the Multiplan command names.

Commands Unique to Multiplan

Format Options
Help
Lock
Name
Sort
Window
eXternal

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Table 1: Multiplan Commands and Their VisiCalc Counterparts

● Review

The process of constructing either formula is started by positioning the cursor at the fourth cell (R1C4) and pressing the Equals (=) key. This action clears the command options menu from the bottom of the screen and places the edit cursor (located in the command line) at the Value prompt. The specific coordinates of the operands (values or numbers to be added) and the appropriate arithmetic operators for addition can now be typed followed by ENTER.

While this approach seems straightforward enough, consider what happens if a column between columns 2 and 3 is inserted. The formula, now in column 5, handily adds the contents of row 1, columns 1 through 3, and promptly provides the wrong answer by omitting the value previously in column 3 but now in column 4. Clearly, a way is needed to reference cells that allows some flexibility when moving formulas around on the spreadsheet.

Relative cell referencing, *Multiplan*'s second option, provides this flexibility. Using the previous example, the equivalent relative formula (in cell R1C4) would read `[R1C[-3] + R1C[-2] + R1C[-1]]` where the notation '-X' should be read as 'this column (or row) minus X'. Just as '-X' can refer to rows above or columns to the left of the current active cell (in this case the cell containing the formula), so can '+X' refer to rows below or columns to the right of the current active cell.

Returning to the original problem (before inserting the extra column), we can begin to construct the relative formula by placing the cursor in the fourth column (R1C4) and pressing Equals to indicate that a formula is about to be entered.

Pressing CursorLeft causes the cursor to move from the active cell to the cell containing the operand-to-be (in this case the value in column 1, 2, or 3). As the cursor moves left, its present position relative to the active cell is displayed on the formula line at the bottom of the screen.

Once you're at the desired location, entering an operator (in this case a plus) causes the cursor to jump back to the active cell where the formula is being constructed, ready to be repositioned to the cell containing the next operand. The formula is complete when you press ENTER. If a column is inserted between columns 2 and 3, *Multiplan* automatically adjusts the cell references

Multiplan permits page length, print length and width, and top and bottom margins to be defined.

contained in the formula to maintain their original relative positions and delivers the correct result.

Relative cell referencing solves the problems encountered when inserting, deleting, moving, or copying cells that contain or feed a formula, and it provides a simple way to construct the formula. Instead of keying the formula, as in the explicit referencing example, relative formula construction can often be accomplished with the cursor keys only and your favorite arithmetic operators—a reprieve for those of us with less than virtuoso keyboard skills.

Naming Cells

Multiplan's relative cell referencing facility provides considerably more flexibility than explicit referencing. Its problem-solving syntax, however, is still dramatically different from that which we use when thinking. In yet another attempt to provide a user interface to bridge the gap between people and machines, *Multiplan* has the ability to reference cells by name.

For example, suppose that row 4, columns 2 through 13 (R4C2:13), contains the 12-month sales figures for your company, and that row 15, columns 2 through 13 (R15C2:13),

contains total monthly costs. With *Multiplan* you can calculate the gross profits for the year at row 17, column 2 (R17C2). Using the Name command you can define R4C2:13 as 'Sales' and R15C2:13 as 'Costs'. The formula to calculate gross profits could then be structured as
GROSS PROFITS =
SUM(SALES) - SUM(COSTS)
in which the SUM function adds the range of cells defined by Name.

The Name command is an explicit reference to a cell or group of cells that allows spreadsheet row/column jargon to be replaced by descriptive words or phrases of up to 31 characters. I found this feature most useful since defined "names" are easier to remember than specific cell coordinates. Once defined, names can be used much like a program variable to pass values to other areas of the spreadsheet, or, as we'll see later, to other linked spreadsheets.

Defining names that correspond to the row or column labels I set up on the spreadsheet was helpful since names are not visible once defined. Should you forget the list of names you've already defined, however, pressing F3 followed by CursorLeft or CursorRight will allow you to display and step through the list of names in use.

While *Multiplan*'s cell referencing techniques are quite powerful, cells alone do not make a spreadsheet. In addition to supporting all the functions offered by *VisiCalc*, *Multiplan* provides several new ones (see Table 2). The 12 new functions support a broad range of applications ranging from statistics to text calculation to the generation of numerical series. Combine these capabilities with the iteration option and the ability to view your spreadsheet through as many as eight windows, and your PC becomes a highly analytical engine.

Before you rush out to add another 256K of memory and jump into some light number crunching such as

Multiplan**VisiCalc**

| | |
|---------------------------------------|---------------------|
| ABS(N) | (a ABS(N) |
| use PI()/2 - ATAN (N/SQRT(1 - (N*N))) | (a ACOS(N) |
| AND(list) | (a AND(list) |
| use ATAN(N/SQRT(1 - N*N)) | (a ASIN(N) |
| ATAN(N) | (a ATAN(N) |
| AVERAGE(list) | (a AVERAGE(list) |
| INDEX (area,subscripts) | (a CHOOSE |
| COS(N) | (a COS(N) |
| COUNT(list) | (a COUNT(list) |
| use undefined name | (a ERROR |
| EXP(N) | (a EXP(N) |
| FALSE() | (a FALSE |
| IF(1,v1,v2) | (a IF(1,v1,v2) |
| INT(N) | (a INT(N) |
| ISERROR(N) | (a ISERROR(N) |
| ISNA(N) | (a ISNA(N) |
| LN(N) | (a LN(N) |
| LOG10(N) | (a LOG10(N) |
| LOOKUP(N, area) | (a LOOKUP(N, range) |
| MAX(list) | (a MAX(list) |
| MIN(list) | (a MIN(list) |
| NA() | (a NA |
| NOT(1) | (a NOT(1) |
| NPV(dr, list) | (a NPV(dr,range) |
| OR(list) | (a OR(list) |
| PI() | (a PI |
| SIN(N) | (a SIN(N) |
| SQRT(N) | (a SQRT(N) |
| SUM(list) | (a SUM(list) |
| TAN(N) | (a TAN(N) |
| TRUE() | (a TRUE |

Functions Unique to Multiplan

| Function | Description |
|-------------|--|
| COLUMN() | Current column number |
| DOLLAR(N) | Text form of N formatted as dollar amount; negative N shown in parentheses |
| FIXED(N,d) | Text form of N formatted with d decimal places |
| LEN(T) | Length of text T in characters |
| MID(T,s,c) | The c characters of text value T starting at s |
| MOD(N1,N2) | Remainder of N1/N2 |
| REPT(T,N) | Text made of N repetitions text T |
| ROUND(N,d) | Value of N rounded to d decimal places |
| ROW() | Current row number |
| SIGN(N) | -1, 0, or +1 depending on N |
| STDEV(List) | Standard deviation |
| VALUE(T) | Number value of text T |

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iterative proportional curve fitting, take note that *Multiplan* can use only a modest 64K of working memory. Initially I thought this characteristic the tragic flaw in an otherwise superlative piece of software.

Splitting Worksheets

Exploring the intricacies of linking multiple sheets, however, suggests that program designers at Microsoft have taken advantage of one of *Multiplan*'s most impressive features to minimize memory requirements. By endowing *Multiplan* with the ability to exchange data between different yet related worksheets, a large "virtual" sheet composed of many smaller sheets can be created.

If an application is too large for a single worksheet or will require more than 64K of memory, it can be broken into smaller modules and put on different sheets. These are referred to as either "supporting" or "dependent" worksheets based on their relationships to other sheets.

Supporting sheets provide data for another sheet; dependent sheets use the data from supporting sheets for their calculations. Once a supporting sheet is set up, named cells can be copied to the dependent worksheet. If a named value is changed on the supporting worksheet, the related numbers on the dependent worksheet are automatically updated the next time the dependent sheet is loaded. A financial statement, for example, can be set up so that line item details are calculated on the supporting sheet and then passed to the dependent sheet, which calculates the financial statement summary.

As you may have guessed, keeping the dependent and supporting sheets straight gets a bit tricky, especially if a single sheet is dependent on Sheet A, for example, but supports Sheet C. Since cumulative changes are reflected only when a sheet is loaded, the integrity of the data depends upon loading the sheets in proper order after a change has been made.

Table 2: Multiplan Functions and Their VisiCalc Counterparts

● Review

In testing *Multiplan* I created a set of six related worksheets and found that the easiest way to keep them straight was to draw a dependency diagram like the one shown in Figure 2. As an ancillary benefit, the smaller, individual worksheets are also considerably easier to work with than large single sheets.

Worksheet Formats

Multiplan is equally resourceful in presenting a spreadsheet as it is in calculating it. With five options to specify alignment within a cell (including centering) and ten options to specify the displayed format (such as scientific, fixed point, and variable decimal accuracy), *Multiplan* is capable of producing elaborate worksheets. If you have a color monitor, the Window Paint option permits you to color the foreground, background, and borders of each sheet from a palette of 15 colors, which makes for snappy presentations.

A far more useful feature, however, is *Multiplan*'s approach to printing. Since spreadsheets can be created that are wider than a standard 80-column printer and longer than 14-inch paper, worksheets often have to be printed in sections and then taped together. Unlike *VisiCalc*, which requires manual calculation of the section size that will fit on a page, *Multiplan* permits page length, print length and width, and top and bottom margins to be defined. When the Print command is selected, the worksheet is automatically partitioned to defined specifications.

Benchmark Comparisons

To test *Multiplan*'s relative computational speed, I created identical spreadsheets in *VisiCalc*, *SuperCalc*, and *Multiplan*. The test consisted of a 50 by 50 cell matrix in which the value of each cell was calculated as a function of the cell immediately above or to the left of it. The only data entry cell was Row 1, Column 1

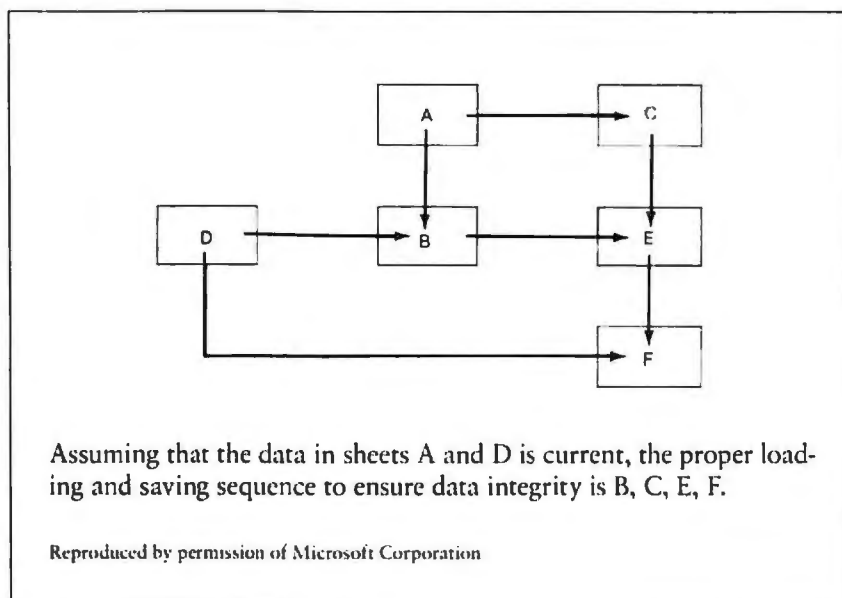


Figure 2: Sample Dependency Diagram

| | VisiCalc | SuperCalc | Multiplan |
|----------------------------|----------|-----------|-----------|
| Average Calculation Time | 44 sec | 26 sec | 30 sec |
| Memory Consumed | 85K | 66K | 40K |
| File Save Time | 80 sec | 32 sec | 21 sec |
| File Load Time | 150 sec | 33 sec | 17 sec |
| Store File Size | 40K | 64K | 40K |
| Program Size (Approximate) | 42K | 45K | 53K |
| Scroll Speed (Horizontal) | 8 sec | 35 sec | 18 sec |
| Scroll Speed (Vertical) | 24 sec | 132 sec | 92 sec |

Table 3: Benchmark Test Results

in the upper left corner of the matrix. The same formula ($+.01 + 1$) was created in another cell and then copied to the remaining cells. I am pleased to report that *Multiplan* performed quite respectably on all accounts. Table 3 summarizes the results of the tests.

I also tested *Multiplan*'s ability to read and convert *VisiCalc* files and encountered some surprising results. While the utility performs as advertised, the file size is greatly expanded in the conversion process. A stored *VisiCalc* file of 384 bytes resulted in a 1023 byte file after *Multiplan*'s conversion. Creating the same worksheet directly in *Multiplan* resulted in a file of 1010 bytes—smaller, presumably, because I took advantage of some economies in *Multiplan*'s formula structure.

The magnitude of this expansion, however, resulted in an insufficient memory error after 11 minutes of processing, when I attempted to load the *VisiCalc* sheet into *Multiplan*. The solution: break the *VisiCalc* sheet into smaller pieces before converting, and then link the resultant sheets in *Multiplan*.

Documentation

The evaluation copy of *Multiplan* was furnished with documentation for the CP/M version. Aside from the obvious differences in program installation, the documentation presented the material in a clear, concise

| Action | Key(s) pressed |
|---|------------------|
| Next window | F1 |
| Next unlocked cell | F2 |
| Absolute reference | F3 |
| Recalculate | F4 |
| Word left | F7 |
| Word right | F8 |
| Character left and next menu item | F9 |
| Character right and previous menu item | F10 |
| Cancel | Esc |
| Enter | ENTER |
| Backspace | Backspace |
| Delete | Del |
| Tab to next field | Tab |
| Help | Alt-H |
| Home in window | Home |
| Home to R1C1 | Ctrl-PgUp |
| End | End |
| Up direction | CursorUp |
| Down direction | CursorDown |
| Left direction | CursorLeft |
| Right direction | CursorRight |
| Page up | CursorUp |
| Page down | CursorDown |
| Page left | Ctrl-CursorLeft |
| Page right | Ctrl-CursorRight |
| with Scroll Lock activated: | |
| Scroll up | CursorUp |
| Scroll down | CursorDown |
| Scroll left | CursorLeft |
| Scroll right | CursorRight |

Table 4: Multiplan's Use of the PC Keyboard

manner with sufficient examples and illustrations of the various commands and functions.

Although this review assumed that the reader was already familiar with one or more electronic spreadsheets, I decided to test the PC version of *Multiplan* and its documentation in the hands of a nontechnical user who had no previous spreadsheet experience. After I booted the program, I left the novice to her own devices with Chapter 1 of the user's guide. In approximately 3 hours she had covered about half of the more than 400-page manual and had demonstrated a good grasp of *Multiplan's* capabilities. An hour and a half later

I saw her leave the terminal mumbling something about the greatest thing since sliced bread.

Multiplan also provides a menu-oriented on-line help function. While this feature usually provides sufficient information to resolve most questions, the best information is still in the manual. Given the mismatch between the PC software version and CP/M documentation, I was pleased to find PC-specific keyboard information in the help files. Table 4 outlines *Multiplan's* use of the PC function keys and control sequences.

Final Remarks

Multiplan's consistent ease of use deserves high marks and begins to address an area of personal computing that has too often been slighted. The program's features and overall performance will undoubtedly extend the usefulness of electronic spreadsheets to a broader group of less-than-technical users.

This expectation is supported by a recent announcement from Wang Laboratories, a major manufacturer of stand-alone and shared-logic word processors, that a CP/M version of *Multiplan* will be available for selected Wang equipment this year. Fortune Systems Corporation, a manufacturer of 32-bit supermicros, offers a version of *Multiplan* running under Bell Labs' UNIX operating system. Both of these manufacturers target the professional and managerial information processing markets.

Even as you read these words, however, the evolutionary process continues. Although satisfied for the moment, we cannot help but wonder what the next generation will bring.

Edward Rodgers is a staff consultant on information systems at a Fortune 100 corporation. He specializes in office systems and personal computers.

Multiplan

Microsoft Corporation

10700 Northup Way

Bellevue, WA 98004

206/828-8080

List Price: \$275

Requirements: 64K, one disk drive

VisiCalc

VisiCorp

2895 Zanker Rd.

San Jose, Ca 95134

408/946-9000

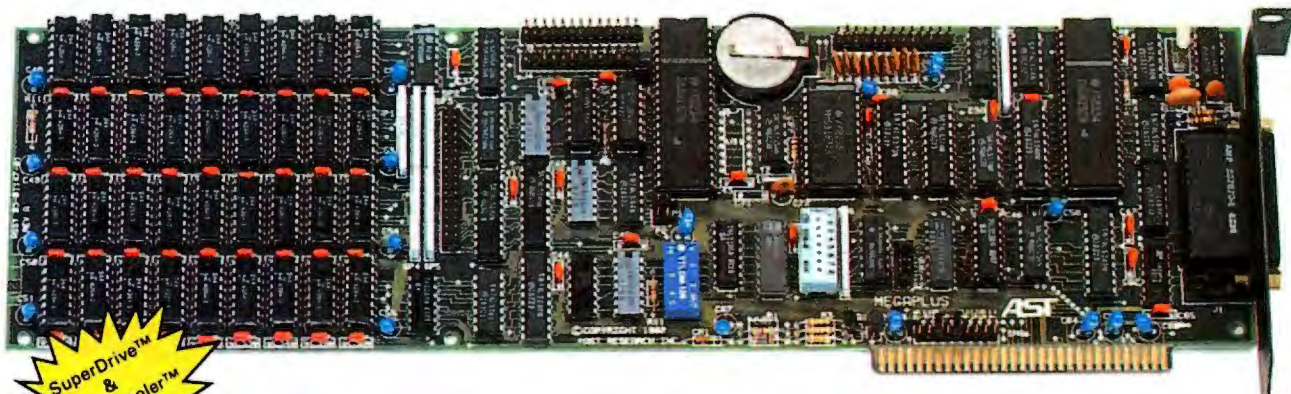
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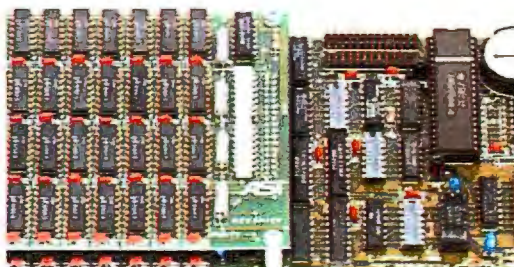
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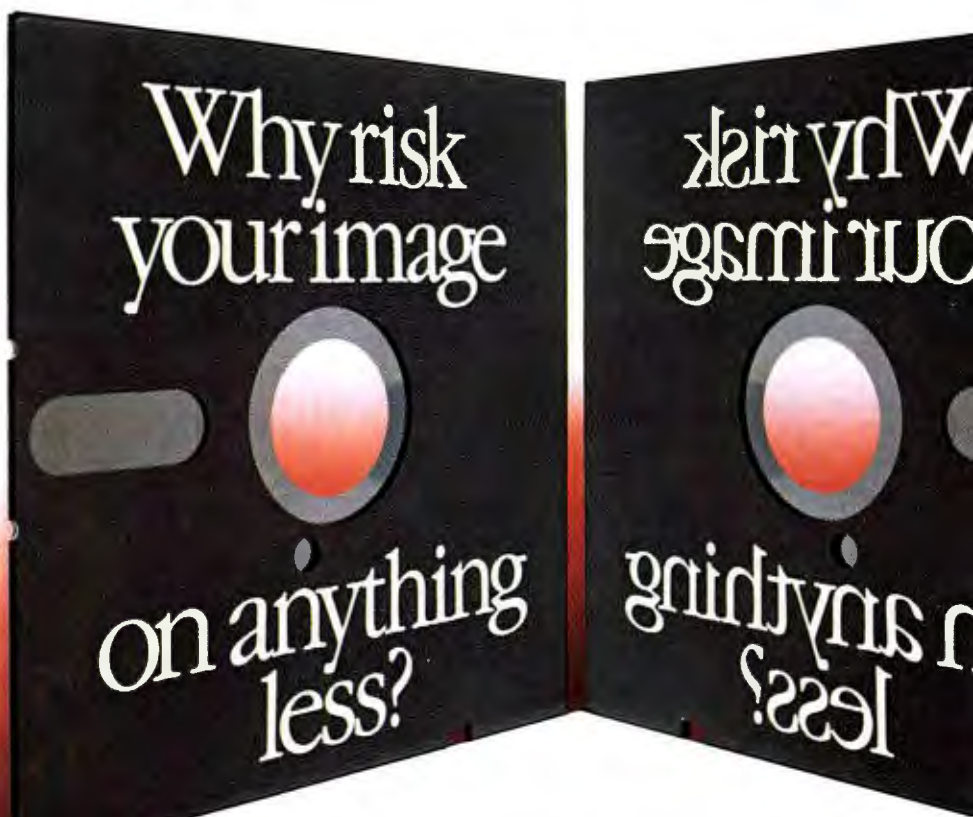
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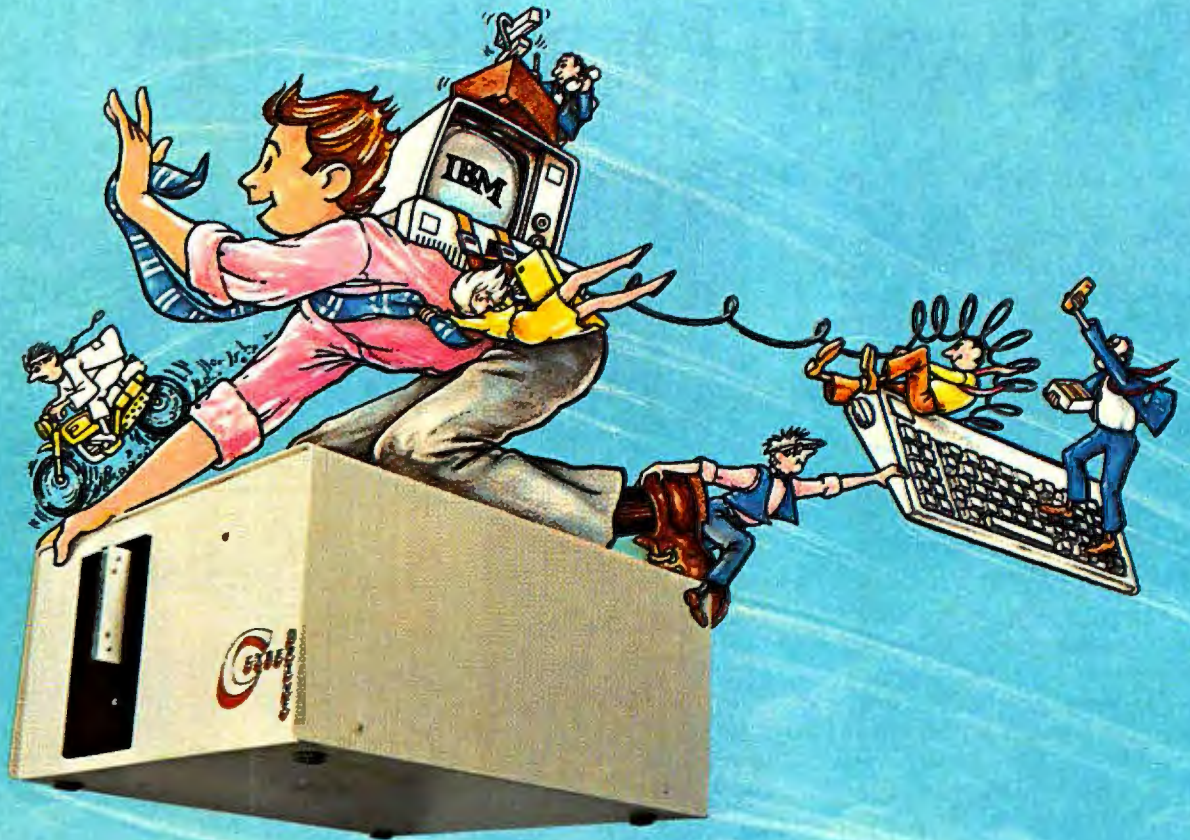
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Printing to a Different Drummer

Sideways is a utility that will turn your spreadsheets on their ears.

Andrew T. Williams

Everyone has days like that. Days when they need a change of pace: Heineken instead of Budweiser, Raymond Chandler instead of Harold Robbins. Sometimes you may even have days when you'd like to print something—a spreadsheet, for example—sideways on a sheet of paper.

Until now it has been easier to indulge your whims in beer and books than to fulfill a desire to run your printer in any fashion other than the standard way—back and forth across the page. Until the introduction of *Sideways*, that is. Now you have a utility that does just what its name claims: it prints sideways on a page.

Sideways has obvious value when it comes to printing spreadsheets longer than the longest line you can print from left to right on a page. But it is more versatile than that. *Sideways* can print any standard DOS file sideways, including text created with a word processor and material created with a text editor, as well as electronic worksheets saved as text files.

What Do You Need?

To use *Sideways* you will need an IBM Personal Computer, a parallel printer interface, and either an IBM dot matrix printer or an Epson MX-80 or MX-100 printer. Your

SIDEWAYS Version 1.00 1-2-100
© Funk Software, Inc. 1982

Printer select: LPT1

Vertical form size (inches): 11 Horizontal form size (inches): 6

Character font: NORMAL Double strike: OFF

Character spacing (dots): 1 Line spacing (dots): 3

Left margin (inches): 0.000 691 characters per line

Maximum printing width (inches): 0.000

Top margin (inches): 0.000 53 lines per page

Printing length (inches): 0.000

Starting page: 1

Enter name of print file:

Strike " " and " " to move from field to field
"F1" to save current options
"F10" to exit from program

Figure 1: Sideways' Main Menu

This line is typed in EPSON NORMAL type.

This line is typed in EPSON CONDENSED type.

This line is typed in SIDEWAYS NORMAL type.

This line is typed in SIDEWAYS LARGE type.

This line is typed in SIDEWAYS NORMAL DOUBLE STRIKE type.

This line is typed in SIDEWAYS LARGE DOUBLE STRIKE type.

Figure 2: Comparison of different Sideways typefaces with the standard and condensed Epson print modes

| Projected Profit and Loss Statement | | | | | | | | | | | | | | Dollar Amounts in (000) | |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------------------------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | TOTAL | % | |
| Net Sales | 408 | 415 | 423 | 431 | 439 | 447 | 456 | 464 | 473 | 482 | 491 | 500 | 5428 | 100 | |
| Cost of Goods | 306 | 311 | 317 | 323 | 329 | 335 | 342 | 348 | 355 | 361 | 368 | 375 | 4071 | 75 | |
| Gross Profit | 102 | 104 | 106 | 108 | 110 | 112 | 114 | 116 | 118 | 120 | 123 | 125 | 1357 | 25 | |
| G & A Expense | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 336 | 6 | |
| Sales Expense | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 180 | 3 | |
| Net Income before D & T | 59 | 61 | 63 | 65 | 67 | 69 | 71 | 73 | 75 | 77 | 80 | 82 | 841 | 15 | |
| Debt w/o Jones | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 168 | 3 | |
| Jones debt | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 120 | 2 | |
| Net Income Less Debt Service | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 56 | 58 | 553 | 10 | |
| Jones loan bal. Beginning of P. Int. | 860 | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | 847 | 845 | 844 | 860 | | |
| Loan Payment | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 102 | | |
| Jones loan bal. End of Period | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 120 | | |
| | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | 847 | 845 | 844 | 842 | 842 | | |

Table 1: Worksheet printed sideways with *Sideways*. Type font is normal and the line spacing and character spacing are the default choices.

printer must be equipped with Grafrax. (If your Epson printer is equipped with the earlier version, Grafrax Type 2, all features of the program will work except the double-strike option.)

If you're going to print worksheets, you will need an electronic worksheet program, and you will have to learn how to save your worksheets as text files. This is usually done through the print command, by which the worksheet is "printed" to a disk rather than to the printer. Check your program's manual for details.

How Does It Work?

Using *Sideways* is simple. Everything you need to know about running the program is in an 11-page manual with exactly 6 pages of instruction and 2 illustrations. The manual is, in fact, somewhat shorter than this review.

Figure 1 shows the *Sideways* menu, which is largely self-explanatory. You can specify the top and left margins, the printing width, and the printing length. These parameters determine where your worksheet will appear on the page.

The program offers two type sizes, normal and large, as well as normal and double-strike. The program's typefaces are shown in Figure 2 along with the standard and condensed Epson typefaces for comparison. Clearly, *Sideways* puts an attractive face forward.

The only things that aren't obvious on the menu are starting page and line spacing (dots), and character spacing (dots). You can specify the starting page that you wish to print of a multipage manuscript. Thus, if you have a report followed by several tables, you can print the tables sideways and skip over the text.

Character and line spacing are both specified in dots. This measure of distance isn't explained in the *Sideways* manual, so you will have to experiment a bit. You can set the character space from 0 to 9 dots and the line space from 0 to 99. At the higher settings the distance between characters and lines is great.

Printing a Worksheet Sideways

Sideways uses standard DOS file names. To print a file, type in the drive designation (omit it and you get the default drive), the file name—the extension is required—and press

ENTER. Then sit back and have a Heineken while *Sideways* does the work. Table 1 shows an example of a worksheet printed sideways in the normal typeface.

Bells and Whistles

Sideways has some unusual and useful features. For instance, you can thumb through the files on a disk by typing the drive designation and a colon and then pressing the right arrow key. Successive file names will be displayed. When you come to one you want to print, press ENTER and the program does the rest. Unlike a similar feature in *VisiCalc*, you don't fall off the edge when you get to the last file name on the disk. *Sideways* simply goes back to the beginning and takes you through the list again.

The settings for character font, line spacing, printer, margins, and other parameters in Figure 1 are the program's default settings. If you want to configure the program with other options, you can save your choices by pressing F1. These new options will be stored and reloaded the next time you use the program.

● Review

Sideways recognizes DOS global file name characters—“*” and “?”—and you can use them to have *Sideways* print a series of worksheets with just one command. For example, if you specify the file name B:*.PRN, *Sideways* will print all the files with the extension .PRN on the disk in drive B. This wonderful feature allows you to do something that is impossible with any of the worksheet programs: print several worksheets with a single command.

Broken Bells and Off-Key Whistles
Sideways isn't perfect, but then what is? To begin with the program is slow. The printer runs at half speed, and it prints in only one direction. It takes about four times longer to print a table sideways than with a regular print command.

More serious than speed is size. In its ordinary compressed form—normal size characters with the default character spacing of 1 dot—*Sideways* can put only 132 characters per line on a standard 11-inch-long piece of paper. That is the same number of characters you could place on an 8½-inch-wide page with the dot matrix printer's built-in condensed type. Thus, on a single 8½-by-11-inch piece of paper the largest worksheet you could print with *Sideways* could also be printed in the normal direction with condensed type. Furthermore, the worksheet printed in the normal direction could contain more lines—66 to *Sideways*' 53 (at the default line spacing of 3 dots)—and it would print faster.

You can crank the line and character spacing down to 0 to fit more text on the page. In that case you can get 158 characters and 64 lines on a page—sideways. The result is cramped, though legible. Table 2 shows an example of a worksheet printed at these settings.

Of course, *Sideways* shines when you allow the lines of the printed worksheet to extend across the perforations of continuous feed paper.

| Projected Profit and Loss Statement | | | | | | | | | | | | | | |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Dollar Amounts in ('000) | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | TOTAL | % |
| Net Sales | 408 | 415 | 423 | 431 | 439 | 447 | 456 | 464 | 473 | 482 | 491 | 500 | 5439 | 100 |
| Cost of Goods | 306 | 311 | 317 | 323 | 329 | 335 | 342 | 348 | 355 | 361 | 368 | 375 | 4071 | 75 |
| Gross Profit | 102 | 104 | 106 | 108 | 110 | 112 | 114 | 116 | 118 | 120 | 123 | 125 | 1357 | 25 |
| G & A Expense | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 336 | 6 |
| Sales Expense | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 180 | 3 |
| Net Income before D & T | 59 | 61 | 63 | 65 | 67 | 69 | 71 | 73 | 75 | 77 | 80 | 82 | 841 | 15 |
| Debt w/o Jones | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 168 | 3 |
| Jones debt | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 120 | 2 |
| Net Income Less Debt Service | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 56 | 58 | 553 | 10 |
| Jones loan bal. Beginning of P. Int. | 860 | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | 847 | 845 | 844 | 840 | |
| Loan Payment | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 102 | |
| Jones loan bal. End of Period | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 120 | |
| | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | 847 | 845 | 844 | 842 | 842 | |

Table 2: Worksheet printed at the minimum line spacing (0 dots) and character spacing (0 dots)

| Statement | | | | Projected Profit and Loss | | | | | | | | | |
|--------------------------------------|-----|-----|-------|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Dollar Amounts in ('000) | | | | | | | | | | | | | |
| 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| | | | TOTAL | % | | | | | | | | | |
| Net Sales | 482 | 491 | 500 | 408 | 415 | 423 | 431 | 439 | 447 | 456 | 464 | 473 | |
| Cost of Goods | 361 | 368 | 375 | 306 | 311 | 317 | 323 | 329 | 335 | 342 | 348 | 355 | |
| ----- | | | | | | | | | | | | | |
| Gross Profit | 120 | 123 | 125 | 102 | 104 | 106 | 108 | 110 | 112 | 114 | 116 | 118 | |
| G & A Expense | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | |
| Sales Expense | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| ----- | | | | | | | | | | | | | |
| Net Income before D & T | 77 | 80 | 82 | 59 | 61 | 63 | 65 | 67 | 69 | 71 | 73 | 75 | |
| ----- | | | | | | | | | | | | | |
| Debt w/o Jones | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | |
| Jones debt | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| ----- | | | | | | | | | | | | | |
| Net Income Less Debt Service | 53 | 56 | 58 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | |
| ===== | | | | | | | | | | | | | |
| ===== | | | | | | | | | | | | | |
| Jones loan bal. Beginning of P. Int. | 847 | 845 | 844 | 860 | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | |
| Loan Payment | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | |
| Jones loan bal. End of Period | 845 | 844 | 842 | 859 | 857 | 856 | 854 | 853 | 851 | 850 | 848 | 847 | |

Table 3: Worksheet with lines wrapped. The left margin was set at 1 inch and the maximum printing width was set at 5 inches, but some lines in the text file were longer than 5 inches.

The number of characters *Sideways* can place on a single line is limited only by the amount of memory in your PC and by the character spacing you specify. My computer has 256K of RAM, so I could print a line 1200 characters (or 100 inches) long when the character spacing is set at 1 dot.

Still, it's too bad that *Sideways* won't let you put more information on a single page than you can already put on the page with the condensed type feature of an IBM or Epson printer. I suspect that this limitation is hardware related; it may be impossible to create a smaller typeface in the *Sideways* print mode.

Finally, the program allows you to specify the printing width (the length in inches of the longest line *Sideways* will print) as one of the print options. But watch out—if you specify a printing width less than the longest line in your text file, *Sideways* will wrap the lines for you (see Table 3).

This is the computer equivalent of getting your kite string tangled. You can outsmart the program, however—and avoid unreadable worksheets—by setting the maximum printing width at 0. At this setting *Sideways* calculates the maximum number of columns it can handle based on the size of your computer's memory. Thus, you should have no trouble printing any worksheet—sideways—that your system's memory can hold.

Despite its few shortcomings, this program is nifty. If turning your output on its ear is what you need, then *Sideways* is your drummer. It's an easy to use program that does what it claims; even, at times, with some elegance.

Sideways
 Funk Software
 P.O. Box 1290
 Cambridge, MA 02238
 617/497-6339
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 Requirements: IBM dot matrix
 printer or Epson MX-80 or
 MX-100 printer with Grafrax

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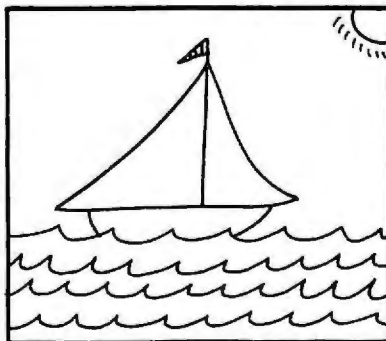
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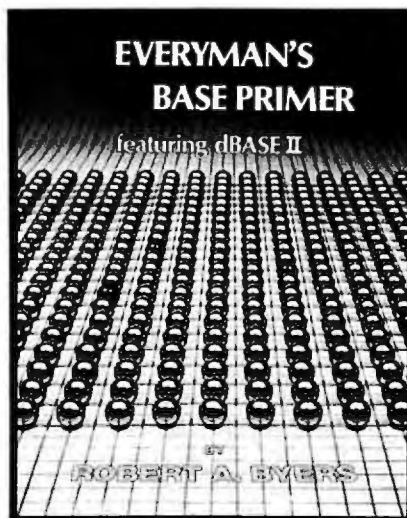
A hands-on primer that guides you through the intricacies of a relational data base management system

David Arnold

You've heard of second-generation software and third-generation hardware, but did you know there are fourth-generation computer users?

The first generation of computer users were hobbyists. They bought their computers with no particular applications in mind, just wanting to have a computer and make it work. The second generation were also hobbyists, but their interest was in software rather than hardware. Some enjoyed programming; others preferred games. Many software hobbyists used their computers for challenging but nonessential applications such as turning their lights on and off or cross-indexing their Christmas card list 37 ways.

Then spreadsheets and word processing came along—the third generation. People bought computers not to play with the hardware or have fun with the software, but to use them as productivity tools. They entered the local computer shop thinking that a cursor was a dissatisfied user and a floppy was some kind of rabbit. Although the third generation knew nothing about computers, their needs were sufficiently straightforward; they could make intelligent selections and put their new tools to use effectively by reading some literature and talking to a few salespeople.



Dealing with Data

The fourth generation, like the third, are applications oriented. But rather than wanting to process words or numbers, they process data. Here words and numbers get thrown together in a seemingly endless array of files and records that need to be retrieved, manipulated, and printed in diverse and unanticipated ways.

Data base programs such as *dBase II*, *Condor*, and *Selector V* are more expensive and complicated than word processors or spreadsheets, and their hardware requirements are more varied. Whereas a word processing program does everything for the user, a data base management system lets the user define what the program will do. Even the experts don't always agree on what constitutes a data base

management system, let alone on how to choose and use one.

Here's where Robert A. Byers and *Everyman's Database Primer* come in. This book is intended as an English-language course in data base management. Actually, it is more than that—it is an English-language course in computers. Byers writes for the fourth-generation reader who needs a computer to do a complex job but doesn't know a bit from a byte and doesn't want to. Byers says his book "may be the first computer book ever that never uses the word *bit*." He does talk about bytes, but not until page 55, where he defines the term: "A byte is the amount of memory needed to store a typewriter character such as *m* or *\$*."

Before this book, Byers' writing was limited to technical articles. When I talked to him recently, I asked why he thought he could explain the data base systems to readers who are not technically oriented. "We all had to begin at one time," Byers replied. "Most of us forget it. I remember. It's the transitions that are difficult. Going from arithmetic to algebra, the algebra isn't hard—it's the transition."

Byers, who is manager of Mission Support Systems Implementation at the Jet Propulsion Laboratory in Pasadena, California, admits to flunking algebra the first time he took it.

Maybe that's why he remembers what being a beginner is like. Whatever the reason, his book does a superb job of easing the transition to data base management.

A Logical Presentation

The book's 15 chapters proceed logically; each chapter builds on the previous chapters, but assumes that the reader has no prior knowledge of the subject. This turns out to be a mixed blessing. Even if you're new to computers, Byers' use of the tell-them-what-you're-going-to-tell-them-then-tell-it-to-them-then-tell-them-what-you-told-them technique can get tedious.

Section one introduces data bases—how they work and the hardware they run on. Section two explores planning, building, modifying, maintaining, and using data bases. Section three explains more advanced topics, including sequential and random access; relational, hierarchical, and network data base systems; and computer logic.

When Byers writes that "Section four is about power, speed, and ease," and about "teaching it [the computer] some new tricks," it reminds me of a statistics class I once took. I was terrified of something called chi-square. I had no idea what it was, but I knew enough to know I really didn't want to know any more. Then one day the professor, whose name was Anderson, introduced a new subject. He gave a clear, logical, exciting presentation of a neat technique that allowed us to tell whether the results of an experiment could have happened by chance. I was enthralled. As the hour ended and we were closing our notebooks, he dropped his bombshell: "The statistical measure you just learned is called chi-square."

Many computer users feel about programming the way I felt about chi-square. So Byers pulls an Anderson. In Section four he tells us that to avoid the extra work and possible errors of typing repeated instructions, we can teach the computer a procedure so that it will remember the instructions by itself. Then with

some help from Winnie the Pooh (he spells it Poo, but Piglet and I forgive him), Byers shows us how to create a fully menu-driven set of procedures to balance a checkbook, and another set of procedures to print a detailed elementary school classroom roster. Only after he has led us through these procedures does he tell us that what we just did was programming.

Up to this point Byers uses the same four examples throughout the book—the checkbook, the school roster, an address book with eight

Demo Disk Derby

In *Everyman's Database Primer* Robert Byers tells us he limited examples in the book to no more than 15 records each "in the interest of conserving paper and your interest." But for the *dBase II* purchaser, there is another benefit to this limit.

The *dBase II* system disk comes in a sealed bag. With it, unsealed, is another disk labeled "DEMO DISK—Limited to 15 records in a data base file." You can try out *dBase II* with the demo for 30 days, and if you're not satisfied and the bag with the system disk is still intact, you may return everything for a refund.

Byers' 15-record file limit allows you to run every example in the book on the demo disk before committing yourself. The one drawback to the 15-record limit is that you don't get to see how *dBase II* performs with large files until you break the seal.

names, and a liquor store inventory with 15 items (see "Demo Disk Derby" for a discussion of the 15-record demonstration disk supplied with *dBase II*.) In Section five, using

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● Review

a retail video store as an example, Byers develops a complete menu-driven system that handles inventory, sales, and rentals, and uses multiple data base files.

dBasic discussion

"The success of your data base management system," Robert Byers explained to me, "will rise and fall on your disks." He warned me not to emulate one PC owner he knows who has 256K of RAM but just a single 160K disk drive.

In *Everyman's Database Primer* Byers writes that "the most critical hardware item for a microcomputer data base system is the disk drive system. A disk system used with a data base management system should have enough storage capability to store the entire data base on a single disk." But he also says that "more than 90 percent of all data bases have less than 100,000 bytes." Since the ideal disk capacity is about 2.5 times the size of the data base, 320K drives should prove more than adequate for most applications.

I asked Rod Turner, Ashton-Tate's director of sales, what configuration the firm recommends for *dBase II* on the PC. He says you can get by with one 160K disk, but for serious applications you should have a pair of 320K drives. As for RAM, the current version of *dBase II* for the PC runs well on a 96K system. Ashton-Tate is planning additional features, however, that will require 128K.

The dBase II Connection

The subtitle of *Everyman's Database Primer* is *featuring dBase II*. This orientation makes the book both broad and narrow in scope. On one hand, it is a general data base primer, and, on the other, it is written about one specific software package and is published by Ashton-Tate, the company that distributes *dBase II*.

Byers suggests that if you have a computer and *dBase II*, you should use it to follow his examples as you proceed through the book, but that if you don't, "you will still be able to follow along without difficulty." I tried it both ways. Reading the primer from cover to cover, I followed along, but I noticed that I had a tendency to skip over details when reading the examples.

Then I tried using the book as a tutorial. It worked so well that I recommend that every *dBase II* purchaser buy *Everyman's Database Primer* to supplement the *dBase II* manual. But keep the manual handy when using the primer this way—although Byers' logical organization is excellent for a book, it isn't entirely appropriate for a tutorial. On page 21 he had me entering data for the sample phone directory. I made an error in the third name, which I didn't spot until I was entering the phone number. Byers doesn't explain how to move the cursor between fields until page 36. But I found the instruction and made the correction, and all went well until the middle of record 6, when I moved the cursor incorrectly and found myself in record 7. An attempt to return to record 6 landed me in record 8 instead. I finally found a clumsy way to handle this in the next chapter, and the next day I discovered the correct procedure 50 pages later.

These were minor inconveniences, and eliminating them might have made the book less readable. The primer has another problem, however, that I hope Byers and Ashton-Tate will correct, perhaps by publishing a separate edition for the IBM PC. All the examples are based on the CP/M version of *dBase II*. Again the inconvenience is minor, since both CP/M and PC-DOS present the

same A> prompt on the screen, but some mention of both operating systems would make this oversight less glaring.

I have just one other complaint: the title. I am surprised that in this day and age a title that excludes half the population could slip by, even unintentionally.

The title notwithstanding, Byers has made a complex topic understandable. *Everyman's Database Primer* will prove useful to the fourth-generation novice, the experienced *dBase II* user, and many in-between. Because of the book's focus on *dBase II*, however, you should also read a more comparative book if you are trying to decide which data base management program to buy. An excellent one is *Data Base Management Systems: A Guide to Microcomputer Software*, by David Kruglinski (OSBORNE/McGraw-Hill, Berkeley, 1983, \$16.95). Kruglinski presents detailed analyses of *dBase II*, *Condor*, *FMS-80*, and *MDBS III*, plus briefer discussions of several other programs.

Everyman's Database Primer grew out of a discussion between Byers and George Tate in Tate's garage a few years ago, before Ashton-Tate became the multimillion-dollar corporation it now is. When I asked Tate about the primer recently, he replied, "We expect the book will sell a lot of *dBase II*s." I also expect this book to sell a lot of computers.

David Arnold is a free-lance writer who teaches sociology at Sonoma State University. His work has appeared in Flying and other publications.

*Everyman's Database Primer:
featuring dBase II
Robert A. Byers
Ashton-Tate, Culver City, California,
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The PC's Processor Carries On a Family Tradition

Intel's 8086 and 8088 star in two books.

Les Cowan

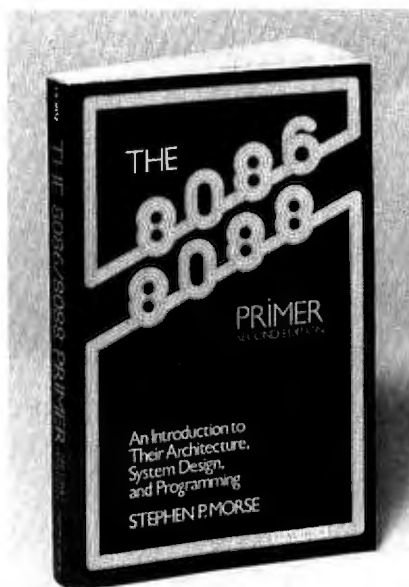
The 8088 is a star among microprocessors. The chip comes from a long line of well-known microprocessors made by Intel: the 8008, the 4004, and that veteran trooper, star of computers, calculators, and special applications, known and loved wherever 8-bit processing is performed—the 8080.

The 8088's uncle is the 8085 8-bit processor. Heir to this venerable tradition, the 8088 has taken a step further into 16-bit internal processing, and, among other roles, may now be seen starring in the IBM PC. Its brother, the 8086, runs even faster, processing in 16 bits and communicating with the outside world in 16 bits as well.

Stephen Morse, author of *The 8086/8088 Primer* and an engineer for Intel, made the 8088 what it is today. We may imagine Morse in the early days, working with the young but unformed prodigy, carefully nurturing logic blocks, developing the instruction set, and resisting pressure from management to bring this talent along too fast.

Sure, Morse made mistakes. On page 98 he informs us of an oversight he made while designing the processor. As a result, to this day a small gap exists in the 8088's repertoire of capabilities: the status flags are un-

affected by the Boolean instruction NOT. But creative efforts rarely achieve the perfection at which they aim. By giving us a glimpse of the 8088's imperfections, Morse has



made this talented chip seem all the more human.

Russell Rector, coauthor with George Alexy of *The 8086 Book*, is a programmer turned technical editor on the staff of OSBORNE/McGraw-Hill. Alexy is an electrical engineer with the title Applications Manager for Microprocessor Products at Intel where, no doubt, he has occasion to collaborate with Morse.

Slightly Off Target

The 8086/8088 Primer is billed as "providing novices and professionals alike with a thorough introduction to Intel's 8086 and 8088 microprocessors." Publishers, of course, court as wide an audience as they can, but novices and professionals do not have the same needs. In catering to the professional, *The 8086/8088 Primer* presents discussions that are over the head of any novice. In trying not to bewilder the novice, however, the book fails to go as deeply into its subject matter as most professionals would want. Because it tries to capture two irreconcilable markets, it winds up serving neither completely.

In the preface Mr. Morse says that *The 8086/8088 Primer* "describes the 8086 architecture, shows how to design a system incorporating an 8086, and discusses how to write programs that run on the 8086." All this material is covered in less than 300 pages. As a result, the serious novice will probably get more out of this book than the professional. While the professional looks in vain for detailed reference material, the novice will be able to get through parts of many chapters and all of some chapters before getting lost.

The Rector-Alexy *8086 Book* makes no pretense of catering to novices. It is a reference text for people who already speak the lan-

guage of microcomputers and have experience programming and/or building microcomputers. Novices will not get very far in this book, but experienced computer users will find a great deal of useful information.

The 8086 Book is about twice as long as *The 8086/8088 Primer*, and it contains a complete reference to the 8086 instruction set, covering every instruction individually and providing sample routines. The worst thing about this book is its proofreading errors, some of which are seriously confusing, and all of which conspire to undermine the reader's confidence. Reading the book is like walking on a frozen lake and hearing, every few steps, the faint sounds of cracking ice.

Assembly Language

Each book is concerned with assembly language, both as a programming language and as a description of the microprocessor's capabilities. Assembly language performs much faster than a high-level language like BASIC. It also demands much more of the programmer because a language like BASIC performs many

Stephen Morse, author
of *The 8086/8088
Primer*, made the 8088
what it is today.

functions automatically, whereas an assembly language program has to tell the computer to carry out each function specifically. A simple BASIC instruction such as "+" (add) causes two numbers to be added, while accomplishing the same thing in assembly language requires that programmers put the two numbers into two memory addresses, transfer them from there into a register in the processor, add them together, and put the result back into the memory somewhere.

Programmers, therefore, must know something about the design of the computer they are programming—where different kinds of information are stored in its memory, what registers the processor has, and for what operations each register is used.

The specific instructions for assembly language are called the microprocessor's instruction set. The instruction set consists of all the operations that a microprocessor performs directly. The instructions of BASIC or any other high-level language are not part of the instruction set; they are not assembly language instructions. Instead, they cause a series of assembly language instructions to be issued automatically. Each microprocessor has its own instruction set, and every instruction set is different.

Since the instruction set is, in effect, a list of the fundamental operations that a microprocessor can perform, it provides the authors of both books with a framework for discussing a microprocessor in detail. For example, hardware such as registers, I/O ports, stacks, memory addresses, or flags are discussed in terms of the assembly language instructions that affect it. Likewise, a particular assembly instruction can be discussed in terms of the part of the computer (registers, I/O ports, and so forth) that the instruction causes values to be put into or taken out of. An assembly instruction may be discussed in terms of which hardware items it causes to do something.

In other words, assembly language operates on the frontier where hardware and software combine to form a system. Both books describe the frontier, although *The 8086 Book* assumes you have had experience with it.

Contents

The 8086/8088 Primer is divided into eight chapters. The chapters programmers will be most interested in are Chapter 2, which explains com-

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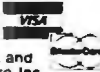
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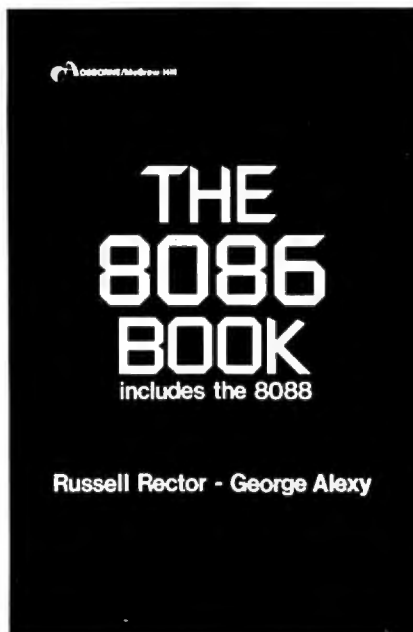
puter system organization (including memory structure, I/O structure, and register structure); Chapter 3, which covers the 8086 instruction set; Chapter 6, on assembly language; and Chapters 7 and 8, which discuss PL/M and Pascal. (PL/M and Pascal are high-level languages comparable to BASIC in that they are easier to use than assembly language—some PL/M programmers might dispute that—but far faster and more powerful than BASIC.)

The chapters on assembly language, PL/M, and Pascal are not long enough to cover their subjects exhaustively. A language cannot be taught in less than a whole book; however, Morse covers many, if not all of the commands used by each language. He briefly discusses the structure of each language—the most efficient manner of grouping commands to accomplish a given task—and leaves it at that. For readers who need more detail, he provides a bibliography of 11 book titles, five of which he either authored or coauthored.

The 8086/8088 Primer will be of some, if limited, use to the systems designer. Especially useful are Chapter 2, which discusses machine organization (this chapter will be fairly easy to follow for someone with minimal computer background), and Chapters 4 and 5, which talk about designing systems that use the 8086 and 8088. While Morse does a good job of explaining the way chips function with the microprocessor in a system, the information is too sketchy to serve a professional computer systems builder.

The 8086 Book is divided into ten chapters and four appendices. In some areas, apparently because of poor editing, the organization is confusing. For example, Chapter 2 provides examples of how to design an assembly language program, and Chapter 3 is the instruction set reference section. A few pages into Chap-

ter 3, however, a discussion of how to program an I/O driver appears that clearly belongs in Chapter 2. This is the worst of several examples of the influence of word processors. Freed from much of writing's routine drudgery, writers and editors are tempted to think that they need do nothing but creative writing. They are given away by such tell-tale mistakes as misplaced chapter parts and linos



(typographical errors involving whole lines of text instead of single characters, a species of mistake which, ironically, is only possible as a result of word processing).

Chapter 1 of *The 8086 Book*, one of the few parts from which a beginner might profit, explains the process of planning, writing, and testing a program in general terms. It is also one of the few times that the book indulges in generalities.

After Chapters 2 and 3, on assembly language programming and the instruction set, Chapter 4 discusses 8086 assembly instructions. The instructions are grouped into functional categories such as arithmetic instructions, logic instructions, I/O instructions, and so forth. Chapter 5 discusses, again in general terms, the nature of programming aids: editors, assemblers, and debuggers. Chapter 6 offers the actual sample programs whose design was discussed in Chapter 3.

The rest of the book covers in detail and in professional terms the hardware that makes up an 8086 system and how to put it together. Chapter 7 covers the 8086 pins and signals, and Chapter 8 gets very technical, discussing timing at length. Chapters 9 and 10 cover 8086 multi-bus and multiprocessor configuration. This part of the book especially is for experienced systems designers and is not too different from *The iAPX 86,88 User's Manual* published by Intel.

In short, *The 8086/8088 Primer* is simpler and more general than *The 8086 Book*; *The 8086/8088 Primer* has more to offer beginners, and *The 8086 Book* will be more useful to experienced programmers or designers. Although similar in organization and topics covered, *The 8086 Book* goes into more technical detail and contains more reference information. *The 8086/8088 Primer*, despite its claim, is not really for professionals. Nor is all of it for beginners, although Chapters 1 and 4 will be appreciated by beginners asking the question, "How do computers work, anyway?" and the introduction to assembly language will show beginners the lay of the land. After reading *The 8086/8088 Primer*, they won't be assembly language programmers by any means, but they just may not be beginners anymore either.

Les Cowan is a sometime programmer and free-lance journalist and technical writer based in San Francisco.

