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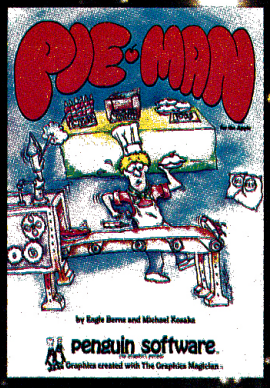
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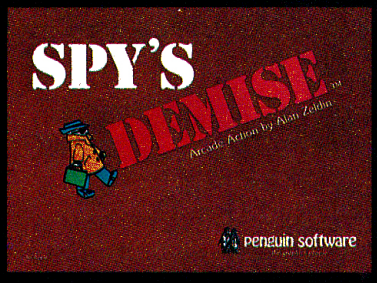
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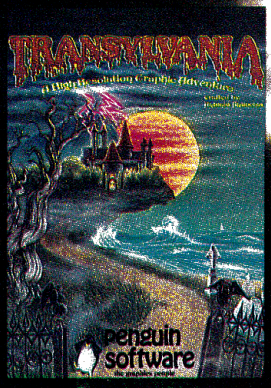
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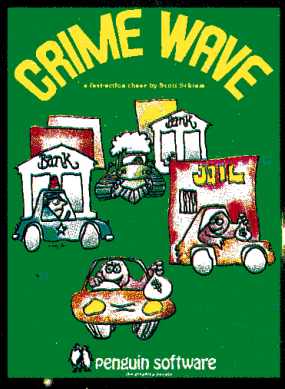


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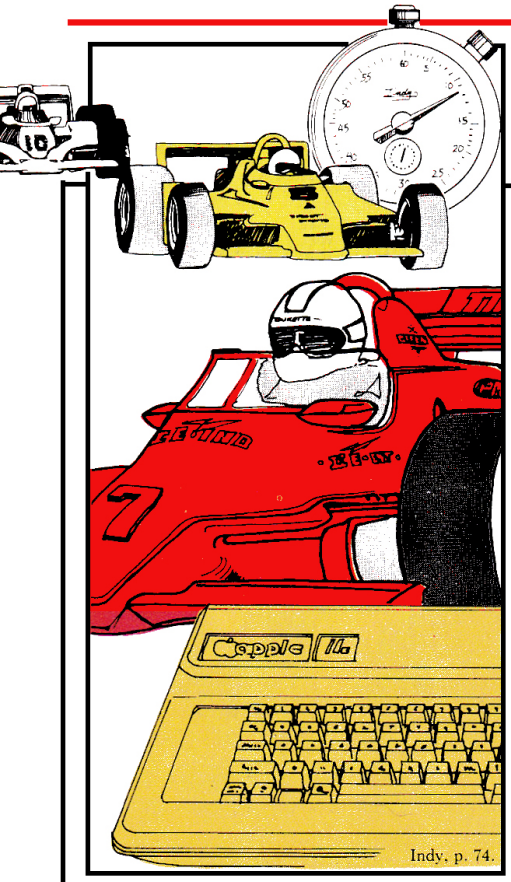
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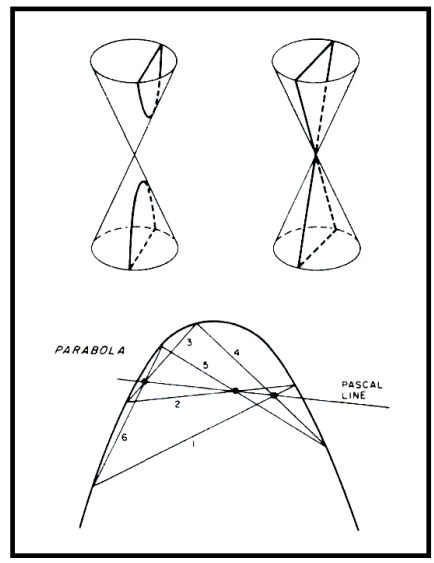
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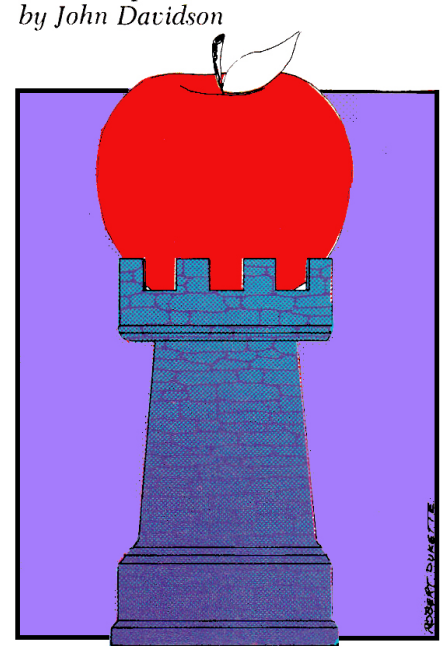
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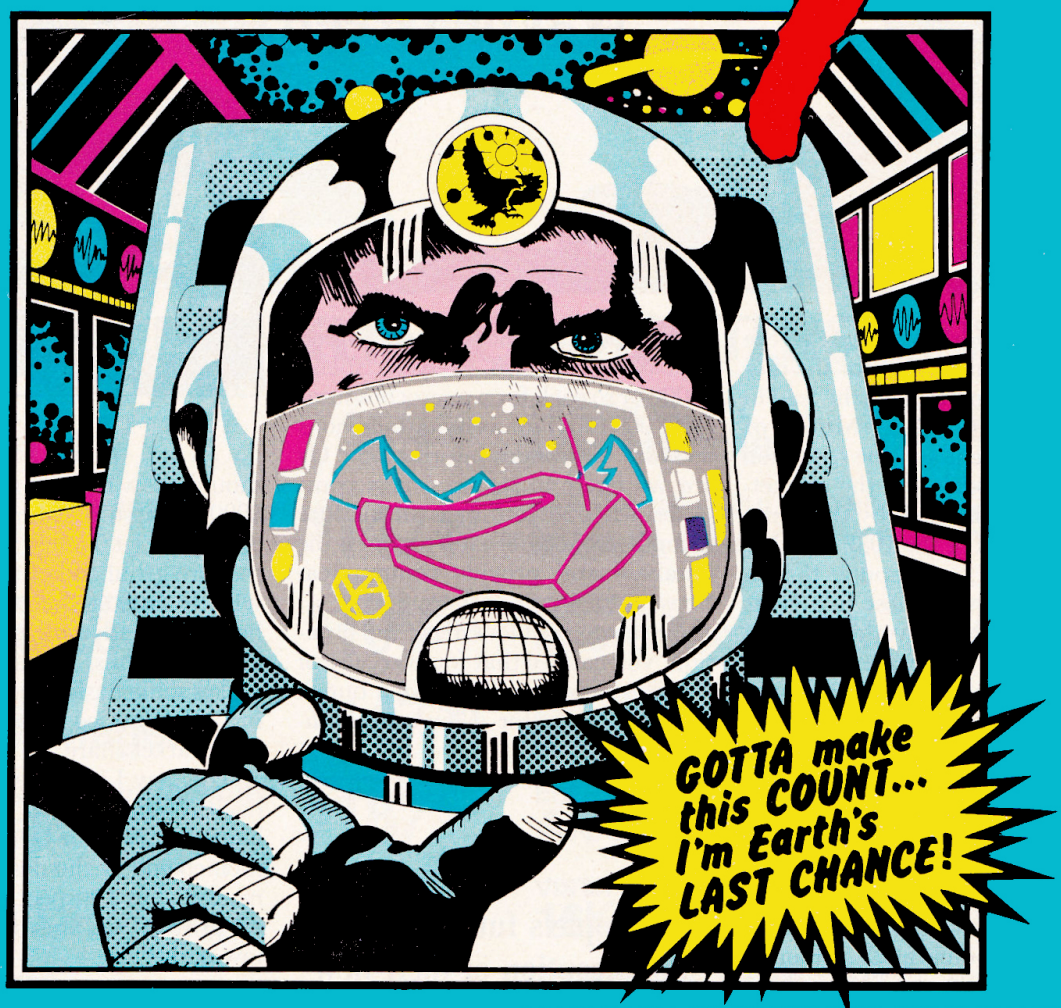


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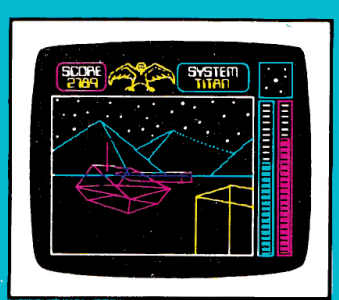
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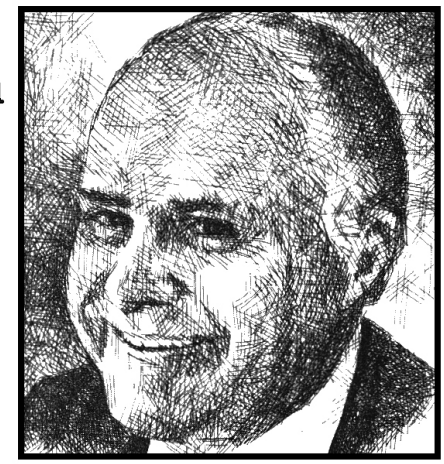
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Remarks from the Publisher . . . Wayne Green



It's a tough world out there in the marketplace, but at least for the moment, Apple seems to have the lead in microcomputer sales. Much of Apple's future relies on the reception of their new models and the marketing support given them by the firm.

With the bulk of the 1982 sales being the Apple II, a computer that in most respects was almost five years old, the need for a newer model was bordering on desperate. Sinclair showed one way to get costs down: reduce the chip count in the computer with specially designed large scale integration chips.

The Apple III never really got going in sales, mostly due to its early problems, so an update on that was overdue.

With the introduction of a barrage of low end computers at CES, there is much market interest in under-$200 computers and much speculation about whether Apple is going to address this market or leave it to others.

Now, before you fall into the usual "toy" trap . . . our microcomputers have been called "toys" by minicomputer firms for the last seven years . . . let me digress (as usual) and put things in perspective.

Let's say that I'm running a shoe store with four or five clerks. I want to have a desktop computer to keep track of the inventory. Now, am I going to buy a $2000 or so computer for each of the clerks to access the inventory data? Or am I more likely to buy a $200 miniature computer for each of them, with perhaps one host computer to manage database?

We have close to 30 people in the ad sales department at Wayne Green Inc. Now, are we likely to spend $2000 or so each for a microcomputer ($60, 000 total) for a communications network of ad sales information? Or are we likely to set up a host computer with 30 terminals (miniature computers) at $100 each to access the database and provide communications . . . total cost perhaps $5000.

Once you start looking at the situation, you can see that for every use of a $2000 computer you have a bunch of applications for a low cost computer with terminals. No, you're not likely to use them for data input or to run a 30-megabyte disk, but you'd be foolish to buy more power than you actually need for the terminals.

". . . Apple's future relies on the reception of their new models and the marketing support given them . . ."

Will Apple abdicate this enormous market to Texas Instruments, Timex and Sanyo?

Radio Shack has so far skated up to the edge of this low end market with their Color Computer, now selling for $250. A reduction in chip count should allow them to get down under $200 and stay competitive. Radio Shack has let Timex, T.I. and Commodore get ahead of them in outlets, with the result that the other firms have some advantages in economies of scale. Thus, unless Radio Shack makes some basic changes in marketing, we may see them continuing to lose market share.

The new Lisa looks as if it will be healthy competition for the Altos, Northstar, Vector Graphic and Cromemco end of the desktop computer market, but I suspect that the greatest growth will inevitably be in the low end.

□

I got a call from a chap who only recently got involved with computers. He worked a while for a software house, then decided to go into business for himself. He ran a third page ad in the first issue of *inCider* and pulled in over $35,000 in sales. I didn't want to get him all excited, but if he keeps that up, which is more than likely, he'll gross over $500,000 for this year. First-ad sales almost invariably pull in less than continuing advertising. And if we apply the normal rule of thumb, this would make his firm already worth over $1 million if he wants to sell it. Not bad.

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Our *80 Micro* has generated hundreds of millionaires so far, with more coming along every month. Now I think we'll see *inCider* doing the same for Apple aficionados. The opportunities are there, if you have the background and the guts to take advantage of 'em.

Now, while the microcomputer industry, which has been growing regularly at a 200 to 300 percent rate per year for seven years, is particularly forgiving, there is still a need for some background before you make the plunge. You do have to remember that 8 percent of small businesses manage to fail, usually due to a lack of expertise on the part of the entrepreneur.

College? Right? Maybe, if you can find the right one... though I honestly don't know of any that are geared for the needs of the 1980's. Sadly, our colleges are, for the most part, a trap. They aim their graduates at either nothing in particular (liberal arts) or at three major categories of jobs that guarantee relative poverty for life: government, big business and teaching. This is the reason that I'm working towards starting up a college that will be geared to today's needs, furnishing a technical and a strong business education.