The 8086/8088 Primer, 2nd ed.
Stephen P. Morse
Hayden Book Company, Rochelle
Park, New Jersey, 1982
276 pages: \$11.95

The 8086 Book
Russell Rector and George Alexy
OSBORNE/McGraw-Hill, Berkeley,
1980
596 pages: \$16.99

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For Game Gourmets

A diverse group of games ranging from international politics to office politics, from armed conflict to a war of words

Richard Cook

From the dark corners of gloomy video arcades computer games have multiplied to invade the living rooms of computer hobbyists everywhere. Recent statistics reveal that 9 out of 10 people who own a personal computer also have at least one software game to go with it. Some of these games are marvelous feats of programming, some are mediocre, and a few are abysmal, but today a far larger selection is available to personal computer owners than can be found in any arcade.

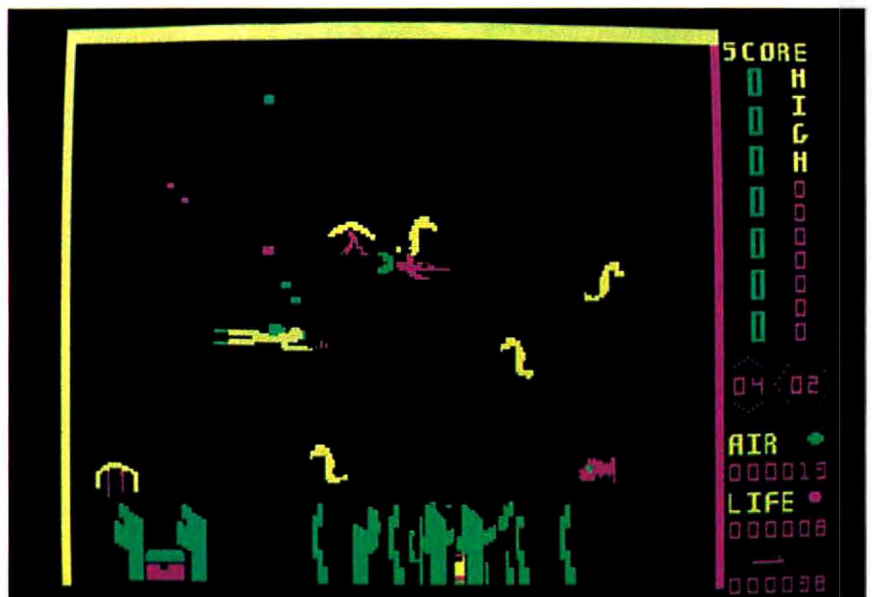
Aqua Run

Aqua Run is a new computer game with a scuba diving theme that will quickly have you in over your head. It has the underwater action of "Sea Hunt," the man-eating monsters of *Jaws*, and the wetsuited excitement of *The Deep*.

Playing the Game

Aqua Run is a zap 'n dodge, arcade-style game whose excellent color graphics take you deep into an undersea world fraught with danger. Danger comes in two ways: you get eaten by the many sea creatures that constantly attack, or you run out of air.

"If it's that dangerous, why am I down there at all?" you may ask. You're down there because you are a



Aqua Run Screen Graphics

salvage diver in search of sunken treasure from a shipwreck, probably to pay off a drunken gambling spree before some two-legged shark puts the bite on you for good.

You begin with a small amount of air and "life rating" points, which you must have to stay alive, and spears with which to attack and kill the unusually hostile sea animals. Your only chance for survival and success is to locate, as quickly as you can, all the treasure chests lying on the ocean floor. You bring them up to the surface, one at a time, for extra air, life rating points, and spears. More importantly, success brings game points.

The game board for *Aqua Run* is a grid of squares, each of which represents a section of water underneath the surface. Only one square at a time is shown on the screen. You are represented on the screen by a small scuba diver who kicks his legs while swimming either vertically or horizontally from square to square in search of treasure. The diver's movement is restricted by barriers such as cliffs or passages that are marked by a red border along one or more sides of the screen.

You must swim from the surface, marked by a blue border, down and through several squares of water until you reach the ocean floor, which is easily identifiable by the wavy green plants swaying in the current. En route you will be set upon by vicious tuna, tadpoles, and jellyfish (at the higher skill levels sharks, octopi, and other dangerous denizens of the deep await you). To survive long enough to reach the bottom, scoop up a treasure chest, and bring it to the surface, you must avoid contact with these creatures, pausing only to shoot them with your spear gun.

This is tough enough, but when you finally do reach the bottom and grab a treasure chest, you discover to your dismay that you can only move half as fast as before. The game is a challenge on skill level one; levels two, three, four, and five are even more difficult because each higher level brings twice as many squares and twice as much ocean to explore. The number of barriers increases until you need a map to find your way around. With each level the aquatic life gets bigger, faster, nastier, and more numerous. Captain Nemo never had it so rough.

If you are successful in bringing all the treasure chests up to the surface, you are congratulated, informed that another ship has gone down, and offered the chance to explore for more treasure. Who could resist?

Evaluation

Aqua Run demands nimble fingers more than a nimble wit. There is nothing wrong with zap 'n dodge games, except that many are cheap imitations of *Space Invaders* that offer little excitement or challenge. Many games lack a random variable to scramble the settings or responses of each new game. This feature can mean the difference between quick boredom or lasting fun.

With *Aqua Run* each new game presents a different arrangement of treasures and barriers with which to

contend. The game uses more colors than most, and the little diver with his air bubble gurgling to the surface is far more fun to look at than a crudely drawn ack-ack gun.

The Controls

Aqua Run can be played with a joystick control or with the keyboard's ten key controls, which were used for this review. A joystick is preferable, but the keypad controls work fine if you use the ten-key touch method. Key 8 moves your diver up, key 2 down, 4 left, and 6 right. Key 7 shoots a spear to the left, 9 to the right, 1 up, and 3 down.

With each level the
aquatic life gets bigger,
faster, nastier, and
more numerous.
Captain Nemo never
had it so rough.

Swimming in any given direction, your diver will continue forward until he either runs into a barrier, you input a different direction, or you hit the GrayPlus key to stop his movement. The GrayPlus key was a poor choice for the stop function: You have to stretch your little finger way over to the right and/or pull your hand off the keypad to reach it. This stretch can have fatal results, especially at the higher levels of play. Why wasn't key 5 made the stop key? Its central location in the keypad would make it easier to use.

Even so, adapting to the keypad doesn't take long. Anyone who uses a ten-key calculator regularly has an advantage; the hunt-and-peck method is useless, even at level one. Keep this fact in mind if you are considering buying *Aqua Run* and have ten left thumbs. If you want to buy or already own a joystick, it must have two buttons and two 0-100K potentiometers.

Aqua Run makes good use of the Esc key. Not only does it allow you to freeze the action at any point during a game, which is useful when answering the phone, making a map, or coming up for air, but it is also a key you can use with your left hand. Other such keys are the Space bar (which continues the game after you've frozen the action), the T key (which causes your diver to pick up or drop off treasure), the S key (which switches the sound effects off or on), and the X key (which ends the game).

Although *Aqua Run* is a well-designed program, it does have a few problems. The Esc key sometimes requires two or three strikes before it freezes the action. A beep is supposed to signify a speared fish, but the beep doesn't always sound, even though the fish vanishes and the score increases. Occasionally the spear passes through a fish with no effect—but this may be part of the game.

Near the end of one of my games, my diver had picked up the last treasure chest and was heading for the surface. I pressed T, which normally causes the diver to drop the treasure chest. For some reason the game abruptly ended, as if the diver had successfully carried the treasure chest to the surface.

Documentation and Warranty

The first thing you may notice about *Aqua Run* is that it appears to lack documentation. Don't despair; pull the disk out of its pouch, and behind it you'll see a folded slip of white paper with printed instructions so tiny that you may need a magnifying glass. Despite the miniscule print, the instruction sheet is concise and comprehensible.

When you do read the instructions, you'll be pleased that loading and running *Aqua Run* is as easy as sticking the disk in the drive and turning on the PC. When the title

● Review

appears, one tap on the Space bar and the various play options screen up one by one until you are ready to begin.

Aqua Run's excellent warranty is a definite selling point. Most other software manufacturers offer limited—in some cases extremely limited—warranties, but Soft Spot Micro Systems will send you a free replacement any time your disk fails to load and start properly. Even if you have dropped the disk in the garbage disposal or have otherwise damaged it, the company will mail you a new one if you send \$5 and whatever is left of the disk.

Aqua Fun

If you don't want to be left high and dry in your search for fast-paced action, give *Aqua Run* a try. It's a fresh and original game that is easy to use, fun to play, and offers enough variety and challenge to send even the most skillful gamester to many a watery grave. Once word gets out about this splashy new game, *Aqua Run* will be making waves in the software entertainment field.

Executive Suite

At last, a computer game for that much-maligned minority, the business executive. Never before has a game supplied the business exec with the kind of ego-whipping, backstabbing fun that can be found in any corporate office. If this is your sort of action, you might want to pick up a copy of *Executive Suite*.

Armonk Corporation sets a high standard in the packaging and overall quality of *Executive Suite*. The game is sold in a small, gray cardboard briefcase labeled "Gray Flannel Fun." Opening the briefcase reveals a small file folder labeled *Executive Suite* that contains the disk and the playing manual. Besides being clever, the packaging fulfills its function: both items are well protected.

With *Executive Suite* there is no need to boot up with DOS, no copying onto a blank disk, and no time-wasting code words, asterisks, colons, or capitals to bother with. This is a user-efficient game that is a welcome improvement over most other games on the software market.

Playing the Game

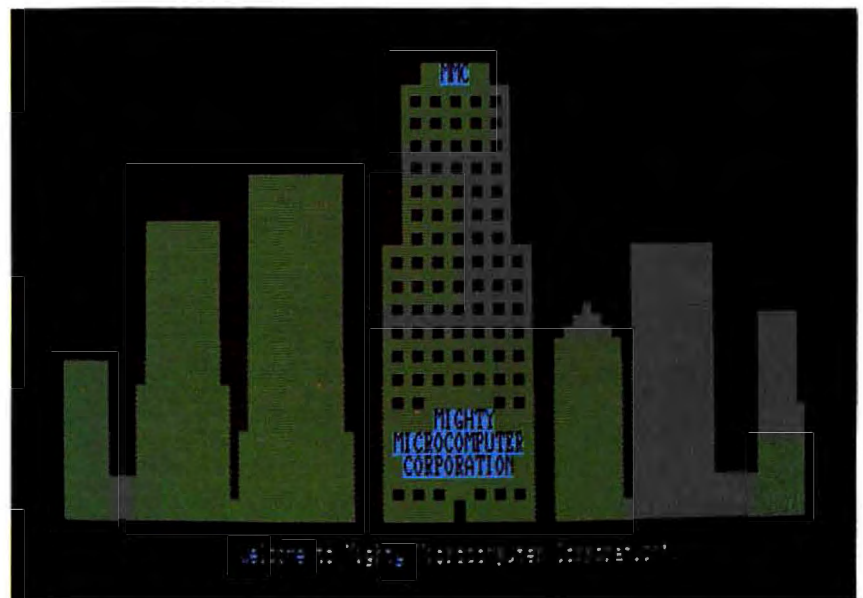
Executive Suite is a situation/question/response game, but it punctuates the prose with bold graphics. *Executive Suite* provides a simulated corporate world. To begin the game, you apply for work at the Mighty Microcomputer Corporation. Unless you're a complete turkey, you'll get hired. From then on, you proceed through a series of situations that simulate conditions you might face in corporate life: moral dilemmas, compromises, challenges, problems, and decisions.

will understand, or offer to meet Jack later?

Your decision and answers to other questions determine whether you move up in position, pay, and prestige, or whether you are demoted or even fired. Your performance is reviewed periodically, and unless you have put the company in financial straits, you are given the chance to move into another position. Assuming that you are promoted, you are faced with a new set of problems and challenges that become more difficult as you advance up the corporate ladder. The object of the game is to ultimately make it into—what else?—the Executive Suite.

Evaluation

Executive Suite is not just for those employed in the business community; this game is enjoyable even if you are not interested in office politics or the



Executive Suite Screen Graphics

Your project manager, Harriet Nance, for example, has given you an assignment that she wants completed by tomorrow. You are planning to work late when Regional Sales Manager Jack Stark invites you to have a few drinks with some of the guys. Do you decline the invitation so you can finish your work, accept the opportunity to establish good relations with the higher-ups and hope Harriet

problems of corporate America. The game has a humorous aspect that keeps you laughing, even when you are sweating over a tough decision. Even the instruction manual cleverly satirizes pamphlets passed around during corporate training seminars

that feature cartoons with cheerful advice for getting ahead.

Once the program is loaded into the IBM PC, on-screen cues provide directions for play. Pressing either the Space bar or typing the number of a selection and pressing ENTER activates play. Accepting an instruction without the use of the ENTER key would be an improvement to the program.

Executive Suite also takes advantage of the IBM PC's function keys. F1 tells what the function keys do; F2 offers an itemized review of your current worth; F3 saves the current game; F4 ends the game; F5 blanks out the screen in case the boss walks in while you're in the middle of a game; and F6 returns you to where you were before the boss walked in.

The program is well written; it successfully incorporates numerous details that make use of the PC's capabilities. At the beginning of each game, for example, when you enter your name, hometown, and state, the program automatically capitalizes the first letter. You can reuse the name and background given in the previous game by selecting that feature as an option, even if play had been interrupted and the machine turned off. These and many other interesting touches make *Executive Suite* a polished and entertaining game. Other software manufacturers would be wise to buy copies and make a few notes.

Unfortunately, *Executive Suite* fails in its overall concept by being much too limited. Only a limited number of situations are available for each of the 12 job levels within the program. It doesn't take many games before you start running through situations you have played in previous games.

After the third time through any one situation, no surprises are left; it's like hearing the same joke over and over. As repetition occurs, three things can happen: any previous errors you might have made can be corrected, and you can easily advance to progressively higher levels; you soon learn how to respond to new situations; and you get bored.

Since the program is so limited, you can reach the Executive Suite

without much difficulty; and once that corporate climb is done, the game has nothing to offer. What is needed to prolong interest in this game are random variables that could rotate additional situations and choices into each job at each job level.

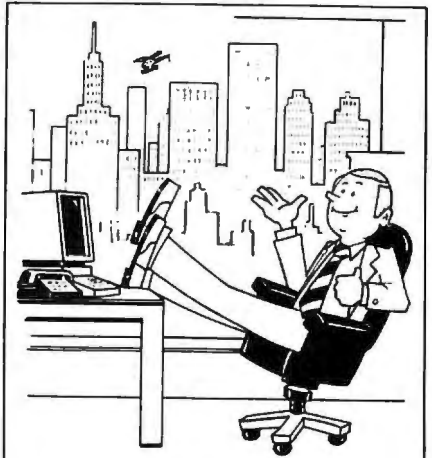
The game might be better if it offered more than one path to the Executive Suite. It would be fun, for example, to act like the infamous J.R. Ewing of "Dallas," lying, cheating, and backstabbing en route to the top, or to provide some sort of take-over or purge action that could open the way for a smart, opportunistic player to catapult several levels ahead. An-

This game is enjoyable even if you are not interested in office politics or the problems of corporate America.

other random variable could select a specific employee who would have the chance to advance to the top. Some of the fun of *Executive Suite* would be trying to figure out what kind of employee you need to be and what sort of answers are required if you want to get ahead. For one game, the strict conformist would be the winner; for another, the rugged individualist with wild ideas; another, the straight arrow; another, the J.R. Ewing type, and so on. Several people could play at once, each having different roles and opportunities, although these alternatives might require additional memory.

Problems

A strange quirk showed up when I tested *Executive Suite*. During the later rounds I could no longer advance within the Mighty Microcomputer Corporation. Stuck in lower middle-level management, I was of-



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But be warned, some of the answers that might seem most sensible turn out to have unfortunate consequences. Just like in real life.

Executive Suite is a Gray Flannel Fun game from Armonk Corporation. It runs on the IBM® Personal Computer.

To find out more, ask your local software dealer. Or call Armonk.

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● Review

ferred positions of equivalent rank or lower, but never higher. This treatment seemed odd since I hadn't quit or been fired. Eventually, I used up the remaining lower-level positions and was forced to retire. If this pitfall is part of the game design, it isn't mentioned in the manual.

Personal insights revealed during play are perhaps the best and most surprising aspects of *Executive Suite*. The ways in which you respond to the different situations reveal how honest or dishonest, frivolous or serious, daring or conservative you are. Whether these revelations make *Executive Suite* worth the price is up to you.

While this game would be a scream for an evening's fun at the office Christmas party, it lacks challenge and becomes repetitive and tedious after a few plays. It's a finished product with many nice touches but, like a pretty picture, after a while all you can do is look at it.

Bug Off

Bug Off is the latest twist in a seemingly endless line of zap 'n dodge video games that can be traced to *Space Invaders*. These offspring share a common theme: move and shoot at a ubiquitous enemy that is moving and shooting at you. With one minor change, *Bug Off* can be added to this *Space Invaders* list of heirs apparent.

The game's documentation, a four-page folder, reflects its simplicity. The folder and disk are sold in a zip-lock baggie one size too small; insertion and removal of the contents are a struggle. Because *Bug Off* can be played on a color monitor only, its marketability may be limited, but colors do make for an easier to play and more entertaining game than a black-and-white game.

Playing the Game

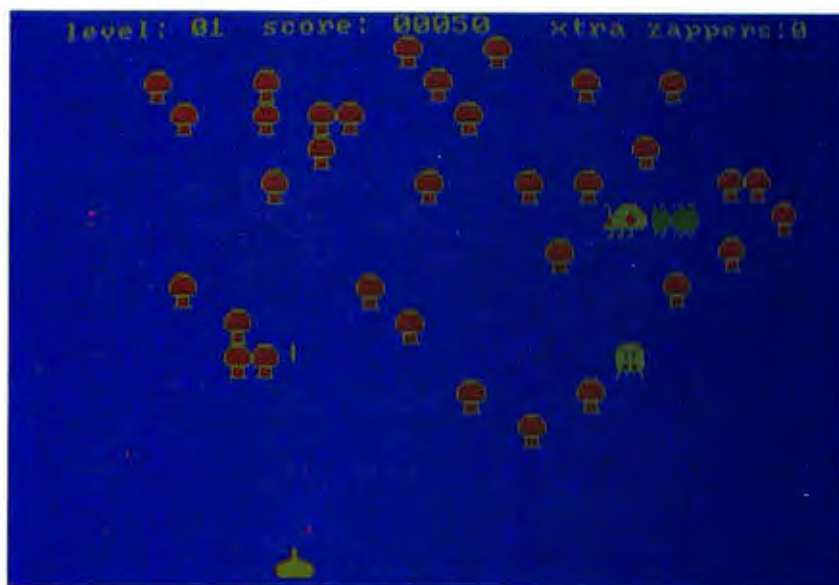
Bug Off is another video arcade-type game for home computer hobbyists and their kids. The shooter can move in four directions within an area about 2 inches high running across the bottom of the screen. Above the shooter is a field of mushrooms within which millipedes and strollers move back and forth. The mushrooms protect them from your missiles, but at first these cooties are easy to blitz and present no real threat.

Droppers appear suddenly at random intervals among the mushrooms and fall vertically until they hit the bottom of the screen. They turn into

The 15 levels appear in different color combinations, so you won't get too bored with a continual white on yellow or blue on black screen. For every three levels advanced you get an extra shooter and 2,000 bonus points. Points are awarded for each bug zapped, and all points are doubled in the high-speed mode.

Evaluation

You either like zap 'n dodge games or you don't. *Bug Off* is a typical example of one—no better or worse than most of this genre. You may want to avoid this game if you are



Bug Off Screen Graphics

millipedes and move back and forth through the area of the shooter. Spiders also appear at random intervals. Much larger than millipedes, strollers, and droppers, they move erratically in the shooter's area and can be killed only by being blasted from underneath.

All these creepy crawlers move constantly, either around or back and forth. They can destroy the shooter simply by coming in contact with it, so you must avoid them. The first level is not difficult, but each of the 15 skill levels increases the number of bugs, the speed at which they move, and the number of mushrooms.

terrified of insects, but those who are only slightly entophobic might actually enjoy a game in which bugs are the bad guys. Consider the game computerized revenge for all the cockroaches, fleas, ants, and silverfish you've encountered.

The graphics are colorful, and the bugs keep players busy. This game should be especially exciting for children. Certainly the attraction would last longer with children than with adults, and playing *Bug Off* may be good training for when they move into their own apartments and have

to deal with real bugs: it will sharpen their killer instincts.

Bug Off was tested with the keyboard controls instead of a joystick. Although joystick control operates the game at high speed only, the extra control and response make *Bug Off* more fun to use than with the keyboard controls.

Using the Space bar to fire and the keypad arrows to move is extremely frustrating. The response time is slow; there is always a 1-second lag

Consider the game computerized revenge for all the cockroaches, fleas, ants, and silverfish you've encountered.

between the time you hit a key and the time the shooter responds on the screen. If response lag upsets you, the following will really drive you buggy: the keyboard responds to only one key at a time. If you try to move and shoot at the same time, the controls freeze up: you have to release all the keys and rehit one. The natural instinct is to mash the keys frantically in an attempt to get them working before the spider gets you. But you can be sure that if you are frantic, the spider will get you. The keypad would be clumsy for even a concert pianist. Keeping your place on the keypad is almost impossible, a reality that makes for a short game.

Even when you learn how to use the keyboard controls, they take abuse during the course of a game. This is no way to treat an expensive computer, so if you don't already have a joystick and want to play *Bug Off*, you may want to purchase one. *Bug Off*'s warranty offers free replacement for defective disks within 30 days.

Although the computer game market encompasses a wide variety of

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● Review

tastes, *Bug Off* offers little that hasn't already been seen or played. As yet another version of *Space Invaders* or *Centipede*, *Bug Off* is flogging a horse that has already carried too many riders. Let's hope Bella Software's next game shows more refinement, wit, and originality.

Jotto

Who says computer games must be complex, gimmicky, and expensive? *Jotto* is a simple word game that has been around since 1956. Word Associates adapted it for the IBM PC, and they have come up with a winner.

Playing the Game

Jotto is a guessing game. To begin play, you pick any five-letter word in the English language except proper

while you are making one wild guess after another. *Jotto* also knows 6,800 five-letter words, while the average human has a total working vocabulary of about 5,000 words.

Jotto is like a polite executioner who offers the condemned a blindfold before giving the order to fire; it always lets you guess first. Your word shows up on the left side of the screen next to a number that tells how many of your letters are in *Jotto*'s secret word.

When *Jotto* takes a turn, its guess appears on the right side of the screen. A cue at the bottom of the screen tells you to indicate how many of the letters in *Jotto*'s guess are in your secret word. That's the difficult part, especially when *Jotto* comes up with a word that has four or five of the letters in your secret word. When this happens, you know *Jotto* is only one or two guesses away from thumping you again. This is the time to apply all your powers of logic and

Evaluation

Once you've organized your playing disk, *Jotto* is a snap. Cues at the bottom of the screen always tell you what is happening, and a loud beep sounds when incorrect instructions are entered.

At the end of each game a replay is as easy as pressing the Space bar. Because *Jotto* is fun to play, you'll find yourself pressing the Space bar often.

Jotto comes in a zip-lock baggie that includes the disk, instructions, and a *Jotto* pad to help you remember your secret word. Extra *Jotto* pads can be ordered from the manufacturer. The game has no warranty card, so hang on to your receipt for 90 days.

Final Talley

Jotto has the perfect blend of low price, challenge, quality, and user-friendliness to make it a welcome addition to any gamer's software collection. Parents will be glad to know that this game is both educational and nonviolent. If you are the type who likes to fill in crossword puzzles, figure out anagrams, or play *Scrabble*, you will enjoy *Jotto*.

Call to Arms

Call To Arms is a computerized version of the popular Parker Bros. game, *Risk*. Legends of titanic *Risk* battles, lasting hour upon hour, in which normally meek and timid men and women have been transformed into brutal empire-building, world-conquering tyrants, tell of fortunes that have been waged and lost on a fickle roll of the dice. They tell also of contestants who, in moments of greed or terror, have suddenly turned and savaged their friends and allies, and of discussions that degenerated into bloody fistfights in the backyard of a neighbor's suburban home. *Call To Arms* promises to carry this outstanding mantle of tradition well into the twenty-first century.



Jotto Screen Graphics

nouns. The program does the same. You try to guess the program's word and the program tries to guess yours. *Jotto* usually wins because it knows a secret algorithm that enables it to narrow down its choices quickly

deduction: close your eyes, open the dictionary, stab at a page with your finger, type in the word, and pray.

You can beat *Jotto*, but you need a system similar to the one the program uses. Figuring one out is part of the fun. The rest of the fun lies in playing with words.

Playing the Game

If you are familiar with *Risk*, you'll have a good idea of what *Call To Arms* is and how it is played. The object of both games is to conquer the world. *Call To Arms* is played on a map of 36 countries in Europe, while *Risk* is played on a world map of 42 countries. In *Risk* you play against one to five people. In *Call To Arms* you have the option of playing against one, two, or three people, or you can play against one, two, or three computer opponents. You can also mix and match human and computer opponents. You can even set up a four-player game with the computer playing all four positions.

Each player's countries have their own colors. The action begins after the computer automatically places armies in each player's countries. A list of play options appears, allowing you to: 1) reinforce a country with additional armies allotted at the beginning of each round; 2) attack an

Jotto has the perfect blend of low price, challenge, quality, and user-friendliness.

opposing country; 3) pull armies from one country per round to be redistributed elsewhere at the beginning of the next turn; 4) finish your turn without attacking or pulling armies; and 5) save the game. You can press Esc at any time if you want to break off an attack or change an option currently in use.

Players begin each turn by pressing R for reinforcements. The amount of extra armies to distribute for each round is shown near the top of the screen. The Space bar moves the cursor in a circuit from one country to the next until you reach the country you want to reinforce.

When you've allocated your armies, you may choose to attack or



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● Review

finish your turn. If you prefer not to attack anyone, type F. You can also remove armies from one country each turn and use them later by typing P and positioning the cursor in the appropriate location.

To attack, type A, identify the attacking country and which country you wish to attack, and hit the Space bar. Each tap of the Space bar constitutes one battle. The outcome is determined, as in *Risk*, by a roll of the dice, which is done by the computer. If you win, your opponent loses one army from his defending country. If you lose, one army is removed from your attacking country. You may choose to attack until you take over the defending country or, if the battle is going poorly, you may want to advance to the rear by pressing the Esc key.

While *Call To Arms* and *Risk* have many similarities, they differ in one interesting way. During the course of either game, players are eliminated, one at a time, until only the winner remains. In *Risk* once you're out, you're out for good, but in *Call To Arms* you can be resurrected by a Resistance Factor.

The Resistance Factor is an underground resistance movement in each country that is not occupied by the forces that controlled it when play began. Let's say you occupied France when the game started, but you were kicked out by a gang of Nazis from Germany who then left only one army unit (the minimum force allowed to hold any country) behind in France while they invaded Spain and Africa. During the next few rounds of play, the French resistance movement would become stronger until it gained enough strength to recapture France.

Even if you have been wiped off the face of the Earth, you can return to the fray through the Resistance Factor. If the occupying force is too strong, the Resistance Factor will

reduce the invaders by one army unit. This happens automatically, even if you happen to be fighting in Sweden or Turkey.

Any other dissimilarities between *Call To Arms* and *Risk* are mostly cosmetic. In both games the object is to take over the world. The modus operandi is the same: strategy, planning, aggressiveness, and luck.

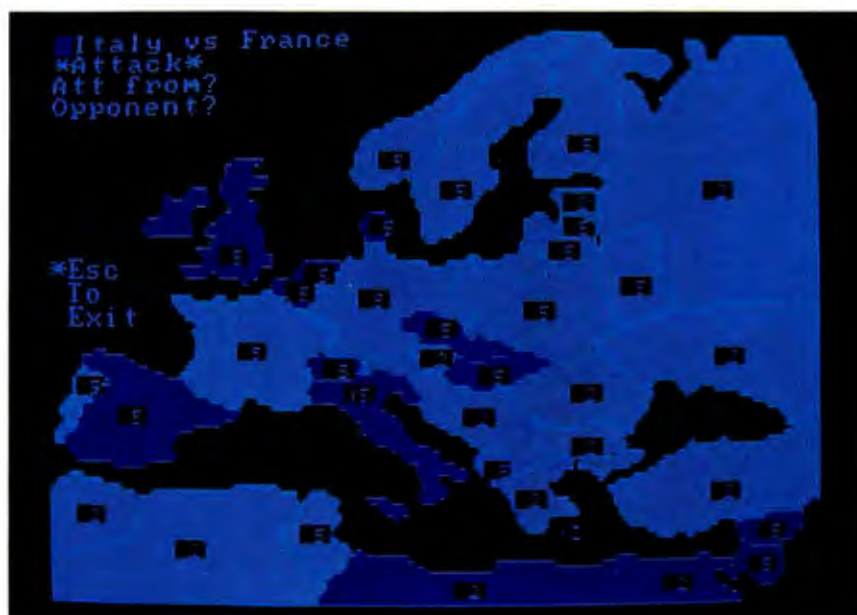
Evaluation

Call To Arms is the kind of game you play with a few friends when you're all in the mood for action, challenge, or a group primal scream session.

decide to regroup, repair, and rearm for a later assault.

Revenge may also provide satisfaction. Winning is the ultimate revenge, but if you can't wait, go for it while your rage smolders and your blood runs hot. Such action may prove very cathartic.

Call To Arms' big edge is that you can play it with other people rather than one-on-one with the computer. The program is a worthy adversary, but it can be mastered easily after you figure out its battle plan. Humans, as we all know, are much more complex, impetuous, and unpredictable than computer games; they can



Call To Arms Screen Graphics

Throughout the game you try to consolidate your position, build up forces, and beat your enemies. Suddenly someone decides you are getting too big for your britches and attacks you. Although it may be a smart move, you are overwhelmed with the suspicion that your friend is after you because you still owe him \$10 for a Super Bowl bet. You want to respond by smashing into his Soft European Underbelly with your Iron Fist, but if you do, you may weaken yourself so badly that someone else may step in and pick up the pieces. With this in mind, you may pru-

learn from past mistakes and improve, which game programs cannot yet do. Mastering a machine may be a source of pride, but a computer won't squirm, beg, cajole, threaten, or become hysterical the way a human will.

Your friends can laugh and get rowdy with you while playing *Call To Arms*. One-participant-only games isolate the player; either everyone plays one at a time or the group looks for something it can play together, such as *Call To Arms*.

Problems

Call To Arms has a few rough edges. Identifying the country you want to attack or reinforce involves moving a floating cursor from country to country until you hit the right one. The cursor moves in a set pattern for each group of countries and in one direction only. You can speed up the process by holding down the Space bar; the cursor will skip countries during the attack option if they haven't enough armies (two is a minimum) to wage a battle, but even so, you spend time watching the cursor flit from place to place in the course of a game. Perhaps an expanded-memory version of *Call To Arms* will someday be developed that will enable a player to use an elec-

Throughout the game you try to consolidate your position, build up forces, and beat your enemies.

tronic pen to point to targets more quickly.

Another time waster is the way a defeated country changes to the conquering army's color: first the perimeter of the country changes color in the manner of a burning fuse, and then the interior fills in. This amusing but time-consuming bit of graphic gimmickry soon grows boring and then annoying.

At the beginning of each game the program chooses what countries each player will have and distributes armies equally among each country. The game would be more interesting if, as in *Risk*, each player could choose which countries to occupy and distribute armies according to personal strategy.

The instruction manual is logically organized into easy-to-find headings and subheadings, and it gives examples, although one conspicuous omission is a map of the battlegrounds.

Call To Arms is a polished product. The graphics are attractive, the game is not difficult to understand or play, and it runs smoothly. Playing *Call To Arms* is fun long after other computer games have run out of demons, secret passages, alien invaders, and snappy comebacks.

Keith Richard Cook is a San Francisco free-lance writer, computer hobbyist, and semiretired video arcade warrior.

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"What type?"

"Wingtip."

Williams winced. Worldwide hadn't made a wingtip widget since way back when.

"We wouldn't have a wingtip widget at Worldwide, Sir. They're obsolete."

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Williams was no programmer, but that didn't matter. Turning to the computer, he put the question to RL-1 in simple English:

```
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Within seconds, Williams had his answer. A dozen wingtips went to Wally's Widgets 6 years ago. But would Wally have any left?

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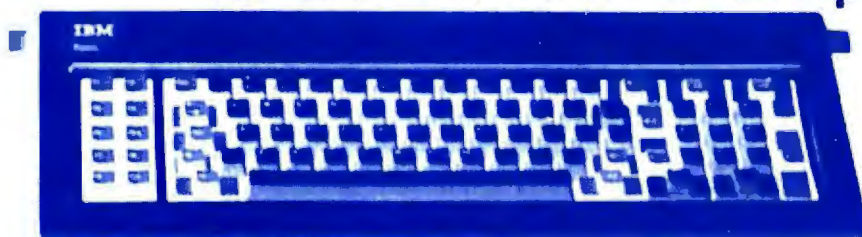
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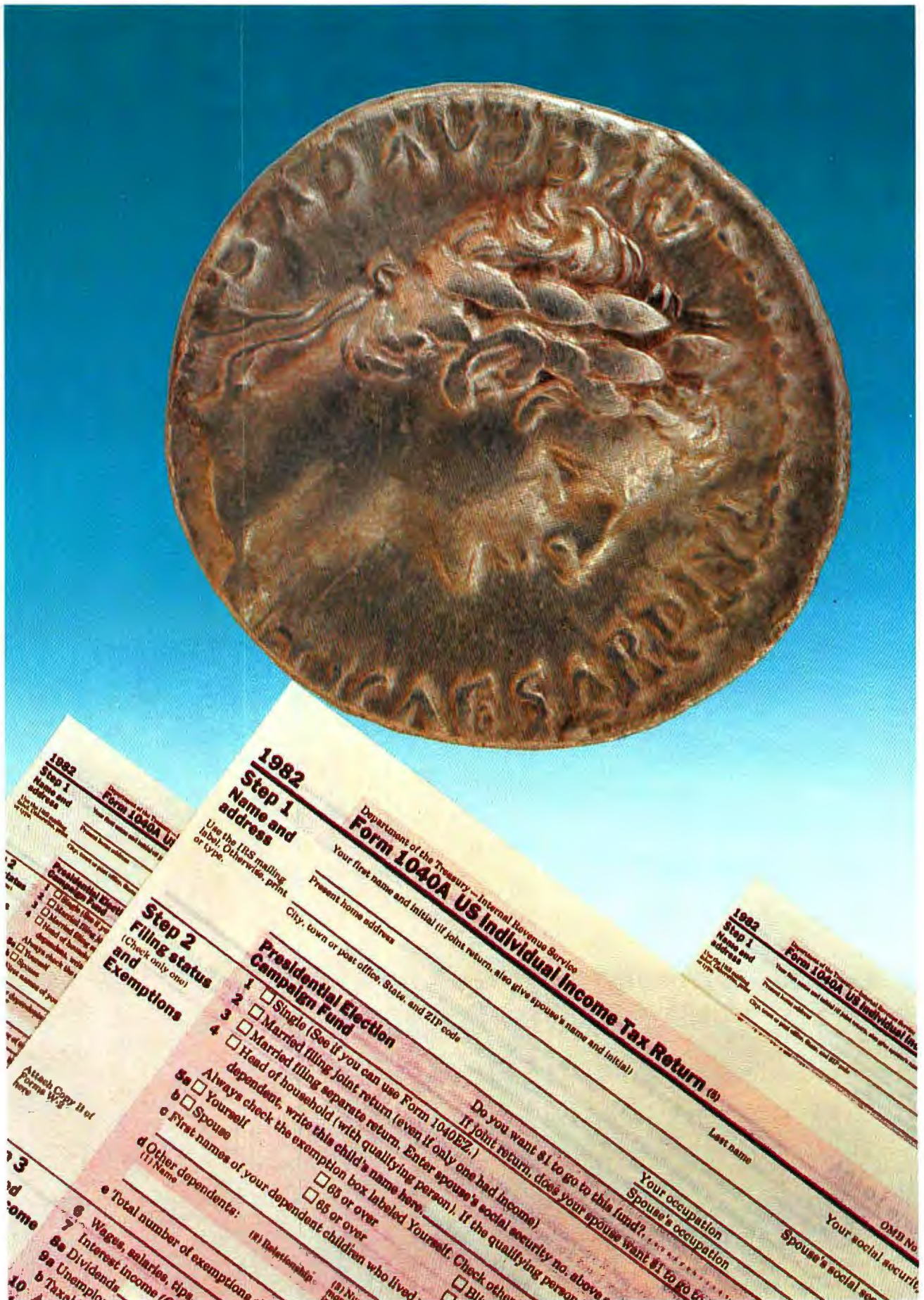
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Render unto Caesar As Little As Possible

Andrew T. Williams

Had William Shakespeare been a twentieth-century American playwright, he might have had his soothsayer warn Julius Caesar to beware the ides of April rather than the ides of March. While Caesar was carved up only once, we good citizens of the republic get carved up by the tax collector year after year.

Just think how much Shakespeare might have saved on his income taxes (not to mention how much he might have written!) if he'd had a PC. And not just because he could have plugged in one of those nifty tax packages to calculate Uncle Sam's share of the royalties. No, his PC itself would have made a handsome tax deduction.

This article will tell Will Shakespeare and anyone else who's interested the secrets of qualifying a PC as a tax deduction. It will explain how to keep records, where and how to claim the deduction, and how to file an amended return in case you filed your tax return before you learned about this little gem.

How to Qualify

To be able to deduct all or part of the cost of a PC from your taxes, you must use your PC either wholly or partly in a trade or business or in preserving or increasing your wealth. According to Raymond Bregante, a CPA based in San Francisco, "The general concept—in layman's terminology—is that the equipment must be used in the production of income."

There are two parts to this test; your PC may qualify under one or both. First, if you use the PC in a trade or business, it is just like any other business machine—it qualifies for treatment as necessary equipment. Shakespeare's PC would qualify because he was a writer. Yours will qualify if you also are a writer, or a consultant, accountant, engineer, financial analyst, or self-employed business person who uses the PC in the course of earning an income.

The use of a PC when you are an employee is not as clearly defined in tax regulations. In this case the PC

must be required as part of your employment and you must supply it, in much the same way a mechanic may be required to supply his or her own tools. If a computer isn't required for your work, the IRS might not accept the claim that your PC is a legitimate business expense.

Tax rulings in this area are still unclear. Bregante recommends that anyone who is not a sole proprietor or

Your machine may qualify for special tax treatment even if it isn't used in a trade or business.

engaged in a trade or business should discuss the financial and tax ramifications with an expert because, he notes, "it's still a very gray area."

The second way to qualify the computer—using it to conserve or increase your wealth—is more interesting and is likely to apply to many people, whether employees or self-employed. This second option means that your machine may qualify for special tax treatment even if it isn't used in a trade or business.

If you use your PC to keep track of taxes and prepare tax returns, it qualifies. If you track a stock portfolio, access financial data bases, or perform investment analyses, it qualifies. In short, if you use your PC to maintain wealth (keeping tax records) or increase wealth (analyzing investments), it qualifies. But just like part-time business use, it qualifies only for that fraction of the time that it is actually used to maintain or increase wealth.

● Hands On

Pin-Stripe Pencil Pusher

Simply put, your PC can lead a double life. By day it can be the swashbuckling game player your children love to beat. By night it can be the pin-stripe pencil pusher you use to find that hot stock that could pay for your kids' braces. When it is used for games, the PC doesn't qualify; when it is used for investments, it does.

You must establish to the satisfaction of the IRS the fraction of the time your PC is used in tax-deductible activities and the fraction it is used in non-tax-deductible activities. The surest way to satisfy the IRS is to keep a minute-by-minute log of the uses to which the machine is put. At the end of the year calculate the percentage of time your PC was used to maintain or improve your

You can also save money on your taxes by depreciating the cost of the software you purchased during the year.

wealth. This calculation yields the fraction of the purchase price that can be depreciated and that qualifies for the investment tax credit.

If you can't keep a minute-by-minute log, an alternative is to keep sample logs for several weeks throughout the year and to estimate from these samples the fraction of time the machine is used in tax-deductible activities. Be fair and you probably won't have any trouble with the IRS. If you load the numbers in your favor—by picking the week you do your taxes, for example—the IRS is likely to question your method, and you may have great difficulty claiming any deduction at all.

Tax Basis

After you have assured yourself that your PC qualifies for some deduction, the next thing you must do is determine your "tax basis." This is the portion of the cost of your PC that corresponds to the tax-deductible portion of the use. The tax basis is a very important concept; it is the foundation for your deductions.

If, for example, your system cost \$4500 and you used it 42.3 percent of the time in tax-deductible activities, your tax basis would be \$1903.50 (42.3 percent of \$4500). If you used the machine solely in a trade or business, your tax basis would be 100 percent of the purchase price, or \$4500.

Depreciation and Investment Tax Credit

Now for the good stuff. After you have determined (1) that your PC is used in tax-deductible activities, (2) the fraction of the total time the machine is used in these activities, and (3) your tax basis, you are ready to reduce your taxes.

You can do this in two ways. The first is through the investment tax credit. This is a direct reduction of your tax liability (a credit against taxes owed). For the 1982 tax year it is equal to 10 percent of your tax basis. If you bought a PC in 1983, the treatment of the investment tax credit is slightly different, as discussed later in this article.

If your tax basis is \$1903.50, your investment tax credit will be 10 percent of this, or \$190.35. To claim the investment tax credit, complete IRS Form 3468, which you must pick up at an IRS office or request by mail or phone; it is not included in the standard booklet mailed to taxpayers. The investment tax credit reduces your income tax liability dollar for dollar—its worth to you is exactly the amount of the credit you claim.

In addition to taking this credit, you can reduce your taxes by depreciating the tax basis of your computer over a period of five years. The tax basis, of course, may or may not be the full purchase price, depending on whether you use your PC full-time for tax deductible activities.

The idea behind depreciation is simple: your PC is a business expense with a useful life of more than one year. The IRS has decreed the useful life of computers and other office equipment to be five years. Since you are expected to use your PC for five years, you get to reduce your income by some amount each year. This amount is called a depreciation allowance.

The IRS specifies the percentage of the tax basis you can claim as depreciation in each of the five years. This is the schedule: year one, 15 percent of the tax basis; year two, 22 percent; year three, 21 percent; year four, 21 percent; year five, 21 percent.

To calculate your depreciation, multiply the tax basis by the appropriate percentage. If the tax basis for your PC were \$1903.50, you would deduct 15 percent, or \$285.53, from your income the first year. In the second year, you would deduct \$418.77, and so on for the remaining three years.

The deduction for depreciation can be claimed either on Schedule C (Profit or Loss from Business or Profession), or if you do not file Schedule C, Schedule A (Itemized Deductions). If you are an employee claiming a PC as a business or educational expense, you would claim the depreciation on Form 2106, Employee's Business Expenses, which you must request from the IRS. As noted previously, this last may be a difficult deduction to claim, and it is one for which you should consult a tax advisor.

| TAX RATE | PREVAILING INTEREST RATE | | | | | | | | |
|-------------|--------------------------|----------|-----------|------------|------------|------------|------------|------------|------------|
| | 6% | 7% | 8% | 9% | 10% | 11% | 12% | 13% | 14% |
| 15% | \$314.43 | \$294.81 | \$275.92 | \$257.73 | \$240.20 | \$223.29 | \$206.98 | \$191.24 | \$176.04 |
| 20% | \$277.73 | \$252.89 | \$229.00 | \$206.02 | \$183.90 | \$162.59 | \$142.05 | \$122.25 | \$103.15 |
| 25% | \$241.03 | \$210.97 | \$182.09 | \$154.32 | \$127.60 | \$101.88 | \$77.11 | \$53.25 | \$30.25 |
| 30% | \$204.33 | \$169.06 | \$135.17 | \$102.61 | \$71.30 | \$41.18 | \$12.18 | (\$15.74) | (\$42.65) |
| 35% | \$167.63 | \$127.14 | \$88.26 | \$50.91 | \$15.00 | (\$19.53) | (\$52.75) | (\$84.74) | (\$115.55) |
| 40% | \$130.93 | \$85.22 | \$41.34 | (\$0.80) | (\$41.30) | (\$80.23) | (\$117.69) | (\$153.74) | (\$188.44) |
| 45% | \$94.24 | \$43.31 | (\$5.57) | (\$52.51) | (\$97.60) | (\$140.94) | (\$182.62) | (\$222.73) | (\$261.34) |
| 50% | \$57.54 | \$1.39 | (\$52.49) | (\$104.21) | (\$153.89) | (\$201.64) | (\$247.56) | (\$291.73) | (\$334.24) |

Table 1: The dollar amounts shown represent the relative advantages of treating a \$4500 PC by the depreciation and investment tax credit method over the expensing method. Tax rates are listed along the left, and prevailing interest rates are shown across the top of the table. The positive values at each intersection of tax and interest rates indicate that the depreciation method is preferable; negative values (in parentheses) indicate that expensing the computer is preferable.

If you use your PC in tax-deductible activities only part of the time, it is a good idea to append a note to your tax return explaining how you determined your tax basis and how you calculated your depreciation allowance.

Software

You can also save money on your taxes by depreciating the cost of the software you purchased during the year. The software, of course, must be something like the word processing program Shakespeare would have used to write his plays, or the tax package he would have bought to figure out how much to pay the government.

If some software—such as a disk operating system—is used in both tax-deductible and non-tax-deductible ways, you must split its cost in the same way you apportioned the cost of the hardware. Keep a log and use it to decide how much of the total price may be depreciated.

Software remains one of the gray areas in IRS interpretation. You may be able to treat certain software—programs costing less than \$100, for instance—as business supplies. This cost would be deducted from your income rather than depreciated. You would be wise to consult a tax advisor if you have questions about how to report software costs.

Expensing Your Computer

If you use your PC only in a trade or business or only to conserve or increase your wealth, you have two options when considering it for tax purposes. This choice isn't open to anyone who uses the PC for non-tax-deductible

activities. So if you are in that category, skip this section.

If you do qualify, you have the option of “expensing” the PC's cost, rather than depreciating it and taking an investment tax credit. Expensing means that you may reduce your income by the actual amount you spent on your PC (or other major business equipment), up to a limit of \$5000. If you paid \$4500 for the system, you could deduct \$4500 from your income. Enter that deduction on Schedule C or Schedule A.

If you expense your system, you cannot claim depreciation or the investment tax credit. Which of these two alternatives you choose will probably depend on which method gives you the greater tax savings.

Table 1 compares expensing a \$4500 PC against taking an investment tax credit and depreciation. Because depreciating the computer's cost is a five-year process, it's difficult to measure against the all-in-one-year expensing method. By using a standard accounting technique called present value, however, you can make an estimate that treats the several years of depreciation as if it were all available in one year. Most electronic spreadsheet programs and many hand-held calculators have built-in routines for determining the present value of an item such as depreciation.

In Table 1 the present value of depreciation and investment tax credit for a \$4500 PC is compared to the value of expensing the same equipment. The amounts shown in the table represent the difference between the depreciation method and the expensing method; in most cases the relative tax advantages are greater for depreciating than for expensing.

As Table 1 shows, the difference in tax savings between the two methods is affected by both tax and

● Hands On

interest rates. The prevailing interest rate is generally considered the rate at which dollars invested today would earn; a good index of this earning power is the rate currently paid on federal bonds. The prevailing interest rate for the first quarter of 1983, for example, is likely to be between 8 and 9 percent.

The values in Table 1 demonstrate that expensing is most advantageous if you are in a high tax bracket in a time of high interest rates. If you are in a tax bracket below 35 percent and the interest rate is 10 percent or less, however, taking the investment tax credit and depreciation would be better for you.

You should notice that Table 1 takes into account only the effect of your income tax rate. If you also pay

In addition to saving on federal income taxes, you can take a depreciation allowance for your PC on your state tax return.

social security tax as a self-employed person, you should take that into consideration because it will increase the value to you of any deductions you claim. In general, taxpayers who pay the self-employment tax and whose income tax is greater than 25 percent when the interest rate is at least 11 percent will find it more advantageous to expense than to take the investment tax credit and depreciation.

1983 and Beyond

The information presented so far applies to a PC purchased sometime in 1982 by a taxpayer whose tax year began that year. But if you bought a PC in 1983 or if you intend to buy a system sometime in the future, you will be subject to some recent changes in the tax laws.

Briefly, the IRS has tightened up the investment tax credit and depreciation features but has left everything else unchanged. Under the new law (which applies to systems purchased after December 31, 1982) you must either reduce your tax basis (and hence the amount you can depreciate) by 50 percent of the investment tax credit, or you can depreciate all of the tax basis but the investment tax credit will be limited to 8 percent of the tax basis rather than the 10 percent allowed for 1982.

Exactly which option you choose depends on your tax rate and the prevailing interest rate. According to Ray Bregante, the higher your tax rate, the more you'll

benefit from taking your deductions as soon as possible. However, the actual benefit also depends on the prevailing interest rate. "It is a very simple calculation of present value," says Bregante. "Everyone should sit down and run the numbers—given the facts and circumstances at the time they buy their computer."

Filing an Amended Tax Return

It is just possible that you have already filed your 1982 income tax return and were unaware of some of the tax deductions discussed in this article. Don't worry, you can take advantage of each of these provisions by filing an amended tax return. You can obtain Form 1040X, Amended U.S. Individual Income Tax Return, from your nearest IRS office. Follow the instructions that accompany the return, and you will be able to make any changes you wish to the deductions you have taken and the credits you have claimed.

State Taxes

In addition to saving on federal income taxes, you can take a depreciation allowance for your PC on your state tax return. The rules vary from state to state, however, so you will have to find out exactly what rules apply in your situation. In any case, the state tax savings will be limited to the depreciation allowance because the investment tax credit and expensing up to \$5000 in business equipment are features that are unique to the federal tax laws.

Do You Need an Accountant?

Probably not. As long as you have purchased a PC as a self-employed person for use in your own trade or business, or to conserve and increase your wealth, claiming the investment tax credit and the depreciation allowance is a straightforward matter. Just read the instructions and fill out the appropriate forms.

If you work for someone else and wish to use your PC in that capacity, however, you should definitely consult an accountant or a tax advisor. You should also seek advice if you are involved in anything more complicated, such as leasing your machine or buying machines and leasing them to others.

Otherwise—file and enjoy!

The following pamphlets, available free from the IRS, may help you claim the investment tax credit and depreciation on your PC: Investment Credit (#572), Depreciation (#534), and A Guide for Small Businesses (#334).

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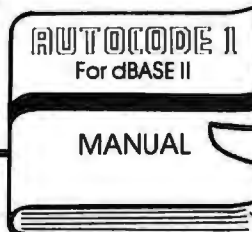
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WordStar Made to Order

Patches that let you customize this popular word processing program to meet your particular needs

Emil Flock

The standard-issue *WordStar* is a powerful program. After three years of using it, I'm still discovering new features. The trouble is that after all this time the few complaints that linger seem to loom larger and larger.

As powerful as the program is, *WordStar* insists on "coming up" or "starting out" the way it wants to. When you put the disk in the drive and turn on the power, MicroPro's *WordStar* lays down the following commandments:

- 1) The Left Margin is Column 1.
- 2) The Right Margin is Column 65.
- 3) The Variable Tab Stops are in Columns 6, 11, 16,..., 56.
- 4) Variable Tabbing is ON.
- 5) Word Wrap is ON.
- 6) Justification is ON.
- 7) The Ruler Line display is ON.
- 8) The Page Break display is ON.
- 9) The Print Control display is ON.
- 10) Soft Hyphen entry is OFF.
- 11) Hyphen Help is ON.

Criticizing the program for these and other default values is difficult. The defaults were chosen to please most people most of the time. It would hardly do to force people to reconfigure *WordStar* each time they begin a session. But why did MicroPro neglect to provide IBM PC *WordStar* users with customization notes, the information they need to customize the program to their own needs? (Comparable notes for the CP/M-80

versions of *WordStar* are sold by MicroPro, and a sampling of these customization instructions is included in the user manual for CP/M-80 versions of the program.)

Patching WordStar

You don't have to be a programmer to customize, or patch, *WordStar*. The tool needed, called *DEBUG.COM*, is on the PC-DOS disk and is quite simple to use. (See the IBM PC-DOS documentation for more information about *DEBUG.COM*.) *DEBUG.COM* alters the main *WordStar* command file, *WS.COM*. (All patches discussed here are made on the *WS.COM* file; no other *WordStar* command files need be changed.) Before starting to patch, make a copy of the *WS.COM* file and then patch the copy only, saving the original for backup purposes.

Start by responding to the PC-DOS prompt like this:

```
A>DEBUG WS.COM
```

—

Notice the minus sign that appears before the blinking cursor. This symbol is *DEBUG*'s prompt, just as *A>* is the PC-DOS prompt and *OK* is the BASIC prompt. The prompt indicates that *DEBUG* has loaded *WS.COM* and is ready to accept commands. A complete explanation of *DEBUG*'s commands is given in the PC-DOS

manual. You use only three commands: *F* (Fill), *W* (Write), and *Q* (Quit). The *F* command does the actual patching on *WS.COM*, *W* command writes the patched *WS.COM* to disk so that you can run it, and *Q* ends the *DEBUG* session.

We'll start out with a patch that changes *WordStar*'s default drive, or the disk drive that the program searches to find the command files. Normally, *WordStar* expects to find these files on drive A, no matter which drive is the logged drive. Once you've changed the default drive, you can take advantage of the speed of an electronic disk. If you don't change the default drive, *WordStar* searches drive A for the command files, even though you have copied them onto your electronic disk.

The procedure for changing the default drive is

```
-F 2DC L1 3 press ENTER
```

This procedure uses the *F* (Fill) command to place the value 3 in hexadecimal location 2DC of the *WS.COM* file. Three (3) is the code for drive C that replaces 1, the code for drive A. *L1* refers to the length of the patch, in this case 1 byte.

When the fill command is finished, issue the *W* (Write) command

```
-W press ENTER
```

DEBUG should respond with 'Writing 5000 bytes'. When you receive

| START | STOP | STYLE |
|---------------|-------------|----------------------------------|
| ^PQ | ^PR | Compressed |
| ^PQ^PD | ^PD^PR | Compressed Doublestrike |
| ^PQ^PB | ^PB^PQ | Compressed Boldface |
| ^PQ^PE4 | ^PE5^PQ | Compressed Italic |
| ^PQ^PD^PE4 | ^PE5^PD^PR | Comp. D.Strike Italic |
| ^PQ^PB^PE4 | ^PE5^PB^PR | Comp. Bold. Italic |
| | | |
| ^PW | ^PR | Double Width |
| ^PW^PD | ^PD^PR | D. Width Doublestrike |
| ^PW^PB | ^PB^PQ | D. Width Boldface |
| ^PW^PE4 | ^PE5^PQ | D. Width Italic |
| ^PW^PD^PE4 | ^PE5^PD^PR | D. Width D.Strike It. |
| ^PW^PB^PE4 | ^PE5^PB^PR | D. Width Bold. It. |
| | | |
| ^PEE | ^PEF | Emphasized |
| ^PEE^PD | ^PD^PEF | Emphasized Doublestrike |
| ^PB^PEE | ^PEF^PB | Emphasized Boldface |
| ^PEE^PE4 | ^PE5^PEF | Emphasized Italic |
| ^PEE^PD^PE4 | ^PE5^PD^PEF | Emphasized D.Strike Italic |
| ^PB^PEE^PE4 | ^PE5^PEF^PB | Emphasized Bold. Italic |
| | | |
| ^PQ^PW | ^PR | Compressed Double Width |
| ^PQ^PW^PD | ^PD^PR | Compressed Double Width D.Strike |
| ^PQ^PW^PB | ^PB^PR | Compressed Double Width Bold. |
| ^PQ^PW^PE4 | ^PE5^PR | Compressed Double Width Italic |
| ^PQ^PW^PE4^PD | ^PD^PE5^PR | Compressed D.Width D.Strike Ita. |
| ^PQ^PW^PE4^PB | ^PB^PE5^PR | Compressed D.Width Bold. Italic |

Figure 1: Advanced Print Enhancements

| Name | Result | Address |
|---------------------|---------|---------|
| Short Delay | 0 | 2CP |
| Medium-Short Delay | 0 | 2D0 |
| Medium-Long Delay | 0 | 2D1 |
| Long Delay | 4 | 2D2 |
| Redisplay Delay | 0 | 2DC |
| Disk Reset | Disable | 2DB |
| Default Drive | C: | 2DC |
| Help Level | 2 | 360 |
| Help Message | ON | 361 |
| Insert | OFF | 362 |
| Right Margin | 39 | 380 |
| Justification | OFF | 386 |
| Hyphen Help | OFF | 389 |
| Page Numbers | Omit | 3D3 |
| Printer CR w/o LF | | 746 |
| Quadstrike Boldface | | 747 |
| Enable ESCape | | 789 |
| | | 78A |
| Compressed | ON | 77F |
| | | 780 |
| Double Width | ON | 784 |
| | | 785 |
| Comp. & D. Width | OFF | 78E |
| | | 78F |
| | | 790 |

Table 1: Customized Version of WordStar for Writing

| Name | Result | Address |
|--------------------|---------|---------|
| Short Delay | 0 | 2CF |
| Medium-Short Delay | 0 | 2D0 |
| Medium-Long Delay | 0 | 2D1 |
| Long Delay | 4 | 2D2 |
| Redisplay Delay | 0 | 2D3 |
| Disk Reset | Disable | 2DB |
| Default Drive | C: | 2DC |
| Help Level | 2 | 360 |
| Page Numbers | Omit | 3D3 |
| Non-Document | | 392 |

Table 2: Customized Version of WordStar for Programming

this message, you are ready to issue the Q (Quit) command to end the DEBUG session:

-Q press ENTER

A>

"WordStar Patches" is a list of 77 patches for *WordStar*. The patches have been separated into five categories: screen display, printing, advanced print enhancements, function keys, and others. Examples of the advanced print enhancements and the control codes required to produce them are shown in Figure 1.

Within the five categories are two types of patches: those that can be accessed from within *WordStar* (while the program is running) and those that must be patched before the program is run.

Only an Epson dot matrix printer was used to test the patches. Patches for daisy wheel printers were not tested. I've chosen values for the patches that might be typical. You can substitute different values (within limits) for the patches to suit your needs.

Each patch listing in "WordStar Patches" contains the information you need to make the patch. NAME gives the name of the patch; FUNCTION explains what the patch does; ADDRESS gives the patch's WS.COM location in hexadecimal notation; CHANGE gives the original value and suggests a new value; DEBUG is the command line you must enter to make each patch; and RESULT gives the effect of the patch on the workings of *WordStar*. ACCESS FROM WS tells how to access the patch while *WordStar* is running. ("No" indicates that the patch cannot be accessed while the program is running.)

Customized Program

Depending on your needs, you may want to customize several versions of *WordStar* for different applications. Versions can be designed for business letters, forms processing, or for providing output compatible with a spreadsheet or relational data base program.

I constructed two versions of *WordStar* for my own use. One is for

writing, the other is for programming. My writing *WordStar* comes up in the configuration shown in Table 1. (For an explanation of delays, disk reset, and default drive, see Appendix C in the *WordStar Reference Manual*.) My programming *WordStar* comes up in the form shown in Table 2. With this configuration you can directly enter Non-Document mode by calling up the program with C>ws filename. (The table on page 4-5 of the *WordStar Reference Manual* gives the defaults for other parameters in Document and Non-Document modes.)

These patches are only the beginning. If you take a few minutes to customize *WordStar*, in the long run you'll save time, use fewer keystrokes, and avoid errors. You don't have to accept *WordStar*'s defaults. You're in control.

Emil Flock is a computer handholder living in San Francisco. He specializes in customizing WordStar.

WordStar Patches

Screen Display

Short Delay

Function: Controls length of time that messages remain on screen

Address: 2cf
Change: From 1 to 0
Debug: -F 2cf L1 0
Result: Quicker messages
WS Access: No

Medium-Short Delay

Function: Controls length of time that messages remain on screen

Address: 2d0
Change: From 4 to 0
Debug: -F 2d0 L1 0
Result: Quicker messages
WS Access: No

Medium-Long Delay

Function: Controls length of time that messages remain on screen

Address: 2d1
Change: From 8 to 0
Debug: -F 2d1 L1 0
Result: Quicker messages
WS Access: No

Long Delay

Function: Controls length of time that messages remain on screen

Address: 2d2
Change: From 10 to 4
Debug: -F 2d2 L1 4
Result: Quicker messages
WS Access: No

Redisplay Delay

Function: Controls length of time that messages remain on screen
 Address: 2d3
 Change: From 9 to 0
 Debug: -F 2d3 L1 0
 Result: Quicker messages
 WS Access: No

Help Level

Function: Determines initial appearance of on-screen help messages
 Address: 360
 Change: From 3 to 2
 Debug: -F 360 L1 2
 Result: Level 2
 WS Access: Ctrl-JH2

Help Flag

Function: Produces initial help-level message
 Address: 361
 Change: From ff to 0
 Debug: -F 361 L1 0
 Result: Initial help message
 WS Access: No

Insert

Function: Determines initial insert setting (ON or OFF)
 Address: 362
 Change: From ff to 0
 Debug: -F 362 L1 0
 Result: Off
 WS Access: Ctrl-V

Directory

Function: Determines initial file directory setting (ON or OFF)
 Address: 363
 Change: From ff to 0
 Debug: -F 363 L1 0
 Result: Off
 WS Access: F

Left Margin

Function: Determines initial left margin setting
 Address: 37f
 Change: From 0 to 11
 Debug: -F 37f L1 11
 Result: Margin 10(valid from 0 to Right Margin-3)
 WS Access: Ctrl-OL

Right Margin

Function: Determines initial right margin setting
 Address: 380
 Change: From 40 to 27
 Debug: -F 380 L1 27
 Result: Margin 39(valid from 2 to Screen Width-4)
 WS Access: Ctrl-OR

Word Wrap

Function: Determines initial word wrap setting (ON or OFF)
 Address: 385
 Change: From ff to 0
 Debug: -F 385 L1 0
 Result: Off
 WS Access: Ctrl-OW

Justification

Function: Determines initial justification setting (ON or OFF)
 Address: 386
 Change: From ff to 0
 Debug: -F 386 L1 0
 Result: Ragged right
 WS Access: Ctrl-OJ

Variable Tab

Function: Determines initial variable tabs setting (ON or OFF)
 Address: 387
 Change: From ff to 0
 Debug: -F 387 L1 0
 Result: Off
 WS Access: Ctrl-OV

Soft Hyphen

Function: Determines initial soft hyphen setting (ON or OFF)
 Address: 388
 Change: From 0 to ff
 Debug: -F 388 L1 ff
 Result: Soft
 WS Access: Ctrl-OE

Hyphen Help

Function: Determines initial hyphen help setting (ON or OFF)
 Address: 389
 Change: From ff to 0
 Debug: -F 389 L1 0
 Result: Off
 WS Access: Ctrl-OH

Print Control Display

Function: Determines initial print-control display setting (ON or OFF)
Address: 38a
Change: From ff to 0
Debug: -F 38a L1 0
Result: Off
WS Access: Ctrl-OD

Ruler Line

Function: Determines initial ruler line setting (ON or OFF)
Address: 38b
Change: From ff to 0
Debug: -F 38b L1 0
Result: Off
WS Access: Ctrl-OT

Page Break Display

Function: Determines initial page break display (dotted line) setting (ON or OFF).
Address: 38c
Change: From ff to 0
Debug: -F 38c L1 0
Result: Off
WS Access: Ctrl-OP

Page Break Suppress

Function: Determines initial page break setting (ON or OFF)
Address: 38d
Change: From ff to 0
Debug: -F 38d L1 0
Result: Off
WS Access: Ctrl-OP

Line Spacing

Function: Sets initial line spacing (from 1 to 9)
Address: 38e
Change: From 1 to 2
Debug: -F 38e L1 2
Result: Double space
WS Access: Ctrl-OS

Column Move Mode

Function: Determines initial column-move mode setting (ON or OFF)
Address: 38f
Change: From 0 to ff
Debug: -F 38f L1 ff
Result: Enable column
WS Access: Ctrl-KN

Change Decimal Point Tab Character

Function: Allows substitution of alternate character (e.g., ',') for decimal point
Address: 393
Change: From 2e to 2c
Debug: -F 393 L1 2c
Result: Comma replaces decimal point
WS Access: No

Change Dot Command Character

Function: Allows substitution of an alternate character for period in dot commands
Address: 395
Change: From 2e to 25
Debug: -F 395 L1 25
Result: Percent sign replaces decimal point
WS Access: No

Change Nonbreak Space Character

Function: Allows substitution of alternate character for nonbreak space
Address: 396
Change: From f to 26
Debug: -F 396 L1 26
Result: Ampersand replaces Ctrl-O
WS Access: No

Hyphen Criterion

Function: Determines number of columns short of right margin that hyphen help is activated
Address: 39a
Change: From 4 to a
Debug: -F 39a L1 a
Result: 10 Columns
WS Access: No

Printing

Default for Print Options

Function: Sets default print query response to Yes
Address: 3ca
Change: From 0 to ff
Debug: -F 3ca L1 ff
Result: Disk file output: Yes
WS Access: P

Default for Print Options

Function: Sets default print query response to Yes
Address: 3cb
Change: From 0 to ff
Debug: -F 3cb L1 ff
Result: Use form feed: Yes
WS Access: P

Default for Print Options

Function: Sets default print query response to Yes
Address: 3cc
Change: From 0 to ff
Debug: -F 3cc L1 ff
Result: Suppress page format: Yes
WS Access: P

Default for Print Options

Function: Sets default print query response to Yes
 Address: 3cd
 Change: From 0 to ff
 Debug: -F 3cd L1 ff
 Result: Pause between pages: Yes
 WS Access: P

Omit Page Numbers

Function: Causes omission of page numbers
 Address: 3d3
 Change: From 0 to ff
 Debug: -F 3d3 L1 ff
 Result: No page numbers printed
 WS Access: .OP

Microjustification

Function: Determines initial microjustification setting (ON or OFF)
 Address: 3d4
 Change: From ff to 0
 Debug: -F 3d4 L1 0
 Result: Off
 WS Access: .UJ

Bidirectional Print

Function: Controls print-head movement during printing
 Address: 3d5
 Change: From ff to 0
 Debug: -F 3d5 L1 0
 Result: Off
 WS Access: .BP

Paper Length I (Paper Length I, II, and III must be used together)

Function: Sets paper length
 Address: 367
 Change: From 42 to 3c
 Debug: -F 367 L1 3c
 Result: 60 lines
 WS Access: .PL

Paper Length II

Function: Sets paper length
 Address: 368
 Change: From 10 to e0 (lsb in 1/48 inch format)
 Debug: -F 368 L1 e0 (lsb in 1/48 inch format)
 Result: 60 lines
 WS Access: .PL

Paper Length III

Function: Sets paper length
 Address: 369
 Change: From 2 to 1 (msb in 1/48 inch format)
 Debug: -F 369 L1 1 (msb in 1/48 inch format)
 Result: 60 lines
 WS Access: .PL

Top Margin I (Top Margin I, II, and III must be used together)

Function: Sets top margin
 Address: 36b
 Change: From 3 to 28
 Debug: -F 36b L1 28
 Result: 40 lines
 WS Access: .MT

Top Margin II

Function: Sets top margin
 Address: 36c
 Change: From 18 to 40 (lsb in 1/48 inch format)
 Debug: -F 36c L1 40 (lsb in 1/48 inch format)
 Result: 40 lines
 WS Access: .MT

Top Margin III

Function: Sets top margin
 Address: 36d
 Change: From 0 to 1 (msb in 1/48 inch format)
 Debug: -F 36d L1 1 (msb in 1/48 inch format)
 Result: 40 lines
 WS Access: .MT

Bottom Margin I (Bottom Margin I, II, and III must be used together)

Function: Sets bottom margin
 Address: 373
 Change: From 8 to 24
 Debug: -F 373 L1 24
 Result: 36 lines
 WS Access: .MB

Bottom Margin II

Function: Sets bottom margin
 Address: 374
 Change: From 40 to 20 (lsb in 1/48 inch format)
 Debug: -F 374 L1 20 (lsb in 1/48 inch format)
 Result: 36 lines
 WS Access: .MB

Bottom Margin III

Function: Sets bottom margin
Address: 375
Change: From 0 to 1 (msb in 1/48 inch format)
Debug: -F 375 L1 1 (msb in 1/48 inch format)
Result: 36 lines
WS Access: .MB

Standard Character Pitch

Function: Sets standard character pitch
Address: 37b
Change: From ff to 0
Debug: -F 37b L1 0
Result: Sets alternate pitch as default
WS Access: Ctrl-PA

Set Default Character Pitch

Function: Sets default character pitch
Address: 37c
Change: From 0c to 8
Debug: -F 37c L1 8
Result: 8 characters per inch (1/120-inch format)
WS Access: Ctrl-PA

Set Alternate Character Pitch

Function: Sets alternate character pitch
Address: 37d
Change: From 0a to 10
Debug: -F 37d L1 10
Result: 16 characters per inch (1/120-inch format)
WS Access: Ctrl-PA

Page Offset

Function: Sets page offset for form feeders
Address: 37e
Change: From 8 to 32
Debug: -F 37e L1 32
Result: 50 replaces 8 (for sheet feeders)
WS Access: .PO

Advanced Print Enhancements

Printer CR without LF

Function: Allows carriage return without line feed (may not apply to all printers)
Address: 746
Change: From 0 to ff
Debug: -F 746 L1 ff
Result: Allows CR without LF
WS Access: No

Quadstrike Boldface

Function: Allows quadruple-strike boldface
Address: 747
Change: From 2 to 4
Debug: -F 747 L1 4
Result: Quadstrike boldface
WS Access: No

Enable ESCape I (Enable ESCape I and II must be used together)

Function: Allows sending of escape (ASCII CHR\$(27)) to printer
Address: 789
Change: From 0 to 1
Debug: -F 789 L1 1
Result: Send escape sequences
WS Access: Ctrl-PEx after installation

Enable ESCape II

Function: Allows sending of escape (ASCII CHR\$(27)) to printer
Address: 78a
Change: From 0 to 1b
Debug: -F 78a L1 1b
Result: Send escape sequences
WS Access: Ctrl-PEx after installation

Compressed I (The Compressed and Double Width patches should be used together)

Function: Assigns codes for turning on compressed print to User Patch Q
Address: 77f
Change: From 0 to 1
Debug: -F 77f L1 1
Result: On
WS Access: Ctrl-PQ after installation

Compressed II

Function: Assigns codes for turning on compressed print to User Patch Q
Address: 780
Change: From 0 to f
Debug: -F 780 L1 f
Result: On
WS Access: Ctrl-PQ after installation

Double Width I

Function: Assigns codes for turning on double-width print to User Patch W
Address: 784
Change: From 0 to 1
Debug: -F 784 L1 1
Result: On
WS Access: Ctrl-PW after installation

Double Width II

Function: Assigns codes for turning on double-width print to User Patch W
 Address: 785
 Change: From 0 to e
 Debug: -F 785 L1 e
 Result: On
 WS Access: Ctrl-PW after installation

Compressed/Double Width I

Function: Assigns codes for turning off compressed and double-width print to User Patch R
 Address: 78e
 Change: From 0 to 2
 Debug: -F 78e L1 2
 Result: Off
 WS Access: Ctrl-PR after installation

Compressed/Double Width II

Function: Assigns codes for turning off compressed and double-width print to User Patch R
 Address: 78f
 Change: From 0 to 12
 Debug: -F 78f L1 12
 Result: Off
 WS Access: Ctrl-PR after installation

Compressed/Double Width III

Function: Assigns codes for turning off compressed and double-width print to User Patch R
 Address: 790
 Change: From 0 to 14
 Debug: -F 790 L1 14
 Result: Off
 WS Access: Ctrl-PR after installation

Function Keys*

F1 Function Key I (F1 Function Key I and II must be used together)

Function: Sets F1 to Save—done edit
 Address: 671
 Change: From 0a to 0b
 Debug: -F 671 L1 0b
 Result: Ctrl-KD
 WS Access: No

F1 Function Key II

Function: Sets F1 to Save—done edit
 Address: 672
 Change: From 48 to 44
 Debug: -F 672 L1 44
 Result: Ctrl-KD
 WS Access: No

F2 Function Key I (F2 Function Key I and II must be used together)

Function: Sets F2 to Abandon edit
 Address: 67a
 Change: From 0f to 0b
 Debug: -F 67a L1 0b
 Result: Ctrl-KQ
 WS Access: No

F2 Function Key II

Function: Sets F2 to Abandon edit
 Address: 67b
 Change: From 47 to 51
 Debug: -F 67b L1 51
 Result: Ctrl-KQ
 WS Access: No

F3 Function Key I (F3 Function Key I and II must be used together)

Function: Sets F3 to Reform paragraph
 Address: 682
 Change: From 3 to 1
 Debug: -F 682 L1 1
 Result: Ctrl-B
 WS Access: No

F3 Function Key II

Function: Sets F3 to Reform paragraph
 Address: 683
 Change: From 0f to 2
 Debug: -F 683 L1 2
 Result: Ctrl-B
 WS Access: No

F4 Function Key I (F4 Function Key I and II must be used together)

Function: Sets F4 to Delete word right
 Address: 68b
 Change: From 3 to 1
 Debug: -F 68b L1 1
 Result: Ctrl-T
 WS Access: No

F4 Function Key II

Function: Sets F4 to Delete word right
 Address: 68c
 Change: From 0f to 14
 Debug: -F 68c L1 14
 Result: Ctrl-T
 WS Access: No

F5 Function Key

Function: Sets F5 to Left side screen
Address: 695
Change: From 10 to 11
Debug: -F 695 L1 11
Result: Ctrl-QS
WS Access: No

F6 Function Key I (F6 Function Key I and II must be used together)

Function: Sets F6 to Right end line
Address: 69e
Change: From 10 to 11
Debug: -F 69e L1 11
Result: Ctrl-QD
WS Access: No

F6 Function Key II

Function: Sets F6 to Right end line
Address: 69f
Change: From 42 to 44
Debug: -F 69f L1 44
Result: Ctrl-QD
WS Access: No

F7 Function Key I (F7 Function Key I and II must be used together)

Function: Sets F7 to Delete line
Address: 6af
Change: From 02 to 01
Debug: -F 6af L1 01
Result: Ctrl-Y
WS Access: No

F7 Function Key II

Function: Sets F7 to Delete line
Address: 6b0
Change: From 0b to 19
Debug: -F 6b0 L1 19
Result: Ctrl-Y
WS Access: No

F8 Function Key I (F8 Function Key I and II must be used together)

Function: Sets F8 to Delete character
Address: 6b8
Change: From 02 to 01
Debug: -F 6b8 L1 01
Result: Ctrl-G
WS Access: No

F8 Function Key II

Function: Sets F8 to Delete character
Address: 6b9
Change: From 11 to 01
Debug: -F 6b9 L1 01
Result: Ctrl-G
WS Access: No

F9 Function Key

Function: Sets F9 to Beginning of file
Address: 6ba
Change: From 43 to 52
Debug: -F 6ba L1 52
Result: Ctrl-QR
WS Access: No

F10 Function Key

Function: Sets F10 to End of file
Address: 6c3
Change: From 52 to 43
Debug: -F 6c3 L1 43
Result: Ctrl-QC
WS Access: No

*Michael Lasefield located the function key patch areas and provided the information.

Other

Disk Reset

Function: Prohibits disk reset
Address: 2db
Change: From 0 to ff
Debug: -F 2db L1 ff
Result: Reset never issued
WS Access: No

Default Drive

Function: Sets drive that program looks to for command files
Address: 2dc
Change: From 1 to 3
Debug: -F 2dc L1 3
Result: Drive C
WS Access: No

Non-document Mode

Function: Allows program to boot up in non-document mode
Address: 392
Change: From 0 to ff
Debug: -F 392 L1 ff
Result: Non-document mode
WS Access: N

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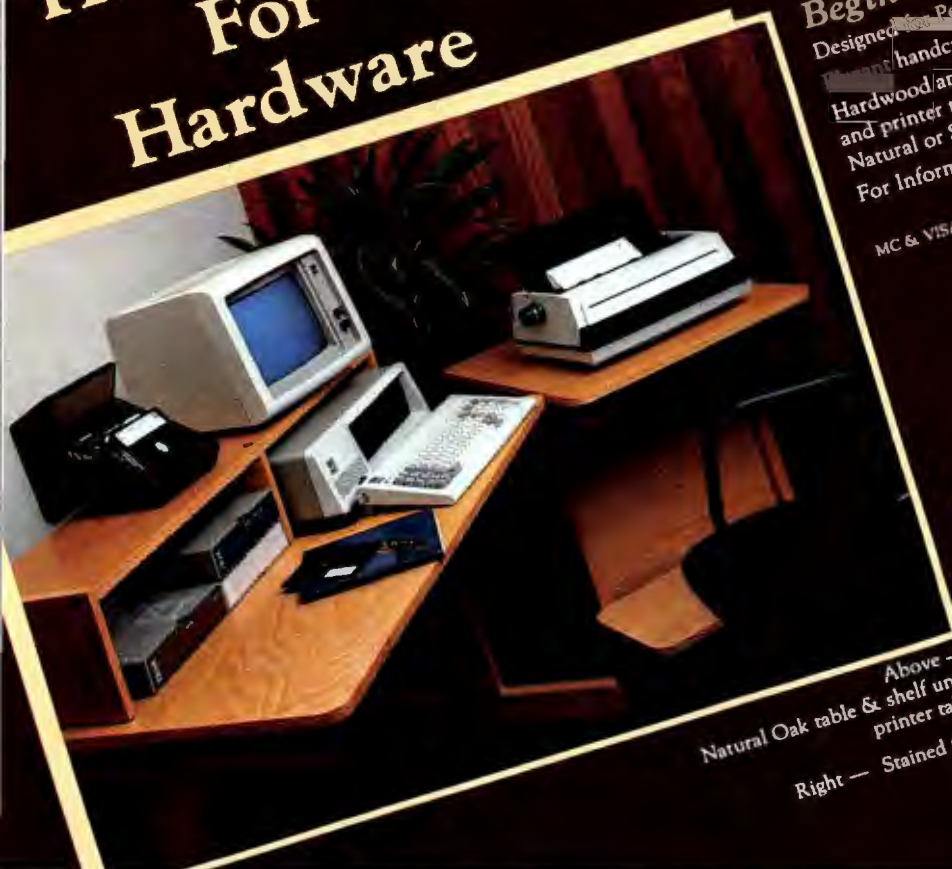
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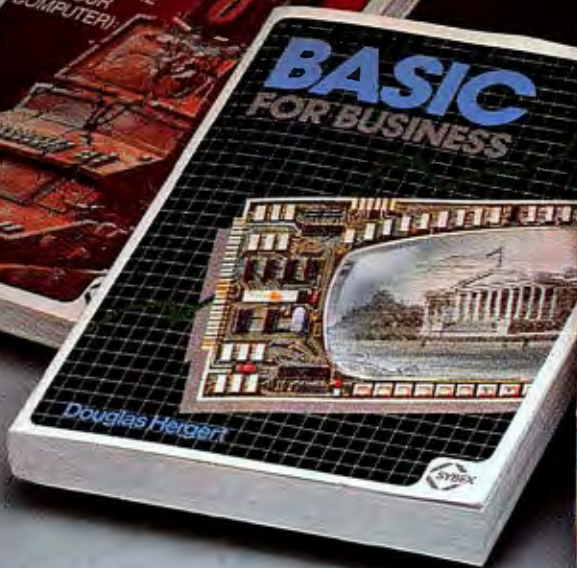
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Disk Data Files

A practical discussion of the efficient use of both sequential and random access disk data files

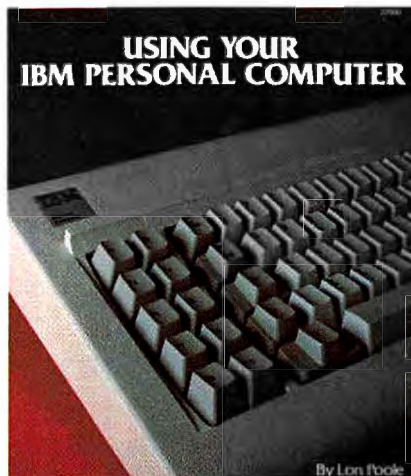
Lon Poole

The following excerpt is from the newly released book *Using Your IBM Personal Computer* (Howard W. Sams & Co., Inc., Indianapolis), a comprehensive text that takes the user from turning on the power to advanced programming in BASIC.

The book is divided into two parts. Part 1 is a detailed explanation of the most basic concepts involved in operating a PC, including thorough discussions of the disk operating system and procedures for getting packaged programs started. Part 2 teaches BASIC programming to those who have never programmed a computer. Chapter 12, excerpted here, culminates with a useful program for tracking personal inventory.

When the amount of data a program handles gets large enough, it must be organized into files and stored outside the PC dynamic memory or RAM. Disks are the most efficient media for external data storage, and most PC systems have at least one disk drive. This chapter describes how a BASIC program can store and retrieve data on disk files and it assumes you understand the material presented in Chapter 3.

Chapter 3 discusses disks and disk drives. It covers diskette selection and handling, describes what the disk



operating system is and what it does, explains what files are, and tells you how to use the most important disk commands. The statements and functions described here apply only to Disk BASIC and Advanced BASIC.

Data File Structure

Chapter 3 introduced the concept of disk files and likened them to the file drawers in a filing cabinet. Data file organization extends beyond that. Each file is further subdivided into one or more *records*, which are like the file folders in a file drawer. Each record usually contains several data values, just as file folders usually contain individual items. Each data value is called a *field*.

Typically, a file is organized so that every record has the same configura-

tion. The number of fields, their sequence, and their lengths are all the same from one record to the next. The only things that vary are the values of the fields. Therefore two things define a file's layout: the configuration of its records and the number of records it has.

Thus a list of fields in one record will adequately describe the structure of a file. Programmers often list the fields on a preprinted form and call the result a *file layout* (Fig. 12-1). The file layout usually shows the file name, states the number of records it has, and lists its fields in order. For each field, the layout shows the description, the length, and the variable name customarily used to hold its value in a BASIC program.

A single drive can only access a finite amount of data, so it's a good idea to calculate ahead of time whether enough space remains on a particular diskette for a new file you are planning. To calculate the disk space a file will require, add up the field lengths of one record and multiply the sum times the number of records in the file. Do that for every data file you plan to put on a disk and compare the total to the total disk capacity. (The PC DOS command CHKDSK, described in Chapter 3, reports disk capacity.) There must be enough room left over to

accommodate the program files that you plan to put on the same disk.

Sometimes reducing the size of a field or two will make a too-large file fit. If not, you will have to divide it into several files and distribute the smaller files among several disks. You can split a file into several volumes, putting part of its records on one disk and part on another. Or you can split up each record, putting some of its fields into a file on one disk and other fields into a file on another disk.

Sequential and Random Access

PC BASIC offers two ways of locating a desired record. The simplest is called *sequential access*, because the program must always start at the beginning of a file and examine each record in turn, until it finds the one it wants. The alternative method lets the program access records by number, in any random order. It is called *random access*.

A file may be set up to use either sequential access or random access, but not both. Each method has its pros and cons. Sequential access is much simpler to program and tends to use less disk space, but it can be slow in finding a record near the end of a long file. Also, updating existing records is difficult with sequential-access files, and may be impossible. Random-access files require more programming and usually take more disk space, but they are very easy to update and all records can be found with equal speed.

Record length in a random-access file is constant, while in a sequential-access file it need not be. In a sequential-access file, the length of a record depends directly on the value of each field. Since field values are not the same in every record, record lengths will differ. Random-access record length is set when the file is created, and each field gets a fixed amount of space on the record. Values must fit in the space allocated.

| FILE NAME | | RECORD SIZE | NO OF RECORDS |
|------------------------------------|-----------------------|-------------|---------------|
| ITEM. DAT | | 129 | |
| DESCRIPTION | | | |
| Personal inventory file—sequential | | | |
| VARIABLE | FIELD DESCRIPTION | MAX SIZE | COMMENTS |
| ITMNR\$ | Item number | 3 | |
| CTGRV\$ | Category | 10 | |
| DSCR\$(1) | Description—line 1 | 20 | |
| DSCR\$(2) | Description—line 2 | 20 | |
| DSCR\$(3) | Description—line 3 | 20 | |
| IDNBR\$ | Identification number | 15 | |
| LCN\$ | Location | 15 | |
| ACQRD\$ | Date acquired | 8 | |
| COST# | Cost | 9 | |
| VALU# | Value | 9 | |

Fig 12-1: File layout for a sample sequential-access personal inventory file

Long values are truncated and short values are padded with blank spaces. To minimize truncation, the size of each field is usually made large enough to accommodate its largest likely value.

Using Disk Data Files

To get at a particular field in a record, a program must first open the file, then locate the proper record, next transfer the record from disk to dynamic memory, and finally isolate the desired field as the value of a variable. Writing data to a file is similar, but this time the program transfers data values in the other direction, from dynamic memory to the disk file.

To reduce the number of disk accesses, PC BASIC transfers data values to and from disk in blocks, not one value at a time. It sets aside part of dynamic memory for transfer areas, called *file buffers*. Each active file has its own file buffer.

Generally, PC BASIC manages the file buffers automatically, and you do not have to be concerned about them. But when a program finishes writing to a file, there will probably be some data left in the file buffer that PC BASIC has not written to the disk. Somehow the program must force PC BASIC to write out the final buffer contents. Closing a file will write out anything left over in the file

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buffer. At the same time, it updates the disk directory with changes to the file extents or other statistics kept there. Therefore, when a program finishes with a file, it must close the file or risk losing part of the file contents.

File Names and Numbers

Data files are identified on disk by a standard file name that conforms to the DOS guidelines. Programs, though, refer to data files mainly by number. The OPEN statement correlates a file name with a file number. Here is an example:

```
1050 OPEN "B:ITEM.DAT" AS #1
```

The file name can be specified by a string constant, variable, or expression. A drive designation prefix is required unless the file is on the default drive.

The file number can be specified by a numeric constant, variable, or expression. Normally, only file numbers 1, 2, and 3 are allowed. Each file number can identify just one file at a time, so a program can have at most three files open simultaneously. A way to raise that limit is described at the end of this chapter.

A program can have fewer data files open while it uses PRINT# or PRINT# USING statements with the printer or display screen, because it must use one file/device number for each open device or file. If two devices are open (say the printer and display screen), the program can only have one data file open at the same time. However, the regular PRINT, PRINT USING, LPRINT, and LPRINT USING statements do not use file/device numbers, so a program can use those statements freely, even with all three file/device numbers assigned to data files.

The CLOSE statement frees a file/device number for re-use in a subsequent OPEN statement. Here is an example:

```
1100 OPEN "LPT1:" AS #1
7510 CLOSE #1
7520 OPEN "A:TAXRATE.DAT" AS #1
```

A CLOSE statement that lists one number, like the one above (line 7510), closes just the specified file or device it is assigned to. To close more than one file with a single CLOSE statement, you can list several file numbers, separating them with commas, like this:

```
2140 CLOSE #1,#3
```

A plain CLOSE statement that lists no file numbers will close all open files and devices. Several other BASIC statements do the same thing, including END, CHAIN (but not CHAIN MERGE), LOAD, NEW, RUN, and SYSTEM. However, most programmers prefer the positive, precise effect of a CLOSE statement with explicit file numbers listed.

Sequential Disk Files

A BASIC program can create a new sequential-access data file and store data values there, or it can add values to the end of an existing file. It can also retrieve values from an existing file. Data on a sequential-access file must be read or written in consecutive order. In order to retrieve a value from the middle of the file, a program must read past all the values that come before it. Values can only be written at the end of a sequential-access file. That means there is no way to read a value from a sequential-access file, change the value, and rewrite it in the same place on that file.

Sequential-access files use file buffers in a simple-minded way. Data sent to a sequential-access file accumulates in the file buffer. When the file buffer gets full, PC BASIC writes the whole thing at once onto the disk file, clearing the buffer for subsequent outgoing data. Going the other direction, program requests for data retrieval are filled from the file buffer, not directly from the disk surface. When the program has retrieved all the data in the buffer, PC BASIC replenishes it all at once from the disk file.

Opening and Closing Sequential-Access Files

In addition to assigning a file number to a named file, the OPEN statement determines the access mode that will be allowed with the file. For sequential-access files, a program may either write data starting at the beginning of a new file, write data starting at the end of an existing file, or read data. Table 12-1 lists the OPEN statement format that selects each access mode.

An OPEN statement with the FOR OUTPUT clause creates a new disk file with the specified file name. If a file already exists with that name, PC BASIC will automatically delete it and create a new file with the same name. An OPEN-FOR APPEND statement looks for an existing file to start at the end of, but if it finds none, it creates a new file with the

| Access mode | Sample OPEN statement formats* |
|--|---|
| Write starting at the beginning of a new sequential-access file Write starting at the end of an existing sequential-access file Read starting at the beginning of an existing sequential-access file Write or read a random access file | 1050 OPEN "B:ITEM.DAT" FOR OUTPUT AS #1 1835 OPEN "ADDRESS.DAT" FOR APPEND AS #3 2320 OPEN "A:ITEM.DAT" FOR INPUT AS #2 1040 OPEN "ITEM.DAT" AS #1 LEN = 126 |
| *The line numbers, file names, file numbers, and record length shown are all arbitrary and are for illustration only. | |

Table 12-1: OPEN statement alternatives for data files

specified name. An OPEN statement with the FOR INPUT clause must find the named data file or an error occurs.

It is possible to open a sequential-access file in append mode using one file number, and in input mode using another. But each file number uses a different file buffer, and there is no cross-communication between them. Therefore, in order to change access modes on a file, you need to close the file and reopen it. However, different files can be open simultaneously for unlike access modes.

Writing and Reading Sequential-Access Files

The PRINT# and PRINT# USING statements will write values to a disk file. INPUT# or INPUT# LINE statements will read the values back in and assign them to variables. Here is a simple example:

```
List
10 OPEN "SAMPLE.DAT" FOR OUTPUT
   AS #1
20 PRINT#1, 123 'Write value to disk file #1
30 CLOSE #1
40 OPEN "SAMPLE.DAT" FOR INPUT AS
   #1
50 INPUT#1, A 'Read value from disk file #1
60 PRINT "First value on file: ";A
70 CLOSE #1
Ok
run
First value on file: 123
Ok
```

PRINT# statements format output in exactly the same manner no matter what the output device is. They always append an extra blank space to the end of each numeric value. Other than that, semicolons concatenate neighboring values and commas introduce extra blank spaces between them. The extra blank spaces needlessly use up disk space, so semicolons are preferable.

PRINT# USING statement template characters work the same with disk files as with the display screen or printer. Use caution with monetary prefixes (\$\$, **, and **\$), because

they put numeric values into non-numeric formats. Numeric values prefixed with \$ or * characters on a disk file cannot be read back in as numeric values. The following example illustrates:

```
List
10 OPEN "SAMPLE.DAT" FOR OUTPUT
   AS #2
20 PRINT#2, USING "$$###.##";99.50
30 CLOSE #2
40 OPEN "SAMPLE.DAT" FOR INPUT AS
   #2
50 INPUT#2, A
60 PRINT "First value on file: ";A
70 CLOSE #2
Ok
run
First value on file: 0
Ok
```

In the program above, the PRINT# USING statement (line 20) sends the characters "\$99.50" (the quotation marks are not sent) to file SAMPLE.DAT. The INPUT# statement tries to read them as a numeric value, but the \$ character makes the value nonnumeric, so its numeric value is zero.

The absence of a terminal semi-colon in a PRINT# or PRINT# USING statement yields a carriage return character after the last value. A terminal semicolon suppresses the carriage return character.

Separating Values on Sequential-Access Files

In order for the INPUT# statement to read values correctly from a disk file, the values must be separated from each other on the file. That means the PRINT# and PRINT# USING statements that write values to disk files must also write a character between each value to separate it from its neighbor. Without such a delimiting character, the INPUT# statement runs neighboring values together. The following example demonstrates what can happen:

```
List
10 OPEN "TEST.DAT" FOR OUTPUT AS #3
20 PRINT#3, "Silicon";14;28.0855
30 CLOSE #3
40 OPEN "TEST.DAT" FOR INPUT AS #3
50 FOR K%=1 TO 3:INPUT#3, AS
60 PRINT "Value no." ;K%;";";AS
70 NEXT K%:CLOSE #3
Ok
run
Value no. 1 : Silicon 14 28.0855
Input past end in 50
Ok
```

The PRINT# statement (line 20) writes three values, but the semi-colons that separate them cause them to be run together on the file. When the INPUT# statement tries to read them (line 50), they all come back combined into one value. There is no second or third value on the file, so an error occurs when the program tries to read past the last value on file.

For string values, the delimiting character can be a comma or a carriage return. Those same characters or blank spaces will delimit numeric values. There are any number of ways to make sure a delimiting character occurs between values. One of the simplest is to assign a comma to a string variable and write that variable between every value in a PRINT# statement, like this:

```
5 D$=","
20 PRINT#3, "Silicon";D$;14;D$;28.0855
```

The INPUT# statement interprets every comma it encounters as the end of a value. The only exception is a comma that is enclosed in quotation marks on the file itself. In other words, quotation marks must be written to the disk file around any string value that might contain a comma. The INPUT# statement will eliminate the quotation marks from the value. Here is an example:

```
List
10 OPEN "TEST.DAT" FOR OUTPUT AS
   #1
20 PRINT#1, CHR$(34);"Managua,
   Nicaragua"; CHR$(34)
```

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```
30 CLOSE #1
40 OPEN "TEST.DAT" FOR INPUT AS #1
50 INPUT#1, AS
60 PRINT "First value on file: ";AS
70 CLOSE #1
Ok
run
First value on file: Managua, Nicaragua
Ok
```

Ignoring Disk Field Delimiters

A related problem arises with a PRINT# USING statement that has a comma included in a numeric template. A single numeric value written with such a template ends up being several values on the disk file. Here is an example:

```
List
10 OPEN "SAMPLE.DAT" FOR OUTPUT
   AS #2
20 PRINT#2, USING
   "###,#####"; 123456789
30 CLOSE #2
40 OPEN "SAMPLE.DAT" FOR INPUT AS
   #2
50 INPUT#2, A
60 PRINT "First value on file: ";A
70 CLOSE #2
Ok
run
First value on file: 123
Ok
```

The LINE INPUT# statement, which reads a single string value, sidesteps the comma problem by only recognizing carriage returns as value separators. Commas are just another string character. Here is an example:

```
List
10 OPEN "SAMPLE.DAT" FOR OUTPUT
   AS #3
20 PRINT#3, "Stine, Frank N."
30 CLOSE #3
40 OPEN "SAMPLE.DAT" FOR INPUT AS
   #1
50 LINE INPUT#1, AS
60 PRINT "First value on file: ";AS
70 CLOSE #1
Ok
run
First value on file: Stine, Frank N.
Ok
```

Recognizing the End of the File

An INPUT# or INPUT# LINE statement that tries to read past the end of a sequential-access file causes an error. To avoid that error, the program must somehow recognize when it has read the last value from the file and stop reading at that point. An EOF function in a WHILE or IF-THEN statement provides the easiest way to do that. Here is an example:

```
1850 IF NOT EOF(1) THEN 1700 ELSE CLOSE #2
```

The numeric value in parentheses specifies the file number. The EOF function returns a value of false (numeric 0) as long as there are more values left, but it returns a value of true (numeric-1) after the last value has been read.

Using Sequential-Access

Data Files

Sequential access will work for most data files, though it is certainly less convenient than random access for files that must be updated periodically. But it is adequate for files with static contents, or for files which only have new records added to them from time to time. For example, a simple program that keeps track of major personal possessions is unlikely to change frequently. Fig. 12-1 presents a layout for such a file, and Fig. 12-2 lists a program that stores personal inventory records on a sequential-access disk file. Fig. 12-3 lists a program that reads back the records created by the program in Fig. 12-2 and displays them one at a time on the screen.

Personal Inventory File Creation Program Analysis

The personal inventory creation program (Fig. 12-2) begins by asking the user whether he wishes to add records to the existing file, or start a new file (lines 1030 and 1040). Depending on the user's response, the program opens file ITEM.DAT using

the FOR OUTPUT or FOR APPEND access mode (line 1050). Variable D\$ contains a comma for delimiting values written to the disk file (line 1060). The program uses two PRINT# statements to write each record on the sequential-access disk file (lines 1800 and 1810). After the user finishes entering items, he has a choice of reviewing the whole file or ending the program altogether (lines 2000-2040).

To keep the program simple, the keyboard entry phase is crude (lines 1400 through 1520).

Personal Inventory File Review Program Analysis

The personal inventory file review program (Fig. 12-3) displays one record at a time on a display screen form. The program starts by opening file ITEM.DAT for input (line 1030). Then until it finds the end of the file (line 1200), it reads the values in the next record (lines 1210 and 1220). It displays the screen form (lines 1300-1360) and the values it just read (lines 1400-1490). After that, the program asks whether it should continue with the next item (lines 1900-1930). If so, it continues reading records; if not, it ends.

Random-Access Files

PC BASIC has a special set of statements designed to read and write random-access files. The only familiar statements are OPEN and CLOSE. There are new statements to use instead of PRINT# for output and INPUT# for input. Another new statement declares which variables will identify field values, and there are even special statements and functions for assigning those variables new values.

Random-access files use file buffers to minimize the number of disk accesses. A file buffer is always large enough to hold one record, sometimes more. When a program wants a certain record, PC BASIC first looks to see if that record is in the file


```

990 '--Open file-----
1000 CLS:KEY OFF:WIDTH 40
1020 PRINT "Personal Inventory Program--Entry phase"
1030 PRINT "Erase existing file? (Y/N)"
1040 INPUT;"",NTRY$
1050 IF NTRY$="Y" OR NTRY$="y" THEN OPEN "ITEM.DAT" FOR OUTPUT AS #1
ELSE OPEN "ITEM.DAT" FOR APPEND AS #1
1060 D$="," 'Delimiting comma for file output
1390 '--Enter all items in sequence-----
1400 CLS
1410 PRINT "Personal Inventory Program--Entry Phase"
1420 LOCATE 5,1
1430 INPUT "Item number";ITMNR$
1440 INPUT "Category";CTGRY$
1450 INPUT "Description-1";DSCR$(1)
1460 INPUT "Description-2";DSCR$(2)
1470 INPUT "Description-3";DSCR$(3)
1480 INPUT "ID number";IDNBR$
1490 INPUT "Location";LCN$
1500 INPUT "Date acquired";ACQRD$
1510 INPUT "Cost";COST$
1520 INPUT "value";VALU$
1790 '--Output one record to data file-----
1800 PRINT#1,ITMNR$;D$;CTGRY$;D$;DSCR$(1);D$;DSCR$(2);D$;DSCR$(3);D$;
1810 PRINT#1,IDNBR$;D$;LCN$;D$;ACQRD$;D$;COST$;D$;VALU$
1890 '--Continue with entries?-----
1900 LOCATE 2,1
1910 PRINT "Enter another item? (Y/N)"
1920 INPUT;"",NTRY$
1930 IF NTRY$<>"N" OR NTRY$<>"n" THEN 1400
1940 CLOSE #1 'no more entries this time
1990 '--Review file contents?-----
2000 CLS
2010 PRINT "Personal Inventory Program-Review Phase"
2020 PRINT "Review file contents? (Y/N)"
2030 INPUT;"",NTRY$
2040 IF NTRY$="Y" OR NTRY$="y" THEN CHAIN "12-3",1000,DELETE 1000-7000
2090 '--End of program-----
2100 CLS
2110 PRINT "Personal Inventory Program--Ended";TAB(39);
2120 PRINT TAB(5);TIME$;TAB(15);DATE$
2130 END
7000 REM End of CHAIN-DELETE range (see line 2040)

```

Fig. 12-2: Personal inventory creation program—sequential-access output

```

1000 CLS:KEY OFF:WIDTH 40
1010 PRINT "Personal Inventory Program-Review phase"
1030 OPEN "ITEM.DAT" FOR INPUT AS #1
1190 '--Input next record from file-----
1200 WHILE NOT EOF(1)
1210 INPUT#1,ITMNR$,CTGRY$,DSCR$(1),DSCR$(2),DSCR$(3)
1220 INPUT#1,IDNBR$,LCN$,ACQRD$,COST$,VALU$
1290 '--Display review form-----
1300 CLS
1310 PRINT "Personal Inventory Program-Review phase"
1320 RESTORE 7000
1330 FOR ROW%=5 TO 14
1340 READ COL%,LABEL$
1350 LOCATE ROW%,COL%:PRINT LABEL$;STRING$(13-LEN(LABEL$),".")
1360 NEXT
1390 '--Display all values-----
1400 LOCATE 5,18:PRINT ITMNR$
1410 LOCATE 6,18:PRINT CTGRY$
1420 LOCATE 7,18:PRINT DSCR$(1)
1430 LOCATE 8,18:PRINT DSCR$(2)
1440 LOCATE 9,18:PRINT DSCR$(3)
1450 LOCATE 10,18:PRINT IDNBR$
1460 LOCATE 11,18:PRINT LCN$
1470 LOCATE 12,18:PRINT ACQRD$
1480 LOCATE 13,18:PRINT USING "#####.##";COST$
1490 LOCATE 14,18:PRINT USING "#####.##";VALU$
1890 '--Continue with entries or end program?-----
1900 LOCATE 2,1:PRINT "Review another item? (Y/N)";TAB(40)
1910 LOCATE 3,1:PRINT TAB(40) 'Erase stale text
1920 LOCATE 3,1:INPUT;"",NTRY$
1930 IF NTRY$="N" OR NTRY$="n" THEN 2100
1940 WEND
2090 '--End of program-----
2100 CLS
2110 PRINT "Personal Inventory Program--Ended"
2120 PRINT TAB(5);TIME$;TAB(15);DATE$
2130 CLOSE #1
2140 END
6980 '---locations and labels-----
6990 ' for entry form
7000 DATA 4,Item number,4,Category,4,Description-1,4,Description-2,4,
Description-3,4,ID number,4,Location,4,Date acquired,4,Cost,4,Value

```

Fig. 12-3: Personal inventory review program—sequential-access input

buffer. If so, no disk access is necessary. If not, it transfers the contents of the buffer back to its proper spot on the disk and then transfers the desired record into the file buffer.

Opening Random-Access Files

Opening a file for random access assigns it a file number and establishes the length of each record on the file. All records in a single file must have the same length. Here is an example:

```
1010 OPEN "ITEM.DAT" AS #1 LEN=128
```

The absence of a clause between the file name and the AS specification in an OPEN statement means the file will be opened for random-access mode, which allows both reading and writing. Such an OPEN statement must include a LEN clause, which specifies the record length.

All records in a random-access file have the same fixed length. It is important to specify the record length correctly in order to avoid garbling the file contents. Normally, the maximum record length is 128 bytes, but there is a way to increase that, as explained at the end of this chapter.

To compute the length of a record, add up the lengths of the fields in it. Allow two characters for an integer field, four characters for a single-precision field, and eight characters for a double-precision field. For a string field, use the maximum number of characters you plan to allow its value to have. Write these numbers on the file layout you prepare (Fig. 12-4).

Declaring Record Structure

After opening a random-access file, a program must declare the structure of the file's records. The FIELD statement does that. Here is an example:

```
1020 FIELD #2,3 AS I$,10 AS C$,10 AS D$(1)
```

The field statement identifies the file it pertains to by number, as usual. Then it lists the fields in the order

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that they appear on the file. For each field, it states the length and names a variable that the program will use to identify the field. All fields for a single file must be listed in one FIELD statement, separated by commas.

The total length of all fields declared by a FIELD statement must not exceed the record length established by the corresponding OPEN statement. If it does, an error occurs.

All values are transferred to and from a random-access file via the variables listed in a FIELD statement. All variables listed in a FIELD statement must be string variables. The FIELD statement effectively defines fixed lengths for each of the variables listed in it. Numeric values have to be converted to string values using special functions, a process which will be described shortly.

Using FIELD Statement Variables

Two special statements, LSET and RSET, are used to assign values to the variables defined in the field statement. Here are examples:

```
5340 RSET DAT$ = NTRY$
```

```
5550 LSET LCN$ = BLDG$ + ROOM$
```

Never use a variable listed in a FIELD statement in an INPUT statement of any kind. Never assign such a variable a value in a LET statement (with or without the command word LET present). Breaking either rule cancels the association that the FIELD statement established, so that the program can no longer use the variable to transfer a value to and from random-access file records.

The LSET and RSET statements guarantee that the variable's length will exactly match its FIELD statement definition. If the value assigned is too short, it is padded with blank spaces. The LSET statement aligns the value on the left, padding with extra blanks on the right, and the RSET statement does the opposite. If

| FILE NAME | | RECORD SIZE | NO. OF RECORDS |
|---------------------------------------|-----------------------|-------------|----------------|
| ITEM. DAT | | 126 | 10 |
| DESCRIPTION | | | |
| Personal inventory file—random access | | | |
| VARIABLE | FIELD DESCRIPTION | MAX. SIZE | COMMENTS |
| ITMNR\$ | Item number | 2 | ITMNR% |
| CTGRY\$ | Category | 10 | |
| DSCR\$(1) | Description—line 1 | 20 | |
| DSCR\$(2) | Description—line 2 | 20 | |
| DSCR\$(3) | Description—line 3 | 20 | |
| IDNBR\$ | Identification number | 15 | |
| LCN\$ | Location | 15 | |
| AC2RD\$ | Date acquired | 8 | |
| COST\$ | Cost | 8 | COST# |
| VALU\$ | Value | 8 | VALU# |

Fig. 12-4: File layout for a sample random-access personal inventory file

the value assigned is too long, both LSET and RSET drop characters from the right. The following example uses the RSET statement to illustrate.

List

```
10 OPEN "SAMPLE.DAT" AS #1
   LEN = 20
20 FIELD #1, 10 AS A$
30 RSET A$ = "DISK"
40 PRINT A$
run
   DISK
Ok
```

Numeric Values on Disk Files

In order to store numeric values on a random-access file, they need to be converted to numeric strings. PC BASIC has three functions ideally suited to the job.

The MKI\$, MKS\$, and MKD\$ functions make numeric values into integer, single-precision, and double-precision string values respectively. MKI\$ always returns a two-character string, MKS\$ a four-character string, and MKD\$ an eight-character string. For large values, they achieve a considerable savings in string length over any other conversion functions.

The MKI\$, MKS\$, and MKD\$ functions do not convert numeric values to their ASCII character equivalents, as the other conversion functions do. Instead, they pack the values into two, four, or eight characters using the same scheme the PC uses to represent numeric values in dynamic memory. Therefore, you cannot print or display the results of

an MKI\$, MKS\$, or MKD\$ function with a PRINT statement.

The converted numeric values must still be assigned to file variables using the LSET or RSET statements, like this:

```
4700 LSET COST$=MKD$(NTRY#)
```

Numeric string values generated by the MKI\$, MKS\$, and MKD\$ functions can be converted back to numeric values by the CVI, CVS, and CVD functions, respectively.

Writing to Random-Access Files

When a program is ready to write an entire record out to a random-access file, it must use a PUT# statement. Here is an example:

```
1550 PUT #1,ITMNR%
```

The first value in a PUT# statement specifies the file number and the second value specifies the record number. The record number is optional; if it is omitted, PC BASIC uses a record number one higher than the last record number used with the same file number.

Reading From a Random-Access File

The GET# statement reads an entire random-access record. After that, the program can use the variables named in the FIELD statement to get at the field values. Here is an example:

```
4020 GET#1, ITMNR%
```

The first value in a GET# statement is the file number and the second value is the record number. If the record number is absent, PC BASIC uses a record number one higher than the last record number used with the same file number.

End of File

Programs can read or write past the nominal end of a random-access file without a direct error. If a GET# statement specifies a record higher than any ever written by a PUT# statement to that file, PC BASIC

assigns each character of every field variable a character code number of 0. (The CVI, CVS, and CVD functions all convert that to a numeric 0.) A PUT# statement that specifies a record number higher than any on the file increases the file size enough to accommodate the specified record. Any unused records between it and the former highest record will contain garbage. A GET# statement that retrieves one of those intermediate records will get garbage, which may cause errors elsewhere in the program. Therefore, programs should take steps to restrict the record numbers that will be accessed.

A random-access file has no length restrictions except the amount of disk space remaining. The LOF function tells you how much space the file is taking, to the nearest 128 bytes.

The LOC function identifies the current record number, that is, the record number last used in a GET# or PUT# statement to the specified file. Here is an example:

```
1650 IF LOC(1)=150 THEN CLOSE:END
```

The value in parentheses specifies the file number.

Trapping Errors

Using disk data files makes a program vulnerable to several errors that will stop it prematurely. For example, when a diskette fills up, the message "Disk full..." appears, files are closed automatically, and the program stops. Or suppose someone mistakenly puts a write-protect label on a diskette that the program needs to write on. In that case, the message "Disk Write Protected..." appears and the program stops.

A BASIC program can take control of more than 70 errors (not all of them disk-related, to be sure) that would otherwise disrupt program execution. The ON ERROR GOTO statement makes that possible. It stipulates a line number to which PC BASIC will branch should it detect an error later. Here is an example:

```
ON ERROR GOTO 30000
```

Most programmers place a statement like the one above in the first

part of a program and put a special routine at the specified line number to handle the errors that occur. The action taken by the error-handling routine depends on the nature of the error. For a disk write-protect error, it might give the program user a choice of ending the program or fixing the problem and retrying the operation.

The error-handling routine can test the value of function ERR to determine what kind of error occurred. Errors are classified by number, and Appendix C has a list of error numbers and interpretations. Sometimes the error number alone is not enough. For example, a program that opens more than one file risks a separate write-protect error at each OPEN statement, and it may need to handle each one differently. The ERL function divulges the line number where the last error occurred, so a program can use it to differentiate between errors that have the same code.

The error-handling routine must conclude with a RESUME statement. If the program executes a STOP, END, or RETURN statement first, an error occurs. The RESUME statement has three forms. The simplest is the solitary command word, and it terminates the error-handling routine by branching back to the very statement that caused the error. Another option is the RESUME NEXT statement, which branches back to the statement after the one that caused the error. The third alternative lets you specify a line number to branch to, like this:

```
RESUME 30100
```

You certainly will not want to write an error-handling routine that attends individually to each of the more than 70 error codes. Fortunately, PC BASIC will take over error recovery if the program executes an ON ERROR GOTO 0 statement during the error-handling routine. In that case, program execution halts and the standard message appears for the error that occurred.

PC BASIC can only cope with one error at a time. If an ON ERROR

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GOTO statement sends a program into an error-handling routine in which a second error occurs, the second error will not be trapped, but will cause an error message to appear and the program to halt.

Using Random-Access

Data Files

The two personal inventory programs described earlier in this chapter can be improved by using a random-access file. That allows immediate updating of volatile information like location and value. The file layout in Fig. 12-4 describes the file structure, and the program listed in Fig. 12-5 will create new records, review existing records, and allow changes to be made to existing records.

Improved Personal Inventory Program Analysis

The improved personal inventory program (Fig. 12-5) includes a general input subroutine that announces entry errors (lines 190-470).