I can just see hundreds of computerists out there, kicking the dirt, looking shifty-eyed, and mumbling about how much work is involved in starting a new firm... and what products are needed, anyway? Yep, starting your own firm is a lot of work, no question about that. But the rewards are all out of proportion to the effort involved. Remember that even the president of Tandy doesn't make $1 million a year... yet by generating another $35,000 a month in sales you can outdo this chap... and without all those stockholders ready to can you if something screws up.

Before you start mortgaging your house to start a business, let me offer some avuncular advice. Know the territory before you gamble. Work for someone else until you really know the ropes. Only an idiot tries to learn on his own money, and that accounts for the majority of the 80 percent failure rate of small businesses. Why throw your own money away getting an education when there are almost an infinite number of small firms that will pay you while you learn. Learn on their money, not yours.

Now, about those needed products that you couldn't think of. Golly, I don't know what is so difficult about that. Just give the matter some thought! Take these new $100 computers, for example. Golden opportunity for you. All you have to do is come up with a networking hardware/software system so a bunch of these can be used with an Apple host computer. Why should small offices use $3000 computer systems for every desk when a $100 computer terminal will do most of the work adequately when connected to a larger system that stores the data and programs?

"Sadly, our colleges are, for the most part, a trap."

If you're into hardware, think about the possibilities of uninterruptable supplies for the low end computers. What about a light pen interface that will allow magazines to print the table of contents in bar code and have it read into a computer for a reference? Or a bar code reader and printer system for coding books in a library... home, business or lending? Or even better, a bar code system for records for the home or broadcast station?

Once you get thinking about needed hardware and software products, there is just no end to it. So, are you going to be reading about all the people who got rich during these frantic years of the microcomputer... or are you going to be one of the people sailing around the world on their yachts about ten years from now? You will never find a better time to get rich... or an easier industry in which to do it. ■

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Welcome to the May issue of *inCider*. In our cover article this month auto racing enthusiast Earl Johnson shares a program designed to chart the Indianapolis 500, the major event in American auto racing. And Johnson's Indy Program can be adapted easily for other types of races—like a local marathon race—as well.

This magazine endeavors to promote a perfect marriage of hardware and software for the Apple computer. But, for better or worse, jealous competitors have invaded Apple's ground. A growing number of machines incorporating the 6502 microprocessor will, with varying success, run programs written for the Apple II. Tim Daniel recently put the Franklin Ace 100 through its paces, and offers his view of this alternative. Hartley Lesser, after chatting with an Apple attorney, gives his opinion in the Fermentations column. So what does this mean to you? Lower prices and high quality, or third-rate Apple copies that accept commands only if they're in the Applesoft dialect of Chinese? We'll be bringing you the latest in this struggle as it happens.

Greg Glau, author of the Bent on Business column, didn't want to spend $400 on payroll software. And so he wrote his own payroll program. Unfortunately, it could not separate data by quarters. Then he discovered the subject of this month's column—double-dimension arrays.

In Part II of Blaising Bibliographies, James R. Florini continues his discussion on using Pascal programs to create bibliographies. And John Stephenson shows how two handy Pascal file routines can help you write an address book.

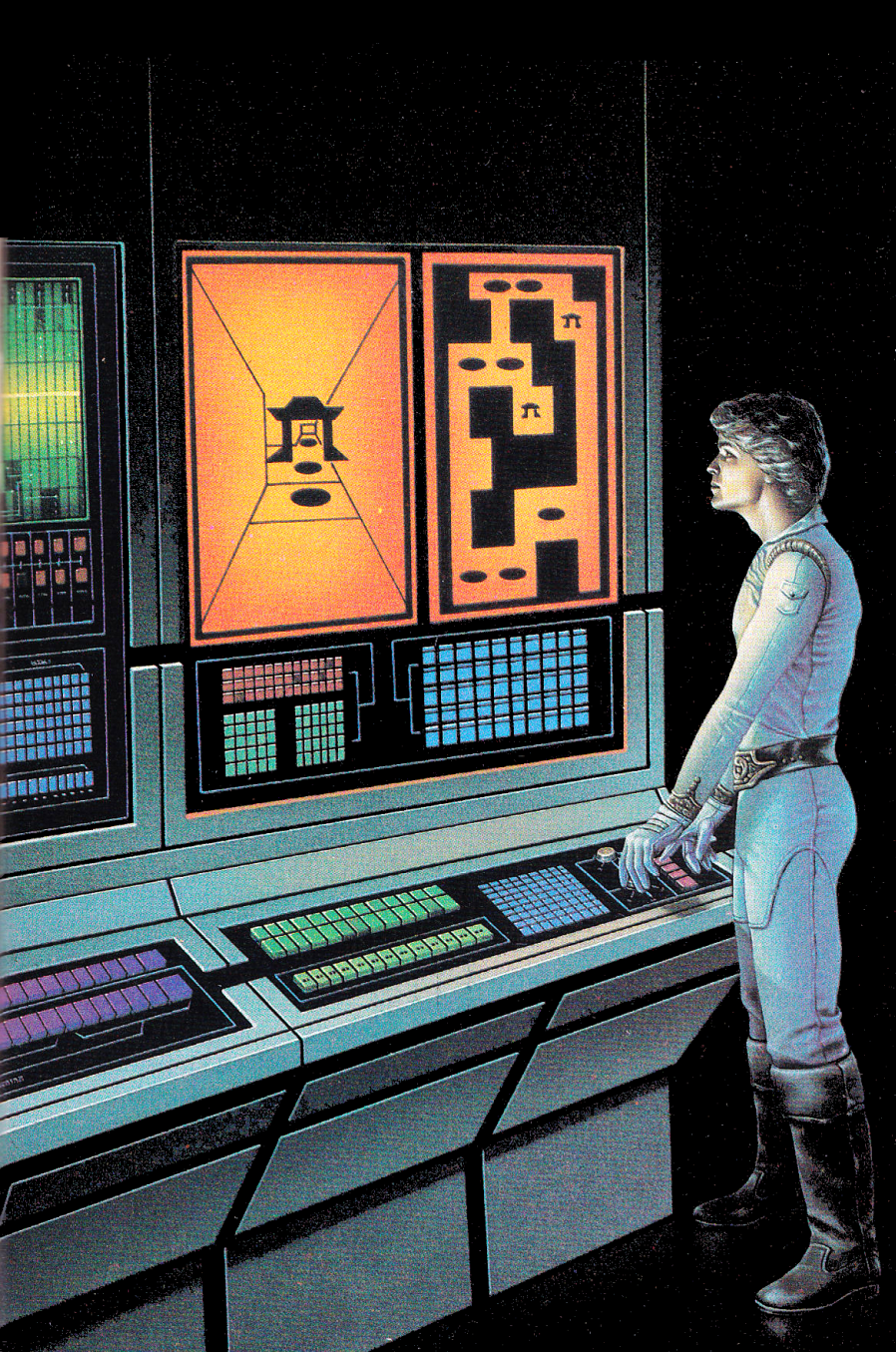
Bill O'Brien, author of the III's Company column, decided to tinker, inside his Apple III. And he found some problems beneath the cables and the connectors. For those of you who are thinking of doing repair work on the Apple III, Bill provides step-by-step instructions on how—and how not—to dismantle your machine.

Starting this month John Davidson begins a tutorial series on the popular operating system, CP/M. Learning to use CP/M offers portability and compatibility that will certainly expand the versatility of your Apple. And Don Fudge, our graphics expert, discusses how to unite graphics and sound to create an original game program.

Blaise Pascal, a master of structure and form in mathematics and namesake of the programming language, discovered and proved a theorem that is one of the cornerstones of projective geometry. Swain Pratt deciphers this Pascalian puzzle for the mathematics buffs among our readers.

In Solving Problems With Logo, Greg Stone uses this powerful Lisp-like language to eliminate much of the labor involved in reviewing and evaluating job applicants. For game enthusiasts, six new games are reviewed in the back of the magazine.

Watch for our June issue which covers every aspect of telecommunications. ■



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Circle 36 on Reader Service card.

by Hartley G. Lesser



On the Warpath

There hasn't been much press lately concerning Apple's attempts to legally blockade copy-cat computer systems. A maneuver by Apple to enjoin Franklin Computer Corp.'s distribution of their Ace computer, based on alleged copyright violation, has failed in Philadelphia Federal Court. The absence of a continued visible assault by Apple on the work-alikes prompted me to pursue the matter with Daniel G. Wendin, Associate Counsel for Apple Computer. He assured me that Apple is not taking lightly the domestic production of Apple work-alikes or the importation of foreign copies into the U.S.

Look-alikes, trading on the Apple name and sold to unsuspecting mail-order comsumers as Apple computers, are a threat to Apple's reputation. According to Wendin these inferior copies are being smuggled into the U.S. from Taiwan in large numbers. Court action is sought to reinforce Apple's efforts to stop them at the border.

Work-alikes, such as the Ace, inhabit hazier territory. The law is unclear on this question of copyright. Where ROM comparisons and other technical considerations further complicate the case, a binding decision is particularly hard to get. Judge Newcomer, when he denied Apple's preliminary request for an injunction against Franklin, stated he was unable to determine the law and desired a full trial to decide the issue. Apple has appealed the decision to the Third Circuit Court of Appeals and is confident of a reversal.

But the focus of Mr. Wendin's attention is squarely upon the island of Taiwan. He stated that 85 to 90 percent of all Apple II copies are shipped from Taiwan, with many being sent to Singapore and Hong Kong in an attempt to further cloud the supply route. Apple is claiming success in both Hong Kong and Singapore, thanks to stiffer local laws dealing with copyright and patent infringement. Agents for Apple purchase the copies and gain supplier information; armed with this information, Apple's attorneys have been able to obtain court orders against the suppliers. These tactics have brought the problem there under control, Wendin stated.

Taiwan is a different story, however. Some real problems remain there, the Apple counsel admitted, and Apple has been able to accomplish little on the island. Fortunately, Apple and U.S. Customs have a close working relationship, according to Wendin. Apple has trained personnel on call to assist U.S. Customs in checking suspicious machines. Copies brought in by individuals are frequently seized by Customs officials, and stiff fines are assessed; these measures serve as an effective deterrent against the flood of imports by individuals. But the problem of undetected bulk shipments remains.

Apple is currently investigating mail-order firms who advertise Apple copies. Truth-in-advertising laws are also being researched as another means of bringing pressure upon copy promoters.

A hearing scheduled before the International Trade Commission will determine Apple's right to exclude copies on patent grounds; more than 20 respondents have been named. Mr. Wendin hopes for a positive judgement within four months to a year. This would reinforce Customs' right to deny importation.

Taiwan also exports a good percentage of their Apple copies to Europe. Germany and Italy have their own manufacturers, perhaps with Taiwanese components, but the operations are mostly covert.

Until recently the Apple II imitations presented a widespread and irrefutable challenge to the original. But where litigation failed, product development may succeed. Wendin pointed to a brand new Apple IIe on a table to his right. "This changes things," he said, as a broad grin creased his face. "Their Apple II copies won't sell so well anymore."

Which may be quite true. After all, why bother with a cheap Apple II Plus copy when you can buy the upgraded IIe with 64K RAM and upper/lowercase? Granted, the copies' lower price will continue to tempt consumers. But a buyer concerned about warranties, product reliability, peripheral compatibility, and the future of American industry will find the Cupertino machine more attractive.