The main program starts by setting up the display screen (lines 1000 and 1010) and assigning a couple of variables (lines 1020 and 1030). Variable FILSIZ% sets the maximum number of records in file ITEM.DAT. Variable RETKEY\$ contains the characters needed to display a facsimile of the symbol printed atop the ENTER key.

Next the program opens the file ITEM.DAT, the inventory file, for random access and defines the field variables (lines 1040 and 1050). If the file is empty, the program initializes every record by setting the item number to -1 (lines 1060 through 1140). If the disk should become full in the process, that error is trapped (line 1090). An error handling routine (lines 900 through 960) reopens the file and bypasses further initialization. After all records have been

```

20 GOTO 1000 'Jump to start of main program
190 '==General input subroutine=====
200 LOCATE INROW%,INCOL%,1:PRINT STRING$(INLEN%,INTMPL$); ' Display template
210 LOCATE INROW%,INCOL%,1 'Set cursor for entry
220 NTRY$="" ' Clear stale entry
230 K$=INKEY$:IF LEN(K$)=0 THEN 230 ELSE K$=ASC(K$) ' Wait for a keystroke
240 IF K$=13 THEN 300 ' <--' ends entry
250 IF K$=8 THEN 350 ' Backspace
260 IF LEN(NTRY$)=INLEN% THEN 230 'Entry full?
270 IF K$>31 OR (K$<28 AND K$>13) OR (K$<8 AND K$>0) THEN PRINT K$;
    :NTRY$=NTRY$+K$ ELSE BEEP 'If keystroke ok, echo it; otherwise ignore it
280 GOTO 230 ' Get another character
290 '---Done; check numeric range-----
300 NTRY$=VAL(NTRY$) ' convert to numeric
310 IF NTRY$>INMAX% THEN ERM$="smaller":GOTO 400 ' too big
320 IF NTRY$<INMIN% THEN ERM$="larger":GOTO 400 ' too small
330 RETURN
340 '---Backspace 1 character-----
350 IF LEN(NTRY$)=0 THEN 230 ' Not if entry is empty
360 PRINT CHR$(29);LEFT$(INTMPL$,1);CHR$(29); 'Redisplay template
370 NTRY$=LEFT$(NTRY$,LEN(NTRY$)-1) ' Delete last character
380 GOTO 230 ' Get another character
390 '---Flash error message 3 times-----
400 FOR X1%=1 TO 3
410 LOCATE INROW%,INCOL%,0:PRINT LEFT$(ERM$,INLEN%); 'Display message
420 BEEP
430 FOR X2%=1 TO 50:NEXT 'Pause
440 LOCATE INROW%,INCOL%,0:PRINT SPACE$(INLEN%); 'Erase message
450 FOR X2%=1 TO 50:NEXT 'Pause
460 NEXT X1%
470 GOTO 200 'Restart entry
890 '---Error handling routine-----
900 IF ERR=61 AND ERL=1120 THEN 950
910 ON ERROR GOTO 0 'Handle misc. errors
920 STOP: GOTO 910
940 ' Disk full; reopen file
950 OPEN "item.dat" AS #1 LEN=126
960 FILSIZ%=FIX(LOF(1)/126)
970 PUT #1,FILSIZ%
980 RESUME 1140
990 '++Start of main program+++++
1000 CLS:KEY OFF:WIDTH 40
1010 PRINT "Personal Inventory Program--File changes"
1020 FILSIZ%=10 'Set max. no. of records for new file
1030 RETKEY$=CHR$(17)+CHR$(196)+CHR$(217) 'Facsimile of <--' key
1040 OPEN "ITEM.DAT" AS #1 LEN=126
1050 FIELD #1, 2 AS ITMNR$, 10 AS CTGRY$, 20 AS DSCR$(1), 20 AS DSCR$(2),
    : 20 AS DSCR$(3), 15 AS IDNBR$, 15 AS LCN$, 8 AS ACQRD$, 8 AS COST$, 8 AS VALU$
1060 IF LOF(1)>0 THEN 1200
1070 '---Initialize empty file-----
1080 PRINT "Please stand by for file initialization"
1090 ON ERROR GOTO 900 'Trap full disk error
1100 LSET ITMNR$=MKI$(-1) 'Initialize all records to item no. -1
1110 WHILE LOC(1)<FILSIZ%
1120 PUT #1
1130 LOCATE 5,10:PRINT "Item":LOC(1);"initialized";
1140 WEND
1150 '---Wait for user to read screen-----
1160 LOCATE 7,1:PRINT "That is the highest usable item number"
1170 LOCATE 9,6,1:PRINT "Press space bar to continue";
1180 K$=INKEY$:IF K$<>" " THEN 1180
1190 '---Input number of record to change or enter-----
1200 CLS
1210 PRINT "Personal Inventory Program--File changes"
1220 LOCATE 2,1:PRINT "Enter item number (Type END to quit).";
1230 LOCATE 3,4:PRINT " (Press :RETKEY$;" alone for next item).";
1240 INLEN%=3:INMAX%=FILSIZ%:INMIN%=0:INROW%=3:INCOL%=1:INTMPL$="*":GOSUB 200
1250 IF NTRY$="end" OR NTRY$="END" THEN 2100 'End program
1260 IF NTRY$>0 THEN ITMNR$=NTRY$:GOTO 1280
1270 IF NTRY$=0 AND LOC(1)<FILSIZ% THEN ITMNR$=LOC(1)+1 ELSE BEEP: GOTO 1240
1280 GET #1,ITMNR$ 'Retrieve requested record
1290 '---Display entry form-----
1300 RESTORE 7000
1310 FOR ROW%=5 TO 14

```

Fig. 12-5: Personal inventory program—random access

initialized, the program pauses to let the user read the highest usable item number off the screen (lines 1160 through 1180).

When the inventory file is ready, the program asks the user for the first item number (lines 1200 through 1240) and retrieves the corresponding inventory record (lines 1260 and 1280). If the user makes no entry other than pressing the ENTER key, the program automatically retrieves the next record (lines 1270 and 1280). If the user enters the word "END" or "end," the program ends (line 1250).

If the record has never been used before, it will have an item number of -1 (thanks to the initialization of new files on lines 1060 through 1140). In that case, the program has the user enter all values before asking for changes (lines 1400 through 1440). Otherwise, it displays the values read from the disk file (lines 1460 through 1550).

With the record's current values on display, the program lets the user


```

1320 READ COL$,LABEL$
1330 LOCATE ROW$,COL$:PRINT LABEL$;STRING$(13-LEN(LABEL$),".")
1340 NEXT
1370 "--Enter values (new records) or display values (existing records)---
1380 IF CVI(ITEMNR$)>0 THEN 1460 'Is record not blank?
1390 "--Enter all values in sequence-----
1400 LOCATE 5,22:PRINT "(New item)"
1410 FOR N$=1 TO 10
1420 GOSUB 4000
1430 NEXT
1440 GOTO 1600 'Skip redisplaying values
1450 "--Display existing values-----
1460 LOCATE 5,18:PRINT CVI(ITEMNR$)
1470 LOCATE 6,18:PRINT CTGRY$
1480 LOCATE 7,18:PRINT DSCR$(1)
1490 LOCATE 8,18:PRINT DSCR$(2)
1500 LOCATE 9,18:PRINT DSCR$(3)
1510 LOCATE 10,18:PRINT IDNBR$
1520 LOCATE 11,18:PRINT LCN$
1530 LOCATE 12,18:PRINT ACORD$
1540 LOCATE 13,18:PRINT USING "#####.##";CVD(COST$)
1550 LOCATE 14,18:PRINT USING "#####.##";CVD(VALU$)
1590 "--Allow changes to entries-----
1600 N$=2 'Start pointer at item 2
1610 LOCATE 2,1:PRINT "To input entry pointed to, press ";CHR$(26);" key."
1620 PRINT CHR$(24);" and ";CHR$(25);" move pointer. End key exits."
1630 LOCATE N$+4,2,0:PRINT CHR$(16); 'Display pointer
1640 K$=INKEY$:IF LEN(K$)=0 THEN 1640 'Wait for keystroke
1650 PRINT CHR$(29);" "; 'Erase pointer
1660 "--Ignore meaningless keys
1670 IF LEN(K$)<>2 THEN BEEP:GOTO 1630 ELSE K$=ASC(RIGHT$(K$,1))
1680 IF K$=77 THEN GOSUB 4000:GOTO 1610 'right arrow
1690 IF K$=79 THEN 1800 'End key struck
1700 IF K$=72 AND N$>2 THEN N$=N$-1:GOTO 1630 'Up arrow
1710 IF K$=80 AND N$<10 THEN N$=N$+1:GOTO 1630 'Down arrow
1720 BEEP:GOTO 1630 'Meaningless key struck
1790 "--Output one record to data file-----
1800 PUT#,ITEMNR$
1810 GOTO 1200
2090 "--End program-----
2100 CLS
2110 PRINT "Personal Inventory Program--Ended";TAB(39);
2120 PRINT TAB(5);TIME$;TAB(15);DATE$
2130 CLOSE #1
2140 END
3990 "--Input entry number N$-----
4000 LOCATE 2,1,0:PRINT "Type over the template.";TAB(40)
4010 LOCATE 3,1:PRINT "Press ";RETKEY$;" to end entry.";TAB(40)
4020 INMAX$=10+20:INMIN$=-INMAX$:INROW$=N$+4:INCOL$=18:INTMPL$=""
4030 ON N$ GOTO 4100,4200,4300,4300,4300,4400,4500,4600,4700,4800
4090 "--Item number-----
4100 LOCATE INROW$,INCOL$:PRINT ITEMNR$
4110 LSET ITEMNR$=MKI$(ITEMNR$):RETURN
4120 PRINT SPACE$(INLEN$-LEN(ITEMNR$));:RETURN
4190 "--Category-----
4200 INLEN$=10:GOSUB 200:LSET CTGRY$=NTRY$:GOTO 4120
4290 "--Description 1, 2, & 3-----
4300 INLEN$=20:GOSUB 200:LSET DSCR$(N$-2)=NTRY$:GOTO 4120
4390 "--ID number-----
4400 INLEN$=15:GOSUB 200:LSET IDNBR$=NTRY$:GOTO 4120
4490 "--Location-----
4500 INLEN$=15:GOSUB 200:LSET LCN$=NTRY$:GOTO 4120
4590 "--Date acquired-----
4600 INLEN$=8:GOSUB 200:LSET ACORD$=NTRY$:GOTO 4120
4690 "--Cost-----
4700 INMAX$=999999.99$:INMIN$=0:INLEN$=9:GOSUB 200:LSET COST$=MKD$(NTRY$)
4710 "--Redisplay numeric entry-----
4720 LOCATE INROW$,INCOL$:PRINT USING "#####.##";NTRY$;:RETURN
4790 "--Value-----
4800 INMAX$=999999.99$:INMIN$=0:INLEN$=9:GOSUB 200:LSET VALU$=MKD$(NTRY$)
4810 GOTO 4720
6980 "--locations and labels-----
6990 ' for entry form
7000 DATA 4,Item number,4,Category,4,Description-1,4,Description-2,4,
Description-3,4,ID number,4,Location,4,Date acquired,4,Cost,4,Value

```

Fig. 12-5: (continued)

change any one except the item number (lines 1610 through 1720). Item number changes are prohibited to protect the integrity of the file. The user selects the entry to change with the cursor control keys. When the user finishes making changes, the program writes the record (line 1800) and branches back to get another item number.

Notice that the program never uses the field variables with INPUT statements, nor does it assign any of them values with LET statements.

Changing Disk File Limits

PC BASIC normally establishes a limit on the number of files and devices that can be open at the same time (three), and another limit on the maximum length of a random-access record (128 characters). These limits can be changed at the time PC DOS hands over control of the PC to either the Disk BASIC or Advanced BASIC interpreter.

To change the maximum number of concurrently open files and devices, suffix the PC DOS command BASIC or BASICA with a blank

space, the characters "/F:" and the number of files and devices you need to have open simultaneously. Here is an example:

A>basica /f:5

The command above would start Advanced BASIC with an allowance for five files and devices open at the same time. The absolute maximum number is 15.

The maximum length of random-access records equals the file buffer size. You can change the file buffer size by suffixing the PC DOS command BASIC or BASICA with a blank space, the characters "/S:" and the buffer size you want. For example:

B>a:basic /s:512

The command above would start Disk BASIC with a file buffer size of 512 bytes (characters). The maximum file buffer size is 32767. IBM recommends 512 for best results with its diskette drives.

You may combine the effect of the two options described above by including both suffixes at the end of the BASIC or BASICA command, in either order. Here is one possibility:

A>basic /f:5 /s:512

Requisitioning additional file positions or larger file buffers has a price. Each file position appropriates dynamic memory in the amount of 190 bytes plus the size of the file buffer, which is 128 bytes unless changed as described above. Thus, increasing the number of files that can be open or increasing the file buffer size (or both) will decrease the amount of dynamic memory available for program statements and variables.

Lon Poole lives in Oakland, California, and has been writing about personal computers since 1976. He is the author of such books as Some Common BASIC Problems, Apple II Users Guide, and Your Atari Computer.

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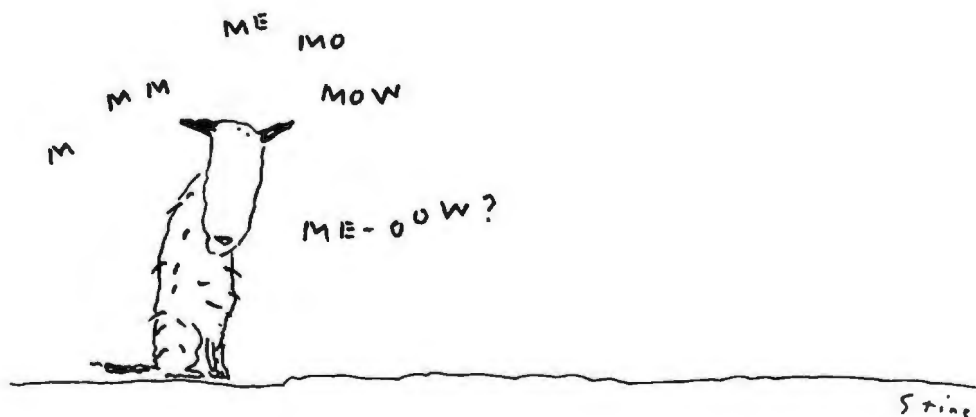


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Getting Acquainted with Graphics

The first in a series of tutorials that divulge everything you might want to know about graphics for the IBM PC

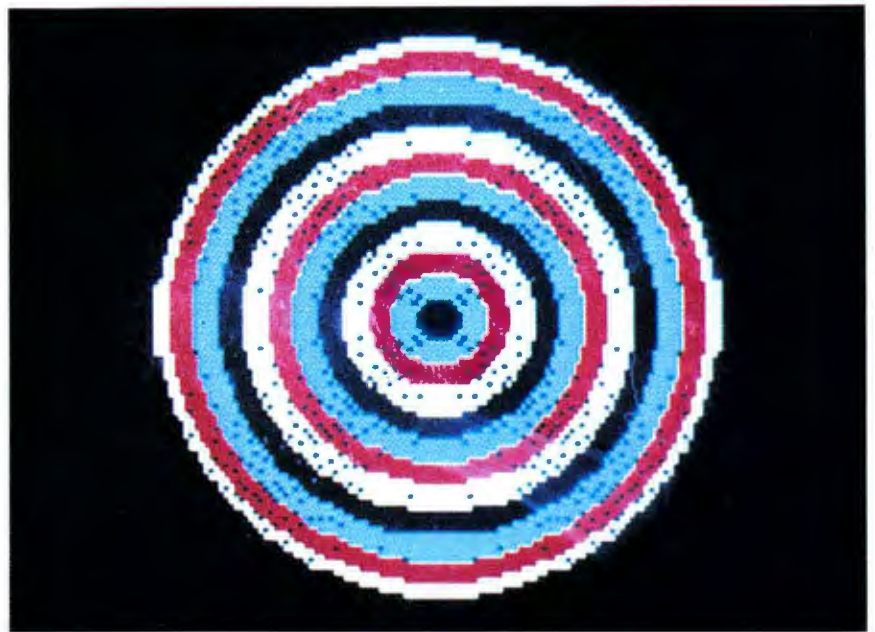
Dan Illowsky and Michael Abrash

You read that your IBM PC has top-notch graphics capabilities, so you purchased the color/graphics adapter. Unfortunately, all you've been able to run is *Donkey* and *Colorbar*, which have proven less than satisfying. Where are the stunning graphics promised in the reviews? And what's your next step in tapping the power of the PC?

Rest assured that yours is, indeed, a machine of enormous graphics potential. The graphics capabilities of the IBM BASIC language are exceptional. When all is said and done, the IBM PC should be able to meet almost all general graphics applications. Of course, if your needs extend to such esoteric uses as real-time three-dimensional imaging, specialized hardware is required. But as Microsoft's *Flight Simulator* shows, the PC can serve remarkably well even there.

Color/Graphics Applications

The applications for the PC's graphics capability range from practical to dazzling. A great deal more information can be conveyed through colors and forms than through words alone. The PC can be used to create slides, pictures, charts, or graphs, but less obvious applications also exist. A flashing red star, for example, is a far more effective warning of the impending erasure of a file than 'ERASE ALL?' In another instance, charts and graphs can be used to answer



An example of medium-resolution graphics using the colors from palette 1 on a black background

"what if?" questions dynamically, providing instant and readily understood feedback.

If these possibilities don't address your needs, there are always games. Whether you want to play them or write them, video games are often irresistible, always entertaining, and occasionally even lucrative.

A Tutorial

To develop your ability to apply the color and graphics capability of the PC to your needs, this step-by-step tutorial will start with the fundamentals of graphics from the BASIC language, building from this base to

a thorough exploration of color graphics on the PC. You'll learn about some of the PC's hardware and software requirements and the available modes of graphics operation, and explore the BASIC graphics commands.

Along the way we'll provide a liberal number of demonstration programs, which you can study, run, and modify to suit your needs. This is not a package of applications programs ready to run, but a reference volume designed to lead you into the world of color graphics and to provide ongoing support for your work.

Graphics Hardware

The hardware required for graphics is simply a color/graphics adapter and a display screen. The color/graphics adapter is to be distinguished from the monochrome board, which operates in tandem with the familiar IBM green phosphor display. The monochrome board has no graphics capability other than characters and no color capability. The color/graphics adapter, on the other hand, has true graphics capabilities. It can provide high-resolution images and up to 16 colors (although not both at once), and it can handle text and graphics simultaneously.

The display needed for graphics output may be an ordinary TV (which will require an RF modulator costing about \$30), or a black-and-white, composite color, or RGB monitor. A TV is adequate for graphics but is barely acceptable for text work, even in the 40-column mode. Sometimes the two left columns of the display aren't visible on a TV. Refer to your DOS manual for the DOS command mode that will correct it.

For graphics and extensive text work a high-quality RGB monitor or a monochrome screen is a better choice than a TV. A standard black-and-white monitor, such as those made by NEC or Sanyo, is an excellent choice for those on a budget. Such a monitor is more than adequate for text work and can also display black-and-white graphics. Together the color/graphics adapter and a monitor cost about \$500, less than the price of the monochrome card and display combination.

Two types of color monitors are available. A composite monitor is essentially a color TV, which means that it must decode one signal into the three necessary color signals. An RGB monitor accepts the three color signals directly, providing the highest quality picture with the fewest problems (and is correspondingly expensive).

There are several potential problems with color monitors. If a monitor does not accept an intensity lead,

for instance, only 8 of the 16 colors can be displayed. When displaying color graphics on some lower quality monitors, only every other colored column is visible, effectively halving the PC's resolution. This problem, also common with TVs, is more prevalent with composite than with RGB monitors.

Finally, various combinations of text and background colors don't display legibly on some screens, and only RGB monitors perform adequately in the 80-column color mode. The best idea is to test a monitor before buying it. Check that it has an intensity lead, that 80-column text is legible (for word processing), and that it uses every single picture element, or pixel, if your work requires high resolution. The program shown in Listing 3 can be helpful in testing the legibility and color quality of a monitor.

Graphics Software

The software required for graphics is Advanced BASIC, the BASICA program that comes with your DOS disk. To start BASICA, boot your PC with a copy of the DOS disk in drive A. (Your DOS manual will help if you are unfamiliar with the booting procedure.) When you receive the

A> prompt, type BASICA and press ENTER. You should then receive the BASICA sign-on message and the prompt OK.

While we will mention specific features of BASICA as needed, we suggest you read any of the numerous books on BASIC or the IBM BASIC manual for detailed information on the language or on the use of the BASIC full-screen editor. There is no separate manual for BASICA, but any good reference source for BASIC will include all the BASICA features and commands. For now, only two points are necessary. First, if you make a mistake typing a line, retype the line. There are better solutions, but this one is simple and will work. Second, to exit BASIC, type SYSTEM and press ENTER.

Two-Screen Systems

If you don't have a monochrome board, you can begin working as soon as the OK prompt appears. Just skip this section and proceed to "A Simple Test." If you have both the monochrome and color graphics boards, however, your system will almost certainly boot on the monochrome screen. To do graphics, switch to the color graphics screen by typing the code in Listing 1

```
10 'Program to toggle from graphics board to monochrome board or vice-versa
20 'Figure which board is active & switch to other board
30 LOCATE 1,1,0 : DEF SEG = 0 : A = (PEEK(1040) AND 48) : IF A <> 48 GOTO 110
40 'Switch to color/graphics board
50 KEY OFF : CLS
60 A = PEEK(1040) : POKE 1040, (A AND 207) OR 32
70 SCREEN 0 : LOCATE 1,1,1,6,7
80 KEY ON : WIDTH 40
90 END
100 'Switch to monochrome board
110 KEY OFF : CLS
120 A = PEEK(1040) : POKE 1040, A OR 48
130 SCREEN 0 : LOCATE 1,1,1,12,13
140 KEY ON : WIDTH 80
150 END
```

Listing 1: Switch, a program to switch between the monochrome board and the color/graphics adapter. The program automatically senses which screen you are on and switches to the other.

● Hands On

exactly as it appears. End each line by pressing ENTER. You can check what you have typed by entering the command LIST.

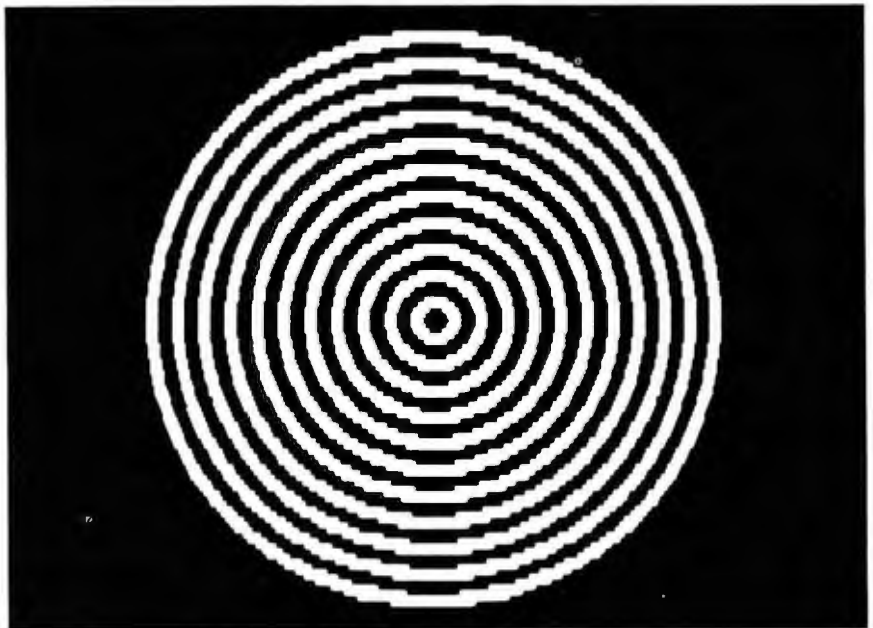
Once you are certain that the program is entered correctly, type the command SAVE "SWITCH" and wait for the OK prompt. The program is now safely stored on disk. Each time you start a session with BASICA just type RUN "SWITCH" to get to the color/graphics screen.

Once *Switch* has been saved, type RUN. The monochrome screen will blink off, the color graphics screen will go blank, and the OK prompt will appear. If this doesn't happen, reboot the system, restart BASICA, and reenter the program *Switch* as described above. If you have problems, don't despair—getting started is often the hardest part.

When you get *Switch* running, you're ready to roll. One note: with two-screen systems, it's best to type SYSTEM to exit BASICA only while on the monochrome screen. To avoid problems, run *Switch* again from the color/graphics screen to get back on the monochrome screen. *Switch* senses which screen you're on and switches to the other screen.

A Simple Test

It's time for a simple test, just to reassure you that you're in the right place. First, type the command NEW. This clears memory of any programs you've run previously and should be done before entering any new program. Next, type Listing 2 exactly as shown. Again, we recommend that you consult your BASIC manual on the use of the BASIC editor; its commands are used for BASICA as well. Notice that the single quote mark is the beginning of a comment in BASICA. Such comments are ignored by the computer and are present only as an aid to humans. You can save yourself some typing by omitting the comments, but thorough commenting is a good programming practice.



High-resolution graphics draws only in black and white

Run the program by entering the command RUN. If it doesn't work, check the program for errors and try again until it does. Once you do get it going, you can begin acquiring and applying specific knowledge about the PC. Never again should you type in a listing without knowing what you're typing; the whole point of this is to help you understand why you're typing it and just what it's supposed to do.

Modes of Graphics Operation

Let's start with the modes of operation in which the color/graphics adapter can operate. There are nine such modes, seven of which are easily accessible from BASICA. These seven modes are controlled with three BASIC commands: WIDTH, SCREEN, and COLOR.

The WIDTH command sets the width of the display in columns and should be typed in as WIDTH *size* in which *size* is 40 or 80. Enter the command WIDTH 80 and the screen will go to 80-column width; enter WIDTH 40 and the screen will go to 40-column width. Experiment with the WIDTH command until you feel comfortable with it.

The SCREEN command selects the display mode and enables or disables color. It should be entered as SCREEN *mode*,*burst* in which *mode* is 0 for text mode, 1 for medium-resolution mode, and 2 for high-resolution mode. *Burst* is not as straightforward. In the text mode a *burst* of zero selects black and white, and any numeral that is not zero selects color; in the medium-resolution mode a *burst* of zero selects color and any numeral not zero selects black and white. Supposedly, there is a reason for this reversed state of affairs. Just check the SCREEN command in your BASIC manual if you have problems choosing between color and black and white. Either *mode* or *burst* may be omitted.

The SCREEN command SCREEN 1,0 will put you in the medium-resolution mode with color enabled. You can't tell much difference between modes at this point, but look over the SCREEN pages of your BASIC manual. (By the way, it's normal for the screen to clear when you switch modes.)

The COLOR command sets the colors to be used in both text and medium-resolution modes. In text mode (selected with the SCREEN

command), the COLOR command is entered as

COLOR foreground,background,border in which foreground refers to the character itself, background refers to the color around the character, and border refers to the border of the TV screen, outside the text area. The foreground color may be represented by any integer from 0 to 15, as shown in Table 1. Background color may be represented by any integer from 0 to 7, and border color may be any integer from 0 to 15 (see Table 1). The background color and screen border color are optional.

Enter SCREEN 0,1 to select text mode with color enabled and experiment with various color settings. For example, COLOR 7,6 would select white characters on a brown background, leaving the border color unchanged. We leave it to you to find more aesthetic combinations.

In medium-resolution mode the COLOR command is entered as COLOR background,palette in which background is the color of pixels you have not activated or have turned off, and palette selects between the two available sets of three colors. Background may range from 0 to 15, as shown in Table 1. There are two palettes: an even value for palette selects palette 0 and an odd value selects palette 1. Both background and palette are optional parameters to the COLOR command. Issue a SCREEN 1,0 command to select medium-resolution mode with color enabled, and try various COLOR commands. For instance, 'COLOR 3,1' will select palette 1 on a cyan (or blue) background. A limited amount can be done with COLOR in graphics modes until we get to some graphics commands, but experiment until you've got a general idea of what COLOR does. COLOR has no effect in high-resolution mode, since this mode is strictly black and white.

As we examine the available modes, don't let the unfamiliar commands in the demonstration programs throw you; by all means look them up. Familiarize yourself with

the selection of color/graphics modes via the WIDTH, SCREEN, and COLOR commands. You will, however, need a firm grasp of BASIC to develop your own programs properly.

Text Modes

Four of the nine color graphics modes are text modes. Limited, although surprisingly powerful and flexible graphics are offered in these modes. Only characters are available, but the user can define some of these characters to fit particular needs. There are 40- and 80-column modes, but TVs will work with only 40-column modes. Twenty-five lines are displayed; in BASIC the twenty-fifth line generally displays the use of the

function keys, but it can be changed. Text modes include black and white and color. The color modes display the full 16-color set of the IBM PC, shown in Table 1. The four text modes can be demonstrated with the program in Listing 3.

Text modes are primarily useful for data entry and display. In black-and-white modes the screen is similar to the monochrome display, while in color modes text may be enhanced or highlighted. Bar graphs and similar block displays may be done as well. One advantage of the color text modes is that all 16 colors are available at once. Black-and-white text modes can be useful for keeping stray colors off the screen; in color modes, white dots may appear tinted.

```
10 CLS                                'Clear the screen
20 DEF SEG=0                          'Prepare to look if on right screen
30 IF ( PEEK(1040) AND 48 ) <> 48 GOTO 60 'If not
40 PRINT "YOU ARE ON THE WRONG SCREEN!" ' say so and
50 END                                ' stop
60 SCREEN 0,1                         'Set COLOR TEXT MODE
70 WIDTH 40                          'Set to 40 characters/line
80 FOR I=1 TO 15                     'Display 15 lines
90 LOCATE I+5,I+5                    'starting at 15 locations
100 COLOR I,0                        'in 15 different colors
110 PRINT "It Works !!!!"
120 NEXT I
130 COLOR 7,0                        'Set screen to white on black'
140 END                               'Return control to BASIC
```

Listing 2: A program that tests if the color/graphics adapter is activated

| Number | Color | Number | Color |
|--------|---------|--------|----------------------|
| 0 | Black | 8 | Gray |
| 1 | Blue | 9 | Light Blue |
| 2 | Green | 10 | Light Green |
| 3 | Cyan | 11 | Light Cyan |
| 4 | Red | 12 | Light Red |
| 5 | Magenta | 13 | Light Magenta |
| 6 | Brown | 14 | Yellow |
| 7 | White | 15 | High-Intensity White |

Table 1: Colors available with the color/graphics adapter. All 16 colors are available as foreground and border in text mode and as background in medium-resolution mode. The first 8 colors are available for background in text mode.

● Hands On

Medium-Resolution Graphics

Two of the nine modes are medium-resolution graphics modes. In medium-resolution graphics the screen is displayed as a matrix of pixels 200 rows by 320 columns in dimension with each pixel individually controllable. Medium-resolution graphics may be either color or black and white, and only four colors—three palette colors and a selected background color—may be displayed at any one time. Enter and run the program in Listing 4, which displays each of the medium-resolution modes.

The medium-resolution color mode is useful for general-purpose graphics. Text may still be used as needed (the PC “draws” the letter in the graphics screen), and graphs, schematics, drawings, and games may be done as well. No other mode can match both the color and the fine detail available in the medium-resolution color mode. Many of the graphics commands are also most powerful in this mode.

High-Resolution Graphics

The seventh mode is the high-resolution graphics mode, which has 200 rows by 640 columns of pixels available. This mode offers the greatest detail; however, the only colors provided are black and white. You also need a monitor capable of displaying 640 pixels across the screen with the high-resolution graphics mode. The program in Listing 5 demonstrates the high-resolution graphics mode.

The two remaining modes are low-resolution graphics modes. These modes are not supported by BASICA or by system software at any level. Some fairly sophisticated programming is required to access them. For this reason, we forewarn you that the average BASICA programmer should stick to the seven available modes and forget about low-resolution graphics.

Although color graphics may be done in either text or graphics modes, let's concentrate on graphics

modes for now. The graphics commands we will cover are the PSET, PRESET, and LINE statements, and the POINT function. Other commands provide more powerful graphics capabilities, but these are all that are needed to create graphs, charts, and detailed outline drawings.

Some Useful Background

Some useful points should be made before specific commands are discussed. First, the background color in graphics modes is always color number 0. This means that setting the color of a pixel to color number 0 will cause that pixel to become indistinguishable from the background; in effect, the pixel will have been erased. The background color is the setting against which graphics are drawn, but it is otherwise no differ-

ent from any other color and may always be drawn by referencing color number 0.

Secondly, after each graphics command is executed, there is a point known as “the last point referenced.” This point can serve as the automatic starting point for the next graphics command executed. Sometimes, as with drawing a circle, it's not clear where this point is. In describing each command, we will tell you what point is the last point referenced.

Thirdly, parameters are values appearing on a line after a statement or function. For example, x is the only parameter to the function called SIGN (x), and i and j are parameters to the statement 'PSET (i,j)'.

Finally, the coordinate numbering system for graphics may be somewhat confusing to the beginning programmer. Each screen location is

```
10 CLS                                'Clear the screen
20 DIM A$(40)                        'Set aside memory
30 A$="40 CHARACTER BLACK AND WHITE TEXT MODE"
40 SCREEN 0,0                        'Set to BW TEXT MODE
50 WIDTH 40                          'Set to 40 characters on line
60 GOSUB 210                          'Display text on screen
70 A$="40 CHARACTER COLOR TEXT MODE"
80 SCREEN 0,1                        'Set to COLOR TEXT MODE
90 GOSUB 210                          'Display text on screen
100 A$="80 CHARACTER BLACK AND WHITE TEXT MODE"
110 SCREEN 0,0                       'Set BW TEXT MODE
120 WIDTH 80                         'Set width to 80 characters
130 GOSUB 210                        'Display text on screen
140 A$="80 CHARACTER COLOR TEXT MODE"
150 SCREEN 0,1                       Set screen to COLOR TEXT MODE
160 GOSUB 210                        'Display text on screen
170 SCREEN 0,0                       'Set screen to BW TEXT MODE
180 WIDTH 40                         Set width to 40 characters
190 COLOR 7,0,0                     'Set to white on black characters
200 END                              'Return control to BASIC
210 FOR BG=0 TO 7                   'Each line is printed on
220   LOCATE 5+BG,3                 ' a different color
230   FOR FG=1 TO LEN(A$)           'Characters will be 16
240     COLOR FG MOD 32,BG,4         ' different colors
250     PRINT MID$(A$,FG,1);        'Display the next character
260   NEXT FG                       'Display characters until
270   PRINT                         ' done displaying all
280 NEXT BG                         ' eight lines
290 FOR I=1 TO 4000:NEXT I          'Wait a while
300 RETURN                          'Finished with this mode
```

Listing 3: A program that demonstrates the four available text modes. 80-character text mode may be illegible on TVs and low-quality monitors. This program is also useful for testing the quality of a color monitor.

described by coordinates x,y . The x coordinate indicates pixels measured horizontally, and the Y coordinate indicates pixels measured vertically. For all graphics modes, the upper left corner of the screen is location (0,0), or row 0, column 0, and the lower left corner is (199,0). In medium-resolution mode the upper right corner is (0,319) and the lower right

The applications for the PC's graphics capability range from practical to dazzling.

corner is (199,319); in high-resolution mode, the upper right corner is (0,639) and the lower right corner is (199,639).

The vertical, or Y , coordinates increase from top to bottom, contrary to graphing convention, so your own graphing programs will have to account for this. Also, it may seem strange that numbering begins at zero and not one, and that in the text mode the cursor positions start at one and not zero. It's a quirk of the PC that you'll learn to work around.

Also, note that all commas shown in the syntax diagram of a command must be entered, unless the commas are at the far right of the command with no parameters farther to the right. For example, in the command `LINE (X,Y)-(X2,Y2),,B` the double comma before the B is required to hold the place for the color parameter, even though the color parameter is not used. If B were omitted, however, the command could read `LINE (X,Y)-(X2,Y2)` since there is no parameter used to the right of the color parameter. The commas ensure that BASICA can tell which parameters are actually specified.

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PSET and PRESET

PSET is the simplest graphics command imaginable: it sets a pixel to a selected color. The command is: `PSET (x,y),color` in which x and y are the column and row coordinates respectively of the pixel and should be within the screen area as described above. In the medium-resolution mode $color$ is a value between 0 and 3; 0 selects the background color, while 1, 2, and 3 select colors from the palettes selected using the COLOR statement. In the high-resolution mode 0 selects black and 1 selects white.

The coordinates are required parameters, while $color$ is optional. If $color$ is omitted, the foreground color (color 3 in medium-resolution mode, color 1 in high-resolution mode) is assumed.

If the coordinates specified are out of range (that is, off the screen), no pixel is plotted and no error message is issued. $Color$ must be in the range 0 to 3 or an error will result. In the high-resolution mode color 2 is equivalent to color 0, and color 3 is

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the same as color 1. The last point referenced by PSET is the pixel selected by the coordinates.

PRESET is remarkably similar to PSET; in fact, the two statements are identical unless the *color* parameter is omitted. In this case PSET will default the color to the foreground

color, while PRESET will default to the background color. Of course, since

PSET (x,y) ,0

is identical to

PRESET (x,y)

PRESET is not a critically useful command, but it can serve to make a distinction between drawing pixels (PSET) and erasing them (PRESET).

Almost any graphics functions may be performed with PSET and PRESET. Lines, circles, and other shapes are composed of a series of pixels strung together to create the effect of the desired form. Of course, it's faster and easier to draw a square with a single command than to position and draw each of the pixels individually. But PSET and PRESET are straightforward and flexible and can always be made to meet your needs if time is not a critical factor.

Let's try a few, quick sample PSETs and PRESETs. Boot your PC

```

10 DIM A$(40)                'Reserve space in memory
20 KEY OFF                    'Clear bottom line
30 SCREEN 1,1                  'Set medium resolution B&W mode
40 A$="MEDIUM RESOLUTION BLACK AND WHITE"
50 GOSUB 160                    'Display mode
60 A$="MEDIUM RESOLUTION COLOR PALETTE 0"
70 SCREEN 1,0                  'Set medium resolution color mode
80 COLOR 0,0                    'Set background black, palette 0
90 GOSUB 160                    'Display mode
100 A$="MEDIUM RESOLUTION COLOR PALETTE 1"
110 COLOR 0,1                   'Set background black, palette 1
120 GOSUB 160                    'Display mode
130 SCREEN 0,1                  'Set text mode
140 COLOR 7,0,0                 'White on black characters
150 END                          'Return control to BASIC
160 CLS                          'Clear the screen
170 LOCATE 25,3                 'Label screen
180 PRINT A$                     ' at bottom
190 FOR I=3 TO 99                'Draw 97 circles
200   CIRCLE (180,100),I,I\5 MOD 4 ' in four colors
210 NEXT I
220 FOR C=1 TO 15                 'Flip through
230   COLOR C                     ' 15 background
240   FOR I=1 TO 1000:NEXT I       ' colors
250 NEXT C
260 RETURN                        'Done showing mode

```

Listing 4: A program that demonstrates the two available medium-resolution graphic modes.

```

10 CLS                          'Clear the screen
20 KEY OFF                      'Clear bottom line
30 SCREEN 2                      'Set high resolution mode
40 LOCATE 25,27                  'Next print at bottom center
50 PRINT "HIGH RESOLUTION GRAPHICS MODE"
60 FOR I=3 TO 199                'Draw 197 circles
70   CIRCLE (320,100),I,I\6 MOD 2 'Draw circles
80 NEXT I
90 SCREEN 0,1                    'Set screen to text mode
100 COLOR 7,0,0                  'Set white on black text
110 WIDTH 40                      'Set width to 40 characters
120 END                          'Return control to BASIC

```

Listing 5: A program that demonstrates the high-resolution graphics mode

Experiment until you've got a general idea of what COLOR does.

and start up Advanced BASIC. Run the program *Switch* (see Listing 1) if you have both a monochrome and color screen. Type SCREEN 1,0 to enter medium-resolution color mode, and type COLOR 0,1 to set a black background with the cyan, magenta, and white palette.

Enter the command

PSET (160,100)

and a dot will appear in the middle of the screen.

Type

PRESET (160,100)

and the dot will disappear. Now type FOR X=140 TO 180 STEP 8: PSET (X,100): NEXT and a line of spaced dots will appear. Change the 'STEP' value to 4, and the dots will be more closely spaced.

Pixels may also be colored. Type FOR X=100 TO 220: PSET (X,100),1:NEXT and a cyan line will be drawn. The 1 that appears after the coordinates in the PSET command selects color number 1, which in palette 1 is cyan. Change this parameter to 2 and execute the command again, and the line will be magenta. Change the parameter to 3, and the line will be white. If the screen becomes too cluttered, enter the statement CLS at any time to clear the display.

To get a feel for PSET and PRE-SET, select palette number 0 with the statement
COLOR 0,0
 and experiment with PSET and PRE-SET with various colors. Also, select high-resolution mode with
SCREEN 2
 and draw and erase some pixels. Listing 6 contains a program that applies the PSET and PRESET commands.

Absolute vs. Relative Coordinates

So far we have addressed points on the screen with x,y pairs, where the upper left corner is $(0,0)$ and the coordinates increase down and to the right. This is known as absolute addressing, in which a coordinate pair clearly indicates a specific point on the screen. Any program that uses absolute addressing will draw the same form in the same place on the screen every time.

There is another form of graphics addressing, known as relative addressing, that allows a form to easily be placed anywhere on the screen. In relative addressing the coordinates specified are an offset, or movement, from the last point referenced (this is why the last point referenced is important). To specify relative addressing, describe the screen address with

STEP (x,y)

X is the number of pixels to be added horizontally to the last point referenced, and y is the number of pixels to be added vertically to the last point, both determining the current location. Negative values may also be used to indicate movement up or to the left.

This may sound complicated, but it's really not. Just remember that with relative addressing the reference, or $(0,0)$, point is the last point referenced, rather than the upper left corner.

For example, in the medium-resolution mode, type
PSET (100,100)



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which makes the last point referenced (100,100). Now enter

```
PSET STEP(10,10)
```

which will put a dot 10 pixels below and to the right of the first dot. Next enter

```
PSET STEP(-30,10)
```

to put a dot 10 pixels below and 30 to the left of the second dot. Note that

```
PSET STEP(20,20)
```

would return the last point referenced to the initial dot.

Experiment with PSET and PRESET using relative addressing until you've gotten the hang of viewing the screen from a relative perspective. Take some time; relative mode can be very useful. For example, suppose you want to put a company logo in any of several locations on any chart produced. Using absolute addressing, each coordinate for PSET would have to be calculated separately, requiring annoying and confusing calculation in your program.

Now suppose instead that you wrote a section of program code to draw the logo using relative addressing. To draw the logo at any screen location, you would just execute one PSET to set the starting point for the logo, and then execute the logo-drawing code. The relative addressing approach is certainly easier to use in this case, and better any time you need to draw the same form in several locations.

The program shown in Listing 7 performs both absolute and relative screen addressing. Study the program to see where relative addressing is used and what the results will be. Then run the program, making sure you understand the connection between each command and the results.

A word of caution when using relative addressing: the last point referenced may be placed off the screen, sometimes garbling the overall picture. For this reason, we suggest you avoid addressing points off the screen altogether for more predictable results.

The POINT Function

Imagine that you are designing a game in which a person is moving around the screen, often colliding with other objects. It would be useful to test whether a certain pixel were already on (that is, differing from the background color, indicating the presence of an object in that location) before turning that pixel on to draw the main figure.

Or suppose that you are drawing a chart with crisscrossing lines of red and blue. The red lines are more important, so you want to draw blue lines only at pixels that aren't already red. Again, you need some way to test a pixel in advance.

A great deal more information can be conveyed through colors and forms than through words alone.

The POINT function is designed for just such applications. Type $z = \text{POINT}(x,y)$ with x and y as the coordinates of the pixel to be tested. Since POINT is a function, it returns a value, which must be used in an IF statement or assigned to a variable (such as z). This value can then be used to test the color of the pixel. For example, if POINT returns a value of 0, then the pixel is the background color.

In the medium-resolution mode, values may also be 1, 2, or 3, corresponding to the three colors available in the currently selected palette. Again, if palette 1 is selected, a POINT value of 1 indicates that the pixel is cyan. In high-resolution mode a POINT of 0 indicates black, while a POINT of 1 indicates white.

Listing 8 is a program that uses PSET, PRESET, and POINT to do simple animation. Note the use of POINT to detect collisions in the screen.

The LINE Statement

The LINE statement can connect two points with a line or draw hollow and solid rectangles. The LINE command appears as `LINE (x1,y1)-(x2,y2),color,BF`

The $x1$ and $y1$ are the coordinates of the start point of the line, and $x2$ and $y2$ are the coordinates of the end point. In the medium-resolution mode *color* may be 0 for the background color, or 1, 2, or 3 for the colors in the currently selected palette. In the high-resolution mode a *color* of 0 selects black and 1 selects white. If *color* is omitted, the foreground color is used.

The parameter *B* indicates that a box should be drawn, with $(x1,y1)$ as the upper left corner of the rectangle, and $(x2,y2)$ as the lower right corner of the rectangle. The parameter *BF* indicates that a box should be drawn and filled with the color selected. All parameters except $x2$ and $y2$ are optional.

LINE is obviously a more complex command than those we have discussed so far. We'll go through some simple exercises to get you used to it.

The $(x1,y1)$ and $(x2,y2)$ are the start and end points of the line to be drawn. Enter CLS to clear the screen, and then enter

```
LINE (100,50)-(200,150)
```

A diagonal line will appear; this is LINE in its simplest use.

Either coordinate pair may be specified in absolute or relative form. (The above example is in absolute.)

Enter

```
PSET (90,60)
```

and then

```
LINE STEP (10,20)-(200,180)
```

which will draw a line parallel to the first. If the relative mode is used for the end point, it is taken relative to the first coordinate. For example, `LINE (100,20)-STEP (100,100)`

will draw another parallel line. Relative mode may be used for both coordinates; enter

```
PSET (0,0): LINE STEP(100,40)-STEP(100,100)
```

to create a fourth line. (Note that the colon in the above line separates


```

10 SCREEN 1,0          'Set medium res color mode
20 CLS                  'Clear the screen
30 FOR X=10 TO 300      'In 291 dot locations
40   PSET(X,100),2      ' put dot on screen
50   PRESET(X-5,100)    ' erase dot 5 behind
60 NEXT X

```

Listing 6: A program that demonstrates the use of the PSET and PRESET commands

```

10 SCREEN 1,0          'Set medium res color mode
20 CLS                  'Clear the screen
30 FOR I=1 TO 200      '201 times
40   PSET (50+I,50),1   ' draw dots
50   PSET STEP(20,30),2 ' in three
60   PSET STEP(20,30),3 ' colors
70 NEXT I

```

Listing 7: A program that demonstrates absolute and relative screen addressing

```

10 SCREEN 1,0          'Set medium res color mode
20 CLS                  'Clear the screen
30 FOR X=20 TO 300      'Draw two horizontal lines
40   PSET (X,60),1      ' 40 dots apart
50   PSET STEP(0,40),1
60 NEXT X
70 PRESET(20,90)        'Set initial dot position
80 Y=1                  'Set for dot to go down
90 FOR X=20 TO 300      'For each x dot position 20-300
100  PRESET STEP(0,0)    'Erase old dot
110  PSET STEP(1,Y),3    ' draw a dot 1 position to the right
120                          ' and y positions down from the last dot
130  IF POINT STEP(1,Y) = 1 THEN Y = -Y 'If hit line reverse direction
140 NEXT X

```

Listing 8: A program that shows how the PSET, PRESET, and POINT commands can be used to do simple animation

```

10 SCREEN 1,0          'Set medium resolution color mode
20 CLS                  'Clear the screen
30 LINE (50,50)-(150,150),2,B 'Head
40 LINE (70,70)-(90,90),1,BF 'Eye
50 LINE (110,70)-(130,90),1,BF 'Eye
60 LINE (65,110)-(80,125),3 'Mouth
70 LINE - STEP(40,0)
80 LINE - STEP(15,-15)

```

Listing 9: A program that demonstrates the capabilities of the LINE command

statements; the command line could work equally well as two separate lines).

The starting point may be omitted; in this case, the last point referenced is used as the starting point, just as if STEP(0,0) had been specified as the starting point.

If the *B* parameter is used, it directs the drawing of a box or rectangle. The sides of the box are always parallel to the edges of the screen; there is no way to tilt the box at an angle. The starting coordinate pair is one corner of the box, and the second coordinate pair is the corner at the opposite end of the diagonal. An example of the operation of the *B* parameter is perhaps the best explanation. Clear the screen and enter

```
LINE (100,50)-(200,150),3,B
```

This will draw a box with corners (100,50), (200,50), (200,150), and (100,150). Four LINE statements without the *B* parameter, or four FOR...NEXT loops with PSET statements would be required to draw the same box.

The optional *BF* parameter indicates that a box should be drawn and filled with a selected color. For example,

```
LINE (100,50)-(200,150),2,BF
```

will draw a red box if palette 0 is selected, and a magenta box if palette 1 is selected.

Finally, the last point referenced by LINE is the end point, (x2,y2). Generally, out-of-range coordinates are changed to the nearest valid value. Any *y* values greater than 200 are treated as 199, and any negative *x* or *y* values are treated as 0. However, in the medium-resolution mode *x* values greater than 319 wrap to the next line, while in the high-resolution mode *x* values greater than 639 are treated as 639. Only Microsoft and IBM know why this is, but be aware of the inconsistency.

And that's all there is to the LINE statement. While LINE is certainly more complicated than PSET, the advantages in speed, clarity, ease of use, and compactness of program code are great. The LINE statement is the fastest way to draw an object of solid color available in IBM BASIC.

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In fact, although LINE is not as versatile as CIRCLE, DRAW, or PAINT, it draws lines and boxes faster than any other forms can be drawn from IBM BASIC.

The LINE statement is also useful for drawing bar graphs, line figures, and graphing and plotting axes. Continuous graphs, such as that of sales over time, are made by omitting the starting point coordinate pair for all but the first point plotted, so that the line is drawn from each point to the next, producing a smooth, unbroken plot. Run the program in Listing 9 for a demonstration of the various capabilities of the LINE statement.

Coming Up Next

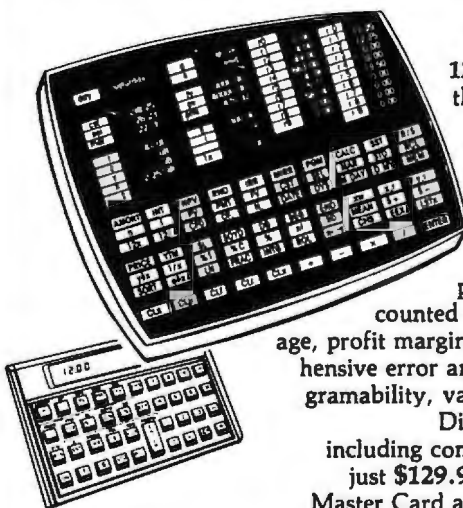
Now you have the tools you need to start doing useful graphics work. The next article in this series will discuss the powerful CIRCLE statement, which is useful for drawings and pie charts, and the PAINT statement, which allows you to fill in solid areas. Also to come are discussions of the keys to graphics animation, the GET and PUT statements.

Eventually we will design a simple graphing program and a simple animation program. Of course, we'll take you through the workings of these programs, and by that time you'll know BASIC well enough to expand on our work.

For the time being, work with the commands we've covered, and familiarize yourself with BASIC in general. Better still, try to expand on what we've covered here, and remember—it never hurts to get ahead!

Dan Illowsky and Michael Abrash coauthored the Snack Attack II video game for the IBM PC. Illowsky, author of the original Snack Attack for the Apple II, is president of Funtastic, Inc., in Drexel Hill, Pennsylvania. Abrash has written several video games and is an energy consultant with Delphi Energy Group in Philadelphia. The authors are planning to adapt the information in this article for a future book.

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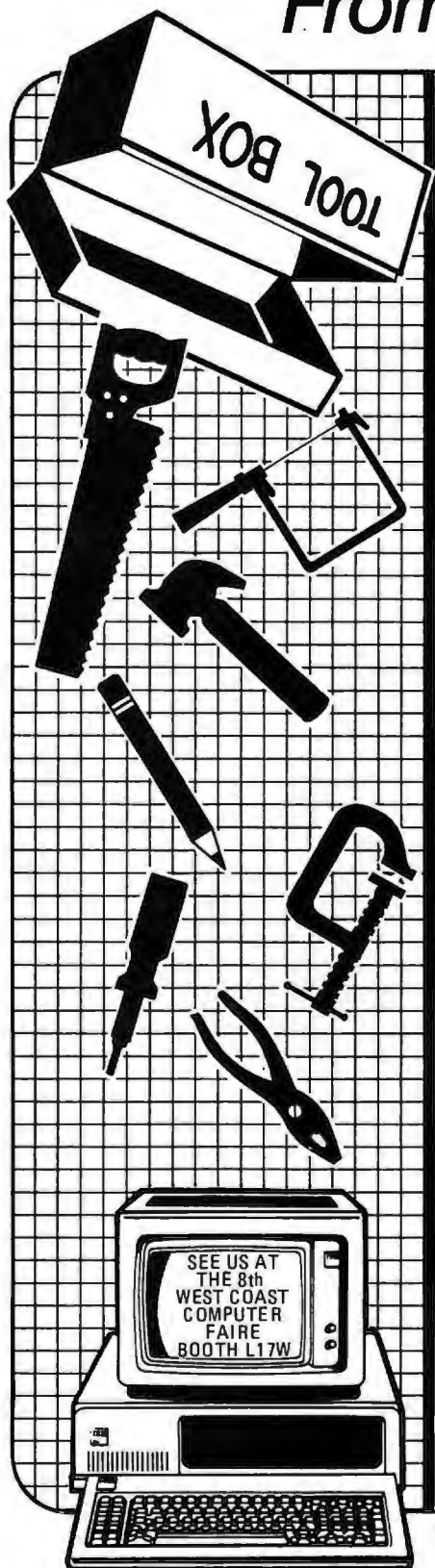
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*Computers come in two parts.
You have to buy both.*

We'd like to help. So here are a few suggestions about how to buy the computer that's right for you.

Computers come in two parts.

One part is the "hardware," which is the machinery itself. The other is the "software," or a program, as it's sometimes called.

Software is the part that tells the computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything.

And vice versa.

You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember, it's the software that knows how to get things done), it makes good sense to pick the software first.

Start by making a list of the things you want to use the computer for. It can include almost anything—any kind of inventory, filing, accounting, graphics, reporting, record-keeping, analysis—you name it and there's probably a software program that does it.

Next, take the list into a computer store and ask the salesperson to give you a demonstration of the program, or programs, that will do the things you want.

Even though you'll need a computer for the software demonstration,

keep in mind the computer is just a vehicle. The software is the driver. And once you've decided on the software, picking out the rest of the computer system will be much easier.

The simpler the better.

Look for software that's easy to learn, easy to use, and that does the job in the simplest way possible.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you have to do without getting in the way.



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ABOUT BUYING A HERE'S SOME HELP.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

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You can read any number of interesting books and magazines about personal computers. You can ask friends who have them. You can look at all the sales literature you can get your hands on. And you should do all those things before you decide to buy.

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Radical Disk Fixes

Sometimes surgery is the only method for recovering data from damaged disks.

Bill Grout

Disk manufacturers agree that there are six rules for handling their products. Stated informally, they are: Don't sweat on the exposed surfaces; don't stick disks to your refrigerator door with a magnet; don't fry or freeze them; don't ram them into the disk drive like torpedoes; don't fold them like wallets; and keep them in their paper bibs when you take them to the dinner table. For the remainder of this article these rules are suspended.

Disk abuse, or even extended use, can take its toll on these fragile devices. Little by little the outer plastic jacket can become bent and cracked, which may eventually cause the disk to turn more slowly than it should. A disk damaged in this way can slow down a disk drive or even stop it.

If you have an obviously damaged disk or one that seems to affect your disk drive strangely, you may want to retrieve its contents and retire that disk. Following are some reasons and remedies for misbehaving disks.

Disk Doctoring

If the manufacturer has provided a hub ring around the center hole of the disk, check to see if it has detached and lodged down within the jacket. Extra material inside the



Courtesy of Verbatim Corporation

jacket sleeve can put the brakes on a disk in addition to causing physical damage and increased wear.

Bent disks sometimes pinch the outer edge of the disk within the jacket, impeding spin. Read and write errors occurring during operation of the disk drives can indicate this problem.

If you have a disk with these problems, you can save the data but not the disk. Carefully cut the two sides of the jacket that run parallel with the read/write oval where the exposed disk appears (see Figure 1). Peel back the two folded edges of the plastic jacket and clip them off with

scissors (Figure 2). Being careful to avoid touching the disk surface, try to get the disk to turn more freely by putting your fingers up through the center hole and working the disk around. Straighten any kinks in the jacket edge caused by bending.

If the disk still won't read when it is inserted in the drive, the time has come for the ultimate disk surgery. Although it may contradict every cautious bone in your body, take the disk out of its jacket entirely. Carefully slide this naked disk into the drive, center it on the hub, and close

the drive door. Then try to copy its contents to another, fully clothed disk. At least some of the time the surgery will be successful and the data will be recovered even though the disk meets with a cruel fate.

This radical disk fix can also be used on disks that no longer turn because they were manufactured incorrectly. Poorly manufactured disks may be hard to detect until errors begin to surface, and valuable data can be stored on disks fated to be short-lived.

The data will be recovered even though the disk meets with a cruel fate.

I once returned a disk that was frozen in its jacket to the Verbatim Corporation for testing. They reported that the disk was manufactured out of specifications and that the torque within the jacket was roughly double what it should have been. (The maximum running torque for the disk should have been no higher than 3.57 ounces per inch, but the torque measured 6.75 ounces per inch.)

Most manufacturers replace irregular disks, but they can't replace lost data. When the problem is discovered too late, radical disk surgery may be required. Because it's unlikely that a manufacturer will accept a disk with the jacket cut open, you'll have to decide which is more important: the information locked up on an unusable disk or the possibility of getting a replacement.

Bill Grout writes computer documentation for a major California bank. He has contributed articles to various publications, including Microcomputing.

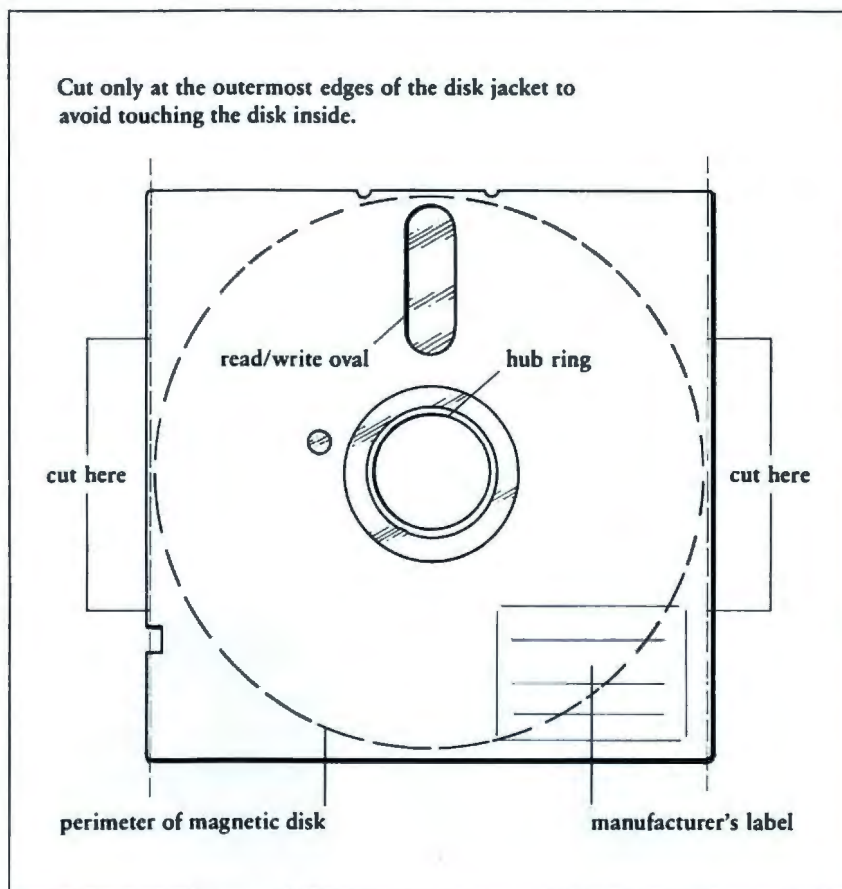


Figure 1: A floppy disk, showing where to cut the jacket so that the disk is not harmed

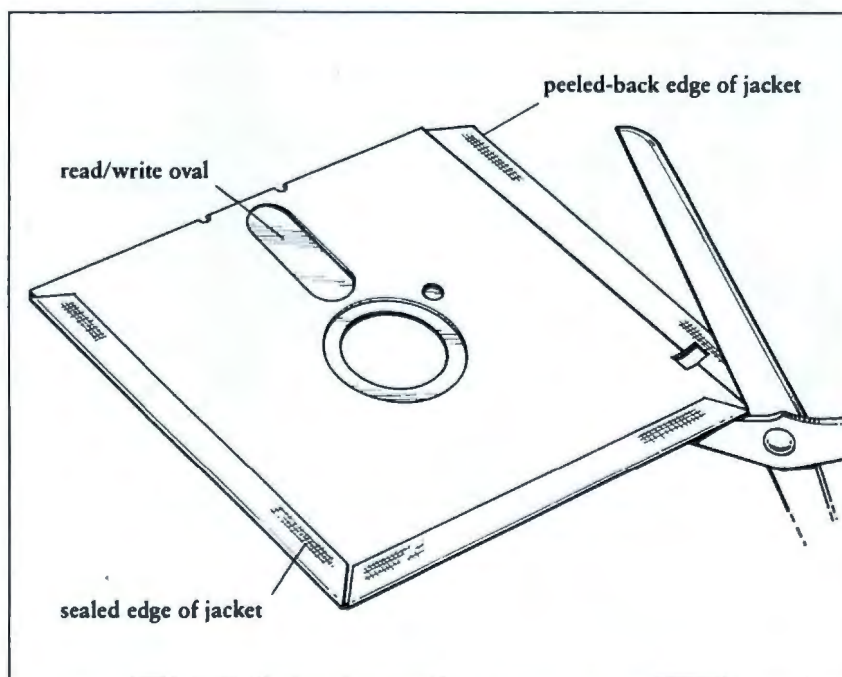
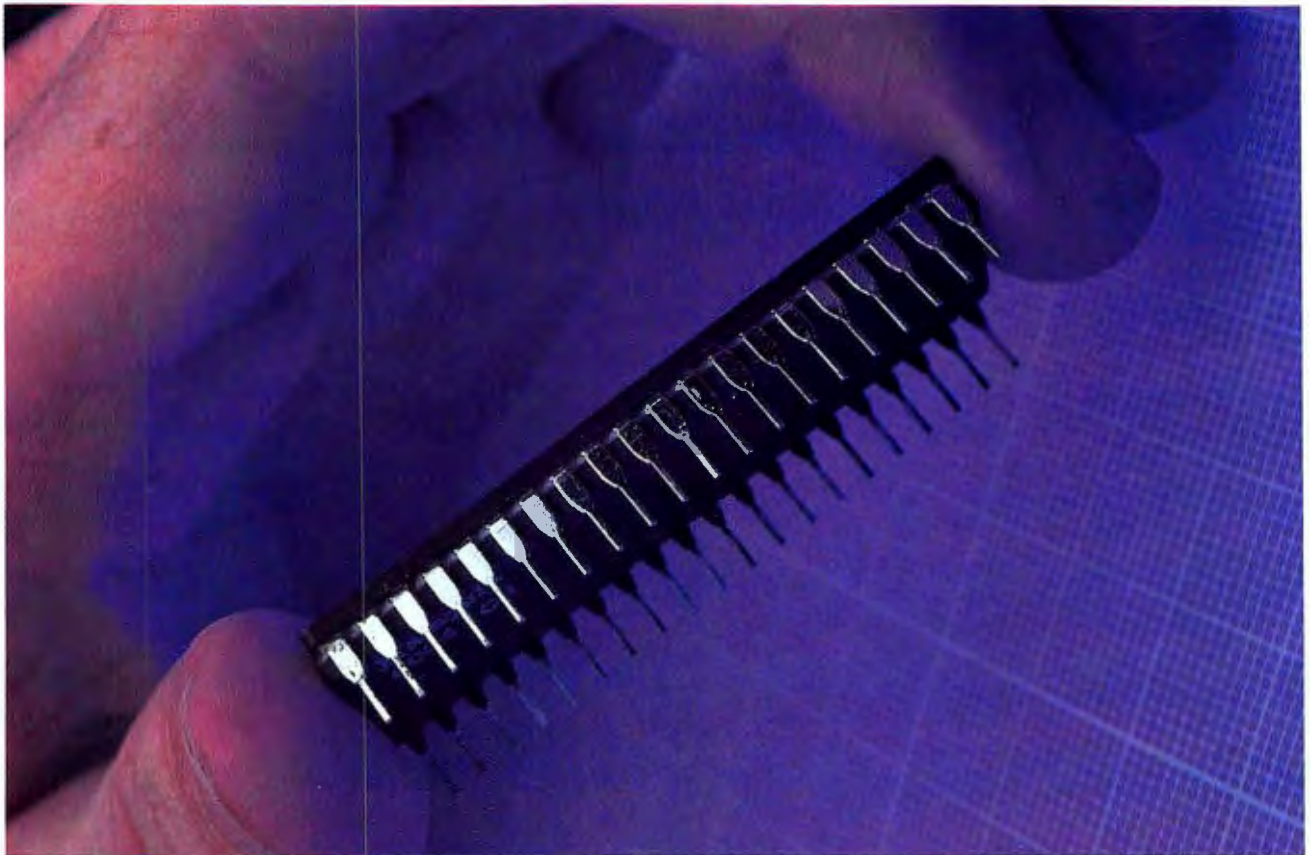


Figure 2: Second step in trimming the jacket of a damaged disk

How the PC Thinks

A probe into the inner workings of the PC

Peter Norton



In the first article in this series on how the IBM PC thinks (see *PC World*, Vol. 1, No. 1) we covered what memory is, how it is used and addressed, and how the PC organizes it. In this article we'll examine four very important areas of the PC brain: registers, interrupts, stacks, and ports.

Registers

The brain of the IBM PC is embodied in the Intel 8088 microprocessor. Like almost all computers, the 8088 uses registers to speed and simplify operation.

A register is a special kind of memory that serves as a high-speed scratchpad for the computer. The contents of main memory can be treated in several ways such as individual bytes or as strings of characters.

Registers, however, don't offer such flexibility. In the 8088 microprocessor, registers are all 16 bits, or 2 bytes in size, although some can be used as half-registers of 8 bits. While main memory may be used for many different tasks, registers are used mainly for doing binary arithmetic and address calculations. Main memory, which lies outside the 8088

microprocessor, must be accessed by address. Registers, however, lie inside the 8088 and are referred to by special codes, meaning that they can be accessed more quickly than ordinary computer memory.

There are four 16-bit registers in the 8088 microprocessor, known as AX, BX, CX, and DX. Each register can be divided into two 8-bit half-registers using the high (H) or low (L) part of the complete (X) register. The 8-bit registers are named AH, AL, BH, BL, CH, CL, DH, and DL. Because of the relationship of the 8-bit half-registers to the 16-bit registers, loading the hex value ABCD into the AX register is the same as loading hex AB into the AH register, and hex CD into the AL register.

While these four 16-bit registers are designed for general use, each one has a special use. When a computer instruction is to be repeated a number of times, for example, the CX register is used to hold the count of how many times the repetition is to be carried out. A special instruction, called LOOP in assembly language, can be used to repeat a part of a program as many times as the count value held in the CX register. (An example of LOOP is given in Listing 1.)

In the first article in this series the four segment addressing registers were mentioned: CS for the code segment, DS for the data segment, SS for the stack segment, and ES for the extra segment. These segment addressing registers indicate the memory location of different working parts of a program, such as instructions in the code segment or data in the data segment. You'll recall that complete addresses in the 8088 have two parts: the segment part and the relative, or offset, part. The four segment registers provide the segment part of an address.

Other registers provide the relative part. For the current address of a program being executed, a special register known as the instruction pointer (IP) is used in conjunction

Editor's note: The statements following semicolons are comments like the REM statements in BASIC. They do not need to be keyed in.

```

; Beep and Warble programs
; (C) Copyright 1983 Peter Horton

; This program, run in two versions, demonstrates the effects of
; clock interrupts on a that program generates a pure tone on the speaker

; The BEEP version, with interrupts disabled, produces a pure tone
; The WARBLE version, with 18 clock interrupts each second, will warble

; The listing here includes the CLI and STI instructions that disable
; interrupts for the BEEP version. For WARBLE, remove these instructions

; If you are new to preparing assembler programs for execution, here is a
; quick guide. After entering the program into a text file named
; BEEP.ASM, do these three steps:

; 1) assemble the program, with      MASM B:BEEP,B:BEEP.COM;
; 2) link the program with          LINK B:BEEP,B:BEEP.COM;
; 3) convert to "COM" format with    EXE2BIN B:BEEP.EXE B:BEEP.COM

; This program operates by sending a series of on and off pulses to the
; speaker; the speed of the pulses is controlled by a loop that kills
; time for 50 loop cycles. The length of the tone is controlled by the
; number of speaker-pulse cycles, 3000 in this program.

beepseg segment 'code'
    assume cs:beepseg
beep proc far
    cli                ; clear-interrupts -- remove this for WARBLE

    mov bx,3000        ; count of speaker cycles
    in  al,61h         ; input control info from keyboard/speaker port
    push ax            ; save on stack
more: and al,0fch      ; turn off bits 0 and 1 (speaker off pulse)
    out 61h,al         ; send command to speaker port
    mov cx,50          ; time for tone half-cycle
11:  loop 11           ; kill time
    or  al,2           ; turn on bit 1 (speaker on pulse)
    out 61h,al         ; send command to speaker port
    mov cx,50          ; time for tone half-cycle
12:  loop 12           ; kill time
    dec bx             ; count down of speaker cycles
    jnz more           ; continue cycling speaker
    pop ax             ; restore speaker/keyboard port value
    out 61h,al         ; send port value out

    sti                ; start interrupts -- remove this for WARBLE

    int 20h            ; return to system
beep endp

beepseg ends
end

```

Listing 1

with the CS register. For the current stack location, the stack pointer (SP) is used with the register.

For addressing data, several registers can be used to provide a relative address to go with the data segment value. The DX register often serves that purpose. Two other registers, called SI and DI, are also used with the data segment. When a string of bytes is operated on, the SI and DI registers are used to provide a source index and a destination index relative to the data segment. When a program has to access data on the stack, a register known as the base pointer (BP) is used for a location relative to the stack segment.

Listing 1 shows an example of the use of registers in assembly language programming.

Interrupts

A computer has to be able to respond to activity that occurs outside the microprocessor, such as acknowledging keys pressed on the keyboard. The computer can respond to this outside activity in two ways. One is to poll, or look, constantly for activity requiring attention. The other is for the computer to carry on internal activity until it is interrupted by activity from the outside. Interrupts

● Hands On

enable the computer to operate efficiently because they save the processor from having to waste time polling for activity from outside.

What are some examples of interrupts? One, mentioned earlier, is pressing a key on the keyboard. Another is a tick of the clock built into the PC. Eighteen times per second the PC's clock interrupts the 8088 microprocessor to signal that time is passing. DOS keeps track of time of day by counting the ticks of the internal clock and making calculations based on the number of ticks since the previous midnight.

Another example of an interrupt is the disk drive signaling the processor that a disk operation has been completed. Because disk operations are slow compared to the working speed of the processor, the 8088 gives orders to the disk drive and then goes on computing until the disk drive issues an interrupt to indicate that the operation is complete.

Sometimes it is important that the processor not be interrupted. To allow for this the 8088 microprocessor has an instruction called clear-interrupts (CLI) that permits a temporary suspension of interrupts. During the suspension requests for interrupts are held until interruption is activated again. Interrupts are normally suspended for very short periods of time, just long enough for the computer to carry out a handful of instructions such as those for loading a new set of values in the segment address registers. The CLI companion instruction, called start-interrupts (STI), turns interrupts back on.

To give a brief but dramatic example of the effect of suspending interrupts, consider the programs *Beep* and *Warble* shown in Listing 1. The listing shows how assembly language code is written and includes instructions for assembling a program and preparing it for execution. If you have the Macro Assembler, you can assemble this program and experiment with it; if not, studying it will teach you some more about the workings of the PC.

Beep and *Warble* are short programs that generate a tone on the PC speaker. The code in both programs produces a pure, steady sound on the speaker. The *Warble* program doesn't suspend interrupts, so 18 times per second it is interrupted by the clock ticking; the interruption is very brief, but it is just long enough to produce a warbling sound. *Beep*, on the other hand, suspends interrupts, and its tone stays solid and pure. Run *Beep* and *Warble*, and you can experience the effect of suspending interrupts.

Each kind of interrupt has a number assigned to it. The clock tick, for

interrupts were just as useful for internal processor activity. This led to the development of three kinds of interrupts: hardware, logical, and software. The interrupts are fundamentally the same; they are classified by their use.

Hardware interrupts are generated by equipment demanding attention. The PC has four hardware interrupts. The first interrupt, the nonmaskable interrupt (interrupt 2), is used to signal situations like a power failure. Interrupt 8 is used for the timer, 9 for the keyboard, and 14 for the disk drives. Seven reserved interrupt numbers (6, 7, 10 through 13, and 15) can be used for additional hardware interrupts. Two of those seven reserved interrupts have their subject matter assigned: 12 is reserved for a communications adapter and 15 for a printer interface.

Logical interrupts are generated by the 8088 microprocessor when it encounters an unusual arithmetic or program testing condition. There are four logical interrupts. Interrupt 0 occurs when the 8088 encounters an attempt to divide by zero. Interrupt 1 causes the 8088 to test programs by executing one instruction at a time. Interrupt 3, which is also used for program testing, is generated by the breakpoint instruction, and interrupt 4 is generated by overflow conditions such as an arithmetic operation that produces a result too large to fit into a register.

Software interrupts are the most interesting kind. When a program passes control of the computer to another program or subroutine, it is usually done with an instruction known as a CALL. To call a routine the program must know the routine's address. The calling mechanism automatically generates the return address for the called routine to use when it is finished.

Software interrupts enable control to pass from a program to a subroutine without requiring either one to know the other's address. If a program needs to have the time of day calculated, for example, it doesn't require the address of the

The brain of the IBM PC is embodied in the Intel 8088 microprocessor.

example, is interrupt 8, and the disk drive is interrupt 14. Stored at the beginning of the PC memory is a table of addresses for programs that are activated when interrupts occur. These addresses, sometimes called interrupt vectors, must be complete segmented addresses that occupy 4 bytes each. The vector for interrupt 0 is stored at memory location 0, the vector for interrupt 1 is at location 4, and so on.

When interrupt *X* occurs, the status of the current program is saved using the stack, and the vector at location 4 times *X* is loaded into the 8088's program address registers, code segment, and instruction pointer. The computer then begins running the interrupt handling program located at that address. When the interrupt handler is finished, it uses an interrupt return instruction (IRET) to return control to the program that was running when the interrupt occurred.

The interrupt process was created as a way for a computer to deal with activity outside the processor. But once the process was developed, it quickly became apparent that inter-

time-of-day subroutine—it only needs to invoke the time-of-day routine with interrupt 26. There are two reasons for using interrupts instead of addresses to call subroutines. The most important reason is that service routines (such as those provided by DOS and the ROM-BIOS) called by interrupts can be changed when necessary. Since changing a subroutine usually alters its size and address, using an interrupt to call the routine avoids the need to change programs that use the routine.

The other reason software interrupts are used to invoke service routines is to make overriding the routines more practical. The built-in ROM-BIOS service routines for the display screen, for example, cause the PC speaker to beep whenever `CHR$(7)` is written. If you wanted to keep the beep from sounding, you could write a program to check the characters being written to the screen, and whenever a `CHR$(7)` appeared, you could change it to a blank.

After doing the check, your program could pass control to the regular display screen routine to complete the work. In effect, you would be tacking a small addition onto the front of the regular display screen program. To put your program into service you would replace the interrupt vector for display screen services (interrupt 16) with the address of your new program.

Before finishing this discussion of interrupts, I want to mention one unusual use of the interrupt vector table. The interrupt vector table at the beginning of memory is intended to hold the complete segmented addresses of programs that service their corresponding interrupts. But IBM extends the use of the vector table in an interesting way to store the addresses of three items that aren't programs, but data. These interrupts aren't used in the same way that other interrupts are: if a program requested interrupt numbers 29, 30, or 31, the computer would look to one of the data tables and try to execute it as a program.

Stacks

Stacks are one of the most fascinating and important features of modern computers. Together with interrupts, stacks make up the heart of efficient and effective computing. Stacks take their name from a metaphor used to explain how the mechanism works in the computer. Consider a stack of plates, particularly the kind of plate stack that you find in a cafeteria, where dishes are supported by a spring-loaded platform that moves up and down. When people in the cafeteria need to store clean plates, they put them on top of the stack and the older plates are pushed down. When someone takes a plate off the top, the rest of the stack pops up. The plates are used in a last-in-first-out basis, so stacks are sometimes called LIFO stacks.

A LIFO stack is an efficient mechanism for the computer to use to keep records of interrupts and other

Together with interrupts, stacks make up the heart of efficient and effective programming.

operations. When a computer receives an interrupt, for example, it needs some place to keep a record of the work it was doing. If it receives another interrupt while it is processing the first one, it needs a place to keep a record of the second one. When the second interrupt is finished, the computer must go back to the most recent task it was working on, which in this case was the first interrupt.

The stack in the PC functions so that a portion of memory is given to stack storage, with the stack segment register pointing to the area in memory where the stack is located. The top of the stack is indicated by a register called the stack pointer (SP). While a stack of plates on a spring physically moves when plates are put on and taken off, the computer stack

doesn't move. Instead the location of the top of the stack moves, as indicated by the stack pointer.

Data is placed onto the computer's stack by an operation called a PUSH, and removed by a POP operation. When an interrupt occurs, the current program address, kept in the code segment and instruction pointer registers, is pushed onto the stack. Then the address of the interrupt's service routine is loaded into the code segment and instruction pointer so that the service routine is executed.

Behind the stack pointer is all the previous work that has been suspended, awaiting reactivation. Ahead of the stack pointer is open memory space that the interrupt service routine can use if it needs any working memory while it is carrying out its tasks. If another interrupt occurs, the new interrupt routine finds its working area further along the stack.

When each routine is finished, it pops the stack. First, working storage is popped off the stack; then the previous routine's program address and code segment and instruction pointer values are popped off and sent into the code segment and instruction pointer registers. During the entire process the stack mechanism automatically keeps order, making sure that everything is done in the proper sequence.

In addition to handling interrupts, stacks are used whenever one program calls another. For both calls and interrupts the principle is the same: old work must be set aside, temporarily and safely, so that new work can begin. When the new work is finished, the old work is taken up again in the order in which it was suspended.

You should know one detail about the stacks used in the 8088 processor if you use the contents of the stack or inspect a working stack. Stacks use memory in a backward fashion, from high memory locations to low, allowing programs to access old stack contents more easily. This means that old stack contents are at higher

Editor's note: The statements following semicolons are comments like the REM statements in BASIC. They do not need to be keyed in.

```

{ PORTTEST program to access every port }
{ (C) Copyright 1983, Peter Norton }

{ This program accesses every possible port value through an }
{ assembly language routine called INPORT, which appears in }
{ listing 3. Based on practical experience, this program }
{ filters out the most common false input values returned: }
{ 0, 78, 110, 188, 202, 203, 207, 254, 255 }

{ If you are new to compiling Pascal, especially to linking }
{ Pascal with assembler routines, here is a brief outline of }
{ how it is done. Assuming you have entered this source program }
{ as a text file named PORTTEST.PAS, on a disk in drive B }
{ and have already assembled the INPORT routine, here is what }
{ you do: }

{ To compile this program, in two steps, do this: }
{ B: }
{ A:PAS1 PORTTEST,PORTTEST,CON; }
{ A:PAS2 }
{ A: }

{ To link the Pascal and assembly module, do this: }
{ LINK B:PORTTEST+B:INPORT,B:PORTTEST,CON; }

{$debug-,$line-,$ocode-}

program porttest (output);

function inport (x : word) : byte;
external;

var
count : word;
b : byte;
w : word;
c : array [wrd(0)..255] of word; { used to hold the value profile }
headc : word;

procedure header1;
var [static]
i : integer;
begin
writeln;
for i := 1 to 8 do
write (' Port Val');
writeln;
end;

procedure header2;
var [static]
i : integer;
begin
writeln;
for i := 1 to 8 do
write (' Val Count');
writeln;
end;

procedure initialize;
begin
count := 0;
headc := 0;
for b := 0 to 255 do { clear profile counts }
c [b] := 0;
for w := 1 to 25 do { roll the screen }
writeln;
writeln ('Program for INSIDE THE IBM PERSONAL COMPUTER');
writeln ('(C) Copyright Peter Norton, 1983');
writeln ('Listing 2 : PORTTEST - read all ports');
writeln;
writeln ('The following may be active ports:');
header1;
end;

procedure soan_all_ports;
begin
for w := 0 to maxword do { loop through every possible port }

```

Listing 2. (continued on facing page)


```

begin
  b := inport (w);      { get the value }
  c [b] := c[b] + 1;    { add to profile }
  if not (b in [wrd(0),78,110,188,202,203,207,254,255]) then
    begin
      write (w:6,b:4);    { show the port number, and the value }
      count := count + 1;
      headc := headc + 1;
      if headc > 159 then
        begin
          headc := 0;
          header1;
        end;
      end;
    end;
  header1;
end;

procedure finish_up;
begin
  writeln;
  writeln ('Here is a profile of the values returned for all of the ',
    'possible ports:');
  header2;
  for b := 0 to 255 do
    write (b:4,c[b]:6);
  header2;
  writeln (count, ' ports may possibly be active');
  writeln;
  writeln ('Finished.')
end;
begin
  initialize;
  scan_all_ports;
  finish_up
end.

```

Listing 2. (continued from facing page)

Editor's note: The statements following semicolons are comments like the REM statements in BASIC. They do not need to be keyed in.

```

; INPORT assembly language subroutine
; (C) Copyright 1983 Peter Norton

; This program, when called from Pascal, reads a requested port, and
; returns the value found in the port

; INPORT -- read port and return to Pascal
; Pascal declaration of this routine:
; function inport (port : word) : byte;
;   external;

inport_code segment 'code'
  public inport

inport proc far      ; Pascal 'external' routines are far calls
  push bp           ; save the base-pointer
  mov bp,sp         ; get the stack pointer
  mov dx,[bp+6]     ; grab the port number from the stack
  in  al,dx         ; get the port's input value
  pop bp           ; restore the base-pointer
  ret 2             ; return to the Pascal routine

  db  '(C) Copyright Peter Norton, 1983'

inport endp
inport_code ends

end

; End of listing 3

```

Listing 3

● Hands On

locations than the position of the stack pointer. So, for example, subroutine parameters that have been pushed onto the stack can be accessed by adding values to the stack pointer. Normally, the open space at the end of the stack is never accessed directly by memory address, but by pushing and popping it can be located by subtracting values from the stack pointer.

Stacks are unquestionably fundamental to the operation of computers today, which is remarkable because they are a relatively recent addition to computer design. The IBM 360 series of computers, the corporation's mainstay since the 1960s, does not use the stack concept.

Stacks can be used for more than what is described here. The 8088 microprocessor uses stacks only as a holding place for suspended work, which is how most computers use stacks. However, the way a computer works with instructions and data may be reoriented so that a stack becomes the core of all computing. Burroughs computers use stacks in this way. Anyone who would like to understand how computers can be radically different from the IBM PC should look at descriptions of Burroughs computers.

Ports

Ports are the only way that the 8088 has of passing data to or from a device other than its memory. Any device that the microprocessor needs to communicate with, such as the keyboard, the disk drives, or the speaker, is given a port to use. A port is a hypothetical data path with a number assigned to it that can accept or send data at the command of the processor.

When the 8088 needs to send data to a port, it uses the OUT instruction, specifying the port number and the data being sent, which is always either 1 or 2 bytes. In effect, the OUT instruction signals the data bus, "Port number X, take this data." The

IN instruction works the same way, signaling the data bus, "Port number X, send some data." The 8088 microprocessor has no idea which ports are actually in use, and all the IN and OUT requests are blind operations.

Just as the 8088 machine language has the IN and OUT instructions mentioned above, BASIC provides the same capabilities with the instructions INP and OUT. The following example demonstrates reading and writing to the speaker ports in BASIC:

```
10 X = INP (97) 'read the speaker port
20 'X is probably 76—see what value you get
30 PRINT "Speaker port 97 was set to "; X
40 OUT 97,X+3 'turn on the speaker bits—a
   sound begins
50 FOR I = 1 TO 1000 : NEXT I 'kill time
   while the sound is made
60 OUT 97,X 'reset the port ending the sound
```

Ports can be used with interrupts. When you press a key on the PC keyboard, for example, no data is sent to the computer. Instead, interrupt 9 is generated, indicating that keyboard data is available. In response to the interrupt, the ROM-BIOS routines issue an IN instruction for the keyboard port, allowing the data indicating which key was struck to pass into the computer.

Port addresses are specified with 16 bits, so there are potentially 64K ports that can be used. Only a few port numbers are actually assigned in the PC, leaving plenty of room for expansion. In the first article in this series, I pointed out that 1024K memory locations exist and that the microprocessor is unaware of which locations actually have memory installed. Because ports act the same way, the 8088 can attempt to communicate with any port, whether it is working or not.

Ports are used several ways on the IBM PC. One way is as an ordinary data path. For example, the key codes that indicate which keys on the keyboard have been struck pass through one port, and data going to the printer passes through another port.

Another way ports are used is to pass control information to devices and to receive back status informa-

tion. Initialization of the monochrome display adapter, for example, is done through port 952. Still another use for ports is reading the switch settings on the system board that indicate the kind of equipment that is installed.

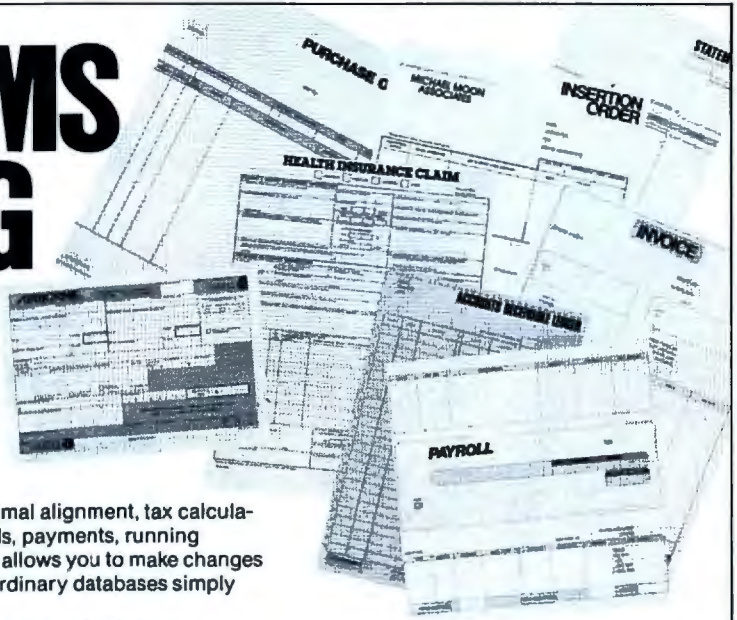
The following is a list of important port assignments: Port 96 (hex 60) is used to pass data scanned from the keyboard. Port 97 (hex 61) is used to control the speaker and the cassette motor. It also activates a hardware timer. Ports 64 to 67 (hex 40 to 43) are used to control the programmable timer used by the speaker and cassette interface. The monochrome display uses a series of ports beginning with 944 (hex 3B0) and the color graphics display uses ports at 976 (hex 3D0). The disk controller uses a series of ports from 1008 (hex 3F0), and the actual data passing to and from the disk drives goes through port 1013 (hex 3F5).

To help you learn more about ports, Listings 2 and 3 give a two-part program, written in a combination of Pascal and assembly language, which reads all the ports and reports on the ones that are active.

Since BASIC gives access to the ports, this program could have been coded in BASIC. The reason I didn't write it in BASIC is that it would run very slowly, compared with a Pascal and assembler version. Studying the listings will show you the simple mechanics of combining assembler and Pascal programs on the PC. Feel free to experiment with these programs and with the information presented here—it's the best way to learn how the PC thinks.

Peter Norton has worked in computing as a programmer, designer, and author. He wrote and produced The Norton Utilities. This article will be included in his forthcoming book, Inside the IBM PC: Access to Advanced Programming. It is used with permission of the Robert J. Brady Co., copyright 1983, Peter Norton.

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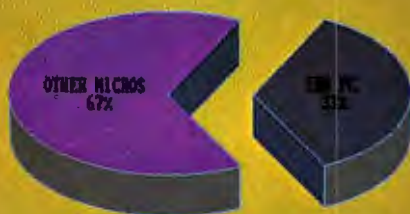


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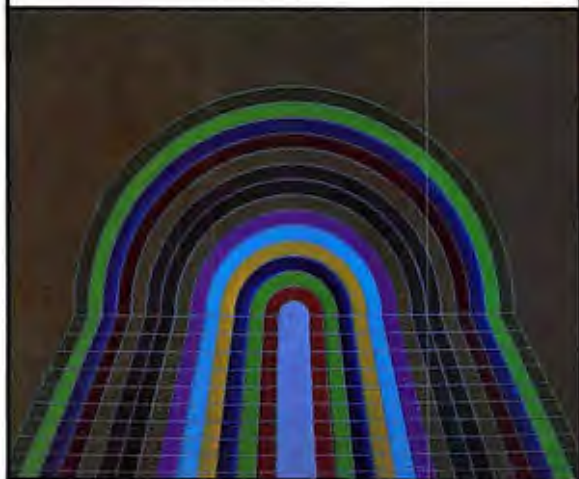
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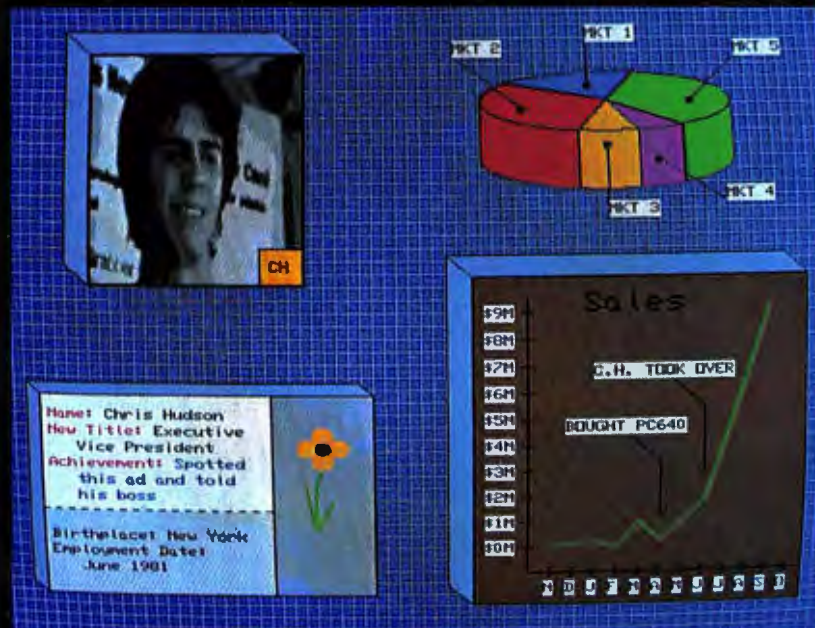
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Digital Dialects

An overview of nine languages to help you choose the right tool for the job

Charles Kelly

Do you do your own dry cleaning? Do you make your own shoes? Do you attempt to create your own laundry detergent?

A society that is economically successful is predicated on a division of labor; each person produces a different valuable service or product. Computer software and programming are not exempt from this principle called the division of labor.

Developing computer programs is a challenging and enticing activity. Unfortunately, there is a big difference between developing programs and developing good, accurate programs. Developing good programs, those in which you have confidence, is extremely time consuming.

This article compares nine prominent computer languages to provide you with the information for making choices about the best languages for commercial and scientific programming. The article also attempts to focus your attention on the most valuable computing resource: your time.

If you can't program a computer, don't worry; you'll never have to. If you are just beginning to learn programming, be sure you have a good reason to invest your time studying about software development. Programming will not save you time or money. If you program, you should enjoy it as a hobby for its own sake

or view it as an employment opportunity. If you insist on programming, become a skilled craftsman and take pride in your work. Learn about the language and utility tools available.

Machine Language

The fundamental language for every computer processor is a set of electrical impulses. A processor architect makes a series of complex decisions

Machine language programmers code, debug, and document approximately 750 machine language statements per year.

that determine the gate design and instruction set for a processor. Boolean logic is used to represent this instruction set as a sequence of 0's and 1's. The instruction set is referred to as the machine's language, or simply as machine language. As a convenience to human programmers, the machine language's 0's and 1's are grouped together, eight at a time, into bytes. The bytes are represented by two hexadecimal digits.

If you think that this discussion of machine language is tedious, you're right. Machine language is tedious. Few people program in machine language; its most common application is patching a program assembled by a higher level language. A high-level language such as BASIC or COBOL uses symbols and statements that resemble natural languages. A low-level language uses code that closely resembles the on/off electrical impulses of the computer.

In addition to being tedious, the representation of machine languages is very long. For example, the BIOS program (basic input/output system) stored in ROM inside your PC would fill your monitor 24 times with a continuous series of bits. If one of these bits were set incorrectly, the BIOS would probably not operate. According to Gordon Bell, vice-president of Technical Development for DEC, machine language programmers code, debug, and document approximately 750 machine language statements per year.

One statement written in BASIC is equivalent to between 10 and 100 machine language statements. If you are curious about machine language, read *The Soul of a New Machine* by Tracy Kidder (Avon, New York, 1982). It is an enjoyable and well-

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written presentation of the engineering work that accompanies the design of a new computer.

Assembly Language

Assembly languages were designed to relieve the tedium and frustration of machine language programming. Machine language coding is extremely prone to error. Since a computer is much more capable than the average human of remembering a long string of 0's and 1's, assembly language programming is much more convenient than machine language programming.

Assemblers allow machine addresses to be represented by symbolic names, and machine instructions to be represented by mnemonic symbols. Data may be represented in forms such as octal, decimal or hexadecimal, or as character strings. Registers and memory areas may be indicated by symbolic names. Data structures may be represented by variable names, symbolic pointers, and symbolic offsets.

Sophisticated assemblers have a macro definition facility that allows a large segment of code to be replaced by a single programmer-defined instruction. Assemblers also permit conditional compilation, meaning that varying versions of code can be produced by supplying different parameters during assembly.

To use assembly language a programmer must be familiar with computer architecture. He or she must understand the use of each register, the addressing modes for the processor, the flags and error codes, and data representations for the machine. Assembly language programming is a vast improvement over machine language programming, but it is still a low-level language.

A disassembler is a programming tool that accepts a machine language program and attempts to convert it into assembly language source text. The source contains pseudo labels and pseudo variable names. These names do not correspond to the label

names and variable names that the programmer used in the original program.

FORTRAN

FORTRAN (FORMula TRANslation) was the first high-level language. It was designed to allow scientists and engineers to express mathematical algorithms in a series of computer statements. The goal of FORTRAN was to separate systems programming activities from applications programming activities.

FORTRAN was the first compiled language. Compiling refers to the process of translating one language, the source language, into another language, the target language. Us-

FORTRAN is still the language of choice among engineers and scientists.

ally the target language is a low-level language, such as machine or assembly language.

FORTRAN is generally considered an engineering or scientific language. Performing character-string manipulations is difficult, but not impossible, with FORTRAN. Graphics processors, data base management systems, and word processors have been written in FORTRAN. FORTRAN is still the language of choice among engineers and scientists.

COBOL

COBOL (COMmon Business Oriented Language) was produced in 1958 as a result of a committee formed by the Department of Defense (DOD). Before the advent of COBOL most software data processing systems were delivered to the DOD in assembly language form.

The only programming task more difficult than writing good programs in assembly language is the task of debugging bad programs that someone else wrote in assembly language.

DOD programmers faced a continuing series of problems when they attempted to modify programs written in assembly languages. In addition to the difficulty of modifying these programs, the programs were not portable: a system designed to run on one computer could not be used on another computer. This is a very favorable environment for computer manufacturers who wish to "lock-in" customers (or force customers to upgrade their systems with products from the original vendor).

To remedy this data processing dilemma, the DOD funded the development of COBOL specifications and fostered the development of COBOL by insisting that every data processing machine installed at a DOD site contain a COBOL compiler. Since the DOD is the largest procurer of data processing equipment in the world, nearly all computer manufacturers developed one or more COBOL compilers for their machines. Once the fixed cost of compiler development had been expended, the marginal cost of providing additional copies of a compiler to other users was small. Computer manufacturers quickly introduced COBOL to their commercial data processing customers.

Although originally conceived by the DOD as a language that would allow a set of statements to be run on many different machines, COBOL is in fact not portable. It has been tremendously successful, however. Many large banks and insurance companies rely almost entirely on COBOL for their data processing operations. By modern standards, COBOL is awkward and balky, but it was considered flexible during the early 1960s.

Several large industry trade groups such as the Association of Data Processing Service Organizations and the Data Processing Management Association have put together suggested curricula for colleges that offer

The Coming of Studio Software

The fundamental cause for growth within the computer industry is the fact that the cost of electronic components has decreased at a constant rate of 25 percent per year since the early 1950s.

This cost decrease is most dramatically illustrated in the price of hand-held calculators. In 1970 the Bowmar Brain was the first hand-held calculator on the market. It was a four-function machine that sold for about \$200. The price of a similar machine today is less than \$5. The major part of this \$5 goes toward the plastic case and buttons for the machine, transportation costs, and profits and overhead for distributors and retailers.

The price of these calculators is now so low that gas station owners in California give away calculators rather than fragile and expensive drinking glasses.

The cost characteristics of the electronic components industry dictate trends within the computer systems industry. Although the price of electronic components has declined rapidly, the price of mechanical components has increased. The major components of the cost of computer systems today are sales and software.

As an interesting tangent, most hi-fi enthusiasts immediately recognize that a major cost in a hi-fi system is software. Record and tape purchases represent ongoing expenditures and eventually exceed initial investments on amplifiers, speakers, and turntables.

As the price of electronics continues to decrease, we will soon see the day when computers are given away free to support the sale of software or commercial advertising. If you think this is outlandish, remember the gas stations and glasses. The computers given away free will not resemble the IBM PC; they will be embedded in credit cards and cartridges. Services these cartridges and credit cards will provide will include access to commercial datalogs with direct purchase facilities as well as print and video literature.

Who will pay for these computers? New kinds of retailers who will no longer have to support expensive shopping center outlets, old retailers who will not allow their markets to erode, and publishers who will wish to sell literature and information—to name just a few.

If you are in the top 10 percent of wage earners, you can expect retailers and publishers to pay you in the form of discounts to use their catalogs. If this also sounds like fantasy, remember that this vision of the computer future is based on economics. It will be cheaper to use these computers than four-color brochures, magazine advertising, or network television.

As this digital wonderland unfolds, what will become of computer languages and programming? Every embedded consumer computer device will require programming. The amount of programming required will be enormous—more than our

society can currently support. Hopefully, computer languages will be developed to enhance programmer productivity.

Users of embedded computers will not do any programming. After all, we don't expect to program our washing machines or talking microwave ovens. Selling a computer with a set of programming tools will be akin to selling an automobile with a drill press and an arc welder. And just as it is possible to make home recordings for your hi-fi system, most listeners prefer buying professional studio recordings. Although writing your own software will certainly be possible, most people will probably prefer to use professional, "studio" software.

One impediment remains before studio software dominates the marketplace: high prices. In ten years we will no longer see \$700 data base packages or \$400 word processing packages. These programs will sell for the prices of current paperback books and stereo recordings. Why? The answer, once again, is economic forces.

As the number of buyers increases, the fixed cost of software development will be spread over a larger number of units. Successful authors and publishers will formulate strategic plans based on new mass markets, while authors and publishers who are unable to reduce their price schedules will join the Edsel, Packard, and Pierce-Arrow.

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courses in data processing. These organizations emphasize COBOL heavily.

APL

APL (A Programming Language) is a system of notation for discrete mathematics that was developed by Kenneth Iverson. The original version of this notation was not intended to be implemented as a computer language. Iverson was working at the IBM Watson Research Center when he developed his "Iverson notation." Several colleagues learned of his work and decided to formulate a working implementation in language form. The temporary name chosen for this implementation was A Programming Language. The name stuck.

Among computer languages APL has the richest set of primitive operators that carry out processes such as random number generation, index generation, factorial computation, and matrix formation and inversion. Because of its many operators, APL uses an order of execution that is strictly "right to left." Most other programming languages that use only 5 to 15 operators establish a hierarchy of operations. Novices often find APL intimidating because it uses Greek symbols to represent its operators.

APL is extremely popular among statisticians and operations research analysts. They enjoy the speed and flexibility with which algorithms can be developed and tested using APL. Most casual observers assume that APL is limited to numeric applications, but such is not the case. Four commercial time-sharing companies promote and use APL exclusively. The majority of their clients are business organizations that use APL for document production, graphical analysis, data base retrieval, financial analysis, and traditional numeric applications.

Pascal

Pascal was written by Dr. Nicholas Wirth and named in honor of the French mathematician Blaise Pascal. It was designed as an educational tool to illustrate the techniques of structured programming. Structured programming, sometimes referred to as "goto-less" programming, encourages modular program development and precise control structures that enable programmers to write large, correct programs.

Pascal has been very well received by the academic computer science community. There is now a generation of computer science students who have learned Pascal and have carried their training into industrial practice. Pascal has contributed extensively to the growth of the new software industry by providing a flexible tool for designing language processors, compilers, operating systems, and applications programs.

Despite its academic success, however, Pascal has not been well-received in the commercial data

Some controversy exists within the computer community as to which is a better language, BASIC or Pascal.

processing community. The data processing industry is formed by business organizations that process large volumes of repetitive data—payrolls, checking accounts, automobile registration lists, etc. Pascal has several disadvantages when it addresses commercial data processing problems. The first is a technical problem within the Pascal language: it does not provide dynamic array allocation.

A Pascal program that uses an array must guess at the largest amount of memory the array will contain, and allocate that amount of memory every time the program is executed. Wirth decided on this style

of implementation so that computer science students would be forced to learn advanced data structures that are created by using pointer variables and list processing techniques.

The second problem with Pascal is also technical: the file structures it supports are unsophisticated. A third problem is institutional: data processing is dominated by COBOL. Pascal is relatively difficult to learn, and it would be very expensive to retrain COBOL programmers to learn Pascal so that they could spend years rewriting existing COBOL programs.

The final problem that plagues Pascal is standardization. There are many versions of Pascal, some of which attempt to cure the deficiencies of ISO (International Standards Organization), or standard Pascal. Unfortunately, the "cures" are mutually incompatible because a user who designs software using a nonstandard version of Pascal is locked into a technical and royalty relationship with one Pascal developer.

Despite the problems with Pascal, it is a very useful and elegant language that enjoys a great deal of popularity. If a person is serious about learning the craft of software design, he or she should seriously consider learning Pascal.

BASIC

BASIC (Beginner's All-purpose Symbolic Instruction Code) was invented at Dartmouth College in 1965 by John Kemeny and Thomas Kurtz. At that time there was one language known as BASIC, with one set of rules and one implementation. Today there are an unknown number of versions of BASIC. Each version stresses features unique to the machine and operating environment in which it resides.

BASIC has two advantages: it is easy to learn and easy to implement on specific computers. BASIC enables users with minimal training to construct simple programs. Since BASIC statements are not standardized, advanced versions of BASIC have bor-

rowed a hodgepodge of control structures and data structures from other languages. Some of these versions are useful while others are downright silly. IBM BASIC is one of the best versions of the language despite several glaring deficiencies such as line lengths limited to 255 characters.

Some controversy exists within the computer community as to which is a better language, BASIC or Pascal. Each language has its place and purpose. BASIC is a fine tool for learning about a new computer. If the BASIC is well designed, a user can delve into the nooks of a computer system. But for writing medium (more than 500 instructions) or long programs, Pascal is the appropriate tool.

C Language

C is the result of research performed at Bell Laboratories. It is part of a series of developments in computer languages; earlier parts of the series were named A and B. C emulates many of the features of low-level languages like assembly language; C, however, is easier to implement and more portable than assembly language.

The basis for C is a small set of instructions written in machine language. This set of instructions constitutes the C kernel. When C is ported to a new machine, only these instructions must be rewritten. Other C language statements are implemented using instructions from the kernel.

An early use of C was the Unix operating system. Unix can easily be transported whenever C is ported to a new machine. This concept of portability is also used by the UCSD p-System, which is written in a pseudo code known as p-code. P-code resembles C in that the UCSD operating system can be transported to a new machine when a small section of the p-code is rewritten.

Ada

Ada is named in honor of the Countess Ada Lovelace, reputed to be the world's first programmer. Lovelace worked during the nineteenth century with Charles Babbage on the calculating engine. Ada is the latest of the Defense Department projects designed to improve data processing. Computer scientists were drawn into groups known as the Strawman Committee, the Woodenman Committee, and the Steelman Committee. The result of their work is a new language that resembles Pascal.

The DOD holds the patents and copyrights to *Ada* and has stated that it will not allow the name to be used for any subset, superset, or extension of the language as it is defined in the *Ada Language Reference Manual*. The DOD's goal is to prevent any infringements upon the language that would limit its portability. Any language to be called *Ada* must pass a suite of validation tests. The DOD is requiring that all systems delivered to DOD installations after 1985 contain a validated *Ada* compiler, the same requirement specified for COBOL 25 years ago.

Ada is not without critics. The notable Oxford University computer scientist C.A.R. Hoare has said that he is afraid to live in a world where nuclear weapons systems are controlled by a computer language designed by a committee.

Your Tools Await You

This article provides a brief overview of programming language tools. In a sense you have been told, "This is a hammer, this is a wrench, this is a lathe." If you wish to use one of these tools, you will have to learn its specifics.

In general, you will need a programming reference guide and user guide for the language you choose. After you have learned to use the language, *Software Tools* by Kernighan and Plauger (Addison-Wesley, Reading, Massachusetts, 1976) will provide invaluable source material for improving your programming techniques.

Before you plunge into a programming project, remember the following facts. Professional programmers, on the average, code, document, and debug only about 15 lines of code per week. Any reasonable program is going to require a minimum of several hundred lines of code. Don't be deceived by the ease of producing the first hundred lines of code; the difficult part begins when you put the pieces together.

It is much easier to produce ten independent programs of ten lines each than it is to produce one program of 100 lines. Similarly, it is

Ada is the latest of the Defense Department projects designed to improve data processing.

easier to produce ten programs of 100 lines each than one 1000-line program. The logic behind this is explained in *The Mythical Man-Month* by Frederick Brooks (Addison-Wesley, Reading, Massachusetts, 1975).

As mentioned earlier, your time is a valuable commodity. Search high and low, and far and wide for a software solution to your problem. It is unlikely that your problem is unique. Request assistance from trade or user groups before you start a programming project. Perhaps they will share the development costs. Programming can be fun, but how much fun can you afford?

Charles Kelly is a professor in the Business Department at the University of San Diego, where he teaches courses in data processing and finance. He has been working with computers since 1967.