Apple hasn't licked the problem. But just because there aren't any headlines announcing injunctions, fines and arrests, don't believe for a second that Apple isn't going after the troublemakers. Apple is on the warpath! ■

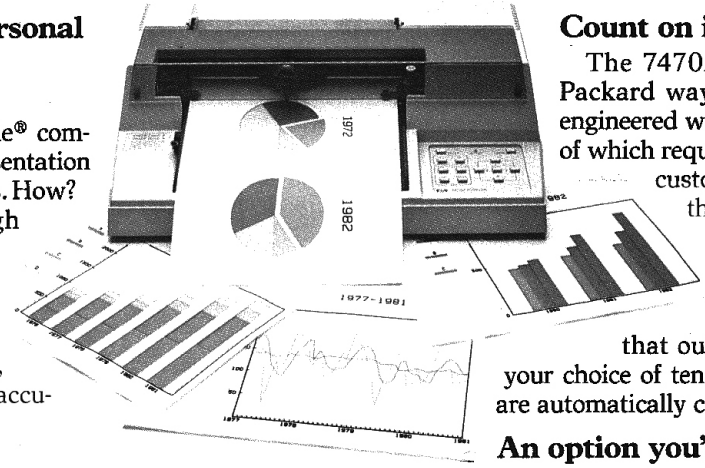
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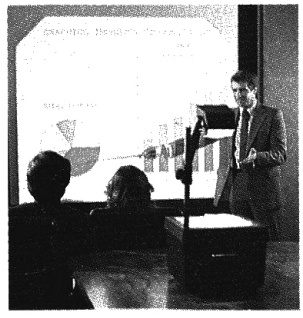
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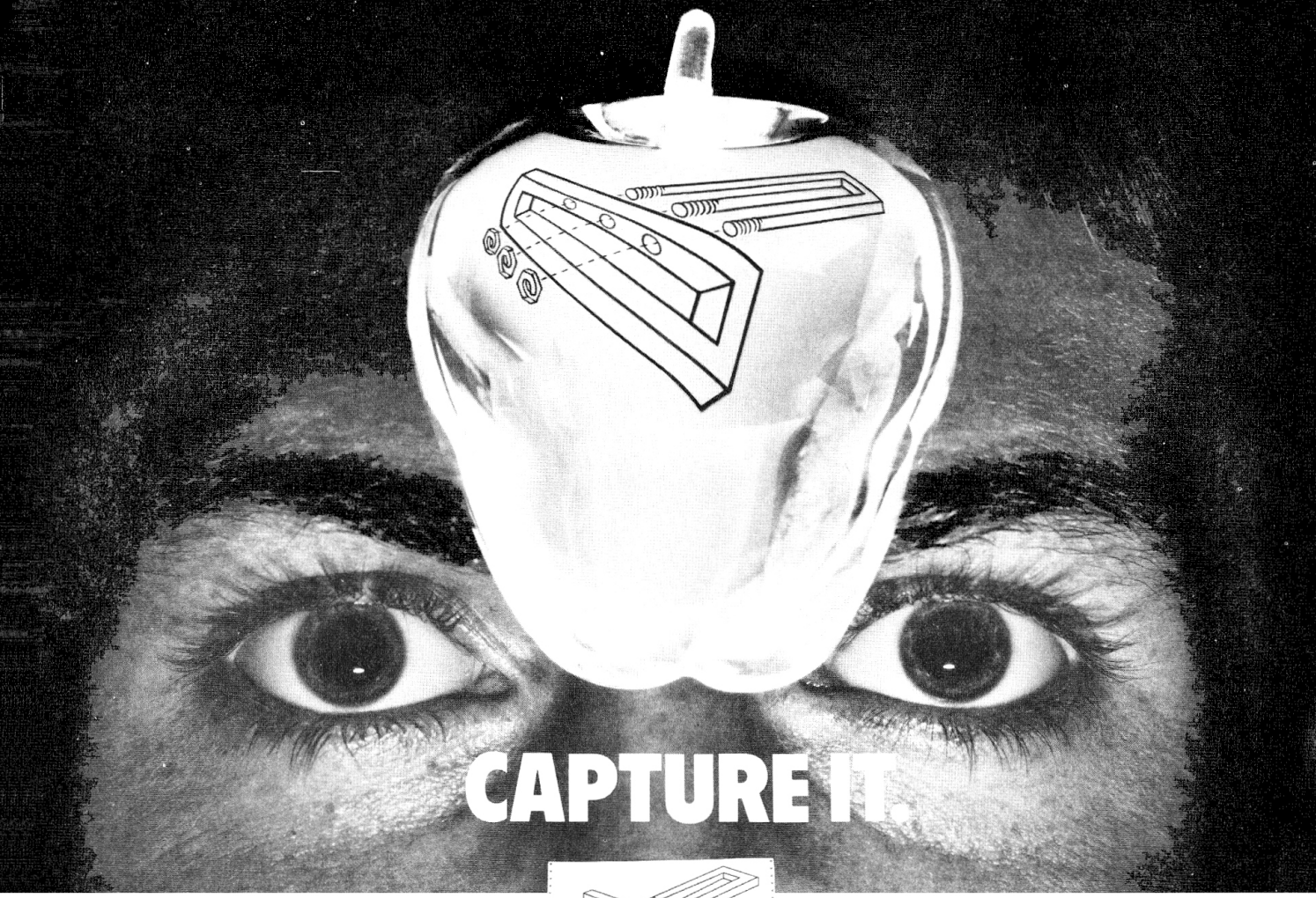
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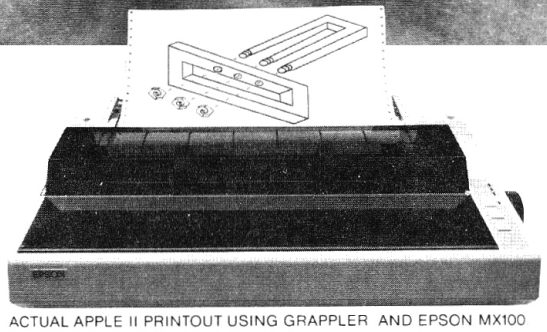
The Grappler + can now be used with the Apple® Dot Matrix, the Okidata 84, and is Apple III compatible*. In addition, the IDS Grappler + is currently available with color capability, including color graphics screen dumps.

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An optional Bufferboard can now be added to all existing Grappler and Grappler + interfaces. See your Apple Dealer for details.

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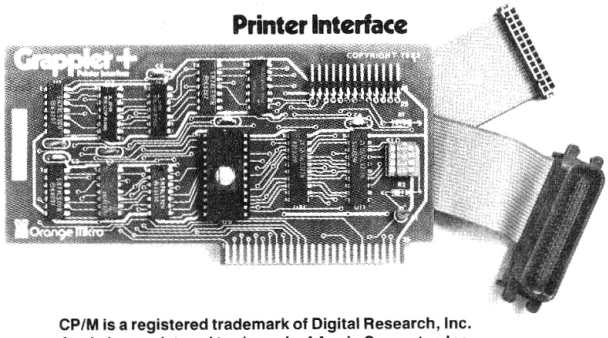
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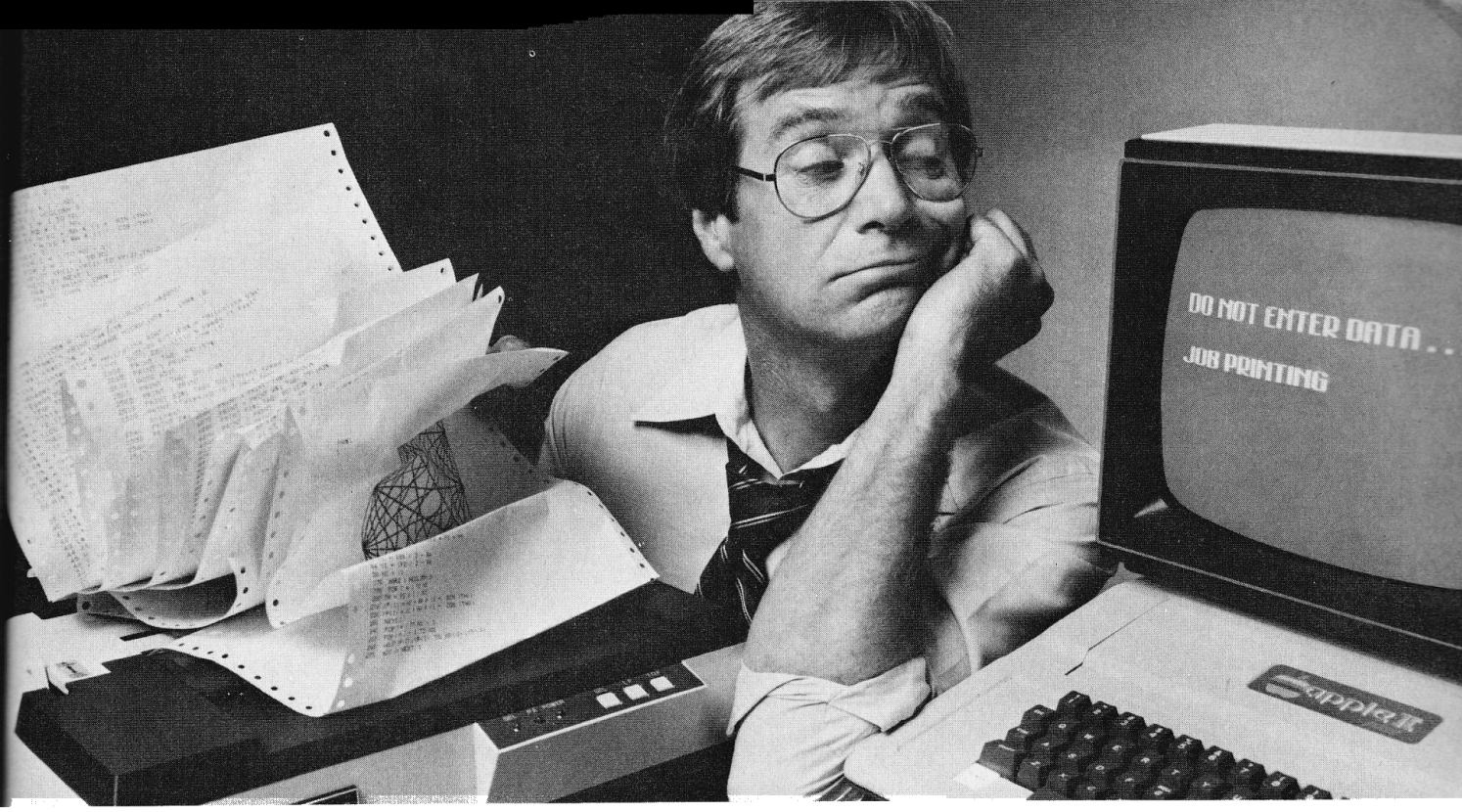
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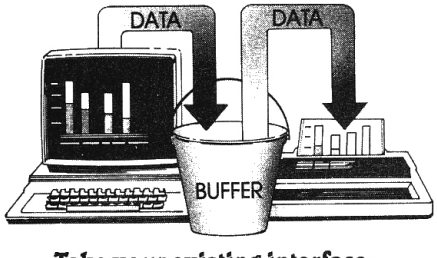
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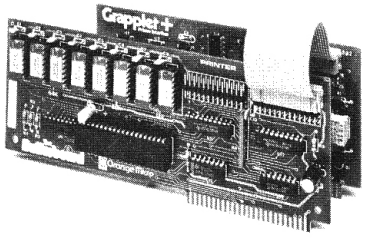
If your printer uses your Apple® more than you do, you need The Bufferboard™.

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Take your existing interface—and buffer it!

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and economical buffering of most popular printer interfaces, including the Grappler + ™ interface, Epson interface, and Apple printer interface. Thirty seconds and a single hook-up are all you need to end the printer waiting game forever.

Up to 20 letter-size pages stored at a time.

The Bufferboard comes standard with 16K, and is expandable to 32K or 64K of buffering capacity with the addition of memory chips. This "bucket" will hold up to 20 pages of a print job, allowing you freedom to use your Apple.

The Bufferboard—designed exclusively for the Apple Computer.

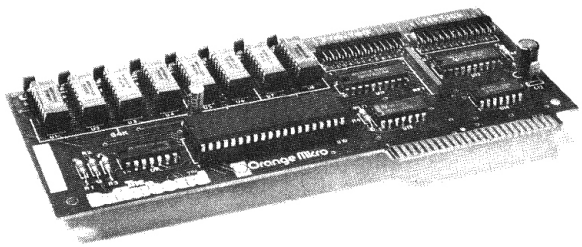
Specifications:

• Versions for Grappler + interface, Epson interface, Apple interface, and other popular printer interfaces • 16K buffer standard • Upgradeable to 32K or 64K • Automatic memory configuration • Automatic self test • Includes interface docking cable.

The Bufferboard is made by Orange Micro, Inc.; the same people who brought you the popular Grappler + printer interface. Both the Grappler + and The Bufferboard are now available at your local Apple dealer.

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Letters

Congratulations!

I'm not in the habit of writing fan letters to publishers. In fact, to the best of my knowledge this is my very first, but I simply couldn't let another day go by without commenting on your newest venture. . . *inCider*. It is fantastic!

R. A. Greene, DVM
Temple, NH

Congratulations to all the staff. Your magazine has made it in just two issues. I must admit that it was off to a slow start with its first issue but, boy!, did you hit full stride by your second. Keep up the great work.

Bob Baker
Yarmouth, MA

Editing Made *Even* Easier

An improvement to Dan Bishop's article, "Apple Editing Made Easier," (Feb. 83) was made by the following readers. To eliminate unwanted spaces in the middle of strings that span multiple lines, simply enter POKE 33,33 before editing. This will limit the size of the output text to only 33 bytes. A POKE 33,40 will then restore the text window to normal after using the right arrow to retype and edit a program line.

Dan Muccianti
Lake Zurich, IL

John D. Brand
Sylmar, CA

A. R. Rogers
Riverton, WY

William Russell
N. Kingston, RI

Mark Saks
Philadelphia, PA

Tape Versus Disk

As the owner of an Apple II for four years, using cassette tape storage only, I take exception to the remark "if you're silly enough to use shapes on tapes. . . ," by author Don Fudge in "Vector Graphics Made Easy" (Feb. 83).