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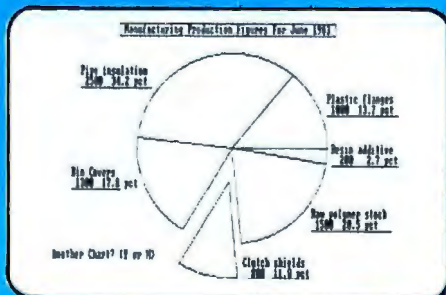
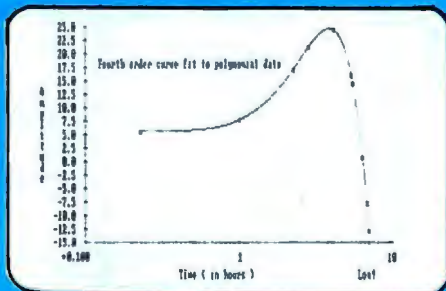
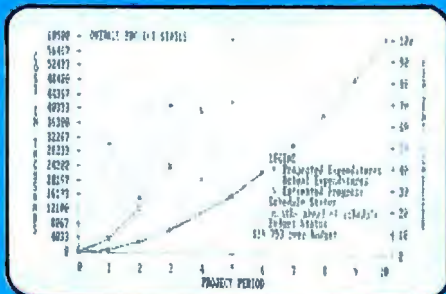
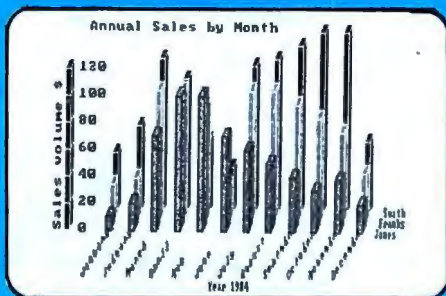
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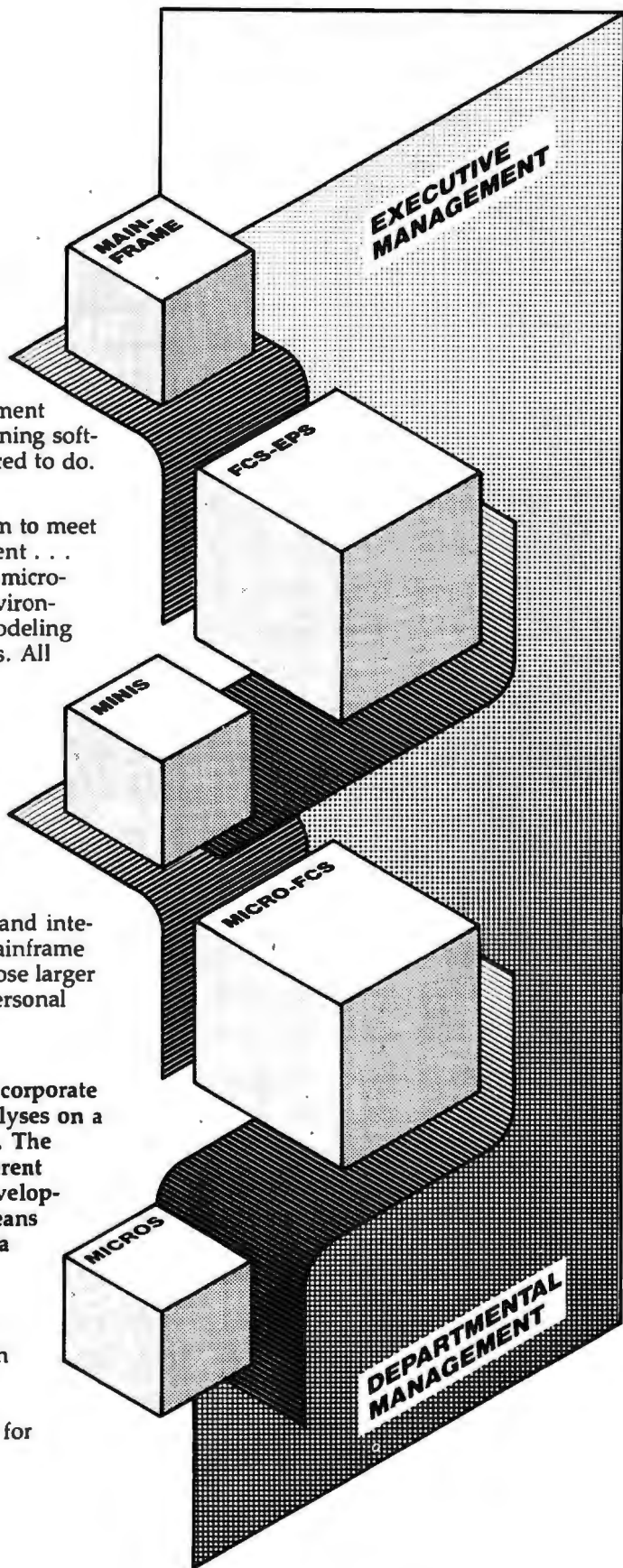
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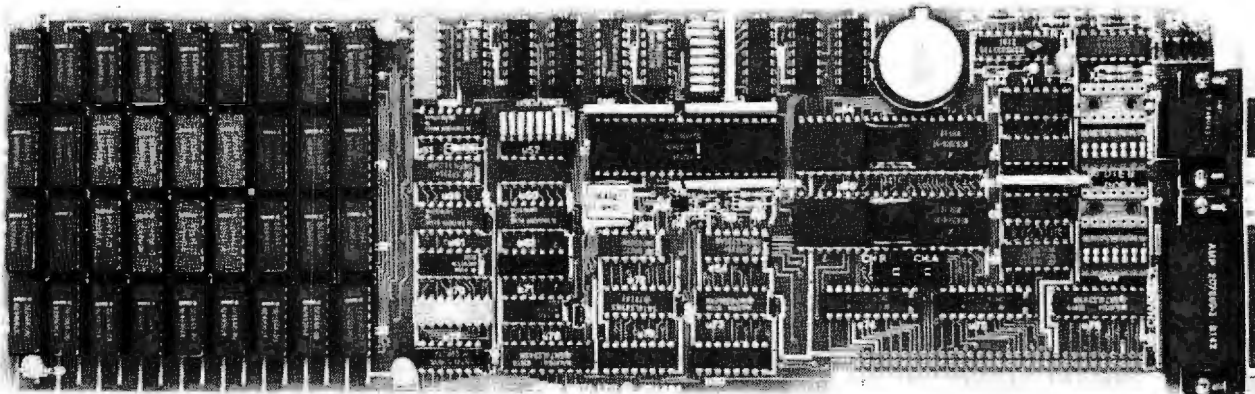
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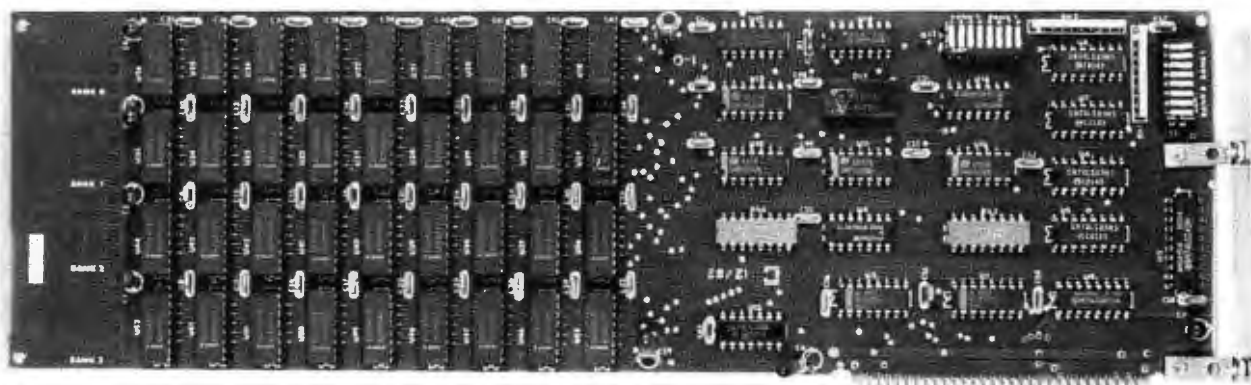
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Tracking Your Expenses with dBase II

A tutorial that helps you learn some dBase basics while creating a system to manage your financial information

Lawrence J. Magid

Because it's so powerful, many people think that the *dBase II* data base management system is complicated and difficult to learn. That's because *dBase II* has such an extensive set of commands that it functions like another computer language. You can write dBase programs just as you write in BASIC or other languages. Although learning to program in dBase can be time consuming, you don't have to become a programmer to use dBase. You can set up and use a *dBase II* file in a very short time by learning only a few of its many commands.

This tutorial shows how to use dBase to set up an expense record-keeping system. This model is not a tax preparation program, but a way to record and report your tax-deductible expenses.

There are programs that will calculate your taxes and print your forms. I have chosen not to use such a program, but instead to rely on the advice and tax planning of a competent accountant. The purpose of this model is to aid the taxpayer or accountant in providing a concise expense report. Even if you don't plan to use *dBase II* for this purpose, the techniques demonstrated here can be applied to other data management tasks.

This article is designed to get you started. For more in-depth *dBase II* instructions, I recommend Robert Byers' new book, *Everyman's DataBase Primer: featuring dBase II* (Ashton-Tate, Culver City, California, 1983), reviewed in this issue.

dBase II has such an extensive set of commands that it functions like another computer language.

Data Base Terms

The following terms apply to most data base programs, including *dBase II*.

A *data base* is the entire set of information with which you are working. An example of a data base is your address and phone directory.

A *record* (sometimes called a case) is one entry in a data base. While your entire phone directory is a data base, a listing for any one person is a record. A person or company's name, address, and phone number constitute one record.

A *field* is one item in a record. In an address book the person's name is a field, the phone number is a field, and the address is another field.

Planning the Data Base Structure

The first step in planning a data base structure is deciding what information you need. Since entering information takes time and storing information requires disk space, you should create a structure that provides room for everything you need without cluttering your disk with unnecessary information.

Another good practice is minimizing the number of fields in your data base. Each field must be filled in or left blank, which takes time and adds data to your disk.

To save space and avoid complexity, I have kept my expense-record data base structure simple, short, and general. It is so general that you can probably use it, even if you have a different tax scenario.

The data base is built around the following fields:

ITEM: The name of the item you are entering.

DATE: The date of expenditure.

AMOUNT: The amount of the expenditure.

MILEAGE: To be used only if you expense your car by the mile and used your car in conjunction with this expenditure.

CATEGORY: Any logical category used to sort your financial data.

VENDOR: The company or person from whom the item (or service) was purchased.

COMMENT: Anything else you care to enter that may help in the event of an audit.

Record Structure

For each field in your data base *dBase II* requires a record structure. You must define the field's name, type, width, and, in the case of numeric fields, decimal places. This is done as soon as you begin to build your data base, using the Create command. Of course, deciding the

```

ENTER RECORD STRUCTURE AS FOLLOWS:
FIELD  NAME,TYPE,WIDTH,DECIMAL
        PLACES
001
  
```

Figure 1: Initial Screen for Defining Record Structure

```

ENTER RECORD STRUCTURE AS FOLLOWS:
FIELD  NAME,TYPE,WIDTH,DECIMAL
        PLACES
001    ITEM,C,50
002    DATE,C,8
003    AMOUNT,N,8,2
004    MILEAGE,N,4
005    CATEGORY,C,4
006    VENDOR,C,15
007    COMMENT,C,60
008
  
```

Figure 2: Record structure for seven fields in file named Taxes

```

STRUCTURE FOR FILE:  TAXES.DBF
NUMBER OF RECORDS:  00000
DATE OF LAST UPDATE: 00/00/00
PRIMARY USE DATABASE

FLD   NAME    TYP  WIDTH  DEC
001   ITEM     C    050
002   DATE     C    008
003   AMOUNT   N    008    002
004   MILEAGE  N    004
005   CATEGORY C    004
006   VENDOR  C    015
007   COMMENT  C    060
** TOTAL **          00150
  
```

Figure 3: Example of the screen's contents when the Display Structure command is entered

specifications for each field in advance is helpful—that's part of the planning process.

Name: The first category you must decide on is the name for each field. It may be anything you want, so long as it begins with a letter or number (no symbols), is no more than 10 characters, and contains no blank spaces.

Type: The next category to decide is the type of each field. *dBase II* has three types of fields. Constant (C) is used for an alphabetic or numeric field that does not require any mathematical function. In this example the fields called Item, Date, Category, Vendor, and Comment contain alphanumeric data and are constant (C) fields. The fields called Amount and Mileage are numeric (N) fields. *dBase II* also has a logical (L) field, but it isn't used in this example.

Width: You must also decide the width of each field. The width determines the maximum number of spaces that will be allotted for each entry. Once you establish a width, data can be entered with fewer spaces than you have assigned, but you cannot enter data with more. *dBase II* allocates as many bytes as the specified width for each item you enter, so you don't want to be overly generous with your width.

I chose 50 spaces for the width of the field called Item. This is more than enough to describe any item I might want to purchase. For Date, I selected 8; that's enough space for the longest possible date code, such as 12-14-83. For Amount, I chose 8 digits with 2 decimal places (the decimal point counts in determining the width). Eight spaces allow for an expense of up to \$99999.99 (commas aren't used in *dBase II*).

For Category, I allotted 4 digits, figuring I'd have to abbreviate the name of each type of expense and that 4 letters would suffice. For Mileage, I selected 4 digits, enough for any trip under 10,000 miles. I allotted 15 digits for Vendor and 60 digits for Comment.

Decimal places are used for numeric fields only. If you are using whole numbers only, you can leave decimal places blank.

Creating a New File

Once you've planned the structure of your data base, enter *dBase II* to create a file. Here's how it's done.

From the DOS prompt, type DBASE. You will see a sign-on message and a period, or dot, under the message at the left side of the screen. The dot is the program's prompt. All your commands are entered from this prompt.

Be sure to consult the *dBase II* manual if you decide to modify a structure after you have entered data.

You are now ready to create a file. This is done by typing CREATE. *dBase II* responds with 'Enter Filename:.'

Let's call the file Taxes. Type TAXES and press ENTER. *dBase II* responds with the display shown in Figure 1.

It's time to specify what the first field will look like. Define the field in the order that appears on the second line of Figure 1 ('Name,Type,Width,Decimal Place'). The field number, 001, is entered automatically by the program.

To begin creating the data base described earlier type:
ITEM,C,50 ENTER

Correcting Errors

If you make an error before pressing ENTER, you can correct it by using the Backspace key and typing over the error. If you make a mistake after pressing ENTER, you can use the editing features (see the *dBase II* manual for more information on editing).

After you press ENTER the screen will display '002', indicating that you are ready to go through the same process for the next field (Date). If you don't enter anything for a field, *dBase II* assumes that you are finished creating your structure.

● Hands On

Therefore, do not leave a field blank until you have finished. Remember, you can always go back and correct your errors.

Go through the same process for Amount, Mileage, Category, Vendor, and Comment. When you are done, your screen should look like Figure 2. Don't worry if your screen doesn't look that way; you will have a chance to make corrections later.

This data base has 7 fields, so when it asks for field 008, press ENTER. That will terminate the Create phase. *dBase II* will then ask you if you want to enter data. Type N for no.

Modifying the Structure

dBase II provides a feature for modifying the structure of a data base. This can be used now or after you have entered the data, should you later decide to make a change. Be cautious about using this feature, however; modifying the structure erases any data in the data base. *dBase II* provides a simple method for copying data to a scratch file before making modifications so that all the data is retained. Be sure to consult the *dBase II* manual if you decide to modify a structure after you have entered data.

Since you haven't entered data, it's safe to modify the structure without copying the file. But before you can do that, you have to tell *dBase II* that you are using a file called Taxes. This is done from the ':' prompt by typing USE TAXES, which loads the file into memory.

To display the structure type DISPLAY STRUCTURE (Figure 3 shows how the program responds). If you need to make a correction, type MODIFY STRUCTURE. *dBase II* will warn you that modifying erases all data in the data base.

To modify the structure use the cursor movement keys to position the cursor where you want to make a

| | |
|----------|-------|
| RECORD # | 00001 |
| ITEM | _____ |
| DATE | _____ |
| AMOUNT | _____ |
| MILEAGE | _____ |
| CATEGORY | _____ |
| VENDOR | _____ |
| COMMENT | _____ |

Figure 4: A sample record without data

```
ENTER REPORT FORM NAME: TAXREP
ENTER OPTIONS, M=LEFT MARGIN, L=LINES/PAGE, W=PAGE WIDTH
                                M= 1,L= 55,W= 70

PAGE HEADING? (Y/N) Y
ENTER PAGE HEADING: 1982 TAX REPORT
DOUBLE SPACE REPORT (Y/N) N
ARE TOTALS REQUIRED (Y/N) Y
SUBTOTALS IN REPORT? (Y/N) Y
ENTER SUBTOTALS FIELD: CATEGORY
SUMMARY REPORT ONLY? (Y/N) N
EJECT PAGE AFTER SUBTOTALS (Y/N) N
ENTER SUBTOTAL HEADING: CATEGORY

COL          WIDTH,CONTENTS
001          50,ITEM
ENTER HEADING: ITEM
002          8,DATE
ENTER HEADING: DATE
003          8,CATEGORY
ENTER HEADING: CATEGORY
004          8,AMOUNT
ENTER HEADING: AMOUNT
ARE TOTALS REQUIRED (Y/N) Y
005          4,MILEAGE
ENTER HEADING: MILES
ARE TOTALS REQUIRED (Y/N) Y
006          ENTER
```

Figure 5: On-screen format for data base report; words in italics indicate items from data you've entered.

change. Don't press ENTER; just use the arrow keys (you can also use the same cursor controls used by *Word-Star*—Ctrl-E, up; Ctrl-X, down; Ctrl-S, left; Ctrl-D, right). Ctrl-G deletes a character and Ctrl-V inserts a character. Once you are satisfied with the structure, you can type Ctrl-W (the W stands for "write") to save the modifications.

Quitting and Reentering

Before you enter any data, it's useful to know how to quit *dBase II* and reenter the program. To quit, type QUIT from the ':' prompt and you will be returned to DOS. To reenter *dBase II* type DBASE. You'll soon see the sign-on message and the familiar dot.

01/31/83

1982 Tax Report by Category

| ITEM | DATE | CATEGORY | AMOUNT | MILES |
|--------------------------|-------|----------|--------|-------|
| * CATEGORY Car | | | | |
| Meeting in San Rafael | 02-04 | Car | 0.00 | 120 |
| Meeting in San Jose | 06-30 | Car | 0.00 | 50 |
| Meeting in Santa Cruz | 07-24 | Car | 0.00 | 90 |
| ** SUBTOTAL ** | | | 0.00 | 260 |
| | | | | |
| * CATEGORY Empl | | | | |
| Secretarial Help | 05-20 | Empl | 125.00 | 0 |
| Secretarial Help | 01-25 | Empl | 85.00 | 0 |
| Secretarial Help | 09-23 | Empl | 115.00 | 0 |
| ** SUBTOTAL ** | | | 325.00 | 0 |
| | | | | |
| * CATEGORY Ent | | | | |
| Dinner with Sam Smith | 02-21 | Ent | 24.95 | 55 |
| Lunch with Harry Carlos | 03-15 | Ent | 17.50 | 8 |
| ** SUBTOTAL ** | | | 42.45 | 63 |
| | | | | |
| * CATEGORY Soft | | | | |
| dBASE II | 12-08 | Soft | 675.00 | 0 |
| VisiCalc | 01-12 | Soft | 250.00 | 0 |
| ** SUBTOTAL ** | | | 925.00 | 0 |
| | | | | |
| * CATEGORY Subs | | | | |
| Subscription to PC World | 11-30 | Subs | 24.00 | 0 |
| ** SUBTOTAL ** | | | 24.00 | 0 |
| | | | | |
| * CATEGORY Sup | | | | |
| Computer Paper | 03-22 | Sup | 26.75 | 0 |
| Office Supplies | 02-21 | Sup | 45.86 | 10 |
| Pencils | 08-03 | Sup | 12.55 | 8 |
| ** SUBTOTAL ** | | | 85.16 | 18 |
| | | | | |
| * CATEGORY Trav | | | | |
| AirFare to NY | 02-15 | Trav | 438.00 | 60 |
| ** SUBTOTAL ** | | | 438.00 | 60 |

Figure 6: Expense Report Produced by dBase II

To access your Taxes data base (from the ':' prompt) type USE TAXES. You will still see the familiar ':' prompt, but the next command you type, such as APPEND to add data, will present you with the first record. You are now ready to add data.

Adding Data

Several commands are used for adding data to a file, but the simplest is Append, which appends data to the end of the data base. Since you are starting with an empty data base, you will automatically begin with record number 00001 (Figure 4).

Enter information for each field and press ENTER when you are done with that field. If you want to

leave a field blank, press ENTER to skip that field. The only exception to this procedure is the first field: the program assumes that you are finished appending data if you don't enter information in the first field. If for some reason you want to leave the first field ('Item' in Figure 4) blank, enter a space before you press the ENTER key.

When you have entered data or skipped all the fields, *dBase II* will clear the screen and take you to the next record.

Correcting Errors

dBase II has several procedures for correcting errors. The simplest is when you discover them before pressing ENTER. Use the Backspace key to move the cursor to where you made the error and either type over the error and insert a correction or delete unwanted material. You can delete characters one at a time with Ctrl-G; you get into insert mode with Ctrl-V. If you discover an error in a field after you have pressed ENTER (but before you have left the record for which you are entering data), you can get back to that field using the cursor control keys.

Once you are satisfied that the record is correct, move to the last field in that record and press ENTER to go to the next record. If you do not want to make further changes in the data base, leave the first field of that record blank (press ENTER when it asks for 'Item'). That will write your data to the disk and take you out of Append mode. If you wish to add more data, you can reenter Append mode by typing APPEND from the ':' prompt. You can also correct errors after you have written data to a disk by using the Edit mode.

Retrieving Information

Surely I haven't brought you this far just to leave you with a giant data base and no way to get the information out. There are many ways to get

☛ Hands On

summary data or complete reports from *dBase II*. Again, this article covers just a few; check the manual for more information.

Display Records

You can display the entire data base by typing

DISPLAY ALL

from the '?' prompt. If you want to display everything except the record number, type

DISPLAY OFF ALL

You can also display selected fields.

Type

DISP OFF ITEM,AMOUNT

and you will get only the item and amount.

Summing Data

Now comes the fun part. Let's find out how much money you've spent. All your expenditures are in a field called Amount. To find out the total of all these expenditures, type

SUM AMOUNT

You can also find out how much you've spent for a particular category. If you have a category called Post for postage, type

SUM AMOUNT FOR CATEGORY="POST"

to determine your total postage expenses.

To find out how much you spent in November, type

SUM AMOUNT FOR DATE="11"

You can sum for any field you wish.

To find out how many miles you can write off, type SUM MILEAGE. To find out how many miles you drove to and from the post office, type

SUM MILEAGE FOR CATEGORY="POST"

The possibilities are almost unlimited.

Sorting Data

dBase II has a built-in report generator that makes it easy to create attractive and informative reports. In this example you are going to create a report based on categories. Before doing so, you must sort the data by

category. This is done by sorting the entire file to another file. To do such a sort type

SORT ON CATEGORY TO TAXCAT

The disk will spin for a while, and the program will display a message when the sorting is complete. You have just created another data base, which is identical to Taxes except that it is sorted by category. You have the option of switching to the new data base or deleting the old one (called Taxes) and renaming the new one to Taxes so that your data base always has the same name. If you want to rename it, you must type the following series of commands:

USE TAXCAT <ENTER>

DELETE FILE TAXES <ENTER>

RENAME TAXCAT TO TAXES <ENTER>

USE TAXES <ENTER>

You now have a "new" data base with the same name and you're ready to create your report format.

With a little practice
you might even create a
report that will impress
the IRS.

Creating the Report

Type REPORT from the '?' prompt. *dBase II* will ask you a series of questions, prompting you to design your custom report. Answer them as shown in Figure 5.

When you have created the report format, press ENTER and the program will immediately display the report (Figure 6). Look at the display as it scrolls by to see if it's what you want. Don't worry that it's scrolling faster than you can read; you can reproduce the display whenever you want and route it to a printer or to a disk file so that it can be used with most word processing programs.

You can display the report by typing

REPORT FORM TAXREP

To print the report, type Ctrl-P followed by

REPORT FORM TAXREP

Routing to a Disk File

You can route your report to a disk file so that it can be edited and printed with a word processing program. This procedure uses *dBase II*'s Alternate command sequence as follows:

SET ALTERNATE TO FILENAME

SET ALTERNATE ON

REPORT FORM TAXREP

[Report will scroll on screen]

SET ALTERNATE OFF

The report is now written to a file called TAXREP.TXT. To view the report use your word processing program and enter the file. It can be incorporated into other documents if your word processing program allows you to insert or merge files.

Custom Reports

dBase II provides a number of ways to customize reports. These ways are covered in the *dBase II* manual and in *Everyman's Database Primer*. With a little practice you might even create a report that will impress the IRS.

Other Applications

The principles established in this article can be used for many other applications. *dBase II* can be used to keep income records and household expenses, to do billing, and to handle a multitude of other tasks. Although the model described here is simple, the opportunities for advanced programming are enormous.

The most important thing to remember about *dBase II* is that it's not as difficult to use as it would at first seem. Because the program lacks a menu, using it is not intuitive, but a little practice will pay off very quickly.

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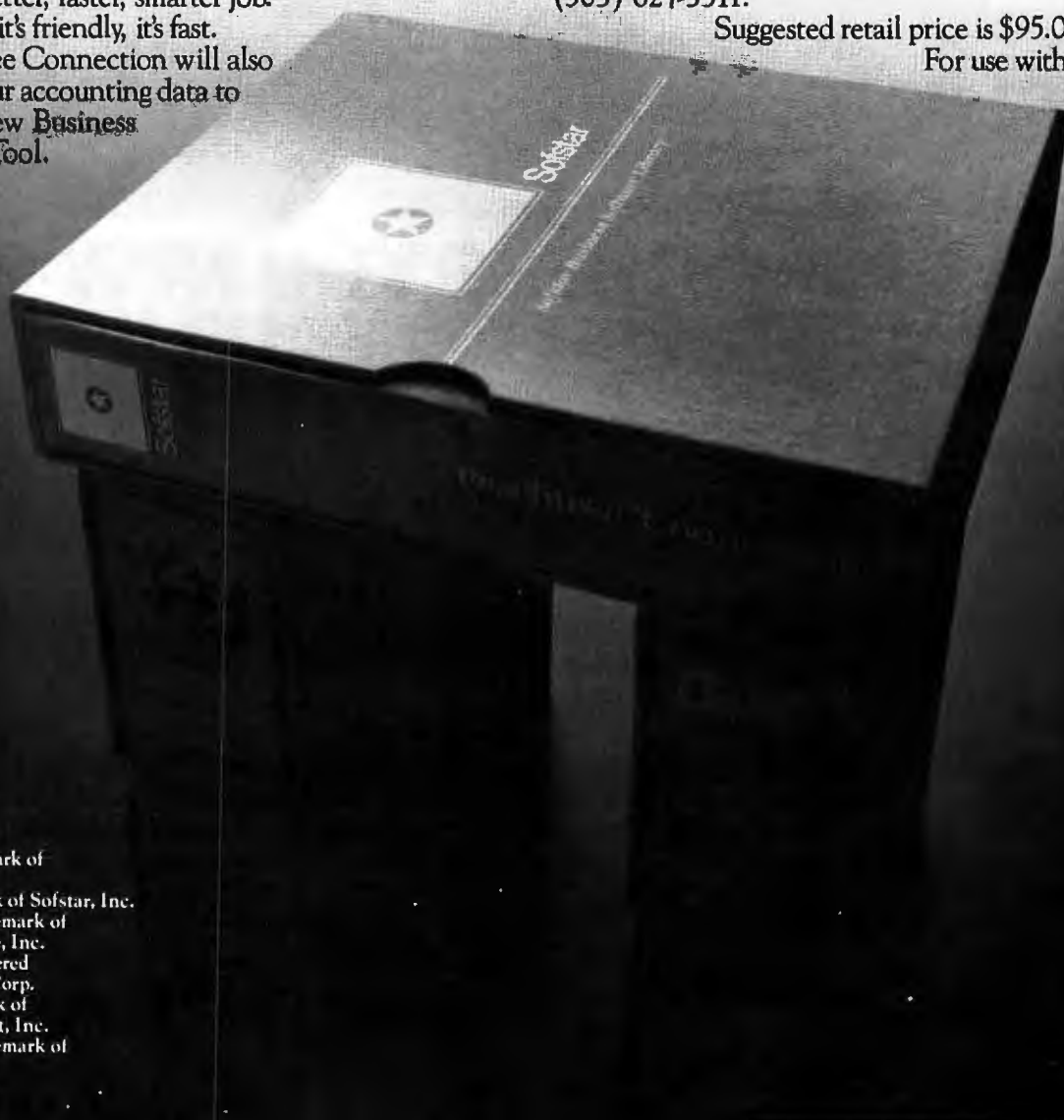
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A Snake in the Glass

A game that lets you challenge your computer to a duel with two fast-growing snakes

Peter Quinn

Snake is a simple computer game that dates back to the time when medium-resolution graphics became common. I first played it in 1979 on the original Commodore Pet, and I am told that early Datapoint Systems had a similar game. The Atari VCS game console version, which has many variations, is called *Surround*. A portion of the arcade game *Tron* is similar also. The Apple has a best-selling machine language game, *Snake Byte*, based on the same theme.

Snake is primarily a "reaction time" game, but some strategy is involved. In this game two "snakes" grow longer in an enclosed area. One is controlled by the computer, the other by the player. Both snakes grow at a constant rate, and control consists of changing the direction of growth. The game ends when one snake runs into the playing area boundary, the other snake, or itself. The object of the game is to avoid running into anything until the other snake does—by "walling off" the other snake in a small area while retaining a larger area in which to maneuver.

I have implemented this standard version with a few embellishments on the IBM PC. The program occupies less than 1.5K of memory but uses Advanced BASIC features. Scoring is based on the length of the game (it's more difficult to win a long game

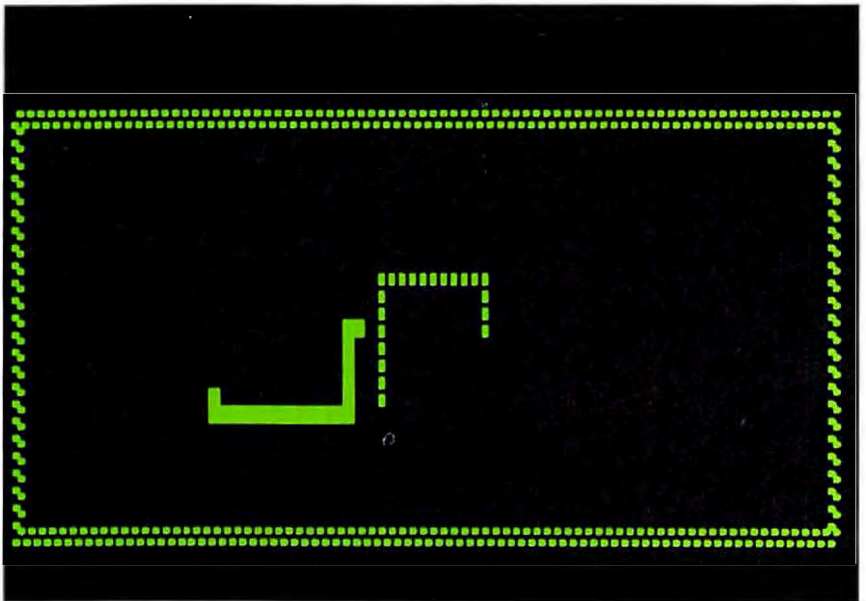


Figure 1

The progress of a game of *Snake* is shown in Figures 1 to 4. The player's snake is solid; the computer snake is dotted. Figure 1 shows the situation after 21 moves. The computer started down and has made two random turns. The player is getting into position to box the computer snake in whichever direction the computer moves. Some 30 moves later the computer snake has moved up and to the right and the player moves to box it in. He turned downward to get into position to cut the computer off in case it doubles back (Figure 2). The next frame shows that the computer has turned down and is blocked by the player (Figure 3). In Figure 4 the computer has boxed itself in and must lose unless the player is suicidal. If the computer turned left instead of right, it would have had a possible escape route. Note that in a high-speed game the action to this point would have taken about 15 seconds.

than a short one); and by varying the speed at which the snake grows, the game has unlimited variation in levels of difficulty. Adding to the difficulty of the game, the computer snake never runs into a wall unless trapped and occasionally changes direction for no particular reason. To the player's advantage, however, the computer snake also has very little

The game ends when one snake runs into the playing area boundary, the other snake, or itself.

strategy. I experimented with giving the snake smarter strategy, but because its reflexes are so much better than mine, a more sophisticated snake is almost unbeatable at high speed.

The Program

The first lines of the program are an initialization routine. They define all variables to be integers (line 30), reset the random number generator (lines 40 and 50), dimension two arrays (line 70), and set the screen attributes (line 80) and the memory segment to the Color/Graphics Adapter (line 90). If you are using the Monochrome Adapter, change 'DEF SEG = &HB800' to 'DEF SEG = &HB000'.

You can vary the speed of the program by entering a number when the message 'Enter value for delay' shows up on the screen. This value is used to determine the number of times a delay is executed for each move of the snakes (lines 100 to 130). Try starting at 50.

Next, several variables are initialized that control the initial position and direction of both snakes, and how often the computer snake makes random turns. The next section of the program draws the border

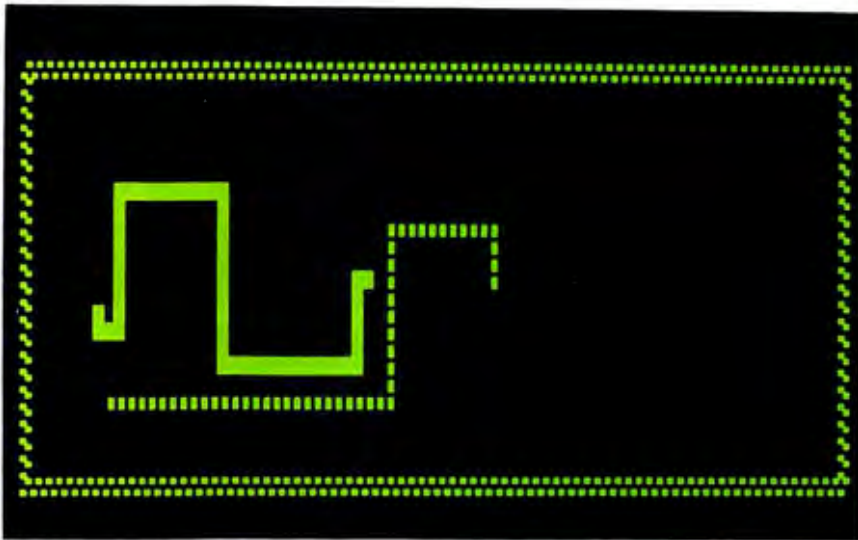


Figure 2

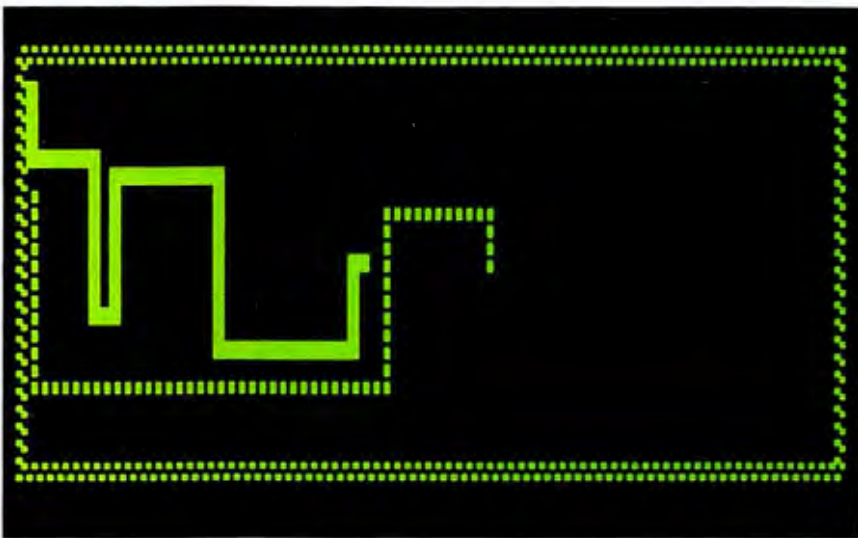


Figure 3

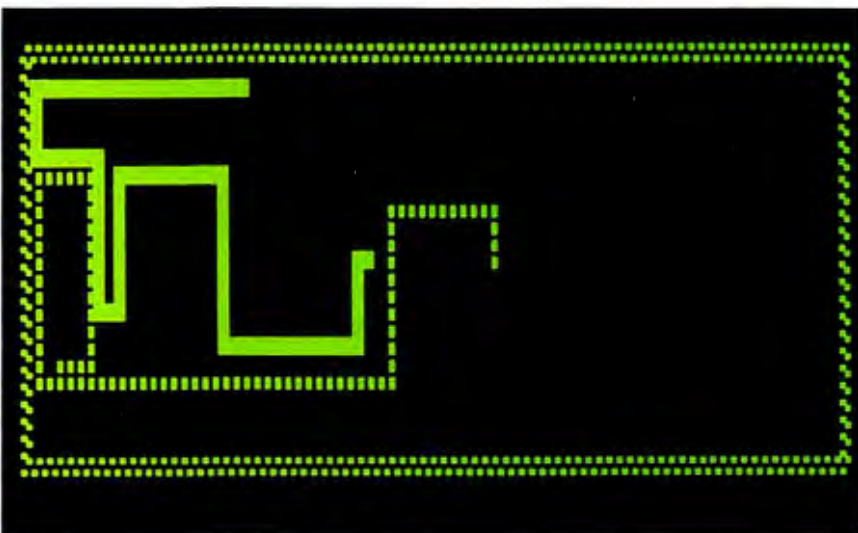


Figure 4

Hands On

barrier around the edge of the screen
(lines 200 to 270).

Player input is accepted by lines 280 to 340. When one of the cursor control keys is pressed, the program determines your snake's travel direction (lines 450 to 480). Your snake turns in the direction of the arrow on the key. If you press the arrow pointing in the opposite direction of current movement, your snake reverses direction, runs into itself, and you lose. Pressing the arrow pointing in the same direction as current movement has no effect.

The next section (350 to 440) is the main body of the program. The first two lines move each snake one unit. Variables P(1) and P(2) store the position of the player's snake and the

A more sophisticated snake is almost unbeatable at high speed.

computer's snake respectively, and D(1) and D(2) store the directions. Line 370 increments a variable (R!) to make it less likely that the computer snake will turn randomly. Also, your score (N) is incremented.

Lines 380 and 390 test for wall contact by either of the snakes and branch to the win/lose routine if there is contact. Lines 400 and 410 add the next unit to each snake. The next line (420) goes to a subroutine that determines if the snake is going to hit a wall in its next movement; if so, it should make a random turn. If not, you return to line 430 in the main section of the program. Line 430 provides a delay by looping the number of times you specified when you responded to the 'delay' input.

The next group of lines (450 to 480) change the direction of movement of your snake when one of the direction keys is pressed.

[illegible]

Listing 1

When the game ends, one of the next two lines is executed, and the win or lose message is displayed at the top of the screen. The scores are calculated by incrementing a variable (N). If you win the game, you receive all the points in that variable. If you

lose, you gain 10 percent of those points. This is to encourage aggressive winning rather than having the game last a long time and losing. Also, to get a high score, you need to take risks; immediately killing off your opponent will yield fewer points than playing the game for awhile and then killing it off.

Lines 600 to 640 compute and display your current score, average score, and high score. If you want to play another game, the program returns to line 100. If not, lines 650 to 670 display your high and average scores when the program ends.

Variations

After you have become proficient at *Snake*, you'll probably want to add some variations. One involves eliminating the border around the playing area, allowing the snakes to run off one side and come back on the other. This horizontal wraparound is automatic when the borders on each side are removed. For vertical wraparound, other changes are required. One way to do it is to insert the following lines of code:

```
365 IF P(1) >= 3840 THEN P(1) = (P(1) MOD
    160):GOTO 367
366 IF P(1) <= 0 THEN P(1) = (P(1) MOD 160)
    + 3840
367 IF P(2) >= 3840 THEN P(2) = (P(2) MOD
    160):GOTO 370
368 IF P(2) <= 0 THEN P(2) = (P(2) MOD 160)
    + 3840
```

Other variations include putting in barriers of various shapes and locations to restrict each snake's area of movement. This can be done at setup time with BASIC's LOCATE and PRINT instructions. Using them during the game slows things down too much.

If you're interested in doing games or other programs featuring graphics that change fairly rapidly, the *IBM PC Technical Reference Manual* may be useful. Otherwise, just enjoy *Snake* for what it is: an opportunity to challenge your computer in a game of quick reactions and clever strategies.

Peter Quinn is majoring in chemical engineering at the University of California, Berkeley. He has written several programs using the PC's color and graphics capabilities.

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The reader questionnaires from the premier issue of *PC World* continue to pour in as this issue goes to press. We appreciate your comments as they help us to provide the kind of magazine you want to read. Please take a few minutes to complete the reader questionnaire in this issue and become eligible to win a free box of Maxell diskettes.

There is a new drawing every month so you must send in a card from each issue to be eligible for the next drawing. The responses have already produced some surprising results that we will share with you in a future issue. In the meantime, keep those cards and letters coming!

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Digital Deduction

The PC's got your number! A quick and easy program for a computer guessing game.

Karl Koessel

Digital Deduction is written in BASIC and will run on any IBM PC system. It is short enough to be keyed in during your lunch break and still leave you plenty of time to play.

If your lunch break is short, you may skip keying in the REMarks. The REMarks in this program all begin with apostrophes. You do not have to key in the apostrophe or any characters to its right, except for line 160, which contains an apostrophe that is part of a PRINT statement.

In this game you try to guess the computer's secret number. The game has three levels. Trying to guess a number that is two digits long is the easiest level, and guessing three digits correctly is easier than guessing four.

After you tell the computer how many digits you want in the secret number, it builds a number with a different nonzero digit in each place. You are then prompted to enter a guess. Line 50 turns on the NumLock so that the numeric keypad on the right side of the keyboard may be used to enter your guess.

The digits you enter are printed as black characters inside a "window" of white on the left side of the display screen. You may use the Backspace key to erase a digit should you wish to change its value—unless it is the last digit of your guess. The last digit of your guess fills the window and signals the computer to compare your guess to the secret number.

The computer responds by clearing the line with the window, its prompt, and your guess. Then the headings of the clue table are printed, under which is printed your guess (in column 1) and two clues. The first clue (in column 2) tells you how many digits in the guess have the right value and are in the right place.

If the secret number were 42 and you guessed 49, column 2 would show a 1 because one of the digits (the 4) in the guess has the same value and is in the same place as one of the digits in the secret number.

The second clue (column 3) tells you how many digits in your guess have the right value but are in the wrong place. If the secret number were 42 and you guessed 23, column 3 would show a 1 because one of the digits (the 2) in the guess has the same value as one of the digits in the secret number but is in the wrong place.

If your guess is not the secret number, the computer beeps, and on the line below your last guess a new guess window appears with its prompt asking you to enter another guess. Each new guess is added to the table. Using the clues provided after each guess, you should eventually be able to deduce which digit belongs in what place.

If you guess the secret number, you are congratulated and given a score based on how many guesses you needed. For a two-digit secret num-

ber, you are allowed 8 guesses. You have 12 guesses for a three-digit number and 15 for a four-digit number. If you do not guess the secret number before you reach the maximum number of guesses allowed, the secret number is revealed.

Whether you win or lose, you are asked if you wish to quit or play again by a prompt printed in inverse characters (black on white) on the bottom line of the screen. The first word of the prompt is printed in blinking characters for emphasis.

If the Esc key is pressed, the program resets NumLock to the state that was in effect before the program was run, clears the screen, and ends. If any other key is pressed, the program will begin again, asking how many digits you want in the new secret number. If the "any other key" you press is a 2, 3, or 4, the value of the key pressed will determine the number of digits in the new secret number, and the program will skip the "how many digits" question.

Take care to key in the program character-for-character; don't miss any blanks or semicolons. If you don't enter it correctly, the program won't work and you'll have to perform an entirely different sort of digital deduction.


```

1 ' Digital Deduction!
2 ' PC WORLD
3 ' karl koessel
10 DEFINT A-Z
20 GUESS(2)=8 'Integer numeric variables
30 GUESS(3)=12 'Set constants. Number of...
40 GUESS(4)=15 '...digits determines number...
50 DEF SEG=65535:PEEK(7):POKE 7,(KBS AND -33)-32 '...of guesses allowed
60 SCREEN 0,0,0,0 'Save NumLock status, set ON
70 WIDTH 80 'Set test mode screen
80 COLOR 7,0 '80 characters per screen line
90 KEY OFF 'White characters, black field
100 CLS 'Turn off soft keys' display
110 COLOR 0,7 'Clear the screen
120 LOCATE ,30:PRINT " Digital Deduction! " 'Inverse characters
130 COLOR 7,0 'Center title on top line
140 GOTO 230 'Standard characters
150 LOCATE 3,1 'Check if length already chosen
160 PRINT "In this game, you try to guess the computer's secret number." 'Choose secret number's length
170 PRINT "Would you like a 2, 3, or 4 digit secret number? "; 'Print an inverse space (white)
180 COLOR 0,7:PRINT " "; 'Cursor on (flashing) in space
190 LOCATE 4,POS(0)-1,1 'Standard characters
200 COLOR 7,0 'Length = value of single input
210 DIGITS=VAL(INPUT$(1)) 'Clear line 4 of all characters
220 LOCATE 4,1:PRINT SPACE$(80) 'Invalid secret number length?
230 IF DIGITS<2 OR DIGITS>4 THEN 150 'Reseed RandOm number generator
240 RANDOMIZE(VAL(RIGHT$(TIME$,2))) 'Initialize variables
250 NUMBER=0:GUESS=0 'Construct secret number
260 FOR I=1 TO DIGITS 'Pick a RandOm digit (1 thru 9)
270 D(I)=RND*9 MOD 9+1 'Reset USED flag
280 USED=0 'Check previously picked digits
290 FOR J=1 TO I-1 'Has digit already been USED?
300 IF D(I)=D(J) THEN USED=-1
310 NEXT J
320 IF USED THEN 270 'Don't use same digit twice
330 NUMBER=NUMBER*10+D(I) 'Value of secret number
340 NEXT I
350 LOCATE 3,1:PRINT "Ok, The computer has chosen a:" 'Instructions
360 PRINT DIGITS"digit number. Zero is not one of the digits."
370 PRINT "You may use the numeric keypad on the right side of the keyboard."
380 LOCATE 5,GUESS,4:DIGITS 'Locate next to window
390 PRINT "C<-- Enter your guess" 'Print prompt
400 COLOR 0,7 'Inverse characters
410 LOCATE 5,GUESS,3:PRINT SPC(DIGITS); 'Make "window"
420 IF INKEY$="" THEN 420 'Clear keyboard buffer
430 FOR I=1 TO DIGITS 'Fill window with guess
440 LOCATE 5,GUESS,2+I,1 'Locate in window, cursor on
450 G$(I)=INPUT$(1) 'Get single character input
460 IF G$(I)=CHR$(27) THEN 1070 'Quitting?
470 IF G$(I)=CHR$(8) THEN GOSUB 750:GOTO 440 'Backspace?
480 IF G$(I)<" " OR G$(I)>"9" THEN 440 'Invalid input?
490 PRINT G$(I); 'Print digit in window
500 NEXT I 'Window is full
510 COLOR 7,0 'Standard characters
520 LOCATE 5,GUESS,1:PRINT SPACE$(80) 'Erase line with window, prompt
530 GUESS=GUESS+1 'Keep track of # of guesses
540 IF GUESS=1 THEN GOSUB 790 'Time to print table headings?
550 RP=0:WP=0 'Initialize variables RP and WP
560 FOR I=1 TO DIGITS 'Compare guess to secret number
570 IF D(I)=VAL(G$(I)) THEN RP=RP+1:GOTO 620 'Right digit in right place?
580 FOR J=1 TO DIGITS 'Check for right digit in wrong place
590 IF I=J THEN 610 'If same place, skip wrong place check
600 IF D(I)=VAL(G$(J)) THEN WP=WP+1:J=DIGITS'Digit in wrong place?
610 NEXT J
620 NEXT I
630 LOCATE 4,GUESS,3 'Indent each guess on new line
640 FOR I=1 TO DIGITS
650 PRINT G$(I); 'Print each digit of guess
660 NEXT I
670 LOCATE ,25 'Print # of correct digits...
680 PRINT RP; '...in the right place
690 LOCATE ,54 'Print # of correct digits...
700 PRINT WP; '...in the wrong place
710 IF DIGITS=RP THEN 890 'Do all places have the correct digits?
720 IF GUESS=GUESS(DIGITS) THEN 930 'Reached maximum # of guesses allowed?
730 BEEP 'Guess isn't secret number...
740 GOTO 380 '...GOTO guess again!
750 IF I=1 THEN RETURN 'Subroutine to backspace digit of guess
760 LOCATE ,POS(0)-1:PRINT " "; 'A destructive backspace erases
770 I=I-1 'Decrement guess digit index
780 RETURN
790 LOCATE 3,1 'Subroutine to print table headings
800 PRINT SPACE$(160) 'Clear lines for table headings
810 LOCATE 3,1:PRINT "Number"SPC(10) 'Print top line, space columns
820 PRINT " # of correct digits"SPC(10)" # of correct digits" 'Finish top line
830 IF (PEEK(0) AND 48)=48 THEN COLOR 1,0 'If monochrome monitor, then...
840 PRINT "Guessed"; '...underline characters of...
850 LOCATE ,17:PRINT " in the right place"; '...the bottom lines of the...
860 LOCATE ,46:PRINT " in the wrong place" '...table headings
870 COLOR 7,0 'Standard characters
880 RETURN
890 SOUND 440,5:SOUND 880,15 'Guess is secret number!!!!!!
900 PRINT "You guessed the number! "; 'Print congratulant
910 PRINT USING "Your score is ##.":GUESS; 'Print score
920 GOTO 990 'GOTO "play again?" routine
930 SOUND 100,20 'Number not found and all guesses used!
940 PRINT "You have had "GUESS"tries. The number is "; 'Print number of tries
950 COLOR 0,7 'Inverse characters
960 PRINT USING STRINGS(DIGITS,"#");NUMBER; 'Reveal secret number
970 COLOR 7,0 'Standard characters
980 PRINT " "; 'Punctuate revealed secret #
990 COLOR 16,7 'Inverse, blinking characters
1000 LOCATE 25,16,0:PRINT " Press "; 'Cursor off, begin prompt
1010 COLOR 0,7 'Inverse characters
1020 PRINT "ESC to quit; any other key to play again. ";
1030 COLOR 7,0 'Standard characters
1040 IF INKEY$="" THEN 1040 'Clear keyboard buffer
1050 AGAIN$=INPUT$(1) 'Get "play AGAIN?" input
1060 IF AGAIN$=CHR$(27) THEN DIGITS=VAL(AGAIN$):GOTO 100 'Play again?
1070 COLOR 7,0:CLS 'Not playing again
1080 POKE 7,KBS 'Reset NumLock status
1090 END

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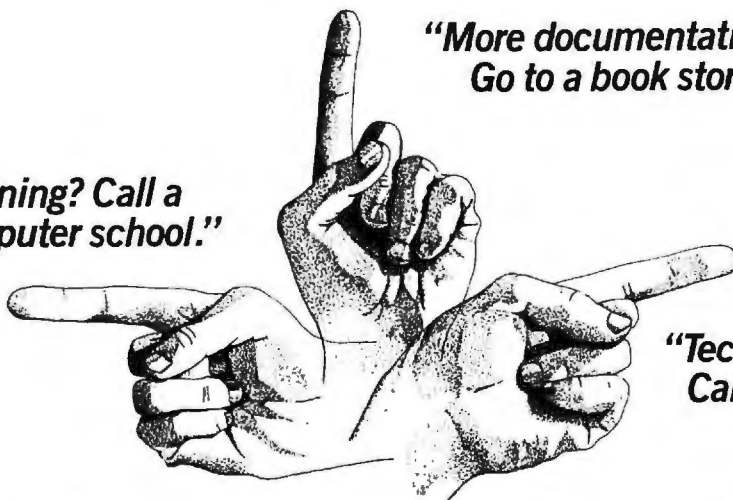


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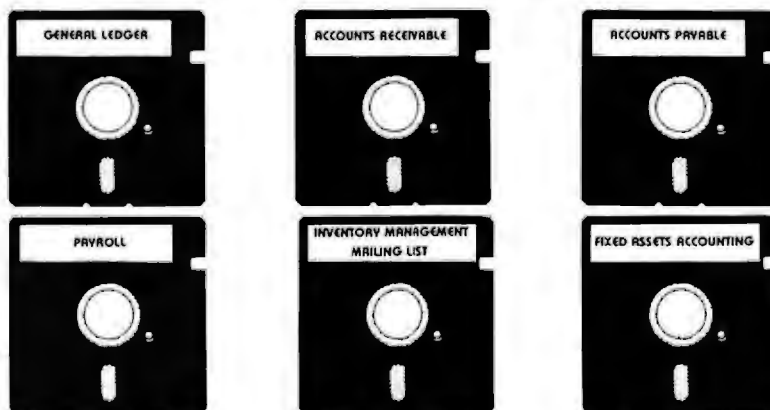
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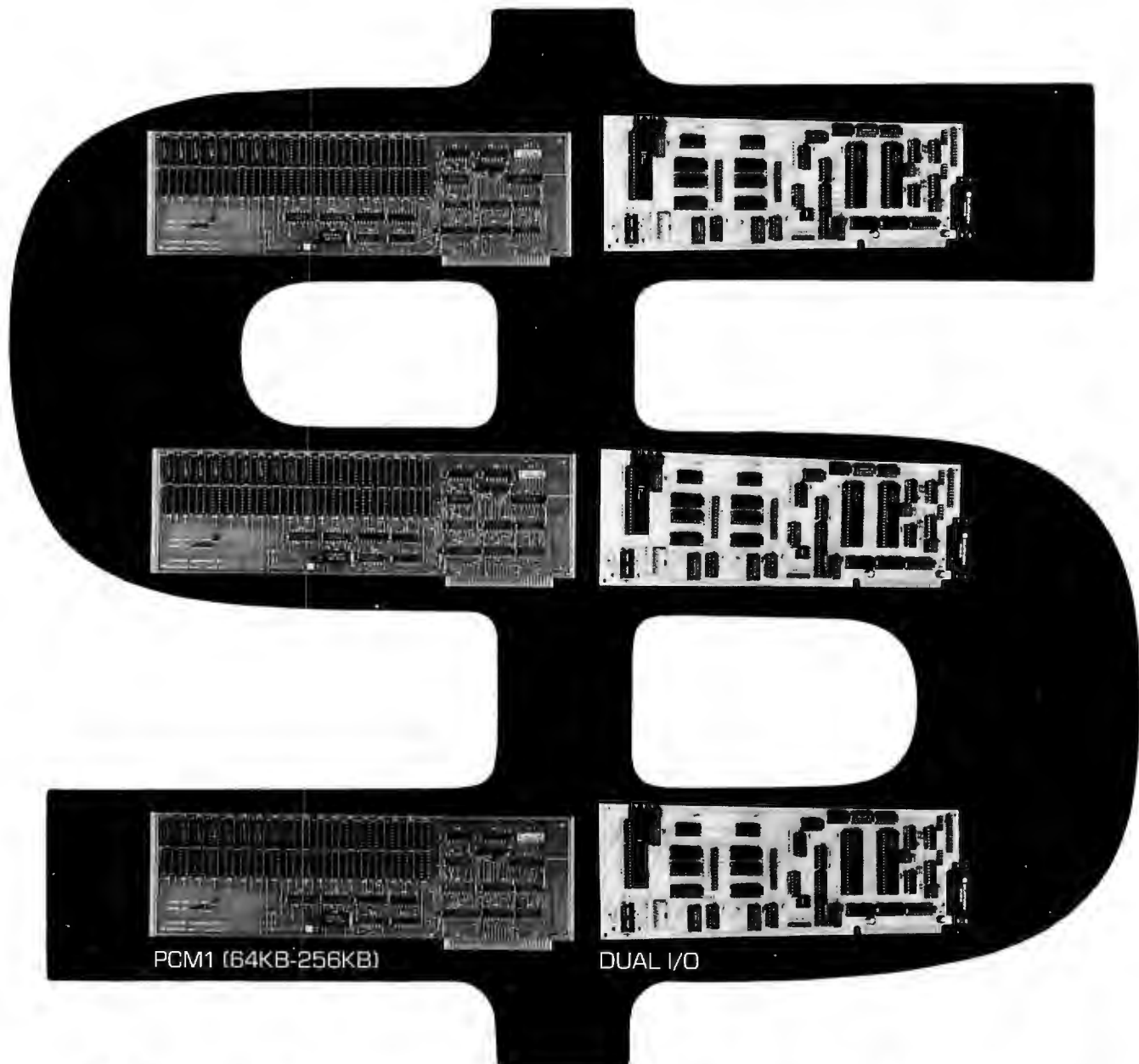
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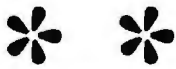
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We're beginning to receive a steady stream of reader contributions to this department, and by next month we should have the global exchange running at full speed. Meanwhile, the feature this month is a short BASIC routine that can add utility and error-proofing to virtually any program.

Q-String

The need for this routine became apparent as I was developing a large interactive BASIC program with many screen menus. There were numerous points in the program at which the user was requested to input information, and I wanted to find the most foolproof way of getting that information.

The most elementary way to get data in BASIC is with the INPUT function, but it has some severe shortcomings. If users try to make use of the Backspace key, they can backspace their way right over the input prompt. Furthermore, if there is any information on the screen to the right of the input prompt, the backspacing will drag that information, corrupting the screen. The INPUT function doesn't restrict the use of the up or down cursor keys either, creating a situation in which users can wander anywhere on the screen and get totally disoriented.

The program I was developing placed some other burdens on INPUT's capabilities. The information that the user would enter might include various control characters (with ASCII values from 0 to 31). But some of these control characters cause catastrophic screen events. For example, if you type a Control-L (ASCII 12) as part of your input, it will clear the screen.