If the main use for the computer is business, a DOS is almost a must. For the computer hobbyist, waiting a minute or two for a tape to load is not of earth-shaking importance. After refining the technique of loading and saving, I find cassette storage 99.9 percent reliable. (It never fails unless I am demonstrating.)

W. S. Skeen
Rt. 1, Ager Road
Hornbrook, CA 96044

Electric Typewriter?

We are presently considering adding a printer and have looked at several. Because we also need a typewriter, we have wondered about using an electric typewriter rather than a printer. However, we cannot find anyone who has had any experience with such a setup and therefore hesitate to experiment. The typewriter that we are considering is the Brother EM-1. Can anyone offer any advice?

Nancy Locker
2013 Schweitzer Road
Poplar Bluff, MO 63901

Royal Request

While the Apple II Plus and Apple Writer II are capable of justified margins they will not handle the proportional spacing on the Royal Adler SE5010 typewriter. My local Apple dealer can offer me no help in programming for proportional spacing. I surely would appreciate any help in this matter.

Bruce R. Burke, Director
Open Bible Ministries, Inc.
PO Box 148
Honesdale, PA 18431

Disk Available

For those readers who would like to use the assembly language plotting routines from my article "Getting Higher on Graphics" (Feb. 1983) but would rather not type in all the hex code, I will supply a DOS 3.3 disk with the object code for a charge of $10.

Paul Schubert
1940 Flandrau St.
St. Paul, MN 55109

No Response

I read in the February 1983 "Letters" column of your magazine that William Volk hadn't gotten a response from Apple to a question regarding disk security. Add my name to that list, too. I'm disappointed with the company and its apparent lack of concern toward its greatest asset—the people out there in computerland who spend millions on Apple products.

Joe Arbona
Rancho Cordova, CA

Future Articles

Translation articles top my list. Another program I'd like to suggest is a machine code text file writer.

Gary Mugford
Bramalea, Ontario

A section that includes program listings which use the language card would be of great interest.

Ronald J. Marlowe
Gainesville, FL

Have you given any thought to looking at energy problems or the solar field? An article or two on compatibility problems would be of great assistance. Have you given any thought to checking the past track records of companies that have just jumped into the market . . . and have a product no one knows about?

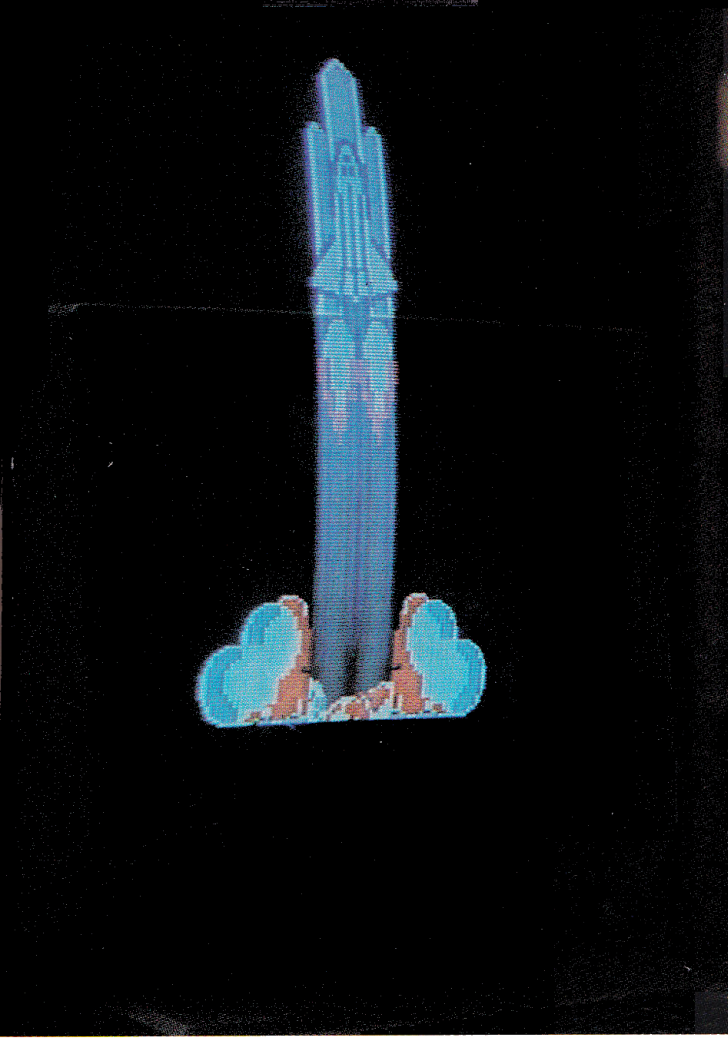
Lawrence T. Pim
Alliance, OH

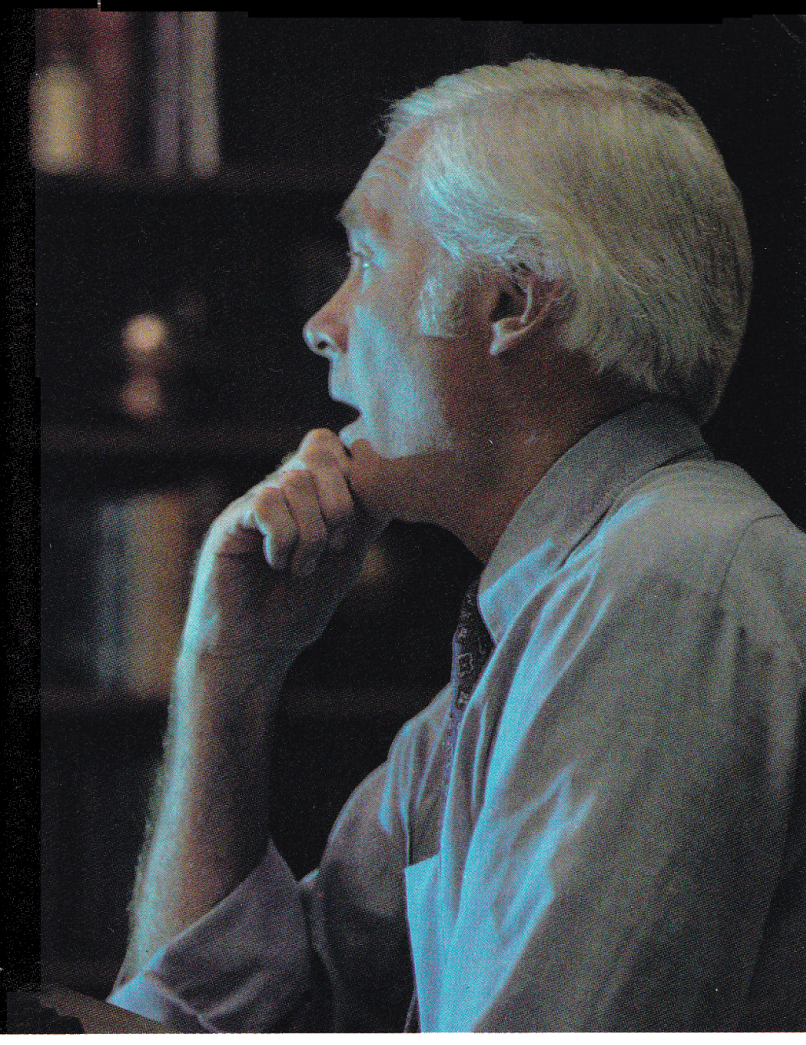
What I would like to see is a detailed analysis of writing programs, games or otherwise, using the much faster assembly language. Emphasis on graphics would be very helpful!

James T. Feezell
Newport, RI

Screen Movements

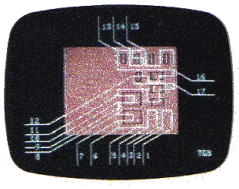
I have an Apple III computer and have invented a game on the VisiCalc III program diskette backup. There are objects which you are not supposed to be able to go through, how-





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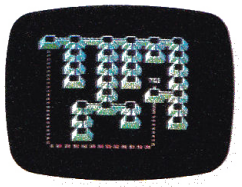


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ever, and I also want to stand in the middle, and have the screen move up. What program can you do this on? I have looked through the index of the owner's manual, but I couldn't find anything. Help!

Fiona Vajk
57 Oakdene Court
Walnut Creek, CA 94596

Disk Copy Wanted

Here's a suggestion that will make the magazine more valuable to people like myself who have little or no possibility of typing in one of the listings without hours of frustration. Make the programs available on disks for a reasonable cost.

Tim Bitler
Pittsburgh, PA

My only suggestion for improvement would be the option to buy your programs on disk.

Bill Plato
Broomfield, CO

Apple III Programs Wanted

I have recently subscribed to your magazine and I'm puzzled. All your articles and advertisements concern the Apple II. I own an Apple III, which I thought to be a more updated version of Apple II. I realize I can use Apple II programs on my machine with the Emulator, but aren't there any written especially for Apple III? I've only been at this computer business for six months and it's still all a little confusing.

Deborah J. Newton
PO Box 26605
Tucson, AZ 85726

Forecasting Suggestions

I was surprised and pleased to see Richard Green's "Graphing Growth" in the February issue. The techniques involved in pressure curve forecasting are simple but have proven to be very reliable for a great many companies in a broad range of industries. I would make two suggestions concerning his implementation of the forecasting technique.

First, while the three month moving total is appropriate for forecasting many highly aggregated series such as industry-wide shipments, it is unusual for the sales of a single company to be smooth enough to make this work. The twelve month total (or average) is usually more appropriate because the result is smoother and easier to interpret.

Second, it is preferable to look at as long a time period as possible in forecasting, and certainly at a period long enough to contain an entire business cycle. While the average business cycle lasts about five years, many run a good deal longer. I have found that high resolution plots spanning eight to ten years are most useful. Of course, for the young enterprise with a short sales history five years may be sufficient.

Mr. Green's article is a good introduction to a simple and widely used, but little acclaimed economic forecasting technique which often yields forecasts as good as the most expensive econometric forecasting service. Keep up the good work.

David B. Lundeen
1430 Massachusetts Ave.
Suite 306-29
Cambridge, MA 02138

inCider *feels that one of its most important roles is to provide a forum for readers. We welcome letters for publication with comments on articles, embellishments to programs, appeals for information—whatever you feel moved to write. And please send responses to letters. Address your correspondence to* ***Letters to the Editor,*** **inCider,** *Pine St., Peterborough, NH 03458.*

—the editors

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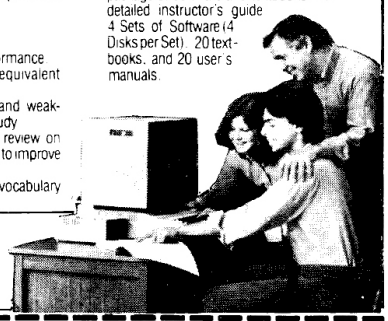
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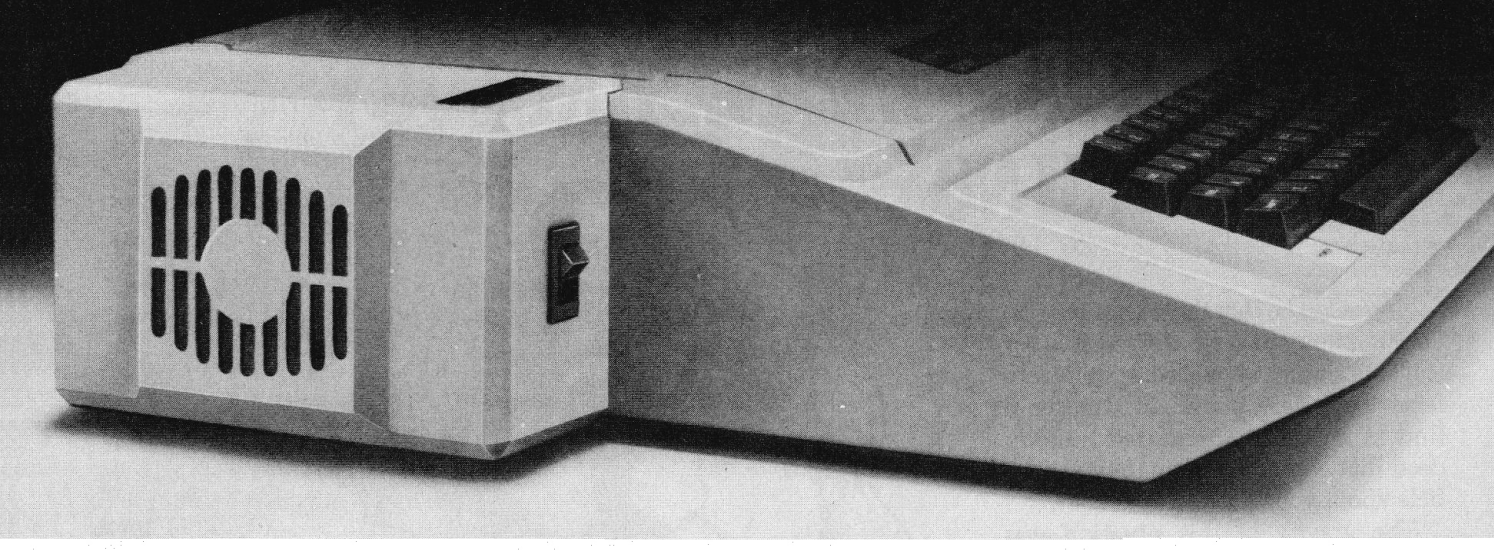
335R5

Canada and Mexico $27.97, 1 year only, US funds. Foreign surface $44.97, 1 year only, US funds drawn on US bank. Please allow 6–8 weeks for delivery.

Circle 86 on Reader Service card.

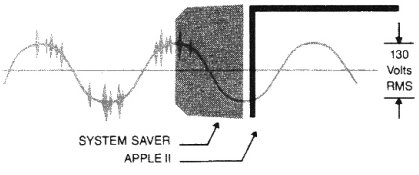
System Saver™

The most important peripheral for your Apple® II.



For Line Surge Suppression

The SYSTEM SAVER provides essential protection to hardware and data from dangerous power surges and spikes.

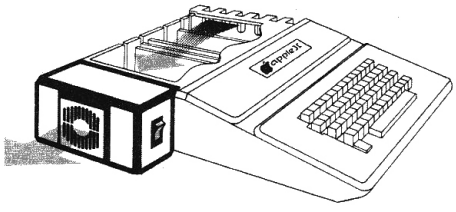


By connecting the Apple II power input through the SYSTEM SAVER, power is controlled in two ways: 1) Dangerous voltage spikes are clipped off at a safe 130 Volts RMS/175 Volts dc level. 2) High frequency noise is smoothed out before reaching the Apple II. A PI type filter attenuates common mode noise signals by a minimum of 30 dB from 600 khz to 20 mhz, with a maximum attenuation of 50 dB.

For Cooling

As soon as you move to 64K RAM or 80 columns on your Apple II you need SYSTEM SAVER.

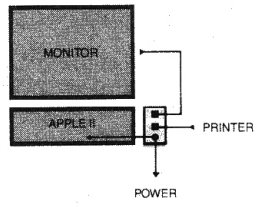
Today's advanced peripheral cards generate more heat. In addition, the cards block any natural air flow through the Apple II creating high temperature conditions that substantially reduce the life of the cards and the computer itself.

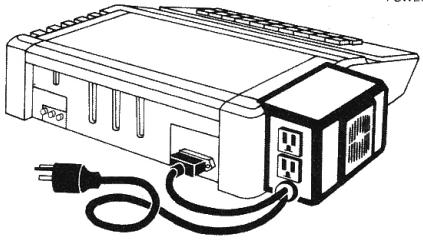


SYSTEM SAVER provides correct cooling. An efficient, quiet fan draws fresh air across the mother board, over the power supply and out the side ventilation slots.

For Operating Efficiency

SYSTEM SAVER contains two switched power outlets. As shown in the diagram, the SYSTEM SAVER efficiently organizes your system so that one convenient, front mounted power switch controls SYSTEM SAVER, Apple II, monitor and printer.

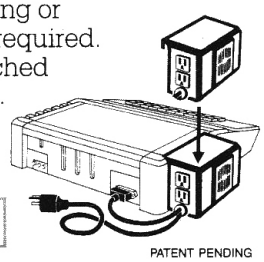




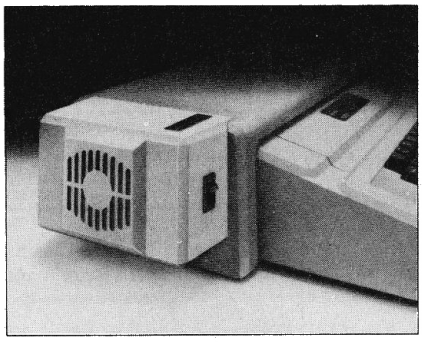
The heavy duty switch has a pilot light to alert when system is on.You'll never use the Apple power switch again!

Easy Installation

Just clips on.
No mounting or hardware required.
Color matched to Apple II.



Compatible with Apple Stand



Suggested Retail $89.95
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EDUCATION

The Apple Bill

Last year, Congress chose to hike taxes rather than the number of micros in the schools. Will it turn its back on the schools again?

by Alan Abbey
Contributing Reporter

Half of the U.S. Congress liked the taste of the Apple it bit into last year. The House of Representatives voted 323–62 in favor of legislation that would have given Apple Computer Inc., and any other microcomputer maker that wanted to participate, a massive one-year tax break for giving microcomputers to public schools across the country.

The measure, which was dreamed up by Apple chairman Steve Jobs and promoted by California congressman Fortney "Pete" Stark, a Democrat, appears to have an even rosier future in the House this year. The new congressmen elected last November, most of whom are liberal Democrats, have said that they favor spending federal money to improve the technical, math, and science skills of the nation's schoolchildren. They have been nicknamed "Atari Democrats" because of their belief that high-tech education is a key ingredient to leading the economy out of its lengthy slump. The primary reason voiced for the Apple bill is that it would encourage gifts of microcomputers to schools, and that would, in turn, increase the number of people interested in and proficient in computer use.

Stark's staff reports an enthusiastic list of co-sponsors for the new version of legislation that passed the House last fall. In 1982, the bill had 80 co-sponsors. The 1983 measure had 112 of 435 congressmen signed on at last count. Co-sponsors add their names to a bill they did not write, but want to go on record as supporting.

The problem this year, as was the case in 1982, will be in the Senate. Both the chairman and the ranking minority member of the powerful Senate Finance Committee, which will review the bill before it goes to the full Senate, have questioned the bill. Without their support, it might never see the light of day.

The bill—now known as the Computer Contribution Act of 1983—has been around for more than a year. It reportedly came to life in early 1982 when Steve Jobs met Pete Stark on a cross-country airplane trip. As they talked, Jobs laid out the scenario: Apple would give each of the nation's 83,000 public elementary and public schools one of its Apple II personal computers. Using the full retail price for the machine, related equipment, training manuals, and shipping, that would cost about $2500 per machine. Multiplied by 83,000, that brings the nationwide total to about $200 million.

Jobs, of course, had something on his mind besides being a Good Samaritan of historic proportions. The giveaway would provide Apple with an unprecedented amount of visibility and marketing opportunities. Schools probably would want more machines in a year or two, Apple officials admit, and the company hopes they would stick with Apple. In addition, when the time came for a middle-income family to buy a personal computer, kids who had used Apple at school probably could be counted on to tell mom or dad Apple should be the one. Some cynics were heard to whisper Jobs needed to clear out the Apple warehouses to make room for the new Lisa computer debuted last January.

In return for his generosity, Jobs asked for something from Congress: a change in the tax laws so Apple could write off as a deduction the full retail cost of the equipment, and the ability to get that deduction for donations to grade schools. The increased deduction would about double the amount Apple is able to write off under present law.

Stark, whose district includes part of the Silicon Valley, introduced the bill. It made its way through the House, despite analyses that showed the tax break would cost the U.S. Treasury $15 million in 1983 and $21 million in 1984. The legislation would boost the ability of the United States to "compete in the ever more sophisticated world of computers and high technology," Stark said.

About the only gripe came from Rep. Bill Frenzel, a regular foe of special-interest tax legislation. The bill would give manufacturers an incentive to build more than the market needs, the Minnesota Republican said, "because they can always sell [the surplus] to the government."

On the other side, education lobbying groups, always hungry for more equipment and funding for public schools, pushed for the computers. Their only gripe was the bill had moved along without much involvement on their part.

After passage by the House in late September, the bill went to the Senate, where the same arguments were made in its favor. There, however, it ran into the high-powered opposition of Louisiana Sen. Russell Long, top ranking Democrat on the Finance Committee. "Why should the government provide every school an Apple computer at the expense of the taxpayer?" Long asked.

The bill made it through the Finance Committee, but with considerable modification. The Senate version stretched the tax break to three years, in a move designed to allow other computer makers to get in on

the action. The Senate bill also included donations made to libraries and museums that promised to use the computers for educational purposes as deductible at the special rate.

The biggest change cut the additional tax break—Apple's initial incentive—in half. Because it would have added two years, however, the Senate version would have been more costly. Estimates of losses to the Treasury were $14 million this year, $23 million in 1984, $17 million in 1985, and $8 million in 1986. Stark said the revenue losses, regardless of the huge federal deficit, are small compared to the value of improving the computer literacy of the next generation.

The committee pushed the bill out in three days, but the Senate adjourned for the November election campaign without acting on it. When they returned for the lame-duck session, senators were preoccupied with raising the gasoline tax and their salaries. The bill died.

Stark was quick to reintroduce the bill in January. It went back into the legislative hopper on January 6, three days after the new Congress was sworn in. But it did not move quickly. The committees receiving it were busy raising Social Security taxes. The rest of Congress was involved with shredding and rewriting President Reagan's proposed 1984 budget.

School groups continued to back the bill, but with a difference. This year they saw the opportunity to make a coordinated push for several pieces of legislation designed to improve the math and science skills of the nation's youth. A lobbyist for the National School Boards Association said the Apple bill has some small value by itself. "It would fulfill the narrow need for a bit of hardware," said August Steinhilber, the association's government relations director. "But it doesn't help with training or retraining teachers."

He would rather see it passed as part of a larger package of measures. They include billion-dollar bills to provide funding for training teachers, for buying software, and for upgrading curriculums.

The bill also continued to face the opposition of Sens. Long and Robert Dole of Kansas. Dole, a Republican, is chairman of the Finance Committee. Therefore, he has carte blanche to hold on to a bill for as long as he wants or take it out of circulation.

The bill cannot be declared officially dead until the 98th Congress adjourns just before the 1984 elections. But its time may have passed. The nation's teachers may have to settle for an edible apple on their desks until they can convince the people who run their schools to buy an electronic one. ■

GAMES

Taps for Custer's Revenge

Blue game shelved after public protest.

Custer's Revenge has gone the way of its namesake.

Its manufacturer, American Multiple Industries of Northridge, CA, has stopped producing the adult-oriented video game.

Stuart Kesten, president of American Multiple, said in a telephone interview his firm terminated the game primarily because "it was creating a negative situation around the country."

The game was condemned by American Indian and women's groups, and government bodies in Oklahoma City and Los Angeles (see *inCider*, March 1983, p. 12).

Detractors of the game claimed it depicted the rape of an Indian woman by General George Armstrong Custer. Kesten denies those claims. "The game was misconstrued," he said. "There was no rape scene in the game."

Two other adult games produced by the firm—"Bachelor Party" and "Beat'em and Eat'em"—were also terminated by American Multiple, Kesten noted. He added American Multiple sold 100,000 copies of each game before halting their production January 1.

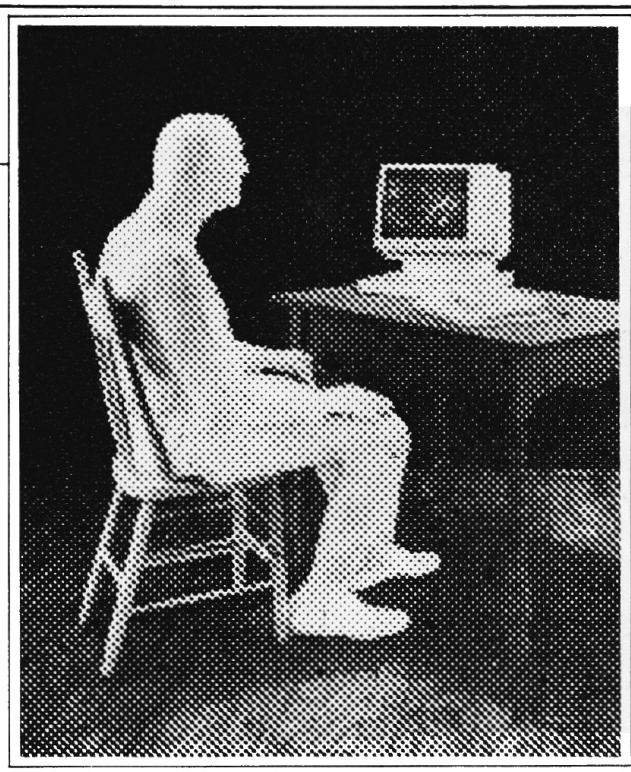
American Multiple made the three games for Atari game systems, a fact that prompted the Warner Communications Company to sue Kesten's firm. However, in light of American Multiple sacking the games, that lawsuit, filed in federal district court in Los Angeles, will probably be dropped.