```
2 ' TEST PROGRAM TO DEMONSTRATE Q-STRING
4 ' (the actual subroutine begins at line 60000)
6
100 ' create a window on the screen
110 CLS:KEY OFF:FOR I=1 TO 10:KEY I, "":NEXT
120 PRINT"Input your data only within the box:
130 LOCATE 10,34:PRINT CHR$(201)+STRING$(10,205)+CHR$(187);
140 LOCATE 11,34:PRINT CHR$(186)+STRING$(10,32)+CHR$(186);
150 LOCATE 12,34:PRINT CHR$(200)+STRING$(10,205)+CHR$(188);
160 LOCATE 11,35,1
200 ' get input via the subroutine
210 QL=10:GOSUB 60000
300 ' use the input in the program
310 WHATYOUINPUT$=Q$
320 LOCATE 20,1:PRINT "You just input: ";WHATYOUINPUT$;
340 END
350
60000 ' Q-String Subroutine - Andrew Fluegelman
60010 ' Q$=string returned - QL=max permitted length of string
60020 '
60030 Q$="":IF QL=0 THEN QL=255 'clear variables
60040 QI$=INKEY$:IF QI$="" THEN 60040 'get a character
60050 IF QI$=CHR$(13) THEN RETURN 'check for ENTER
60060 IF QI$<>CHR$(8) THEN 60090 'if not backspace
60070 IF Q$="" THEN BEEP:GOTO 60040 'if nothing to backspace
60080 GOSUB 60180:Q$=LEFT$(Q$,LEN(Q$)-1):GOTO 60040 'do backspace
60090 IF LEN(Q$)=QL THEN BEEP:GOTO 60040 'check for max length
60100 IF LEN(QI$)=1 THEN 60130 'if not extended key
60110 IF QI$<>CHR$(0)+CHR$(3) THEN BEEP:GOTO 60040 'if not ASCII 0
60120 QI$=CHR$(0):GOTO 60140 'print symbol for null
60130 IF ASC(QI$)>31 THEN PRINT QI$;:GOTO 60150 'if standard text char
60140 COLOR 15:PRINT CHR$(ASC(QI$)+64);:COLOR 7 'if ctrl char
60150 IF QI$="\\" THEN Q$=Q$+CHR$(13):GOTO 60040 'backslash indicates CR
60160 Q$=Q$+QI$:GOTO 60040 'add to Q$ and get more
60170
60180 PRINT CHR$(29); " ";CHR$(29);:RETURN 'destructive backspace
60190 'end subroutine Q-String
```

Listing 1

A third problem would be caused if the user needed to include a carriage return (ASCII 13) as part of the entered information. When you press the ENTER key (or type Control-M), the INPUT function interprets that as the completion of the entry.

All these problems are solved by the routine in Listing 1, which I call "Q-String." The actual subroutine is contained in lines 60000 to 60190 of the listing; lines 2 to 330 set up a test screen and show how the subroutine can be implemented.

The subroutine returns a string variable named Q\$. Before going to the subroutine, you can set a maximum length for Q\$ with the numeric variable QL (see line 210). All the information is entered within the subroutine.

Line 60040 gets one keystroke and assigns it to a temporary variable QI\$. It is necessary to use the INKEY\$ function rather than INPUT\$(1) because INKEY\$ will return both characters of an extended key. (See page G-6 of the IBM BASIC manual.) Using INPUT\$(1) would return an ASCII 0 for both the true ASCII 0 (Control-2) and for any of the extended keys.

The order of the remaining lines may seem illogical at first, but they correctly test for each keystroke possibility. Line 60050 tests whether the user has completed entering information by pressing the ENTER key. This causes a return from the subroutine.

Line 60060 tests for the Backspace key. If there is nothing in Q\$, there is nothing to backspace, so line 60070 sends the user back for another keystroke.

Line 60080 performs the backspace function. The backspace character itself (ASCII 8) is not well implemented on the PC. When you print it to the screen, it does not backspace, but prints a block symbol. The subroutine at line 60180 backs up the cursor and erases any previous screen character. I keep it as a separate subroutine because it may be useful in other parts of the program.

With backspacing out of the way, the routine tests to see whether the addition of a keystroke exceeds the maximum length of the string (line 60090). If so, the user is sent back for another keystroke with a beep as a warning. At this point, the user's only options are to backspace or to press the ENTER key.

Line 60100 tests for extended keys. If the length of the string returned by INKEY\$ is 1, the key pressed was not an extended key. If an extended key string was returned, there are two possibilities. When the second character of the string is anything other than ASCII 3, the keystroke is rejected (line 60110). The remaining case indicates that Control-2 was pressed, which is ASCII 0. QI\$ is converted to this character at line 60120.

The next few lines deal with the problems caused by the control characters. If the key pressed was a standard character (ASCII value greater than 31), it can simply be printed to the screen (line 60130). But as mentioned above, you can't print a control character to the

```

10 ' wsoki.bas
20 '
30 ' inserts additional microspaces before and/or after each character
40 ' so that WordStar output will be right-justified
50 ' with use of the Oki correspondence quality mode
60 '
70 ' 20.02.83 DBP original version
80 '
90 ' characters needing 1 microspace insertion
100 DATA 67,114,116
110 DATA 0
120 ' characters needing 2 microspace insertions
130 DATA 34,42,43,45,60,61,62,63,90,92,94,102,122,126
140 DATA 0
150 ' characters needing 4 microspace insertions
160 DATA 33,39,40,41,44,46,58,59,73,91,93,96,105,106,108,123,124,125
170 DATA 0
180 '
190 ' input required insertions
200 DIM IN(256)
210 FOR I=0 TO 256: IN(I) = 0: NEXT I
220 INS = 1: GOSUB 480
230 INS = 2: GOSUB 480
240 INS = 4: GOSUB 480
250 '
260 ' high-resolution microspaces
270 BS =CHR$(27)+"x1"+CHR$(0)+CHR$(1)+CHR$(0)
280 BBS=CHR$(27)+"x1"+CHR$(0)+CHR$(2)+CHR$(0)+CHR$(0)
290 '
300 ' main program begins
310 INPUT"WordStar document file";CS
320 INPUT "file containing WordStar document";AS
330 OPEN CS FOR INPUT AS I
340 INPUT "printer ready";CS
350 WIDTH "lpt1:",200
360 LPRINT CHR$(27);"1" 'correspondence-quality mode
370 CS = INPUT$(1,1): IC = ASC(CS)
380 IF IC<>10 THEN PRINT CS;
390 IF IN(IC)=0 AND IC<>10 THEN LPRINT CS;
400 '
410 ' add microspaces
420 IF IN(IC)=1 THEN LPRINT CS;BS;
430 IF IN(IC)=2 THEN LPRINT BS;CS;BS;
440 IF IN(IC)=4 THEN LPRINT BBS;CS;BBS;
450 IF EOF(1) THEN CLOSE: STOP ELSE 370
460 '
470 ' microspace input subroutine
480 READ I: IF I=0 THEN RETURN ELSE IN(I) = INS: GOTO 480

```

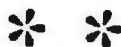
Listing 2

screen because doing so might destroy the screen display in the process. The routine therefore prints all control characters as their high-lighted letter equivalents. If you add 64 to the ASCII value of a control character, you will get the ASCII value of its letter equivalent (line 60140).

Finally, a provision is made for including carriage returns as part of the input. This routine lets the user indicate carriage returns with the

backslash character (\); the conversion is made in line 60150. Using the backslash for carriage return eliminates the possibility of including a backslash symbol as part of the string. The line could be left out or another character used as the substitute.

With all the filtering and converting taken care of, the keystroke is



added to Q\$ at line 60160 and the user is sent back for another key-stroke.

I've gone into detail describing these steps because they illustrate some of the possibilities available when dealing with string input in BASIC.

Is implementing this subroutine worth it just to get an answer to a prompt? I think the initial programming effort pays off in terms of program reliability. Once you have the subroutine coded, you can import it to any program. (I've chosen the high numbering scheme so that this routine won't get in the way of other program lines.)

You can get in and out of the subroutine with a single program

line, as illustrated by line 210. I hope you find Q-String a useful tool for keeping your programs and your screen clean.

A.F.

No-REM Remarks

I stumbled on one of DOS's quirks, which can be put to good use. It seems that DOS will ignore any command that starts with a period. This can be used to add batch file remarks that will print on the screen more cleanly than the standard REM function.

To create a short test batch file, type
copy con:test.bat <ENTER>

.This is a test. <ENTER>

.Look Ma, no REM statements! <ENTER>

.That's all, folks. <ENTER>

<Ctrl-Z><ENTER>

Now run it by typing test from DOS.

Keven Scoot

Boise, Idaho

Correction and Microjustification

Since I use *WordStar* extensively on my PC with an Okidata 84 printer, the WS-DOS program (*.*. Vol. 1, No. 1) is quite useful. In running the WS-DOS conversion, I noticed a small error: if the *WordStar* file does not end with a carriage return, the last line of the file is not copied into the DOS file. To remedy this, I suggest the following correction:

```
2125 IF EOF(1) THEN PRINT #2, LS:GOTO 8045
      ELSE AS = INPUT$(1,#1):A = ASC(AS):IF
      A>30 AND A<128 THEN LS = LS + AS:GOTO
      2125
```

Once I have converted my *WordStar* file, I use the following program (Listing 2) to have my Okidata 84 print a document in correspondence-quality mode with full justification. This is not possible otherwise because in this mode each character has a different width.

Do Ba Phuoc
Hayward, California

Edited by Andrew Fluegelman

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11:00–12:00 p.m.

"The PC Phenomenon"

Panel members: David Bunnell, President and Publisher, *PC World*; Cheryl Woodward, Associate Publisher, *PC World*; Ron Posner, Chairman, National Training Systems; Portia Isaacson, President, Future Computing; Martin Alpert, President, Tecmar.

12:30–2:00 p.m.

"Second Generation Software"

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"PC Multiprocessing, Networking, and Communications"

Panel members: Drew Major, Software Systems Manager, Novell Data Systems; Steve Pomeroy, Product Marketing Manager, 3COM; Steven Cook, Technical Editor, *PC World*; Phil Belanger, Omni Project Manager, Corvus.

4:30–6:00 p.m.

"PC Add-Ons—What Is Compatibility?"

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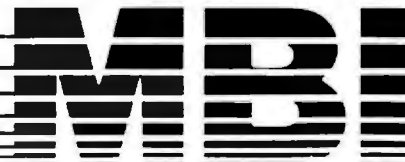
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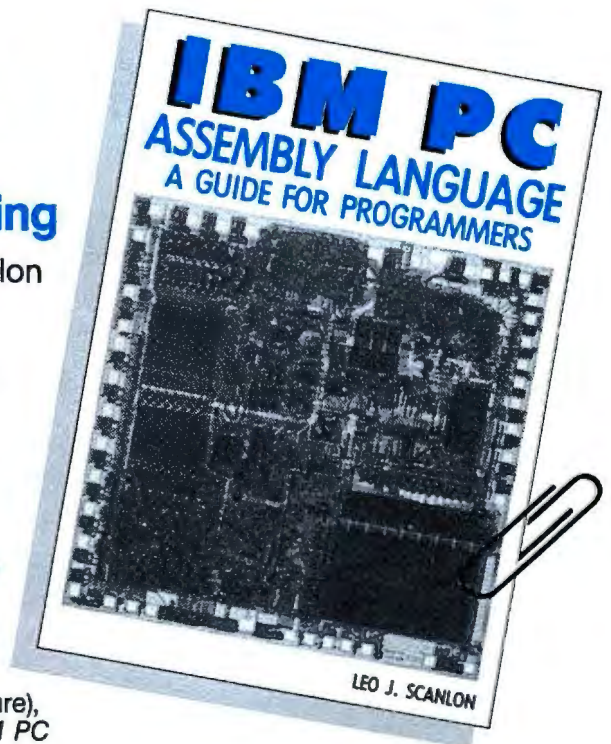
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The World According to Garbers

Katie Seger

Jeff Garbers is hooked on "Days of Our Lives," karate, and Monty Python. He is a regular blood donor and an ice cream aficionado.

By day Garbers ("Garbs" to his friends) is your average, everyday computer whiz kid. At age 23, he is the president of Userview, a two-man software development company. He is currently working on a guarded, confidential, and top-secret program that will "take into account the human factors in computers." And, as if that weren't enough, Garbers is a computer polygamist. We are not talking about an average IBM PC-Apple bigamist. No sir. Garbers shares his Decatur, Georgia, apartment with a PC, an Apple II, a Victor 9000, an Osborne, a Zenith Z100, a Sinclair, Ataris 2600 and 5500, an Intellivision, and a Colecovision.

And by night? Garbers sheds the mild-mannered guise of computer genius and becomes the systems operator of the Midnight Express. Okay, maybe running a software exchange bulletin board is not as daring as donning the Lone Ranger's mask or Superman's cape, but the Midnight Express has gained a cult following not unlike those of the aforementioned superheroes'. And all three men do lose sleep in their fight for truth, justice, and the American way.

As its name suggests, the Midnight Express is turned on at the witching hour; it stays on line until 8 or 9 a.m. EST, depending on when its trusty SYSOP wakes up. Although the Express was designed to run unattended, Garbers said that when he hears the bulletin board telephone, he usually gets out of bed and watches the modem light and the screen to see if the caller is having any trouble with the system. What a guy.

An Ordinary Kid from Illinois

The 6-foot-9-inch Garbers got into computers "because they don't know how to play basketball in the western suburb of Chicago where I grew up. They play hockey there, but that's about all."

Garbers' introduction to programming didn't even involve a computer. His father, who worked at Blue Cross, brought home an instruction manual for the IBM computer at his office. Soon Garbers was writing short programs in COBOL. "But who is going to hire an 11-year-old programmer?" he joked.

His high school's data processing class didn't offer him any hands-on training either. Programs were written on punch cards; every two or three days the cards were taken to the computer at the other district high school, and the printouts were brought back to his school. It was hardly an ideal setup, but Garbers still managed to have some fun in the class with his second semester indepen-

Garbers sheds the mild-mannered guise of computer genius and becomes the systems operator of the Midnight Express.

dent project. The project engaged all the data processing students in an interactive game, Stars II. Every player had his or her own star system and through military or diplomatic means could take over the metagalaxy.

Garbers finally got to sit at a computer keyboard at Wabash College. By his sophomore year he was working as a student aide in the college's computer lab. When he graduated in 1980 at age 21, he received not a B.A., but an A.B. (*Artium Baccalaureus*) in mathematics. "It was a small liberal arts college that still issued degrees in Latin," he said. He then went to the Georgia Institute of Technology with plans to get his doctorate in computer science. But that was not to be.

● Community

Garbers' main interest is software usability—making it truly user-friendly instead of what he describes as “user-chummy.” User-chummy software is the type that “puts a smiling face on the screen with the hello and good-bye of the program” instead of actually assisting the person sitting in front of the computer. Garbers felt that he could make more of an impact with his programming ideas in the marketplace than in school, so he left the Institute in March 1982 with a master's degree in computer science.

Userview

One of the best things to come out of his years at Georgia Tech is Garbers' partnership with Dr. Albert N. Badre, an associate professor of computer science at the Institute. Badre's title at Userview is corporate secretary; his job is critiquing the usability of Garbers' programs. Badre is considered one of the United States' leading experts in software usability. Besides teaching, he does software consulting work for computer companies, government agencies, and private companies both in the United States and abroad. The United States Army,

Garbers' main interest is software usability—making it truly user-friendly instead of what he describes as user-chummy.

UNESCO, and the Ford Foundation are among his clients; he currently has a contract with the U.S. Department of Defense.

Because of his consulting and teaching responsibilities, Badre keeps up to date with the latest ergonomic computer testing and research. Besides studying government and academic reports on hardware and software design, Badre is himself directly involved in software testing. Badre's input helps Garbers decide how to design his software to meet the needs of both novice and expert users.

And what will Userview's first marketed software be? Garbers won't say. He did say that their product is not a data base, communications, word processing, spreadsheet, or graphics program. “But if you liked what I'm giving away on the Midnight Express, just think what I'll sell you for \$200,” he joked. The product will be announced at the spring COMDEX show in Atlanta.

Midnight Express

Many Midnight Express callers probably first encountered Garbers' public domain software on The Source's bulletin board, POST. After three months Garbers realized that his own phone calls to The Source for sending new programs and revising older ones were costing too much. So in June of last year the Midnight Express went on line.

Computer owners who connect with the software exchange system can receive several utility programs. These GUM-UPS (Garbs' Unsupported but Moderately Useful Programs) include some handy, time-saving programs designed to run under DOS. The GUM-UPS include *FK*, one of the first programs for the IBM PC that allowed users to program the function keys for specific duties, and *VDEL*, a program that enables users to delete files selectively without typing in the full file name.

LF, which Garbers describes as a “classier DIR command,” brings the user's directory to the screen with all files, such as .COM, .EXE, and .BAT, sorted by type. Garbers' *STSTAT* program reports how much disk drive space is free on all the drives of the system, and *CD* changes the logged disk drive and brings the directory of the new disk drive to the screen. *TUNE* plays five tunes on the PC (three from *Close Encounters of the Third Kind*, a funeral dirge, and a racing fanfare). Garbers uses the music as an alarm to alert him when a program or operation is completed.

The programs on the Express came from Garbers' programming work for Userview. He wrote the utility programs to speed up his own software development. “I realized that these were things that other people could use, but I didn't want to take the time to work out every bug and produce marketed software,” Garbers said. “I thought the bulletin board would serve as decent public relations for Userview and allow me to make some good contacts.” The Midnight Express has done both, he said.

The Express has been down lately because of Garbers' all-night programming sessions on his PC. But he assured callers that the bulletin board will be running again as soon as his Userview software is perfected.

Katie Seger is an editorial assistant at PC World. She has worked for the British Broadcasting Corporation and the Berkeley Gazette. Her articles have appeared in American Film, Current, and the Christian Science Monitor.

The Midnight Express phone number is 404/294-6879. The bulletin board runs from midnight to 8 or 9 a.m. EST.

PC-HEX from the Midnight Express

One of the most useful programs on Jeff Garbers' Midnight Express bulletin board is *PC-HEX*.

The conversion program changes binary files to hex files or vice versa. This allows a hex file to be sent as a standard ASCII file. The program also contains a check-sum routine that verifies that the file was converted correctly.

The program is shown as it is supplied by Garbers. Like many file conversion programs, *PC-HEX* is slow. Large files can easily take several minutes to process, and during that time most people begin to wonder if it is still working. To alleviate such worries *PC-HEX* displays a visual placebo in the form of dots that appear on the screen each time 32 bytes are read from the input file. This helps avoid the impression that the program has become locked into an endless loop, but it also causes a serious limitation: the program cannot convert files larger than 32K.

The only reason for the 32K limit is that the program uses the MOD operator to restrict the display of these placebos to one for every 32 bytes. MOD is an integer math operator that returns the remainder of a division. Dividing the number of bytes read by 32 results in a remainder of zero only

if the number of bytes read is a multiple of 32.

Unfortunately, the MOD operator cannot process numbers that are 32768 (32K) or larger. When 32K bytes have been read, the program will fail.

If you want to convert a large file, you can modify *PC-HEX* so that the placebos are not displayed. Removing the placebos means that you will have to place your trust in the program and wait patiently, but it will also result in slightly faster conversions.

The lines to change are 4150 and 5140. Each line contains an IF statement that must be completely removed. You can do this by moving the cursor over the colon, which precedes the IF, and typing CTRL-End. To make a less permanent change, you can insert a single-quote just prior to the colon. This technique will leave the line intact but cause it to be ignored by BASIC. Remember to press ENTER as soon as you change a line so that it will be "fixed" in memory as well as on the screen, and don't forget to SAVE the program as soon as both changes have been made.

Steven Cook

```
100 '
101 ' Binary-to-hex-and-back-again conversion program for the IBM PC
102 '
103 ' Copyright (C) 1982 J. P. Garbers. All rights reserved.
104 '
105 '
110 LN$=" "+SPACE$(78)+" "
120 DEF SEG = 64 : KSTATE = PEEK(23) : POKE 23,32 : DEF SEG ' set NUM LOCK
    state, saving current state for later
130 TROFF : ON ERROR GOTO 10000
140 DEF FNA(X$) = 40 - LEN(X$)/2
150 DIM PRO$(6)
170 EXPERT = 0 ' rem expert 1 needs no CR after menu choice, expert 0 wants CR
200 GOSUB 2000 ' do the ego module
210 WHILE NOT DONE : GOSUB 3000 : WEND ' process menu requests
220 GOTO 9900 ' end stuff
2000 ' ego module
2010 COLOR 7,0 : KEY OFF : CLS : LOCATE 12,1 : COLOR 0,7
2020 PRINT " The following program is brought to you by a grant from
    Userview Corporation. ";
2025 COLOR 7,0
2030 FOR TIME = 1 TO 1500 : IF INKEY$<>"" THEN TIME = 1500
2040 NEXT TIME : IF EXPERT THEN RETURN ELSE GOSUB 2300 ' title line and cls
2050 INPUT "Would you like instructions";INST$: IF INST$="" THEN INST$="N"
2060 IF LEFT$(INST$,1)<>"Y" AND LEFT$(INST$,1)<>"y" THEN RETURN
2070 LOCATE 8,1
2080 PRINT "This program allows you to convert binary files from one format to"
2085 PRINT "another. HEX format files may be easily transmitted over phone"
2090 PRINT "lines and information services since they consist entirely of"
2095 PRINT "readable characters, but they cannot be used directly as commands."
2100 PRINT "COM and EXE files may be used directly as DOS commands, but are"
2105 PRINT "difficult to send and receive without special software."
2110 PRINT
2115 PRINT " You can use this program to convert COM and EXE files to HEX"
2120 PRINT "format files to send your files to someone else, and also use"
2125 PRINT "it to convert HEX files you've received to executable format."
2130 PRINT : CV = CSRLIN : GOSUB 2200 : LOCATE CV, 1
2135 PRINT "You'll tell this program what you want to do by selecting choices"
2140 PRINT "from menus. To make a selection, press the numbered key corres-"
2145 PRINT "ponding to your choice and it will light up. You may change your"
```

```

2150 PRINT "mind by pressing a different number, and the new choice will light"
2155 PRINT "up. When the correct choice is lit up, press ENTER. You may also"
2160 PRINT "press ESC to return to the previous menu."
2165 PRINT
2170 PRINT "As you get used to the program, you may wish to use 'expert mode'."
2175 PRINT "In expert mode you don't have to press ENTER after making your"
2180 PRINT "numbered choice, so make sure you press the right key the first"
2185 PRINT "time.":PRINT
2190 GOSUB 2200 : RETURN
2200 ' wait for keypress
2210 LOCATE 24,4:COLOR 0,7
2220 PRINT "Press the SPACE BAR to continue, or ESC to stop using this
program.":
2225 PAUSE$=""
2230 WHILE PAUSE$="" : PAUSE$=INKEY$ : WEND : COLOR 7,0
2235 IF ASC(PAUSE$)=27 THEN 9900 ' stopped in the middle
2240 LOCATE 24,1:PRINT SPACE$(79);: RETURN
2300 ' title line
2310 CLS : IF QUIET THEN RETURN ELSE COLOR 0,7 : PRINT
2320 PRINT USING LN$; " Binary-to-hex-and-back-again conversion program
for the IBM PC";
2330 PRINT USING LN$; " Copyright (C) 1982 J. P. Garbers. All rights
reserved.":
2340 PRINT: COLOR 7,0 : RETURN
2400 ' convert cap$ to caps
2410 FOR I = 1 TO LEN(CAP$):E$=MID$(CAP$,I,1):IF E$>="a" AND E$<="z" THEN
MID$(CAP$,I,1) = CHR$(ASC(E$)-32)
2420 NEXT I : RETURN
3000 '
3001 ' Main menu
3002 '
3020 NC = 5 : TITLE$="Main Menu"
3030 PRO$(1) = "Convert to COM or EXE format (make command file)"
3035 PRO$(2) = "Convert to HEX format (make transmittable file)"
3040 PRO$(3) = "List the files on your diskette"
3045 IF EXPERT THEN PRO$(4)="Turn expert mode OFF" ELSE PRO$(4) = "Turn expert
mode ON"
3047 PRO$(5) = "Stop using this program"
3050 GOSUB 8000 : IF CHOICE = 69 THEN 9900
3060 ON CHOICE GOSUB 4000, 5000, 6000, 7000, 7500
3070 RETURN
4000 '
4001 ' Convert to binary format
4002 '
4010 GOSUB 2300
4020 PRINT : PRINT "Enter name of file to convert to executable format. If
you do not specify an"
4025 PRINT "extension, .HEX will be assumed."
4030 PRINT "-> "; : LINE INPUT INFILE$
4040 IF INSTR(INFILE$,".")=0 THEN INFILE$=INFILE$+".HEX"
4050 OPEN "I", 1, INFILE$ ' open it up
4060 CAP$=LEFT$(INFILE$, INSTR(INFILE$,".")-1)+".COM":GOSUB 2400:OUTFILE$=CAP$
4070 PRINT "Enter full name of output
file (press ENTER alone to use "; OUTFILE$;)"
4080 PRINT "-> "; : LINE INPUT FAME$ : IF LEN(FAME$) THEN OUTFILE$=FAME$
4085 CAP$=OUTFILE$:GOSUB 2400:OUTFILE$=CAP$
4090 LOCATE CSRLIN-1,4 : PRINT OUTFILE$
4100 OPEN "R", 2, OUTFILE$. 1 : FIELD 2, 1 AS O$
4110 NBYTES = 0 : CKSUM = 0 : PRINT : PRINT "Working";
4120 WHILE NOT EOF(1)
4125 LINE INPUT #1, IN$ : IF LEN(IN$)=0 THEN 4180
4130 IF ASC(IN$)=59 THEN GOSUB 4250: GOTO 4180 ' remark handler
4140 FOR I = 1 TO LEN(IN$) STEP 2 : BT = VAL("&H"+MID$(IN$,I,2))
4150 NBYTES = NBYTES + 1 : CKSUM = (CKSUM + BT) MOD 2048 : IF NBYTES MOD 32
= 0 THEN PRINT " ";
4160 LSET O$= CHR$(BT) : PUT 2 : NEXT I
4180 WEND
4190 CLOSE : PRINT : PRINT : PRINT OUTFILE$; " created,"; NBYTES; "bytes
recorded."
4200 GOSUB 2200 : RETURN
4250 ' handle imbedded remarks
4255 IF LEFT$(IN$, 9) <> "checksum" THEN 4270
4258 PRINT:PRINT :PRINT "Checksum mark found..." :
4260 CK = VAL(RIGHT$(IN$,LEN(IN$)-9))
4265 IF CK = CKSUM THEN PRINT "Checksum verified." ELSE PRINT "Checksum
incorrect."
4270 RETURN
4290 RETURN ' go back to the wend
5000 '
5001 ' Convert to hex format
5002 '
5010 GOSUB 2300
5020 PRINT : PRINT "Enter full name of file to convert to .HEX format,
including the extension."

```



```

5030 PRINT "-> "; : LINE INPUT INFILE$
5040 OPEN "I", 1, INFILE$ : CLOSE 1 ' test to see if it's there
5045 OPEN "R", 1, INFILE$, 1 : FIELD 1, 1 AS I$
5050 NBYTES = 0 : CKSUM = 0
5060 IF INSTR(INFILE$, ".")=0 THEN INFILE$=INFILE$+". "
5070 CAP$=LEFT$(INFILE$, INSTR(INFILE$, ".")-1)+".HEX":GOSUB 2400:OUTFILE$=CAP$
5080 PRINT "Enter full name of output HEX file (press ENTER alone to use ";
      OUTFILE$;)"
5090 PRINT "-> "; : LINE INPUT FAME$ : IF LEN(FAME$) THEN OUTFILE$=FAME$
5095 LOCATE CSRLIN-1, 4 : PRINT OUTFILE$
5100 OPEN "O", 2, OUTFILE$
5105 PRINT : PRINT "Working";
5110 GET 1
5120 WHILE NOT EOF(1)
5130 PRINT #2, RIGHT$("0"+HEX$(ASC(I$)), 2);
5135 CKSUM = (CKSUM + ASC(I$)) MOD 2048 ' keep checksum running
5140 NBYTES = NBYTES + 1 : IF NBYTES MOD 32 = 0 THEN PRINT #2, PRINT " ";
5150 GET 1 : WEND : PRINT #2,
5155 PRINT #2, "checksum "; CKSUM
5160 CLOSE : PRINT :PRINT: PRINT OUTFILE$; " created, "; NBYTES; "bytes
      recorded."
5990 GOSUB 2200 : RETURN
6000 '
6001 ' files listing
6002 '
6020 NC = 3 : TITLE$="Diskette file listing"
6030 PRO$(1) = "List files on drive A" : PRO$(2) = "List files on drive B"
6035 PRO$(3) = "Return to main menu"
6040 GOSUB 8000 : IF CHOICE = 69 OR CHOICE = 3 THEN RETURN
6050 GOSUB 2300 : PRINT
6060 INPUT "What sort of files (i.e. COM, EXE, HEX)? Press ENTER alone for
      all files"; EXT$
6065 IF LEN(EXT$)=0 THEN EXT$="*" ELSE IF LEN(EXT$)>3 THEN EXT$=LEFT$(EXT$,3)
6070 CAP$=EXT$ : GOSUB 2400 : EXT$=CAP$
6075 PRINT: IF EXT$="*" THEN PRINT "Files"; ELSE PRINT " ";EXT$; " files:";
6080 PRINT " on drive "; CHR$(64+CHOICE); " : " : PRINT
6190 FILES CHR$(64+CHOICE)+": "+EXT$
6200 GOSUB 2200 : GOTO 6000
7000 '
7001 ' swap expert mode
7002 '
7010 EXPERT = 1 - EXPERT
7020 LOCATE 23, 10:PRINT "Expert mode is now "; : IF EXPERT THEN PRINT "on."
      ELSE PRINT "off."
7030 FOR I = 1 TO 1000: NEXT I : RETURN
7500 '
7501 ' end of program
7502 '
7510 CLOSE : DONE = -1: RETURN
8000 '
8001 ' menu processor
8010 GOSUB 2300 : LOCATE 7, FNA(TITLE$) : COLOR 1,7 : PRINT TITLE$ : COLOR 7,0
8020 LONGEST = 0 : FOR I = 1 TO NC : IF LEN(PRO$(I))>LONGEST THEN LONGEST =
      LEN(PRO$(I))
8030 NEXT I : CHOICE = 0 : XP = 38-LONGEST/2
8040 FOR I = 1 TO NC : LOCATE 8+I*2, XP :IF CHOICE = I THEN COLOR 8,1 ELSE
      COLOR 7,0
8050 PRINT CHR$(48+I); ". "; PRO$(I) : NEXT I : COLOR 7,0
8085 LOCATE 21, 5: IF EXPERT THEN PRINT "EXPERT MODE: Press "; ELSE PRINT
      "Press ";
8090 IF NC = 2 THEN PRINT "1 or 2 "; ELSE FOR I = 1 TO NC-1 : PRINT CHR$(48+I);
      ", "; : NEXT I : PRINT "or"; NC;
8095 IF EXPERT THEN PRINT "to make your choice." ELSE PRINT "to light up your
      choice, then press ENTER."
8100 COLOR 7,0: CM$="" : WHILE CM$="" : CM$=INKEY$ : WEND
8105 IF ASC(CM$)=27 THEN CHOICE = 69 : RETURN
8110 CM = ASC(CM$) - ASC("0") : IF CM >=1 AND CM <=NC THEN CHOICE = CM
8115 IF (EXPERT OR CM$=CHR$(13)) AND (CHOICE>0) THEN RETURN ELSE 8040
9900 '
9901 ' closing frame
9902 '
9910 CLS
9920 LOCATE 12,8:PRINT "End of program. Press the key marked 'F2' to run it
      again."
9925 KEY 2, "RUN"+CHR$(13) : KEY ON ' make sure that boast holds
9930 LOCATE 22,1 : DEF SEG = 64 : POKE 23, KSTATE 'recover former KB state
9940 END
10000 '
10001 ' error handling stuff
10002 '
10010 IF ERL = 6190 THEN LOCATE CSRLIN-2, 1 : PRINT "No ."; EXT$; " files on
      this diskette.": RESUME NEXT
10020 IF ERL = 5040 OR ERL = 4050 THEN PRINT : PRINT "Unable to open input
      file.": CLOSE : RESUME 2200
10030 IF ERL = 5100 OR ERL = 4100 THEN PRINT : PRINT "Unable to open output
      file.": CLOSE : RESUME 2200
10999 CLS : LOCATE 12, 10: PRINT "Unexpected error #"; ERR; "at line"; ERL:
      ON ERROR GOTO : END

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The Computer Store at the Office

A Boston bank has pioneered a learning center where employees can try out and even purchase their own PCs.

J.T. Johnson

The eighteenth-story window next to Judith Larson's shoulder frames a panoramic view up the Charles River toward Cambridge and the Harvard campus, but the young banker doesn't take her eyes off the IBM Personal Computer monitor as she cranks in data on a *VisiCalc* template. "I'm just doing a 'snapshot' of how our 35 local retail branches stood at the end of December," she explains.

Her concentration on this financial data is hardly unique for a staff member of the First National Bank of Boston. What is unusual is her location: the personal computing center established by the bank in its red granite headquarters in Boston's financial district. Larson is using one of five microcomputers designed to introduce employees to the power of disks and chips.

The bank's Professional Computing Center gives employees a chance to "test drive" PCs, Apples, and TRS-80s, and to sample a variety of software packages, all under the tutelage of experienced personnel from the firm's Information Systems and Services Division. As John McCarthy, assistant vice-president of the division, puts it, "We're just fighting for rationality in a crazy, everybody-needs-a-PC world."

First National is among the leaders of the queue of financial, insurance, and manufacturing institutions climbing on the personal computer



Debbie Dolloff, Equal Employment Opportunities compliance coordinator for the bank, is learning *VisiCalc* on the IBM PC. Looking on are Ed Care, center, a systems analyst, and Vic Tine, right, manager of the bank's Professional Computer Center.

train. McCarthy and his staff opened the center last June with a PC, three Apples IIs, and a TRS-80. Two more PCs were added in February.

"About 18 months ago," McCarthy notes, "we began getting employees from around the bank asking, 'What are these Apple things Dick Cavett is

talking about?' Four or five people who had already bought PCs were seeking advice on what software was good and how to use it. Last spring we decided to give some structure to our division's informal consulting."

When a bank employee comes to the center for advice about using computers, one of several consultants begins by determining the person's computing needs. "It may be that what someone wants to do—word processing, for example—can be done better on the Wang system existing throughout the bank," McCarthy points out, "or perhaps our mainframe programs are more appropriate."

If a PC can do the desired job, however, the employee is coached on using the machine and the necessary programs. Once the employee is familiar with the hardware and software, he or she can borrow one of the center's computers. "We also have a loan program," McCarthy adds, "so employees can take a PC to their office here or in the branches for a couple of days or home on the weekends."

From Learning to Owning

The bank's encouraging employees to use microcomputers is not limited to a few days with a borrowed machine, however. First National has established discount buying arrangements for hardware and software with some Boston-area vendors, and the center's staff will make all the arrangements for purchases by departments or individual employees. In this way employees can take advantage of the bank's discounts, which range from 7 to 20 percent, when they buy their own computers.

So far, McCarthy reports, 15 computers have been purchased by departments or employees since the center opened last year. "At first, Apples and PCs were both being purchased, but in the last quarter of 1982 five units were bought through us—all PCs."

McCarthy had not expected the PC to be so popular with employees when he stocked the center with three Apples and only one PC last June. "I changed my views on the IBMs during the summer, as more software became available," he explains. "Right now, we're quite confident that IBM is probably a safer long-term bet. It has compatibility

with our other equipment, and software developers are writing appropriate programs."

Judging from some informal indicators, the computer store at First National has caught on with bank employees. The center held an open house and information seminar in early December. "We sent out 260 invitations," McCarthy reports, "and 170 people showed up."

Victor Tine, one of the center's two full-time consultants, observes that the employees' response to the

First National is among the leaders of the queue of financial, insurance, and manufacturing institutions climbing on the personal computer train.

center continues to grow. "All our equipment is in use nearly all day long," he says. "We now have a reservation system, so those people who need the PCs for work tasks can get on them when they need to."

Matching Computers to Tasks

The center's consultants also evaluate new software for suitability in the banking industry. Spreadsheet programs—which permit a quick look at repetitive or unique "what if" financial issues—are an ideal tool for banking, McCarthy notes.

"Our bank has historically financed creative projects such as Hollywood movies, record industry deals, and cable television facilities," he states. "Each of these calls for a unique set of financial variables, and if a loan officer can run these proposals through *VisiCalc*, for example, it increases that person's efficiency or allows him or her to ask more

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creative questions of the project. One loan officer recently told me he spent 12 hours on a *VisiCalc* model for a project that used to take him 5 weeks."

As the center has gained popularity within the bank, McCarthy's staff has added other computer capabilities. Two of the newest components are a stand-alone color graphics system and a link via two terminals to the bank's mainframe computers. At present the center's PCs are not being used as terminals for the mainframes, as McCarthy explains.

"There are serious security issues to be resolved and substantial up-front costs to install access ports. In most instances the host programs would need to be rewritten somewhat to allow that communication. We don't exclude mainframe access, but we're waiting for a good project proposal to come along to justify it."

The telecommunications capability of the PCs recently came in handy, however, according to Ed Care, one of the center's systems analysts. "Our Human Resources Department recently used the PC to scan the resumes of upcoming graduates from the Harvard Business School. They just hooked up to Harvard's data base, reviewed the resumes, and decided who they wanted to invite for interviews."

Other Firms Follow

Within two weeks after First National's hardware/software advice bureau opened its doors, McCarthy began getting calls from colleagues in other Boston-area corporations asking what was going on and how they could get started. Already the Bank of New England and the Gillette Company have established similar microcomputer advice services.

Although its facilities and operating procedures are slightly different from those of First National, the

Bank of New England has also established an in-house microcomputer center. Employees can use any of seven computers—one PC, one Osborne, and five Apples—although they cannot purchase computers through this center at present.

"Since we set up our micro center in early August, 300 of our employees have signed up for basic training courses on our seven personal computers," notes Stephen Dale, vice-president of the bank's Office Systems Management Division. The Bank of New England "charges" the employees' training against their de-

McCarthy had not expected the PC to be so popular with employees when he stocked the center with three Apples and only one PC last June.

partments' budgets, Dale adds, "so we don't have a lot of curiosity seekers and browsers."

At the Gillette Company, John di Targiani, corporate director of Management Information Systems, reports that his firm opened its consultation center in mid-January. "We have PCs, DEC's, Wangs, and Apples around the office," he says, "so we have to be able to give advice on all of them. Our applications range from word processing to time-sharing with our mainframe system."

Like First National's center, Gillette has followed the in-house buying principle so that employees can benefit both professionally and personally. "The facility is one place where our employees can get straight information on the equipment and software, and it helps us build information networks within the company and get lower prices on the equipment," di Targiani points out. "We're

encouraging the use of personal computers and offering long-term support for their use."

Gillette is not the only corporation encouraging long-term support of the technology. The Travelers Insurance Companies' main office, in Hartford, Connecticut, also opened an in-house computer store last March. Like the service provided by the banks in Boston, the store is staffed by data processing experts who analyze employees' needs and advise them on appropriate equipment, software, and vendor discounts.

But the staff of the Travelers computer store is going a step further: its consultants, with sample kits in hand, are now fanning out across the land to show their wares. Early this year Travelers sent 42 seminar teams around the nation to advise the company's independent agents on implementing PCs and special software designed for the insurance industry.

The Travelers custom-designed insurance system, called AutoMate, consists of a PC with a modem and printer and the special software. Company spokesman Greg Kline states that Travelers has high expectations for this new program: "We anticipate that as many as 500 of our agents will buy our AutoMate system this year."

Even in lots of 500 such a bulk purchase may one day be only a scratch on the PC sales chart. Jake Macy, who has his own PC and uses one in the Strategic Planning Division at First National, sees the day when banks will buy PCs and appropriate software to give to their major customers. "After all," he says, "that can create a certain customer loyalty, and it's different only in scale from giving away pencils or calendars."

J.T. Johnson is a free-lance writer who teaches journalism at San Francisco State University. His work has appeared in publications that include Omni, Time, Discover, and Popular Science.

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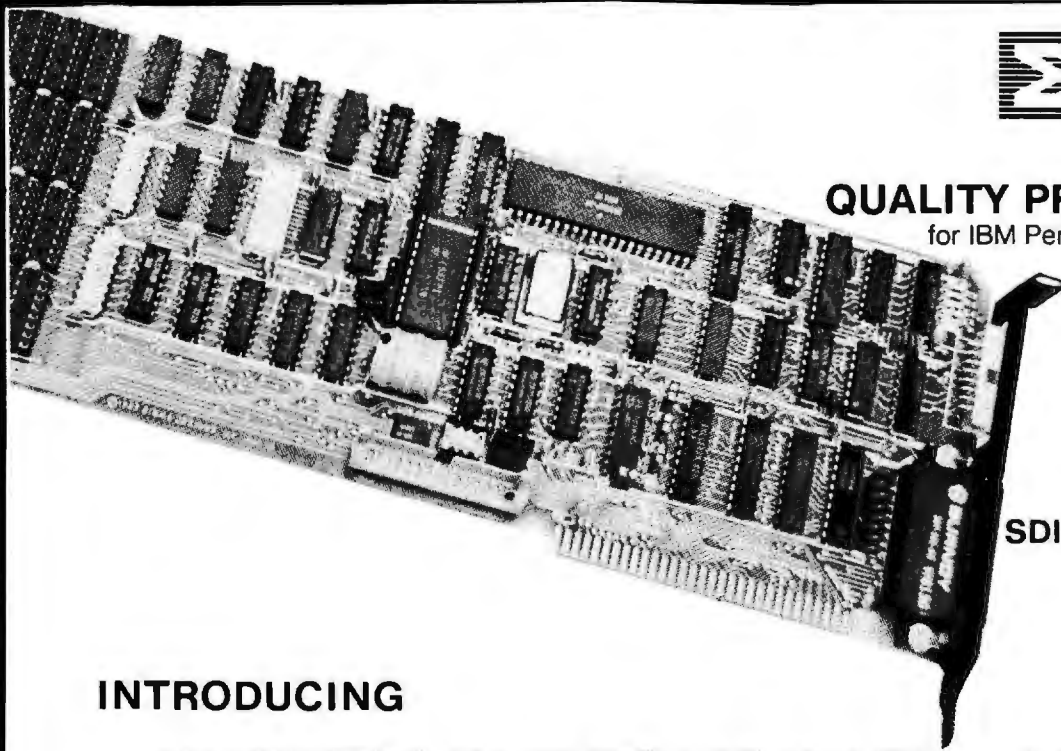
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User Group Dispatch

User Group News from Around the World

User Group Dispatch is a PC World department featuring user group profiles, topics of special interest to group members, and excerpts from groups' newsletters. Each column will include a directory listing the names, addresses, and phone numbers for all IBM PC and compatible user groups, whether the groups publish a newsletter or not.

This month's column is devoted to a discussion of starting a user group, a topic of special interest to owners of all the new PC-compatible computers. Next month *User Group Dispatch* will include a follow-up article about what to do once the group is organized.

Starting a User Group

User groups have been established as a major source of support for computer owners. They serve as a common ground where users can come together to share knowledge and experience. They have also been recognized as a means of protection against uncooperative or uninformed dealers.

If you haven't been able to find a user group in your area or a group that suits your needs, maybe you should consider starting one of your own.

Recently we spoke with five user group members who were active in the formation of their groups: Ramona Landberg from Capital PC (Washington, D.C. area), William O. Ward from Marin-Sonoma PC Users (California); Joe Rigo from the New York IBM Personal Computer Users' Group; Peter Harris from the Silicon Valley Computer Society (California), and Glenn Yunashko from the Association of PC Users in Chicago.

Each of these members had a slightly different perspective on the difficulties and satisfactions of starting a user group. But they shared a general consensus on one point: starting a user group requires dedication and hard work. They also agreed that the most difficult problem user groups have to deal with is a rapid growth rate.

The larger a group grows, the more complex its administration and organization becomes. Experienced members advise new user groups to establish strong organizational foundations so that subsequent growth doesn't become a cumbersome problem.

New user groups should especially consider start-up, administrative structure, and club activities, which can include a software library, product discounts, newsletters, and bulletin boards.

Stating a Purpose

One dedicated person with a precise idea of what a group can accomplish is fundamental to a successful start. A statement of purpose should define a group's intentions, not limit its activities.

The Marin-Sonoma PC Users group has a simple purpose: to provide members with a place to meet and share their knowledge and experience. Capital PC's purpose, as stated in the group's constitution, is "to provide an opportunity for both formal and informal education in computer applications and to encourage experimentation and research in the current and potential uses of the IBM PC."

Joe Rigo of the New York IBM PC Users Group feels that one of the main purposes of his group is to provide members with an alternative to dealer support. Group members do not have to remain dependent on dealers.

On the other side of the spectrum, Glenn Yunashko of the Association of PC Users and Peter Harris of the Silicon Valley Computer Society contend that their groups have a more professional or commercial orientation. The Association of PC Users limits membership to those who have a minimum of three years' experience in some facet of the computer industry. Members are required to own a PC or have daily access to one.

If you haven't been able to find a user group in your area or a group that suits your needs, you should consider starting one.

Similarly, Peter Harris reports that the Silicon Valley Computer Society's primary purpose is to provide members with professional contacts. Of course, the group's location lends itself to commercial involvement in the computer industry.

Another important element in a successful users' club is a dedicated core of people to lay the initial groundwork. This core group often becomes the group's steering committee and makes many of the fundamental decisions for the organization.

Practical Considerations

Finding a place to meet is one of the first things the core group should do. Although a home is fine for the first few meetings, the group is likely to outgrow anyone's living room quickly. William Ward suggests finding rent-free space. He recommends using contacts within the club to find space in a bank or other office building.

Questions to keep in mind when looking for a space are: Is the space large enough to incorporate expected growth? Do the building regulations allow occupants to buy and sell merchandise on the premises? (This last question is important if your group plans to start a buying club or software exchange.)

The next step in the groundwork is to attract members. Although this rarely creates a problem, we offer a few pointers. Mail out a notice publicizing your group. Include the group's official name, the purpose, and the place of the first meeting. Try to find an existing mailing list; a local computer store might be willing to let your group use theirs. Distribute flyers. Local computer store bulletin boards are a good place to pin them.

William Ward notes that many groups attract new membership by offering public-domain software and discounts on supplies purchased from cooperating manufacturers. Some groups attract novices by helping them past the hurdles of getting their PCs up and running, installing disk drives, and adding memory boards.

Finances may pose a problem for a fledgling group. The New York IBM PC Users' Group overcame this problem by getting sponsored by both the

New York Amateur Computer Club and the New York City Chapter of the Association for Computing Machinery. These two organizations provided the group with financial support and a mailing list. Once the new group began earning its own revenue through membership dues, it became independent.

In determining what to charge members for dues, several points should be considered. Will dues be the group's only source of income, with all other services offered to members at cost? Or is the group going to charge members a markup on supplies and software and a fee

Starting a user group requires dedication and hard work.

for classes? What expenses is your group going to have? Those to consider are the cost of printing and mailing a newsletter, rent for meeting and class space, and fees for speakers.

Administrative Structure

Most established groups draw up a constitution and by-laws and elect officers and a steering committee or a board of directors. The constitution's articles can cover the following subjects: the group's purpose, membership, elections, board of directors, and officers. By-laws are required if the group is going to apply for tax-exempt status.

Peter Harris of SVCS is convinced that a dedicated steering committee is

at the heart of every successful user group. The steering committee, says Harris, should form during the very earliest stages of the group's organization and should meet separately to decide on the meeting agendas, the group's budget, and public relations. Most groups welcome all members to attend the steering committee meetings.

Joe Rigo, on the other hand, suggests that active members take the place of a steering committee. The software librarian, bulletin board operator, newsletter editor, and the special interest group chairmen should vote on the key issues and run the group. "The last thing you want," says Rigo, "is a steering committee that doesn't have an active interest in the group."

Incorporation

At some point during the group's development the question of whether to incorporate will probably come up. Though some groups veer away from the idea of incorporation, the larger, more established groups advise it.

Ramona Landberg suggests that the main reason for incorporation is that it limits the group's liability to the assets of the organization. As the group gets larger and more people become involved, the chances of mishap, whether accidental or fraudulent, grow along with it.

Incorporation also lends credibility to the group. Manufacturers are much more likely to trust a large shipment of merchandise to an incorporated group.

Incorporation likewise makes it easier to establish and maintain a

payroll. Though it may seem surprising, nonprofit organizations can and do have payrolls. According to Ramona Landberg, Capital PC is considering hiring a staff to take care of the work that has begun to overwhelm the members who donate their time. For Capital PC hiring help might be the only alternative to breaking the group into smaller, more manageable subdivisions.

User groups can incorporate as nonprofit, nonstock corporations, although incorporation regulations differ from state to state. In California, for example, incorporation entails a very simple procedure of filing Articles of Incorporation with the Secretary of State's office. The fee for filing is \$20; however, the proposed corporation must either pay a franchise tax deposit of \$200 or obtain tax-exempt status before the Articles of Incorporation are filed.

Applying for tax-exempt status is more involved than filing for incorporation. Organizations have to apply separately for state and federal exemption. User groups would most likely apply for tax exemption under Internal Revenue Code 501 (c)(3), which is comparable with California's Revenue and Taxation Code 23701d— Religious, Charitable, Scientific, Literary or Educational Organizations.

Capital PC, for example, applied for tax-exempt status under Internal Revenue Code 501(c)(3), which is desirable because donors would be able to deduct donations from their own taxes. But according to Ramona Landberg, Capital PC couldn't provide the extensive documentation necessary. Now they are applying for

tax-exempt status under Internal Revenue Code 501(c)(7), comparable with California's Revenue and Taxation Code 23701g— Social, Recreational, and Pleasure Clubs for members. At present the IRS is questioning the application because Capital PC is making money.

From stating a purpose to filing incorporation papers is a long road for any group, no matter how large or well organized. But all these efforts are certain to contribute to the creation of a valuable and efficiently operating user group for computer novices and experts alike.

Anna Bunker

User Group Directory

PC World will publish a User Group Directory every month. If your group is not in this list but would like to be, send the group's name, address, contact, and other information to *User Group Dispatch*, *PC World*, 555 DeHaro St., San Francisco, CA 94107.

Alabama

Birmingham User Group
Chet Ellis
ComputerLand, 215 W. Valley Ave.
Birmingham, AL 35209
205/942-8085

Arizona

The Phoenix Personal Computer Club
Fred Lynch
P.O. Box 44218
Phoenix, AZ 85064
602/266-6634

IBM PC Idea Exchange

Lisa May
United Systems Corporation
1074 E. Sandpiper Dr.
Tempe, AZ 85283
602/831-9363

IBM PC User Group

Theresa Baudier
711 E. River Front Dr.
Tucson, AZ 85719
602/622-4751

California

IBM Users Group of California
Neil Zachary
P.O. Box 4136
Los Angeles, CA 90028
213/937-1314

Marin-Sonoma PC Users

William O. Ward
P.O. Box 2909
San Francisco, CA 94126

Modesto User Group

Liz Leedom
P.O. Box 1122
Modesto, CA 95353
209/578-2358

San Diego Computer Society

John Field
1384 Caliente Loop
Chula Vista, CA 92010
714/421-9686

San Francisco IBM PC User Group

Alfred Goodwin
Software Center
4720 Geary St.
San Francisco, CA 94118
415/751-2231

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San Francisco PC Club
Max Brioski
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San Francisco, CA 94109
415/775-8882

Santa Barbara City College Com-
puter Science Department
Stu Swartz
721 Cliff Dr.
Santa Barbara, CA 93109
805/966-2919

Silicon Valley Computer Society
Peter Harris
P.O. Box 60506
Sunnyvale, CA 94088
408/248-9057

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Denver User Group
Steve Leibson
4040 Greenbriar Blvd.
Boulder, CO 80303
303/494-4062

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Dave Foulger
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New Canaan, CT 06840
203/966-9378

Central Connecticut User Group
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ComputerLand, 131 S. Main
West Hartford, CT 06107
203/561-1446

District Of Columbia
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Mike Todd
1414-C Wright Circle
Bolling AFB
Washington, DC 20336
202/433-4380

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Sarasota Chapter of the Autumn
Revolution
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2131 Brookhaven Dr.
Sarasota, FL 33579
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Hawaii
Hawaii IBM PC User Group
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808/735-5769

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Bruce Burns
ComputerLand, 687 S. Capitol Blvd.
Boise, ID 83702
208/344-5545

Illinois
Association of PC Users
Glenn Yunashko
4727 S. Laverne St.
Chicago, IL 60638
312/284-5872

Northern Illinois IBM PC Users
Group
James L. Szafranski
5195 Castaway Ln.
Barrington, IL 60010
312/934-8133

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Susan Shields
ComputerLand, 5450 N. Coldwater
Rd.
Fort Wayne, IN 46825
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Indianapolis IBM User Group
David Reed
6704 Hoover Rd.
Indianapolis, IN 46260
317/259-7892

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South Bend, IN 46615
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Lee Ann Moore
Black Hawk Village Shopping Center
Cedar Falls, IA 50613
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Becky Hinton
Topeka Public Library
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Topeka, KS 66604
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Mettarie, LA 70002
504/831-1138

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Bob Roswell
1516 York Rd.
Lutherville, MD 21093
301/337-5555

Capital PC
Ted Landberg
13700 Beauwick Ct.
Silver Springs, MD 20906
202/275-2102

Massachusetts

Miller Microcomputer Services
61 Lakeshore Rd.
Natick, MA 01760
617/653-6136

Boston Computer Society/IBM User Group

Michael Rohrbach
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New Jersey

Personna Computer Association
The Int'l Association for the PC
Paul Cowan
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Point Pleasant, NJ 08742
201/840-0300

New York

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360 Central Park West
New York, NY 10025
212/222-9027

The New York IBM PC Users Group

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SYSDOC, Inc., 1385 York Ave.
New York, NY 10021
212/249-6418

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P.O. Box 106 Church St. Station
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212/674-1185

North Jersey IBM PC Club

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New York, NY 10036
212/581-4667

The Long Island Computer Association

Marvin Freifeld
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Smithtown, NY 11787
516/724-0574

Pennsylvania

International Personal Computer Owners
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IPCO, Inc., P.O. Box 10426
Pittsburgh, PA 15234
412/561-1857

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PC Users' Group
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Columbia, SC 29202
Source: ST5033

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IBM PC User Group
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Science Applications, Inc.
Plaza Tower #801
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615/482-6649

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3110 Honey Tree Ln.
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512/327-0029

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Utah

Utah ComputerLand
Debby Williamson
ComputerLand, 161 E. 200 South
Salt Lake City, UT 84111
801/364-4416

Virginia

The Central Virginia User Group
Bob Dust
3130 Quail Hill Dr.
Midlothian, VA 23113
804/744-2387

Washington

The PNW IBM User Group
Eileen Bagdonas
P.O. Box 3363
Bellevue, WA 98009

Canada

Northern Alberta PC User Group
Gerry J. Danen
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Edmonton, Alberta
T5W 4S9 Canada
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BBS Watch

Getting Your Message Across the Easy Way

Before you can use a computerized bulletin board you have to know how to dial and connect with one. Although most IBM PC bulletin boards use unique software to control their systems, most of these programs have similar designs. The first few things a caller will see and do when connecting with a system are generally the same.

Preparation

To save time and minimize the cost of your telephone call, before you dial a bulletin board system you should be reasonably familiar with the communications software you use. Take time to review the documentation and the major control codes, or commands. Use the software commands on your communications program to set the same parity and data bit specifications as the system you are calling.

If you don't know what settings a particular bulletin board uses, first try no parity, 8 data bits, and 1 stop bit. Set your modem for originate mode, and both your modem and software for full-duplex operation. This setting will work with almost all computer bulletin boards and the major time-sharing services such as The Source and CompuServe.

You'll need to set the baud rate on your computer to match the baud rate used by the bulletin board system, typically either 300 or 1200 baud.

Some of the technical terms you may have heard in connection with modems and baud rates are modem standards given to the equipment by the Bell System or other communications equipment manufacturers. Modems that transmit at 300 baud are usually referred to as BELL 103

compatible. This means that all modems rated as BELL 103 devices can communicate with each other, even if they are made by different manufacturers.

The 300 baud communications world is easy to work within because the BELL 103 standard is in widespread use. Connecting with bulletin boards that use 1200 baud modems, however, may not be so simple. Three major standards are used in the United States, and they are all incompatible with each other. These standards are the BELL 212A, the BELL 202, and the VADIC. The most common 1200 baud standard for computerized bulletin boards is the BELL 212A.

All modems rated as BELL 103 devices can communicate with each other, even if they are made by different manufacturers.

Most of the major time-sharing services support all the standards; each standard requires that you dial a different phone number for access to the system. You must consult a service's handbook or phone its customer service number to find out the proper telephone number to call for your type of 1200 baud modem.

Before you call a bulletin board, check its hours of operation. Not all systems run 24 hours a day, 7 days a

week, and it can be disturbing to the system operator's (SYSOP's) household or office when people call the system outside normal operating hours.

Connection

If you dial the phone number correctly, you should hear a high-pitched "carrier" tone after the bulletin board phone answers. Most systems answer on the first ring; others power themselves down between calls and may take five to seven rings before they are ready to answer. Once you hear the carrier tone from the remote end, you may have to set some switches or do something with your modem and/or telephone. For example, if you were using an acoustically coupled modem, your telephone handset would need to be placed in the acoustic coupler. This part of the hookup varies according to the type of modem you are using. The newer, "smart" modems make this connection automatically, requiring no action on your part.

Now that you have made the connection, a few different things may happen. Some systems greet you with a welcome message and give you information about the bulletin board and its menu options. Others start to send you messages right away. Still others just sit there and wait for you to press ENTER a few times, allowing the bulletin board to read your baud rate so that it can set its hardware and software to match yours.

No matter what type of system you are connecting with, one of the first messages you will see is the request for your name. In addition, some systems request your address (or just city and state), and some request a phone number. Most systems keep

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track of callers, so you will not be asked for the same information each time you call.

Many systems ask you to enter a password on your first call so that no one else can call in and use your name. Without this protection anyone using your name would have access to your private messages and could delete or modify them. Passwords are also used among two or more bulletin board callers who want their electronic conversations kept private.

Clubs and user groups use passwords to reserve certain sections of a bulletin board's files for their own use. In this way nonmembers do not have to scan messages that are of no interest to them, while at the same time club members can protect their messages and call up their special interest information with just one word.

Once a bulletin board system knows who you are, it may search its message files to see if it has any messages addressed to you. Not all systems do this automatically; some require that you use a search command with your name, or that you scan through all the messages to find those addressed to you.

Message Types

Familiarize yourself with the way the system messages are organized for a given bulletin board system. Most systems have several types of message services available. The most common and useful type is the open message, one directed to anyone who wants to read it. A recent open message on my bulletin board invited any Chicago-area residents interested in joining a *dBase II* club to leave their names

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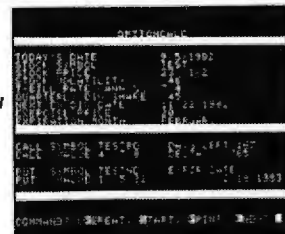
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and phone numbers in a message addressed to the caller.

Open messages often include technical information and callers' personal experiences with hardware or software. The creator of the message has the option of protecting the message with a password so that it can be deleted only by the caller or the SYSOP.

Another kind of message is the private user-to-user type. Private messages can be read only by the creator and the addressee. A typical message of this kind might tell the addressee that the caller has repaired the addressee's disk drives and wants to set up a date to drop off the machine. In most cases other callers will not even know that this message exists on the system because of its password restriction.

The final message type is one addressed specifically to the systems operator. It is similar to a private message. I often receive messages from callers who ask me to review a program they have uploaded to my bulletin board system. The SYSOP is the only one who can read or delete this message.

The procedure for sending a message to a bulletin board is very easy. It requires that you enter one of the menu or command options used by the system; the most common command is E (enter a message). After receiving this command, the bulletin board goes into a prompt mode and asks you for information. In most cases this information includes the name of the addressee, the subject of the message, and a password (if the system allows that protection). The bulletin board system already knows who you are because you gave your name when you logged on. You are then asked to write your message. Most systems will limit message size; a common limit is 16 lines.

Log Off

Keep track of your time on the system so as not to overstay your welcome. Most systems are busy, and other people may be trying to call. Remember that while you are on the bulletin board system, you the only user. When you have finished reading the messages, log off the system with the proper command. Do not just hang up. While most systems can handle this, some take a while to recover and may give another caller a busy signal.

IBM PC Bulletin Boards

Following is a partial listing of the IBM PC bulletin boards on line in the United States. The list is updated as the author receives information about new bulletin boards.

201/678-6670
New York, New York
SYSOP: Donald David
(TC7057)
24 hrs

213/390-3239
Santa Monica, California
SYSOP: Marc Schoenber
24 hrs, download & upload,
10 MB disk, 300/1200

301/949-8848
Rockville, Maryland
SYSOP: Rich Schinnell
24 hrs, download & upload
(Passwd = IBMPC)

301/251-6293
Gaithersburg, Maryland
SYSOP: Larry Jordan
24 hrs, communications info
(Passwd = IBMPC)

301/460-0538
Bethesda, Maryland
SYSOP: Ramona Landberg
24 hrs, upload newsletter
articles

301/937-4339
Beltsville, Maryland
Small People Software
SYSOP: Chet Rhodes
24 hrs, games, messages

312/259-8086
Chicago, Illinois
SYSOP: Gene Plantz
(PCMODEM)
24 hrs, download & upload,
messages, 300/1200

312/376-7598
Chicago, Illinois
SYSOP: Pete Coniceak
24 hrs, download & upload,
messages, 300

404/252-9438
Atlanta, Georgia
SYSOP: Rod Roark
24 hrs, messages, download
& upload, tips, news

406/656-9624
Billings, Montana
SYSOP: George Peck
9a.m. to 5p.m.; 11p.m. to
7a.m./Mountain Time

608/262-4939
Madison, Wisconsin
PC Users Group
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PCEZ

Total Recall*

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LINK SYSTEMS*

DataFax*

259

SELECT INFORMATION SYSTEMS*

Select with SuperSpell®
(Word Processing)

EDS (Electronic Data Systems)*

Communicator Text Editor*
Personal Tax Planner*89
49

IUS (Information Unlimited Software)*

EasyWriter II*
EasySpeller II*
EasyFiler*
EasyPlanner*229
129
289
131

TEXASOFT*

Versatext (Word processing/Data
base with mailmerge)*
The Thinker (Spreadsheet)*
PC Filer (Database)*119
39
39

DENVER SOFTWARE*

EASy (Executive Accounting Sys)*

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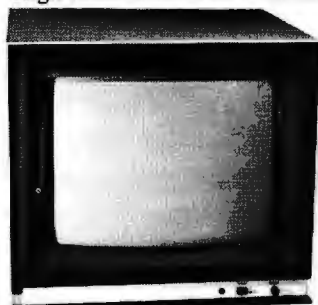
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| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
| 13 | ALLERGY 3 | 12 | 184 | 196 | |

F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

FILE DEFINITION

***** LABEL CONFIGURATION ***** 04-12-1982

File Name: PATIENT FUNCTION: FILE DEFINITION Entry: Record 1 Size: 177 Records: Records Per Disk 1767

| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
| 13 | ALLERGY 3 | 12 | 184 | 196 | |

F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

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***** FILE MAINTENANCE ***** 04-12-1982

File Name: PATIENT FUNCTION: FILE MAINTENANCE Entry: Record 1 Size: 177 Records: Records Per Disk 1767

| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
| 13 | ALLERGY 3 | 12 | 184 | 196 | |

F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

FILE MAINTENANCE

***** SYSTEM MENU ***** 04-12-1982

File Name: PATIENT FUNCTION: SYSTEM MENU Entry: Record 1 Size: 177 Records: Records Per Disk 1767

| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
| 13 | ALLERGY 3 | 12 | 184 | 196 | |

F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

SYSTEM MENU

***** FAST SELECTION ***** 04-12-1982

File Name: PATIENT FUNCTION: FAST SELECTION Entry: Record 1 Size: 177 Records: Records Per Disk 1767

| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
| 13 | ALLERGY 3 | 12 | 184 | 196 | |

F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

FAST SELECTION

***** FAST SORT ***** 04-12-1982

File Name: PATIENT FUNCTION: FAST SORT Entry: Record 1 Size: 177 Records: Records Per Disk 1767

| Field No. | Field Name | Length | Start | End | Column |
|-----------|----------------------|--------|-------|-----|--------|
| 1 | PATIENT NAME | 30 | 1 | 30 | |
| 2 | ADDRESS 1 | 30 | 31 | 60 | |
| 3 | ADDRESS 2 | 30 | 61 | 90 | |
| 4 | CITY | 15 | 91 | 105 | |
| 5 | STATE | 2 | 106 | 107 | |
| 6 | ZIP CODE | 5 | 108 | 112 | |
| 7 | REFERRING PHYSICIAN | 15 | 113 | 127 | |
| 8 | AGE | 10 | 128 | 137 | |
| 9 | DATE BORN | 10 | 138 | 147 | |
| 10 | DATE OF LAST ILLNESS | 10 | 148 | 157 | |
| 11 | ALLERGY 1 | 12 | 158 | 170 | |
| 12 | ALLERGY 2 | 12 | 171 | 183 | |
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F1: SYSTEM MENU F2: FILE DEFINITION F3: END SCREEN

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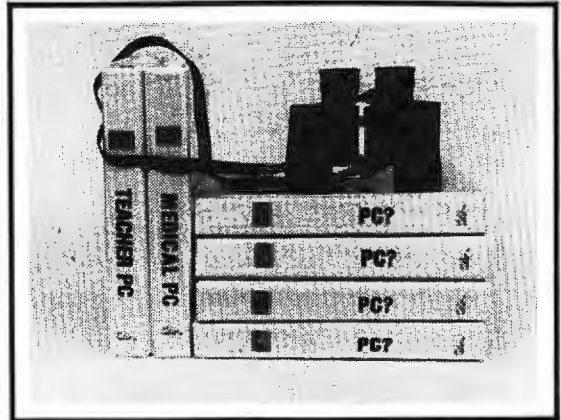
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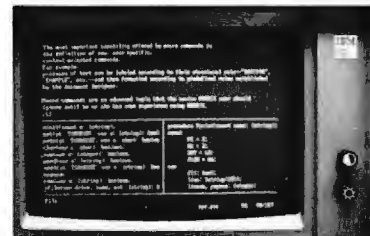
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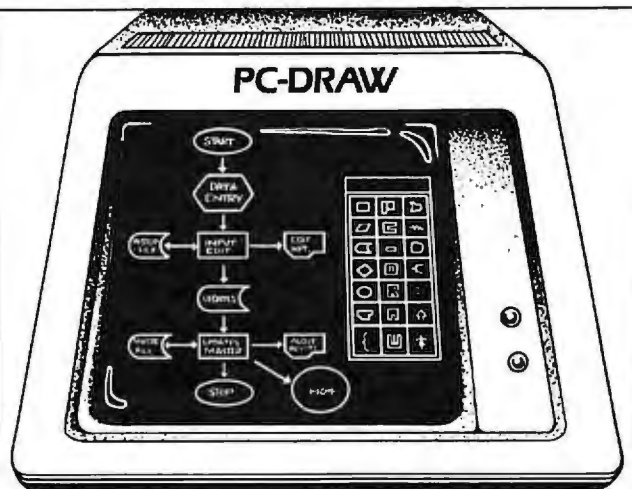
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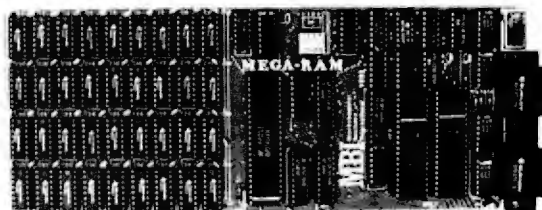
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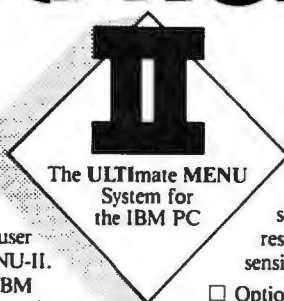


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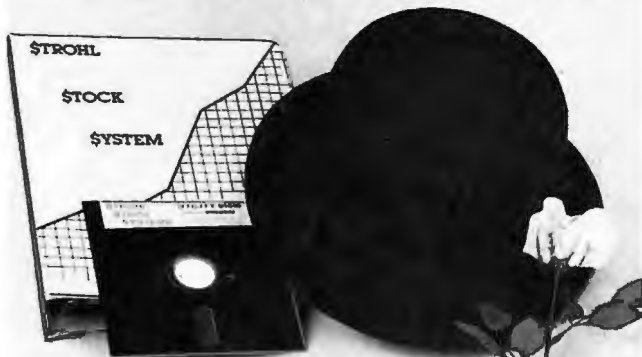
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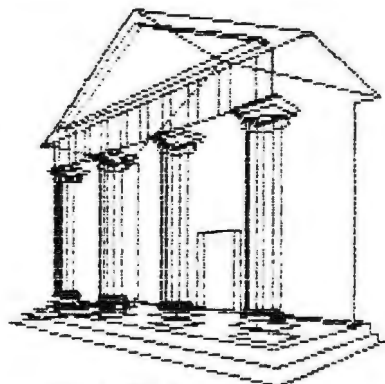
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VDTE emulates HP26xx and VT52 terminals, including hires HP26xx vector graphics. Transfers files, uses either display. Ten speeds include 300, 1200, 9600 baud. 36 page user's manual. Available now! Only \$50 postpaid (Californians add 6% sales tax). Write for free brochure. *Inner Loop Software, P.O. Box 45857, Dept. J, Los Angeles, CA 90045, 213/645-5162*

Compilers

C Compiler/Debugger

Designed around the c-systems optimized C Compiler, the c-window™ package provides source statement execution and breakpoints; variable display and alteration is accomplished using C expression syntax. A must for all C programmers. 128K, two floppy drives required. C Compiler \$195, c-window \$125. *c-systems, P.O. Box 3253, Fullerton, CA 92634, 714/637-5362*

CP/M

Compatible Formats

The creators of CP/M also provide a full line of languages, graphics & Operating Systems. Products include: Concurrent CP/M, CP/M Plus, CBASIC, Pascal/MT+, PL/I, GSS-Kernal & Plot, Network-

ing, productivity tools and utilities. We offer many of our products in IBM compatible formats. *Digital Research, P.O. Box 579, Pacific Grove, CA 93950, 408/ 649-5500*

Cross Reference

Supercref Referencer/Lister

This tool to debug large BASIC programs prints a formatted source listing and cross index of the variables, BASIC words and line references in your program. Can use bold printing to highlight selected words in listing. Many extras. Supercref \$30. *Write Ring, 5050 Garford, #160, Long Beach, CA 90815, 213/498-6496*

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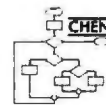


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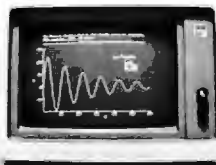
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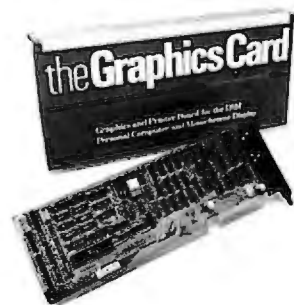
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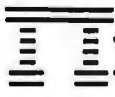
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The Wide World of PC Products

Hardware

Boards

AST-SNA

A hardware and software product family that allows one to four IBM PCs to each emulate a 3270 terminal. It requires 128K, one disk drive, and a modem. If additional PCs or terminals are clustered, an RS-232C interface is required for each additional display.

The SNA 3270 is the foundation product comprising one board and software on disk. It allows one PC to emulate a 3270 terminal and allows the PC's Epson printer to emulate a 3287-type printer.

The SNA 3270P option is an additional cluster communications card with software that goes in the host PC with the SNA 3270 in place and allows the attachment of up to three additional IBM PCs. Each additional PC can then emulate a 3270 terminal and access the printer attached to the host PC. These additional computers can disconnect and function separately, but the host PC must remain in the SNA communications mode as a controller for the other computers. No product is used with the additional computers, but they each require their own RS-232C interface.

The SNA 3270C option allows an alternative compatible terminal design to be used for the additional display stations instead of IBM PCs. Another option is the SNA 3770 Batch, which provides emulation of an IBM 3770 Communications Terminal for batch data transfer operations such as remote job entry.

An SNA 3270X version is planned for the future that will have the

current SNA 3270's software on board and will allow the controlling IBM PC in a cluster to switch to independent operation without interrupting the cluster's SNA operations.

A trade-in program is planned for the X version if the purchaser has already bought the SNA 3270. List price: SNA 3270 \$895, P or C options \$695 each, Batch option \$195. AST Research, Inc., 2372 Morse Ave., Irvine, CA 92714, 714/540-1333.

Nirvana

A board that combines memory expansion, a Z-80B processor, a clock/calendar, an RS-232C interface, a hard disk SASI host adapter, and CP/M on disk. The board requires one expansion slot and 64K already in place. It has 192K, and two additional 192K piggyback cards can be attached at additional cost without using more expansion slots.

The board's Z-80B microprocessor can operate concurrently with the PC's 8088 microprocessor, permitting the user to switch back and forth. The board allows two users to operate simultaneously if a terminal is connected to the board's serial interface. A print spooler and clock/calendar are available only under MS-DOS. Disk and modem buffering and a disk emulator are also included. The board comes with CP/M 2.2 and will come with CP/M 3.0 when it is available. List price: Nirvana \$995, 192K piggyback modules \$375 each. Hurricane Laboratories, Inc., 5149 Moorpark Ave. #105, San Jose, CA 95129, 408/257-8676.

V101-I

A telephone interface that allows the user to communicate with a remote PC over the telephone line without using a modem. It requires one disk

and the memory required for the custom application. The V101-I isn't a voice recognition device but does allow the telephone keyboard to be used for data input. Touch-tone signals are transmitted over the telephone line, which is linked to the interface in the remote computer without a modem.

The interface allows the computer to receive and interpret these signals, which may also be transmitted back to the user on the telephone for data output, but for most purposes this kind of transmission would be incoherent.

Interpretable data output can be provided by a voice synthesizer piggyback module called the V100 VSM that attaches to the V101-I and permits transmission of a voice response to the remote telephone. A 300-word vocabulary disk is provided with the V100 VSM, and the 1300-word V120 expansion option is available. The board has auto-answer and auto-dial features.

The product is intended for commercial users, system integrators, and hobbyists who program their own custom applications. Two examples of applications are catalog telephone ordering for customers without computers and control and monitoring of remote security or mechanical devices.

An optional V200 LSM modem module can piggyback the V101 in addition to the V100 VSM option and provides alternate communications ability. List price: V101-I \$350; V100 VSM and V200 LSM options \$100 for the first option, \$149 for the second option, or \$149 if any additional option is purchased at a later date; V120 \$495. Vynet Corporation, 160B Albright Way, Los Gatos, CA 94030, 408/370-0555.

Display

The Genius

A monochrome monitor that permits display of a 57-line page of text, 80 columns wide, with 800-by-720 resolution. It is available in black and white, green, or amber. Character matrix is 7 by 12. The monitor has inverse video and flash features. List price: 60 Hz version \$1595, 50 Hz version \$1712. Micro Display Systems, Inc., 12310 Vermillion St., P.O. Box 455, Hastings, MN 55033, 612/437-2233, Telex: 29-0766.



The Genius, Micro Display Systems

Printers

630 ECS

A daisy wheel letter quality printer that supports both parallel and serial interfaces. It has a number of character sets for different applications: scientific (includes Greek symbols), teletex for foreign languages, legal with italic characters, and a set for financial and accounting. It prints at 40 cps. The 630 ECS is a 132-column printer that comes with bidirectional tractor feed. List price: \$3495. Diablo Systems Inc., 24500 Industrial Blvd., Hayward, CA 94545, 415/786-5424.

Model-100 Sweet-P

A flatbed paper-moving plotter that produces hard copy graphics. It requires a parallel interface. The disk includes a tutorial program. The unit has an addressable plotting area of 7.5 by 118 inches and accepts paper sized from 8.5 by 11 inches up to 8.5 by 120 inches. Maximum plotting speed is 6 inches per second.

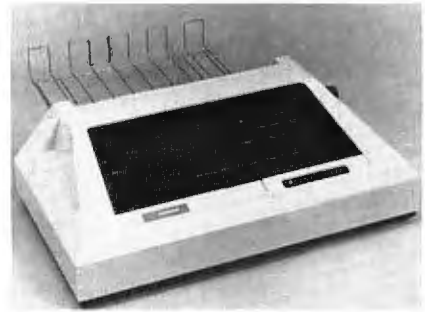
The plotter comes with software that allows it to draw pie, bar, or line charts and technical illustrations. Software features enable the plotter to define window limits, scale, alphanumeric character size, and character orientation.

Provision is made for color fill and digitizing. A front panel keypad controls nine functions related to pen movement and instrument setup. A pause command interrupts plotting to change pen color. Upcoming graphics programs from PFS and BPS will be configured for use with the Sweet-P. List price: \$795. Enter Computer, Inc., 6897 Nancy Ridge Dr., San Diego, CA 92121, 619/450-0601.

DP-9625A

A dual-pass dot matrix printer that prints both text (in eight languages) and graphics. It supports both parallel and serial interfaces. Print modes include near letter quality (10 cpi at 50 cps, 12 cpi at 60 cps, and proportional spacing at 55 cps), enhanced without dual pass (10 cpi at 100 cps, 12 cpi at 120 cps, and proportional spacing at 110 cps), and data processing (10 cpi at 200 cps). Graphics resolution is either 72 or 144 dots per inch in both vertical and horizontal dimensions.

The DP-9625A includes the standard ASCII 96-character set. Down-line loading and sub- and superscripting are optional. It uses tractor paper feed. List price: \$1995. Anadex, 9825 De Soto Ave., Chatsworth, CA 91311, 213/998-8010.



DP-9625A dot matrix printer, Anadex

Sprint 11/40 PLUS

A letter quality bidirectional text and graphics daisy wheel printer. It uses both parallel and serial interfaces and IEEE. The interchangeable communications module that plugs into the back of the printer makes the printer PC compatible.

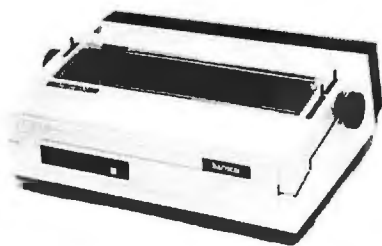
Sprint 11/40 PLUS prints at 40 cps, at 10, 12, and 15 pitch and includes an ASCII 96-character set. Over 100 print wheels are available at \$5 each. The printer comes with friction paper feed; tractor and sheet feed are optional. A .5K buffer is included.

The manufacturer claims that the Sprint will run for 5500 hours if the unit is actually printing 25 percent of that time. That translates to 3 years with the printer running 8 hours a day. The acoustic noise level is less than 63 decibels. List price: \$1776 including choice of interface and cables. Qume Corporation, 2350 Qume Dr., San Jose, CA 95131, 408/942-4000, TWX: 910-338-0232.

Just Announced

Micro Spooler

A printer buffer that stands vertically like a book. It requires a parallel or serial interface. The buffer has 16K of memory and can be purchased with up to 64K or expanded later in 16K increments. Features include a pause button, status readout, internal power supply, and baud rate selection. The unit is available in four interface configurations. List price: parallel to parallel \$199, parallel to serial \$239, serial to parallel \$239. Consolink Corporation, 1840 Industrial Circle, Longmont, CO 80501, 800/525-6705, 303/651-2014.



Transtar 130 letter quality printer, Omega Northwest

Transtar 315

A dot matrix color printer that prints both text and graphics. It supports both parallel and serial interfaces. The 315 has a unique four-hammer printing method. Each hammer prints one primary color, preventing the possibility of bleeding and contamination. Thirty shades can be printed in a single pass of the printhead.

The 315 includes an ASCII 96-character set and prints at 50 cps independent of color or shade. It has both tractor and friction-pin paper feed. Its noise level is less than 60 decibels. List price: \$599. Transtar, Omega Northwest, Inc., Box C-96975, Bellevue, WA 98009, 206/454-9250.

Transtar 130

A letter quality daisy wheel printer in two versions: Model 130P has a Centronics-compatible 8-bit parallel interface, and Model 130S has a RS-232C serial interface. Both print at 16 cps.

The 130S has switch-selectable transmission rates ranging from 300 to 2400 baud and a standard 2K buffer. The Transtar 130 is compatible with some word processing packages including *WordStar*, so it is able to utilize features such as proportional spacing, bidirectional printing, boldface, and underscoring.

The Autoload feature allows users to load cut sheet paper to one of four switch-selectable positions: First printable line, 1 inch, 1 1/2 inches, or 2 inches from the top. List price: \$895. Transtar, Omega Northwest, Inc., Box C-96975, Bellevue, WA 98009, 206/454-9250.



Micro Spooler, Consolink Corporation

Marc 3000

A print accessory that combines the functions of a sheet feeder and envelope feeder. It requires no power, technical interface, special software, or control codes. It is compatible with Qume, Diablo, Ricoh, C.Itoh, and NEC printers. A tilt-back design allows the user to make one-time single envelope, sheet, or form insertions without removing the unit from

the printer. The feeder sits atop the printer and weighs approximately 10 pounds. List price: \$1095. Datamarc, 1251 Columbia, Richardson, TX 75081, 214/783-1691.



Marc 3000 sheet and envelope feeder, Datamarc

Software

Applications

VIZ.A.CON

A program that consolidates *VisiCalc* models by adding a third dimension of calculation. It requires 64K and one disk drive. *VIZ.A.CON* makes summations over periods of time or consolidations by organizational divisions such as departments or companies. Information from up to 50 reports with the same spreadsheet parameters can be consolidated without replicating the model in memory or building formulas to sum the cells. List price: \$120. Abacus Associates, 6565 W. Loop South #240, Bellaire, TX 77401, 713/666-8146.

Purchase Order Manager, Law Office Manager

Versaform applications system templates that require 128K and two disk drives and run in conjunction with *VersaForm*, a general office environment data base. With *VersaForm*

templates the user can use *VersaForm* for specific tasks such as ordering and law office management. Although the templates are designed for a specific purpose, they can be modified without reprogramming to suit individual needs.

Predefined reports for the *Purchase Order Manager* include PO's by vendor, account, date shipment due, status, and date payment due, as well as user-defined reports. The program features accounting and calendar systems. The accounting system includes client billings printed on office letterhead compiled as to hours billed by client, attorney, and type of law. Payments and credits are logged into the system. The scheduling system includes a calendar with case deadlines, filing dates, payroll dates, and hours away from the office. List price: *Purchase Order Manager* \$49.95, *Legal Office Manager* \$249.95. Applied Software Technology, 14125 Capri Dr. #4, Los Gatos, CA 95030, 408/370-2662.

Qbase

Personal database/reports for the novice and the experienced user. It requires 128K and two disk drives. The various uses include index card catalogs, customer records, mailing lists, and inventory records.

Qbase allows the design of personal data bases to suit individual needs. It features extensive data entry checking and an embedded calculator that allows the user to compute sales taxes, sales commissions, and depreciation, and to enter credits and debits. It allows the user to define reports by sorting the data base and selecting up to 27 "and/or" conditions.

The program automatically defines each report condition so that hard-copy reference can be kept on file. It



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also prints out labels four across for mailing or inventory bins. List price: \$189. Applied Software Technology, 14125 Capri Dr. #4, Los Gatos, CA 95030, 403/370-2662.

Runtime

A run-only version of *dBASE II* that enables programmers to market specialized applications written and developed in *dBASE II* without buying a full *dBASE II* system. It requires 128K and one disk drive. *Runtime* uses a code condenser to protect the source code of the applications program. A licensing agreement is included with the package to protect developers as they market their applications. List price: sold in lots of five at \$500 each. Ashton-Tate, 10150 W. Jefferson Blvd., Culver City, CA 90230, 213/204-5570.

Wordvision

A word processing program that allows deleting, copying, moving, finding, and replacing text. It requires 64K, one disk drive, and an 80-column monitor. Because additions to the text are automatically inserted wherever the cursor is moved, the program requires no separate insert facility. *Wordvision* uses color to communicate the program's operation when it is used with a color monitor. It is the first in a line of interactive programs to be released this year. List price: \$49.95. Bruce & James Program Publishers Inc., 4500 Tuller Rd., Dublin, OH 43017, 614/766-0110, CompuServe: 714-351040.

Real Estate Models for the 80s

A set of 16 templates for real estate analysis used with *Multiplan*. Each template requires from 2K to 18K and one disk drive. About half the templates make projections that use a

number of contemporary "creative financing" techniques. These templates are Wraparound Mortgage, Shared Equity Appreciation, Adjustable Rate Mortgage, Growing Equity Mortgage, Supplementary Financing, No-Interest Mortgage, Assumptions, and Loan Buydown Analysis.

Templates for utilities include Internal Rate of Return, Date Calculator, and a Component Calculator. Other templates cover Detail and Summary Amortization, Comparative Depreciation, Cash Flow and Equity Return Projection, and Tax Considerations. This set of templates has been available for several months for use with *VisiCalc*. List price: \$65. Commercial Software Systems, Inc., 7689 W. Frost Dr., Littleton, CO 80123, 303/761-8062.

Data Ace

A data base management system that requires 64K and two double-sided disk drives. The data base is equipped with a full-screen editor, library, and linker, and provides for file manipulation on up to 12 files concurrently. List price: \$850. Computer Software Design Inc., 1911 Wright Circle, Anaheim, CA 92806, 714/634-9012.

Graph 'n' Calc

A program that combines graphing and advanced data analysis. It requires 64K, one disk drive, and a color/graphics adapter. Hard copy can be produced on an Epson MX series dot matrix printer with the Graphtrax option or a Hewlett-Packard two-pen color graphic plotter. The Davong Systems hard disk drive is optional.

Detailed line charts, side-by-side and stacked bar charts, high/low/close volume stock market charts, and a variety of labeled pie charts are among *Graph 'n' Calc*'s repertoire of

high-resolution color graphics. Charts can be plotted from *Graph 'n' Calc*'s files or in conjunction with *VisiCalc* or *Desktop Plan* through DIF files. Graphs can be displayed in slideshow fashion. The data analysis aspect of *Graph 'n' Calc* specializes in trend forecasting and statistical analysis. Among the features not offered by standard spreadsheet programs are multiple linear regressions, net present value, internal rate of return, and exponential smoothing. List price: \$249. Desktop Computer Software, Inc., 303 Potrero St. 29/303, Santa Cruz, CA 95060, 408/458-9095.

Money Decisions Volume II

Thirty-six preprogrammed financial equations. The program requires 64K and one disk drive. The equations are organized into three categories: investments, statistics and forecasting, and business management. The user fills in the variables and *Money Decisions* calculates the answer. The product will generate hard-copy graphs and formatted reports. List price: \$229. Eagle Software Publishing Inc., The Woods #409, 993 Old Eagle School Rd., Wayne, PA 19087, 215/964-8660.

Tax Decisions

A planning aid for tax professionals that requires 64K and two disk drives. With *Tax Decisions* the user can formulate up to five tax plans using Form 1040 and 14 schedules. *Tax Decisions* includes graph and report features that compare the tax plans. List price: \$229. Eagle Software Publishing, Inc., The Woods #409, 993 Old Eagle School Rd., Wayne, PA 19087, 215/964-8660.

E-Z Tax

A personal federal income tax preparation program that requires 48K and one disk drive. *E-Z Tax* can complete the IRS 1040-EZ form, the 1040-A form, and the 1040 long form. The program includes a minimal error-checking feature, and each software kit comes with more than 35 federal tax forms. Each buyer will receive a free year's subscription to the *E-Z Tax Tip Quarterly*, a publication that covers tax changes. List price: \$69.95. E-Z Tax, 2444 Moorpark Ave., San Jose, CA 95128, 800/331-1040, 800/344-1040 in CA, 408/264-1040.

Financier Personal Series

A financial record-keeping ledger that can produce reports for different financial activities. The program requires 64K and two disk drives. It permits the user to keep property inventory, bank, charge, budget, net worth, and tax records. The user reports the transaction once and the program automatically updates the relevant files. List price: \$195. Financier, Inc., 2400 Computer Dr., Westboro, MA 01581, 617/366-0950.

dGRAPH

A graphics program that can be used to form graphic representations from information stored or created by *dBASE II* or independently. It requires 96K and one disk drive. *dGRAPH* supports the following printers and plotters: EPSON MX-70, -80, -100; Okidata Microline; Xerox/Diablo 1750; and soon the NEC Spinwriter and HP7470A Plotter. Users form graphs by typing in data they desire to display or the name of the user's *dBASE II* data base file. Pie, line, pie-bar, and

stacked or side-by-side bar charts can be produced. List price: \$295. Fox & Geller, Inc., P.O. Box 1053, Teaneck, NJ 07666, 201/837-0142.

Powerbase

A data base management system that requires 128K and two disk drives. It accommodates up to 100,00 records of 2560 bytes each. Each record holds up to 32 fields of up to 80 characters each. List price: \$475. GMS Systems Inc., 12 W. 37th St., New York, NY 10018, 212/947-3590.

Medmanage

A medical office management system for the individual doctor, multidocor practice, or medical clinic. It requires 128K, a hard disk for storage, and a backup system. It consists of 60 COBOL programs including scheduling, billing, diagnostic, procedure, insurance management, policy management, and patient history files. The help system is user defined to fulfill individual office requirements. Field names, patient identification codes, and security levels may be specified.

Medmanage interfaces with the company's COBOL-based general ledger package. List price: \$1500. Graham-Dorian Software Systems, Inc., 5925 Wedgwood Dr., P.O. Box 16355, Fort Worth, TX 76133, 817/294-5042.

MetaGraph

A user-interactive color graphics package that generates line plots, bar graphs, and pie charts as well as maps and user-designed charts. It requires 128K and two disk drives. It interfaces with the IBM printer, the NEC 8023, or the Hewlett-Packard 7470 plotter.

MetaGraph features two interdependent graphics capabilities: business graphics and the sketch pad.

The business graphics aspect offers a high degree of flexibility as well as access to six basic formats. The program offers a choice of two- or three-dimensional graphics, clustering and stacking, and different line styles and thicknesses from 1 to 4 pixels. The area below the line may be filled with shade or color. Up to 32,000 points of data may be entered.

In the sketchpad mode any icon can be drawn, and free-form graphics consisting of lines, area, and text may be prepared. Objects can be drawn on the screen or retrieved from a disk file. With the layout facility the user can combine pictures to create a collage effect. The user can switch between the screen display and the data entry mode (without losing the information on the screen) or leaf through chart descriptions.

MetaGraph interfaces with *dBase II*, *VisiCalc*, and *SuperCalc*. It also has an on-screen editing capacity that can move and rescale images. Italic type is available. *MetaGraph* supplies a set of pens of varying shapes, colors, and patterns for drawing and filling objects. List price: \$495. Graphicon Systems, 399 Sherman Ave. #10, Palo Alto, CA 94306, 415/329-1791.

Graphwriter

A business graphics package that was previously available as a stand-alone system for \$20,000 to \$100,000. It is now available to IBM PC users at about one-tenth that cost. *Graphwriter* requires 128K, a double-density (320K) disk, a color monitor and color/graphics adapter, and an

Just Announced

RS-232C serial port and cable. The program supports three plotters: the HP 7470 2-pen, the HP 7220 8-pen, and the IBM XYZ 50 8-pen.

With *Graphwriter* and an inexpensive plotter, PC users can produce business presentation graphics on paper or transparency from 24 programs that are capable of producing over 40 graphic formats. *Graphwriter's* formats are broken down into two sets. The Basic Set includes the standard bar, pie, range, line, scattered or regression, and text charts as well as an overlay chart that allows the user to add to an already plotted chart. The Extension Set includes more elaborate charts, such as bubble organization, Gantt, table, combination pie-bar, and surface charts.

Graphwriter offers a high degree of flexibility; the user is able to intervene and modify each format to suit his or her specifications. It varies pen speed according to paper type and pen width, when appropriate, to produce quality graphics. List price: Basic Set \$395, Extension Set \$395, both sets \$750. Graphic Communications, Inc., 200 Fifth Ave., Waltham, MA 02254, 617/890-8778.

Smartcom II

Communications software for the Hayes Smartmodem 300 and 1200. It requires 96K and one disk drive. The program supports auto-dial/auto-answer and automatically logs onto a remote system. The user forms and stores macros to abbreviate frequently used information and command sequences. Parameters and up to 26 macros for each remote system are chosen from a directory. The program comes prepared with macros for The Source, CompuServe, and Dow Jones information services.

It captures data to disk and printer concurrent with its display on the screen. Data capture may be selectively stored or printed. List price: \$119. Hayes Microcomputer Products, Inc., 5923 Peachtree Industrial Blvd., Norcross, GA 30092, 404/449-8791.

Quotrix

A game program in which players use a variety of clues to discover a hidden quote. It requires 64K and one disk drive. Empty spaces indicate the number of words and letters in each word. One or two players guess the letters in each word. A wrong guess creates a problem-solving situation in which the player must solve clues such as word jumbles, trivia questions, and other word games to find the hidden letters and words.

Scores are calculated by deducting points for mistakes from a standard starting score. There are six difficulty levels and 700 quotes. List price: \$34.95. Insoft, Inc., 10175 S.W. Barbur Blvd. #202B, Portland, OR 97219, 503/244-4181.

Wordtrix

A game that pits the player against the computer or another player to discover words in a random grid of 16 letters. It requires 64K and one disk drive. The player attempts to find and enter as many three- to six-letter words as possible in a 3-minute time period. The player receives points for the number of words entered plus ten points for every second played in the game. The computer uses a dictionary to determine the score, and its score is deducted from the player's. Best scores can be saved. *Wordtrix* features six difficulty levels. List price: \$134.95. Insoft, Inc., 10175 S.W. Barbur Blvd. #202B, Portland, OR 97219, 503/244-4181.

Flexware

An interactive financial management system written in Pascal that includes nine programs: General Ledger, Accounts Receivable, Accounts Payable, Order Processing, Inventory Control, Purchasing, Payroll, Sales Analysis, and Job Costing. It requires 64K and one hard disk drive. The software allows continuous customization by the user. List price: From \$750 to \$1800. Microfinancial, 15404 E. Valley Blvd., Industry, CA 91746, 213/961-0237.

Software Fitness Program

An interactive financial management system that includes eight programs: Accounts Payable, Accounts Receivable, General Ledger, Inventory, Job Cost, Payroll, Sales Order Processing, and Team Manager. The programs require 64K, two floppy disk drives or one hard disk drive, and an 80- or 132-column printer. List price: \$499. Open Systems, Inc., 430 Oak Grove #409, Minneapolis, MN 55403, 612/870-3515, TWX: 910 576 1743.

Perfect Writer, Perfect Speller, Perfect Calc, Perfect Filer

Fully integrated business and professional programs that require 128K (although *Perfect Speller* can run on 64K) and one disk drive (two are recommended). The programs have a split screen that allows the user to view two files simultaneously and virtual memory, the automatic exchange of RAM space with disk space, which allows the user to handle large files and standardized user commands throughout the product line. All four programs are written in C, a high-level language designed to optimize run time, speed, and efficiency.

Perfect Writer is a word processor that can merge and manipulate text from different files. Its unique formatting capacities include automatic placement of footnotes at bottom of page, automatic index compilation, and the creation of tables of contents.

Perfect Calc gives the user the standard spreadsheet functions and lets the user add his or her own. With virtual memory the user can have seven spreadsheets in memory, all working together and sharing data.

Perfect Filer is a data base that sorts and stores information and can be used as a mail merge program in combination with *Perfect Writer*.

Perfect Speller, designed to run with *Perfect Writer*, has a 50,000-word base, a prefix-suffix dictionary, and a root dictionary. *Perfect Speller* corrects 11,000 words per minute. List price: *Perfect Writer* \$495, *Perfect Speller* \$295, *Perfect Calc* \$295, *Perfect Filer* \$295. Perfect Software, 1400 Shattuck Ave., Berkeley, CA 94709, 800/222-4222, 415/644-3001.

WordPlus-PC

A word processing program designed for the IBM PC that requires 64K and one disk drive. *WordPlus-PC* includes a system of color-coded keycaps that fit over the PC's function keys and have the word processing functions printed on them, eliminating the need to memorize word processing codes. *WordPlus-PC* has a built-in mail merger and is able to access spreadsheet programs. List price: \$395. Professional Software Inc., 51 Fremont St., Needham, MA 02194, 617/444-5224.

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Micro Learning Systems

A line of software tutorials designed to allow first-time users to teach themselves about hardware, software, or generic subjects by interacting with the computer in a hands-on approach. The tutorials include *BASIC Teach*, *IBM Teach*, *Accounting Teach*, and a tutorial for *VisiCalc*. These tutorials require 64K and one disk drive. List price: \$69.95. Reston Publishing Company, 11480 Sunset Hills Rd., Reston, VA 22090, 703/437-8900.

Metafile

A software package that integrates several applications under a single architecture and language. It requires 64K and one disk drive. Applications include data base management, word processing, spreadsheet, and mail merge.

Text can be prepared and generated in a number of formats including reports, forms, letters, menus, and documents. Data files can be drawn upon and united with these various formats. Information can be combined into multiple screen windows to form composite reports. Programming aids are provided to help users develop applications. List price: \$1995. SENSOR-based SYSTEMS, Inc., Olmstead Federal Building, Chatfield, MN 55923, 507/867-4440.

TK!Solver

An equation-solving program for engineering and business problems that eliminates the need for programming. It requires 96K and one disk drive. The user enters the equations defining the problem, types in the known values, and presses the exclamation point key; the program finds the unknown values.

TK!Solver Packs are applications packages that use several predefined models with preset equations, tables, and values for solving problems in specific areas. Applications packages will initially be available for mechanical engineering, financial analysis, high school science, and architectural design and construction. List price: \$299. Software Arts, Inc., 27 Mica Ln., Wellesley, MA 02181, 617/237-4000.

TEQ

An equation-solving program that performs numerical calculus. The program currently runs under UNIX and will soon be available for MS-DOS. The MS-DOS version will require 54K and one disk drive. To solve for an unknown variable the user enters the required equation and the known variables and types "solve."

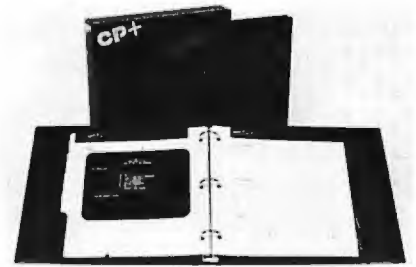
The program can derive an equation from linear or exponential functions. The user inputs the known data, types "fit," and the program gives the equation and unknowns. If desired, a "plot" command graphs the solution. An "analyze" command takes the final derivative, and an "integrate" command computes the integral. List price: \$350. VenturCom, Inc., 139 Main St., Cambridge, MA 02142, 617/661-1230.

Systems

CP +

A utility that replaces the control language in CP/M-86 or MS-DOS with a series of menus of English-language commands. It requires 64K and two disk drives. With *CP +* the user never sees the operating system. The first-time user is not required to learn the complicated CP/M-86 control language.

CP + provides the user with English-language prompts for every function. The user can copy, erase, or format a file by answering yes or no to a series of English-language prompts. No file name typing is required. List price: \$200. Taurus Software Corporation, 3685 Mt. Diablo Blvd. #251, Lafayette, CA 94549, 415/283-7222.



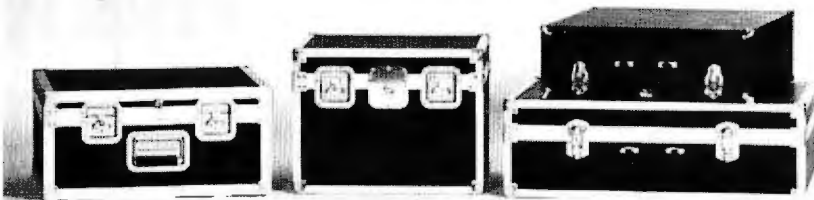
CP +, Taurus Software Corporation

Menu Master

A menu processor that runs with the RM/COBOL compiler and requires 60K and one disk drive. It eliminates the need to implement input/output interface for business programs by providing friendly menu-driven interfaces. The menus are multilevel and tree structured.

Menu Master includes interactive menu editing and automatically generates documentation on the edited menu networks. It features flexible security through optional password, user name, and access-level verification. When used in conjunction with *Cogen*, bytek's COBOL program generator, it cuts down on the time needed to write business applications programs by 80 to 90 percent and allows the user to change or add to already-written programs easily. List price: \$245. bytek, 1714 Solano Ave., Berkeley, CA 94707, 415/527-1157.

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CP/M-86

An operating system now available directly from its author, Digital Research, which costs 25 percent of the price of the same product distributed by IBM. It is fully compatible with Concurrent CP/M-86 and includes a print spooler and a graphic system extension that allows graphics to be run. It supports the HP 7220 and 7470 color plotters, the Epson MX-80, Okidata Microline 92, Printronix and three IDS printers, and the IBM PC monochrome display. List price: \$60. Digital Research, P.O. Box 579, 160 Central Ave., Pacific Grove, CA 93950, 408/649-3896, TWX: 910-360-5001.

Project Viking

An integrated software package that includes Venix, VenturCom's real-time version of Bell Labs' UNIX operating system. The software requires 128K and two single-sided double-density disk drives (a hard disk is recommended for use with the interactive data base).

Besides Venix, the package includes *Logix*, a data base management system, *Graphix*, a graphics program capable of depicting pie charts, multivariable bar charts, plots and line charts, and *FinalWord*, a word processing program. List price: \$900. VenturCom, Inc., 139 Main St., Cambridge, MA 02142, 617/661-1230.

Cogen

An RM/COBOL program generator for standard business applications including file maintenance, inquiries, and reports. It requires 40K and two disk drives. By responding to *Cogen* prompts, programmers are able to

design the record and report formats on screen. *Cogen* produces the application code. The code is standardized, self-documenting, and bug-free. It is produced in a modular structure so that separate tasks can be combined and used repeatedly.

Reports are generated with optional headers, selected data from reference files, and flexible size and spacing. *Cogen* can be used as a teaching tool for COBOL. List price: \$950. Bytek, 1714 Solano Ave., Berkeley, CA 94707, 145/527-1157.

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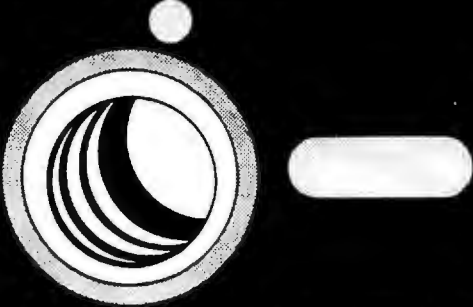
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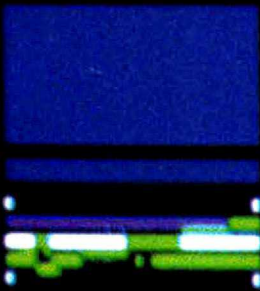
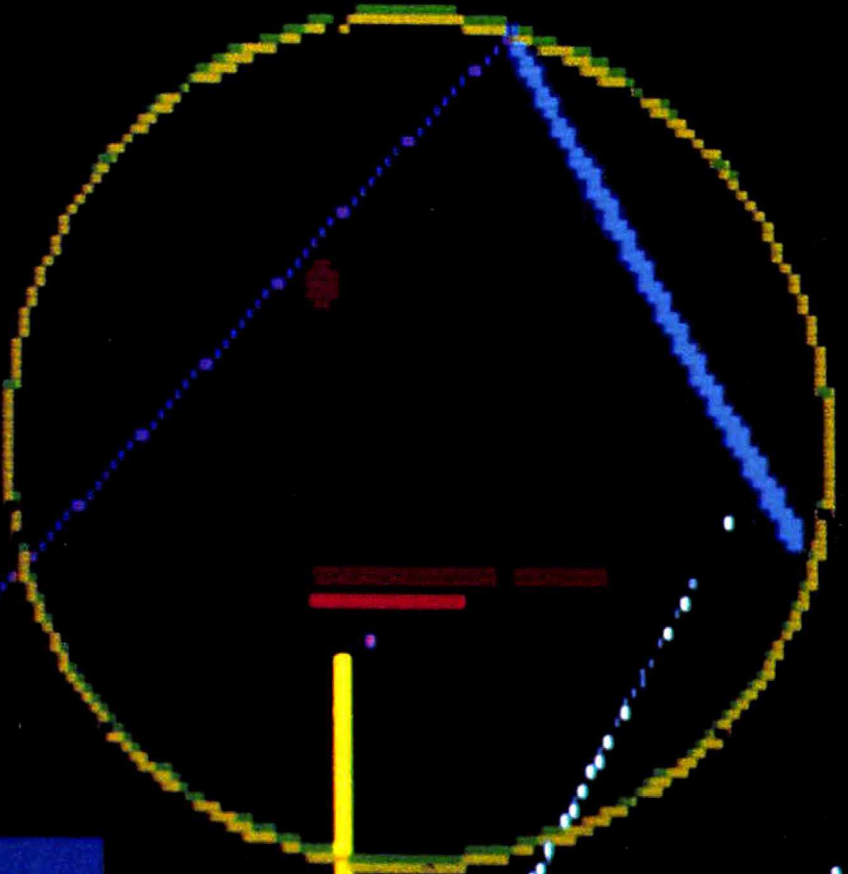
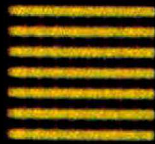
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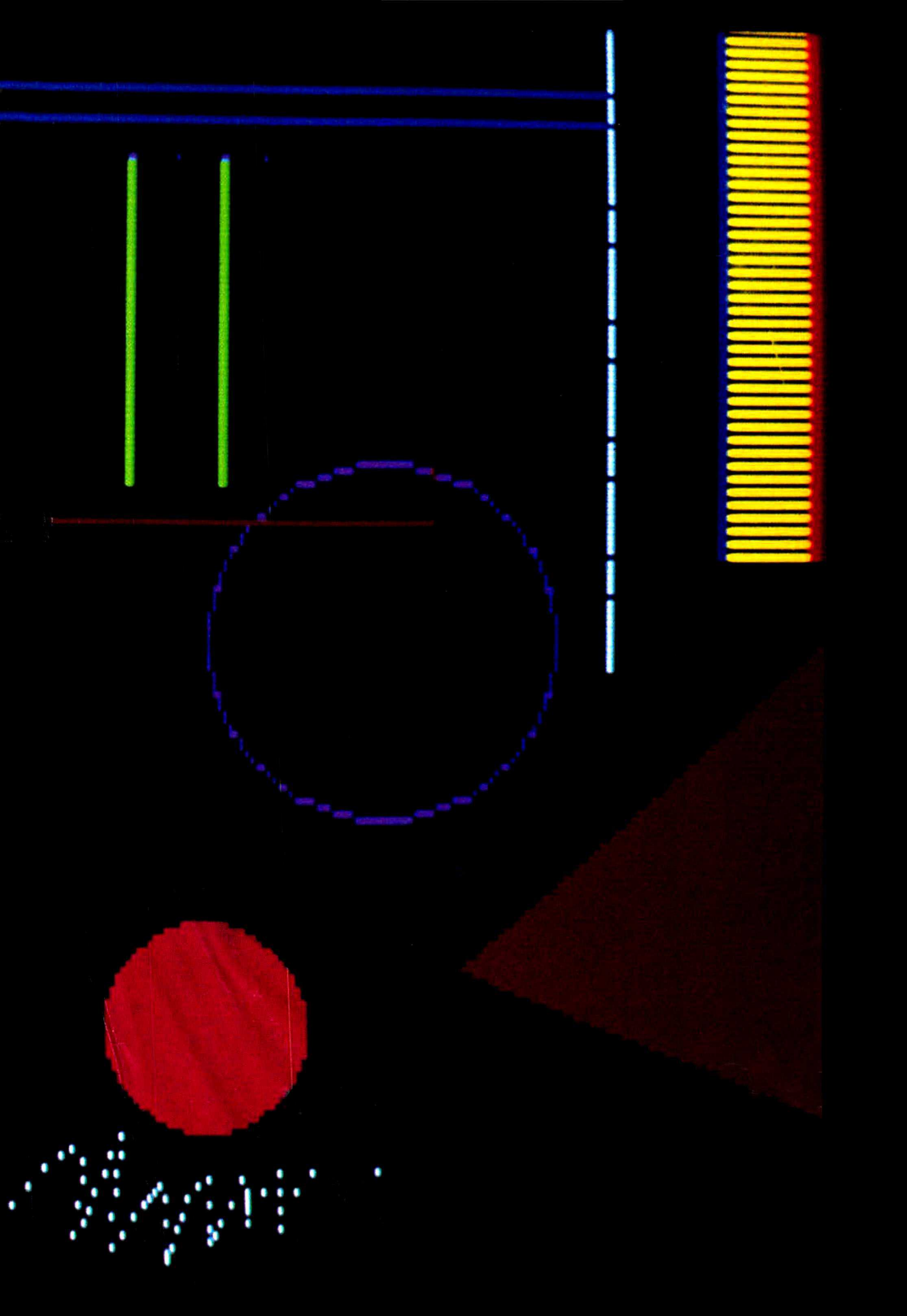
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The Plantronics gatefold will be a regular feature of PC World. Each issue we will ask a different artist, architect, or designer to experiment with this system and create an image. At the end of the year a PC World blue ribbon panel will evaluate the series and award a cash prize and a plaque to the artist who makes the most dazzling use of COLORPLUS. If you have any suggestions or if you have a COLORPLUS board and would like to be considered for our contest, please contact our Editorial Department.





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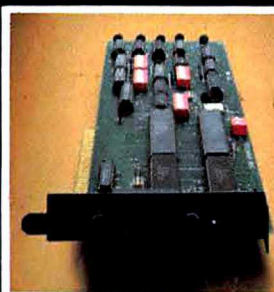
Our philosophy of total support adds uncommon value to your TECMAR products. All TECMAR boards feature a one-year warranty, with guaranteed 72-hour maximum repair turnaround on all standard products. Replacement loaner units are available. Thorough and straightforward documentation comes with each unit. Our customer service staff is available to answer questions or solve your problems.

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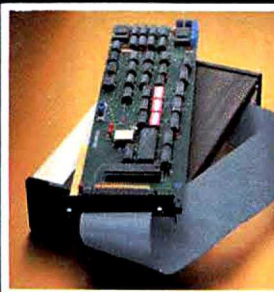
- High Resolution Graphics
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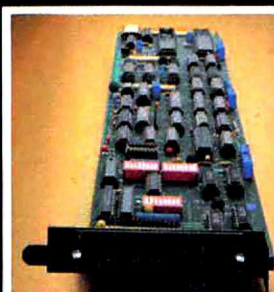
Board implements IEEE488 industry standard to enable PC to operate as system controller or as an addressed talker/listener. Has DMA and interrupt capabilities. Available library of machine-language subroutines called from BASIC or FORTRAN for data transactions with GPIB. Order #20030 INTERFACE, #30030 SOFTWARE.



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