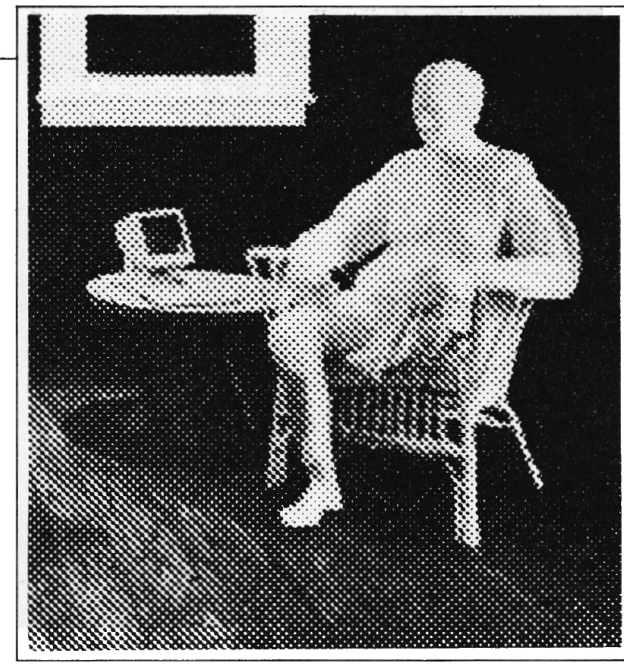
Kesten denied statements appearing in the January 24 edition of *ISO World* that American Multiple had been acquired by another firm.

He said his enterprise would continue producing video games but only ones aimed at family entertainment. American Multiple's new games, he noted, would be shipped before the June Consumer Electronics Show in Chicago.

But Custer's death hasn't deterred other smutware purveyors. Rory O'Connor, in his Speaking Softly column in *ISO World*, made this observation about off-color video games:

"The bad news is that for for every one that dies, ten take its place. At the CES [Consumer Electronics Show in Las Vegas], the area devoted strictly to 'adult' movies and video tapes also displayed several games with goals similar to Custer's Revenge. Next year they may have to double the size of that area just to accommodate this garbage." ■





BUSINESS

Time Study

Study by news mag shows Apple on top.

Apple dominates the minds and homes of computing Americans, according to a survey conducted by *Time* magazine.

The survey, conducted by Beta Research of Syosset, NY, indicated more people own Apples than any other home computer, and when asked to name a brand of computer, respondents most frequently name Apple.

According to the mail-questionnaire survey garnering a response from some 3600 homes, 17 percent of the computer-owning respondents owned Apples. Tandy placed second in the tally with 14 percent of the owners.

Apple dominated ownership figures even though it does not compete in the market for systems below $1000. Tandy ranked first in that market segment with nearly 25 percent of those owners.

But even in the minds of the sub-$1000 set, Apple played a prominent role. "Apple and IBM rank highly with those owning equipment costing less than $1000," the survey found, "although neither company sells to this market."

"Apple and Radio Shack dominate brand consciousness for the personal computer market," the study said. "IBM, a relative newcomer to the personal computer field, has broad appeal. Atari and Commodore apparently have not reached as large a segment of the non-owner public."

The survey showed 60.2 percent of the respondents aware of Apple computers and 48.5 percent aware of Tandy.

Apple's advertising also seems to be effective in capturing the minds of Americans. Nearly 74 percent of the respondents recalled Apple ads, the survey showed, with nearly 50 percent remembering IBM ads and 46.4 percent Radio Shack's.

Of the ads recalled, 92.4 percent of those surveyed recalled the ads in magazines.

In peripherals, the *Time* survey showed more respondents (32 percent) owned Apple disk drives than any other brand. Placing second in that category was Tandy with 8.8 percent. But when it came to printers, Apple placed fourth (3.4 percent) behind Epson (22.9 percent), Radio Shack (11.0 percent) and IBM (5.9 percent).

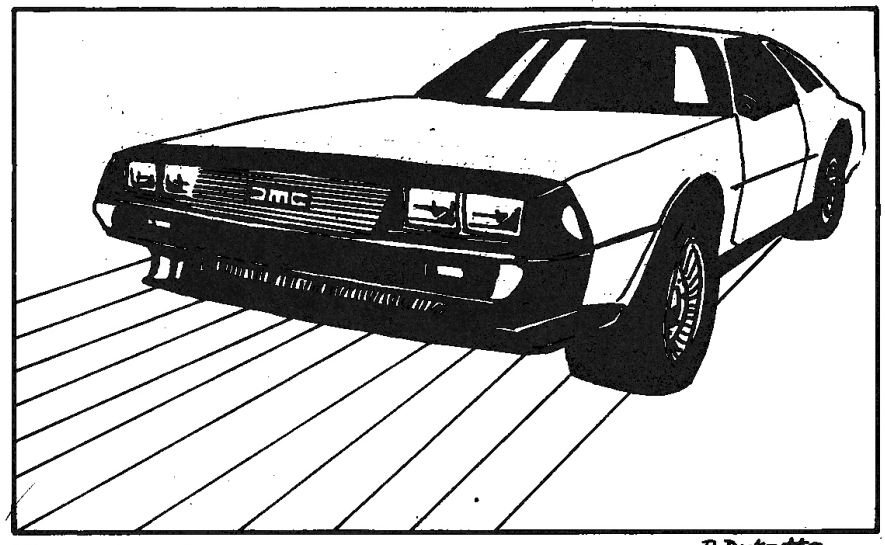
Other findings from the survey included:

- Key factors in home computer ownership are income and school-age children in a household. Of the people with a computer or with intentions of buying one within 12 months, 86 percent had incomes above $25,000 a year. Of all households with annual incomes above $25,000 and with school-age children, 24 percent had home computers;
- When asked what they use their computers for, owners most often mentioned games and hobbies and personal finance. When asked what they wanted to do next with their micro, owners most often responded: hook into some kind of information system;
- Of prospective computer buyers, the highest number (73.6 percent) said they would be using their micro for personal finances and taxes; and
- Respondents most often picked as the primary factor in selecting a computer a company's reputation for quality; next was expandability; then ease of use, service reputation; and adequate software. ■

BUSINESS

Apple Giveaway

Rhode Island firm offers auto jobbers Apple as purchase incentive.



The auto after-market
More and more auto-parts businesses are turning to Apples.

More and more auto-parts businesses may be joining the Apple generation, under an incentive program sponsored by Fram-Autolite Corporation of Providence, RI.

Under the program ending next month, Fram—a manufacturer of PCV valves, windshield wipers, spark plugs, and filters for auto, truck, and heavy equipment engines—offers two computer packages to businesses: one with an Apple II Plus, disk drive, RF modulator, game, and introduction to keyboard software programs; the other includes everything in the first plus another disk drive, printer, and inventory control program.

How much a business pays for the system depends on several factors, including the amount of Fram products purchased, when the purchases were made, and how much the customer contributed to Fram's co-op advertising program.

Peter Monsarrat, Fram's sales promotion manager, claimed in a statement: "The savings will be substantial. In this offer, a $3800 computer system can be obtained for $1000 or less."

He said he expects to move 1500 computers through the premium program; however, the offer has the potential of moving 10,000 systems.

Computer use in the auto aftermarket is increasing, according to a study released this fall by the Motor Equipment Manufacturers Association. Today, more than 32 percent of all jobbers use computers in some aspect of their business. That's nearly twice the amount (17 percent) reported in 1980.

Montsarrat attributes the growth to the lower price of computer hardware and software, smaller size of equipment and improved programs tailored to the automotive aftermarket.

"Computers," he said, "will become a way of life in our industry and others in the next decade. Business has to make decisons fast to maintain profit levels, and computers are the way to do it."

"Inventory control," he continued, "is the most common use of computers in the aftermarket. Computers perform this function more quickly and accurately than the manual method.

"For example, the Apple system can pinpoint obsolete or slow moving parts, so a jobber can replace them immediately with more popular items. This speeds up the ordering process and enables businesses to trim their inventory levels without losing sales because they are out of merchandise."

Montserrat added jobbers can also use their Apples for other business tasks, including monitoring receivables, purchasing, sales analysis, business planning and forecasting, word processing, electronic filing, and customer billing. ■

SOFTWARE

Apples Headed to Junkyard?

People are going to start scrapping their Apple computers and the like because they're too old, too slow, and just don't do much," declared David Callan, president of Callan Data Systems, Westlake Village, CA.

According to a statement from Callan, Apple and similar systems based on CP/M (sometimes referred to as the de facto operating system of the micro industry) risk becoming obsolete.

"If you take an operating system like the Apple," Callan said, "based on an older microprocessor, the 8086 or 8088, you can't upgrade the CP/M operating system. It's impossible. You're stuck with a lot of limited and, eventually, antiquated equipment. That's why we've dedicated all our resources to the development of the Unix operating system." ■

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VERSARECEIVABLES™ $99.95

VERSARECEIVABLES™ is a complete menu-driven accounts receivable, invoicing, and monthly statement-generating system. It keeps track of all information related to who owes you or your company money, and can provide automatic billing for past due accounts. VERSARECEIVABLES™ prints all necessary statements, invoices, and summary reports and can be linked with VERSALEDGER II™ and VERSAINVENTORY™.

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VERSAPAYABLES™ is designed to keep track of current and aged payables, keeping you in touch with all information regarding how much money your company owes, and to whom. VERSAPAYABLES™ maintains a complete record on each vendor, prints checks, check registers, vouchers, transaction reports, aged payables reports, vendor reports, and more. With VERSAPAYABLES™, you can even let your computer automatically select which vouchers are to be paid.

VERSAPAYROLL™ $99.95

VERSAPAYROLL™ is a powerful and sophisticated, but easy to use payroll system that keeps track of all government-required payroll information. Complete employee records are maintained, and all necessary payroll calculations are performed automatically, with totals displayed on screen for operator approval. A payroll can be run totally, automatically, or the operator can intervene to prevent a check from being printed, or to alter information on it. If desired, totals may be posted to the VERSALEDGER II™ system.

VERSAINVENTORY™ $99.95

VERSAINVENTORY™ is a complete inventory control system that gives you instant access to data on any item. VERSAINVENTORY™ keeps track of all information related to what items are in stock, out of stock, on backorder, etc., stores sales and pricing data, alerts you when an item falls below a preset reorder point, and allows you to enter and print invoices directly or to link with the VERSARECEIVABLES™ system. VERSAINVENTORY™ prints all needed inventory listings, reports of items below reorder point, inventory value reports, period and year-to-date sales reports, price lists, inventory checklists, etc.

VERSALEDGER II™ $149.95

VERSALEDGER II™ is a complete accounting system that grows as your business grows. VERSALEDGER II™ can be used as a simple personal checkbook register, expanded to a small business bookkeeping system or developed into a large corporate general ledger system **without any additional software.**

- VERSALEDGER II™ gives you almost unlimited storage capacity (300 to 10,000 entries per month, depending on the system),
- stores all check and general ledger information forever,
- prints tractor-feed checks,
- handles multiple checkbooks and general ledgers,
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VERSALEDGER II™ comes with a professionally-written 160 page manual designed for first-time users. The VERSALEDGER II™ manual will help you become quickly familiar with VERSALEDGER II™, using complete sample data files supplied on diskette and more than 50 pages of sample printouts.

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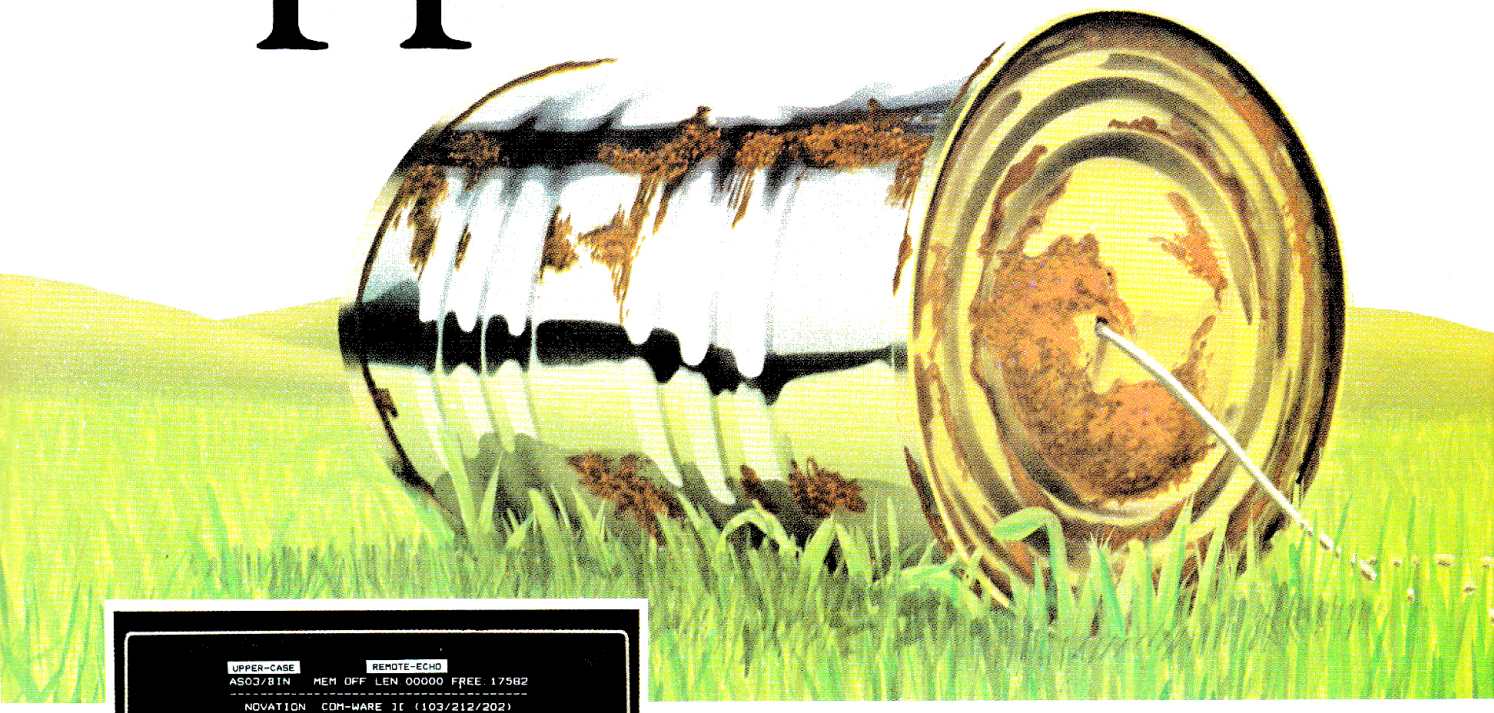
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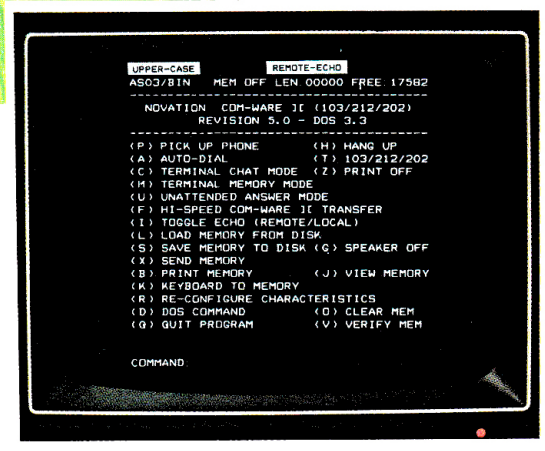
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Circle 66 on Reader Service card.

Apple®-Cat™ II





The Cat system lets you slip something into your Apple II no other modem offers—a complete range of speeds from 110, 300 and 202 half-duplex—to full duplex 212.

Either way, you have state-of-the-art LSI technology. And it means you can start right off with the most advanced system available. Or you can trim your investment, yet always have the option to move up at any step with absolutely no compromises in quality.

Com-Ware™ software is part of the package.

Five minutes after you've booted up the Novation Com-Ware you'll have a good notion of what it's like to work with the best, most accurate, most convenient personal communication system designed for your Apple.

It makes all of the moves you need to work with another computer, swap programs, access data, whatever.

And it's simple to operate. Just follow the menu. No programming, no fussing. It's all there.

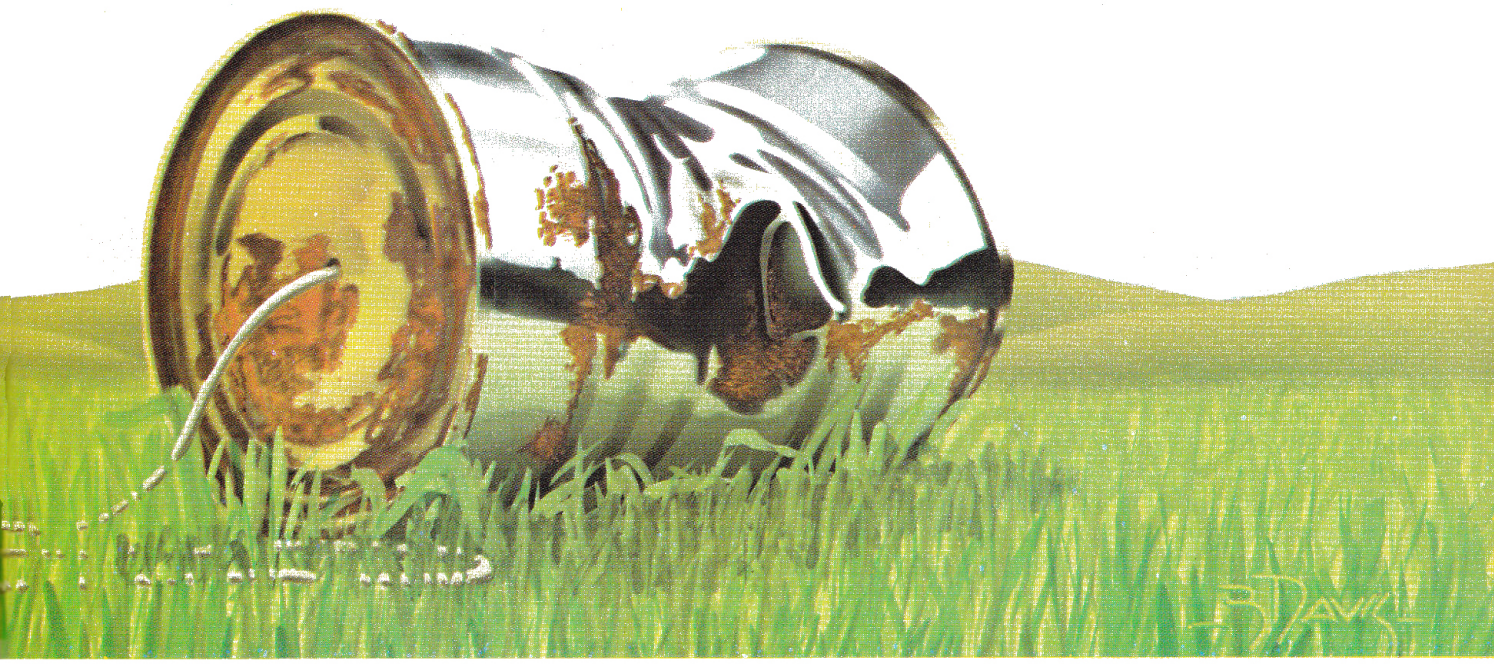
New—telephone directory.

Our engineers have done it again. They've expanded our Com-Ware. Now included: a time-saving directory of 26 telephone numbers with terminal configurations all selected and stored for auto dialing. Handy.

And some nice extras. Print-out during communication, a non-destructive memory mode, a changeable "welcome" message for automatic answer. There's more.

If you have an Apple-Cat II and our earlier Com-Ware (4.4 or earlier), you should really have the new one (5.0). As always, it's free.

It's the modem/communication system you grow into, not out of.



Just send us your old diskette and we'll send you the new one.

It can make all the moves you want.

Start with 110, 300, 202 half-duplex. Or—add 212 full duplex and move data four times faster with accurate, block by block verification. / Automatically send and receive anytime—including the middle of the night when line charges are lowest. / Use 80 or 40 column format. / Set for local or remote echo. And more.

Two more reasons to move right now.

Packed with every Apple-Cat II is a list of options. You get your choice of any one—and save up to $40.

Also, if you've ever wanted to take a look at **The Source**,[SM] this is your chance. With your Apple-Cat II you get a sampler subscription offer. It's limited, but it gives you a taste.

They're at your dealer.

He has all of the details. See him now.

Easy installation.
In less than 10 minutes, you're talking to the world.



More features than any other modem.

• Full range of communication baud rates—up to 1200 (Bell System 100, 202 or 212 series compatible) • Full or half duplex operation • Complete Com-Ware system on a single diskette. Also, wide assortment of excellent software available from other sources • All automatic functions—auto dial (pulse or Touch Tone), redial, auto answer and disconnect • It's a telephone with speaker monitor—switch between data and voice. For regular use, it's a handy intelligent phone with auto-dial • Touch Tone receiver • Built-in BSR X-10 Controller • Remote control for external cassette tape recorder • Works with other Apple parallel or serial printer interface cards • Constant status display on screen • Binary or text modes • Single card installation for Apple Cat II and an additional card for the 212 upgrade • FCC certified built-in phone line interface (PLI) Module • New full Duplex 212 option.

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CAT is a trademark of Novation, Inc., which does not manufacture Apple computers.

Circle 272 on Reader Service card.

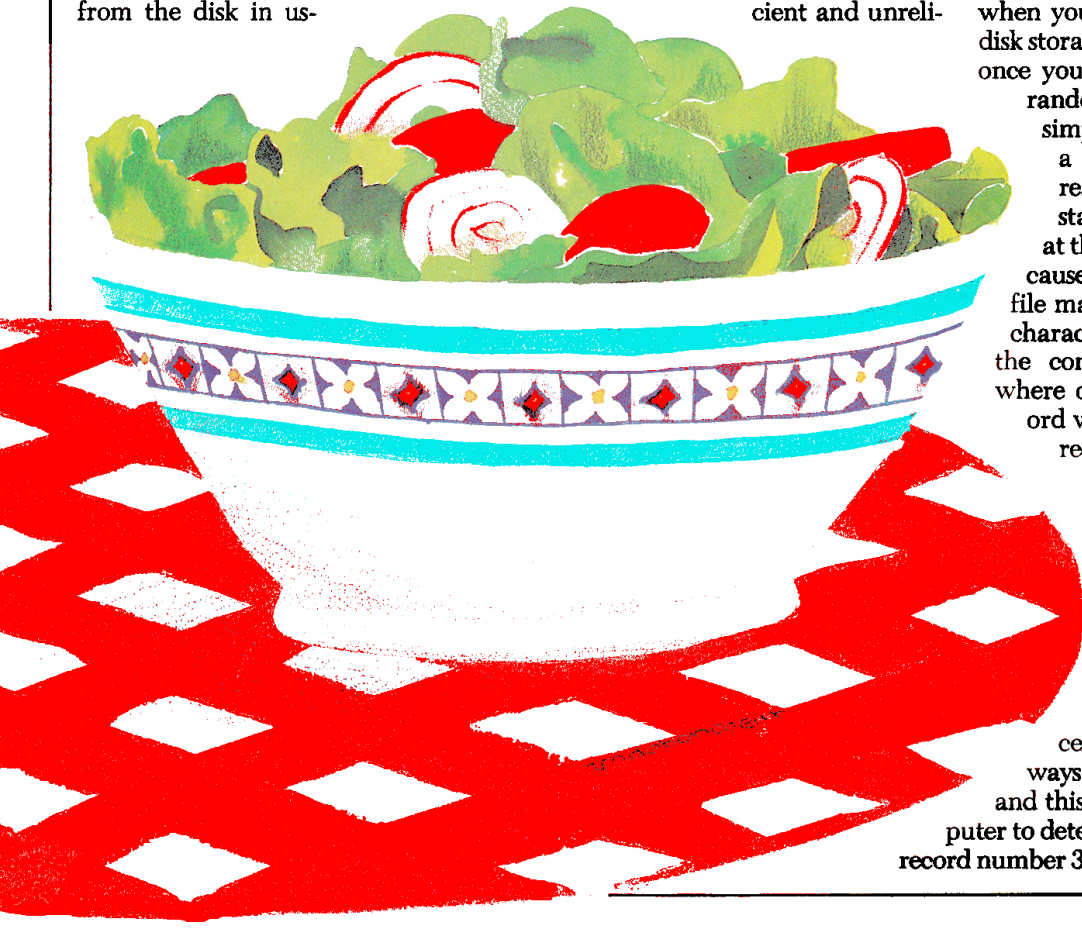
The Applesoft Adviser

by Dan Bishop

Recipe for Random Access Salad

Last month I suggested that you should make every attempt to use structured programming techniques in the Basic programs you write. I briefly outlined how to use the subroutine in Basic to achieve the modularity that is so important to a well structured program.

This month I'll introduce several such modules that can be used in any program that requires random access disk files. Two of these modules may appear without any change in all programs you write that use random access files. The remaining modules are designed to simplify the process of packing data into random access records and of retrieving that information from the disk in usable form.



Why Random Access?

Most truly useful programs require the computer to process a fairly large amount of data. The exact nature of the processing depends on the specific application being undertaken. Processing inventory data is quite different from processing payroll, for example. But all such programs have one common element. Each must store the data to be processed and the results of the processing onto some permanent storage device so that the data may be retrieved at a later date. Although cassettes can be used for data storage, for most practical purposes they are too inefficient and unreliable. The floppy disk overcomes both of these problems.

I am sure that many of you began your computer experience using cassette storage for your data, and finally upgraded your system to include a floppy disk drive. You were undoubtedly amazed at the greater speed with which records could be pulled from the disks. No matter that you may still be using sequential access files on your new disks. Sequential access worked well enough on cassette (which allowed no option), and it works even better now on disk. Why bother with random access file procedures anyway?

Well, if you were pleased with the increased efficiency you observed when you switched from cassette to disk storage, you will be even happier once you convert your data files to random access. The reason is simple. To sequentially access a record, the computer must read every record from the start of the file until it arrives at the desired record. This is because each record in a sequential file may consist of any number of characters so there is no way for the computer to predict exactly where on the disk the desired record will be found. Inserting new records into the file requires that the entire file be rewritten. Deleting old records leaves a gap in the file that can only be filled if a new record happens to have the same length as the one that was deleted.

Records in a random access file, on the other hand, always have the same record length, and this length is given to the computer to determine exactly where to find record number 385 in the file if it knows how

long each record is. The computer can find that record almost immediately. Furthermore, any holes in the file formed by deleting records can be filled with new records, since all records in the file have a standard length. A new record may be inserted easily into the old file simply by moving all higher records up one record position to make room for the new record.

The real advantage to using a disk drive for data storage lies not so much in its greater speed but rather in the ease with which specific data can be located on the disk. Using sequential files nullifies this particular advantage. I hope to show in the remainder of this article that using random access files is not as complicated as you might have believed.

The Ingredient List

Listing 1 (lines 10 and 9400 to 9470) provides the program instructions for the first "recipe" style module to go into a random access program. No aspect of this subroutine will be changed. Every program will contain this instruction set exactly as it is shown here.

This subroutine gives the computer some essential information about your random access files. The first thing the computer must know is the number of random access files you plan to use in this program. That number is given as a Data element in line 9600. For example, if you will be using three random access disk files in the program, then your program will have the following program lines:

```
9599 REM RANDOM ACCESS FILE SPECS
9600 DATA 3
```

Line 9400 in the subroutine from Listing 1 reads this data element as F. (By the way, all other data in your program must come after line 9700 to keep it from interfering with the data elements used by this subroutine.) Line 9410 uses this value to dimension four arrays. F$(I) will contain the names of each of your random access files. FR$(I) will be used by the program to contain all of the data in the current record from file I. FR(I) will be the current record number from file I, and FL(I) will be the length of each record contained in file I.

Lines 9420 to 9440 form a loop that is executed once for each file you plan to use (as indicated by the Data statement in line 9600). Each file you plan to use must be identified with two Data elements. The first will be the file's name (as it will appear on the Catalog listing), and the second will be the record length for each record in that file. You may wish to devote a separate Data line for each file. Thus you might have the following three Data lines in your program:

```
9610 DATA NAMES, 32
9620 DATA ADDRESSES, 32
9640 DATA COMMENTS, 64
```

With these Data elements, you are telling the computer that the first data file will be named "Names" and that each record in this file will require 32 bytes. File number two will be named "Addresses" and will have records occupying 32 bytes, and file number three will be named "Comments" and will have records that contain 64 bytes.

Lines 9450 and 9460 define three string constants that will be used by the subroutine shown in Listing 2. The variables used for these constants are D$ and DB(I). Be sure that you do not use these elsewhere in your program!

Before going further, let's consider just how you can determine the record lengths for your files. You need to know these values for the Data statements shown above. Each

```
10 GOSUB 9400
9398 REM ************************************************************
9399 REM SUBROUTINE TO INITIALIZE PROGRAM FROM DATA
9400 READ F
9410 DIM F$(F), FR$(F), FL(F), FR(F)
9420 FOR I=1 TO F
9430     READ F$(I), FL(I)
9440 NEXT I
9450 D$ = CHR$(4)
9460 DB$(0) = "READ ": DB$(1)="WRITE "
9465 BR$="           ": REM 10 BLANKS
9466 BR$=BR$+BR$+BR$+BR$+BR$:BR$=BR$+BR$+BR$+BR$+BR$+"      ": REM 255 BLANKS
9470 RETURN
```

Listing 1. This listing is a generalized module that is to be used in any program that uses the random access procedures described in this article. The Data statements that are read by this module are described in the article.

```
9498 REM ************************************************************
9499 REM SUBROUTINE FOR ACCESSING RANDOM ACCESS DISK FILES
9500 DA$ = D$ + "OPEN " + F$(F) + ",L" + STR$(FL(F))
9510 PRINT DA$
9515 ONERR GOTO 9580
9520 DA$ = D$ + DB$(FA) + F$(F) + ",R" + STR$(FR(F))
9530 PRINT DA$
9540 IF FA=0 THEN INPUT FR$(F)
9550 IF FA=1 THEN PRINT FR$(F)
9560 PRINT D$;"CLOSE"
9565 POKE 216,0
9570 RETURN
9579 REM ERROR HANDLING ROUTINE TO ESTABLISH NEW BLANK RECORD
9580 PRINT D$;"CLOSE": FA=1
9582 POKE 216,0
9585 FR$(F)= LEFT$(BR$,FL(F))
9590 GOSUB 9500
9595 GOTO #####
```

Listing 2. This module takes care of the actual transfer of data between the computer's RAM memory and the disk. Only line 9595 needs to be changed for this module to work properly in any program that uses my approach to random access disk files. The line number to be inserted in line 9595 should be the line that contains the FA = 0 GOSUB 9500 instructions which caused the error to occur in the first place (the error being that no such record was found).

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record can be thought of as a 3 by 5 card in a small recipe card box. The box itself is the file. Now various items of information may be contained on each card (or in each record). Each item occupies a "field." It is important to remember that in your case every card in this box contains the same number of fields and that the lengths and identities of these fields are the same from card to card.

Imagine that the cards for a certain box have been especially printed with blanks to be filled in. At the top of the cards is a row of 15 blanks. Below that is a row of 22 blanks, then a row of 15 blanks and finally a row that contains two blanks, a space and five blanks. All of the cards are printed identically. In this example, if you use these cards for mailing list information, you might consider the top line to correspond to the name, the second to a street address, the third to a city, and the fourth to the state and zip code. Each record contains five fields and requires a total of 15 + 22 + 15 + 2 + 5 = 59 blanks (or bytes).

The first step in determining record length, then, is to determine precisely what information you plan to place within a single record. Each item of information will correspond to a separate field. Then decide on how many characters (maximum) you plan to assign to each field. Total the number of characters for each field and you have arrived at your record length.

Although the DOS Manual from Apple claims that a record length may be any size from 1 byte to 32767 bytes, I have occasionally run into problems. In all such cases, I have overcome the problem by selecting a record length that is an even factor of 256. This may be reasonable in light of the fact that the Apple DOS transfers 256 bytes at a time from disk into a memory buffer in the computer.

So I would advise sticking to record lengths that are powers of 2, such as 2, 4, 8, 16, 32, 64 and 128. This provides considerable flexibility (you don't have to fill in all the bytes), and if you must decrease a field by one or two bytes to fit one of these numbers, it usually can be done with no great loss.

```
1 REM  SAMPLE PROGRAM USING TWO DISK DATA FILES
2 REM  EACH FILE CONTAINS ONLY ONE FIELD.
10 GOSUB 9400
20 HOME
30 BL$="              ": REM 10 BLANKS
40 BL$=BL$+BL$+BL$+BL$+BL$+BL$+BL$+"    ": REM 64 BLANKS
50 INPUT"WHICH FILE...";F
60 IF F)2 OR F(1 THEN 50
70 INPUT"WHICH RECORD...";FR(F)
80 FR$(F) = ""
90 INPUT "SAVE TO DISK OR LOAD FROM DISK (S/L)..";A$
100 IF A$="S" THEN GOTO 160
110 IF A$()"L" THEN GOTO 90
119 REM PREPARE TO LOAD DATA FROM DISK
120 FA = 0
130 GOSUB 9500
140 PRINT FR$(F)
150 GOTO 50
159 REM PREPARE TO SAVE DATA TO DISK
160 FA = 1
170 INPUT"ENTER DATA YOU WISH TO SAVE...";FR$(F)
180 FR$(F) = LEFT$(FR$(F) + BL$, FL(F))
190 GOSUB 9500
200 PRINT"DATA IS STORED."
210 GOTO 50
9398 REM ****************************************
9399 REM SUBROUTINE TO INITIALIZE PROGRAM DATA
9400 READ F
9410 DIM F$(F), FR$(F), FL(F), FR(F)
9420 FOR I=1 TO F
9430     READ F$(I), FL(I)
9440 NEXT I
9450 D$ = CHR$(4)
9460 DB$(0) = "READ ": DB$(1) = "WRITE "
9470 RETURN
9498 REM ****************************************
9499 REM SUBROUTINE FOR ACCESSING RANDOM ACCESS DISK FILES
9500 DA$ = D$ + "OPEN " + F$(F) + ",L" + STR$(FL(F))
9510 PRINT DA$
9515 ONERR GOTO 9580
9520 DA$ = D$ + DB$(FA) + F$(F) + ",R" + STR$(FR(F))
9530 PRINT DA$
9540 IF FA=0 THEN INPUT FR$(F)
9550 IF FA=1 THEN PRINT FR$(F)
9560 PRINT D$;"CLOSE"
9565 POKE 216,0
9570 RETURN
9579 REM ERROR HANDLING ROUTINE TO ESTABLISH NEW BLANK RECORD
9580 PRINT D$;"CLOSE":PRINT"NO SUCH RECORD ..."
9582 FA=1: POKE 216,0
9585 FR$(F) = LEFT$(BL$,FL(F))
9590 GOSUB 9500
9595 GOTO 120
9600 DATA 2
9610 DATA TEST ONE, 32
9620 DATA TEST TWO, 64
```

Listing 3. A simple random access record keeping program using two files, records with single fields, and the generalized disk access procedures described in this article.

Storing the Ingredients

Listing 2 (lines 9500 to 9595) provides the subroutine instruction set that takes care of all of your random accesses to the disk. These lines, like those in Listing 1, will appear in your program with virtually no changes, with the exception of line 9595, for which a line number must be supplied. The instruction set is designed to handle both storing data to the disk and retrieving data from the disk. The difference is denoted by the value of the operation flag, FA.

This subroutine uses several variables that must be defined within the program before it can be used. The variable F must be assigned a number that corresponds to the number of the file currently being accessed. For example, if you had named your files as shown in the example above (lines 9610 to 9630), then if you were currently accessing the Comments file, you would want F to have a value of 3 (corresponding to file 3). FR(F) must also be defined by the program. It must be given the value that corresponds to the specific record number in the file that you are dealing with. Finally, FA must be assigned a value of 0 if you are retrieving data from the disk ("Read" and

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"Input") and a value of 1 if you are storing the data onto the disk ("Write" and "Print").

So with three assignment statements to give appropriate values to F, FR(F) and FA, you can execute a GOSUB 9500 and retrieve record FR(F) from file F on your disk. The record will come back as FR$(F), with all of the data for each of the fields packed together in one long string. But more about that problem later. If you are saving data to disk, the data must be packed into FR$(F) first, and then, after you have assigned appropriate values to F, FR(F) and FA, you can execute a GOSUB 9500 and Bingo! The record will be stored to disk.

The subroutine at 9500 also contains an error trap in the event that you attempt to retrieve a record from the disk (FA = 0) using a record number that does not exist for that file. Should this occur, the error trap will write a blank record into that position in your file and, using the GOTO command in line 9595, return the program to the instruction that requested that record in the first place. On the second attempt, of course, there will be a record (containing blanks) in that position, and the program proceeds normally.

The POKE 216,0 instructions are necessary to counter the use of the ONERR instruction. Their presence allows errors in other parts of the program to be handled in the usual way by the computer.

Program Listing 3 is a short demonstration program that illustrates the simplest form of random access, in which each record contains only a single field. Two files are set up, and the computer prompts you to input a file number and a record number. You are then asked if you wish to save data (onto disk) or to load data (from disk). If you indicate that you are saving data, you will be prompted to type in the string to be saved and, when you press Return, the record will be saved. If you indicate that you are loading data from disk, the specified record (if it exists) will be retrieved from the disk and displayed on the monitor.

Tossing the Salad

Most applications will require more than a single field for each record. The subroutine at 9500 works properly only if a single record string, identified as FR$(F), is to be written to or retrieved from the disk. In order to use that subroutine with more complex situations, it will be necessary to devise a module, or subroutine, that packs the data from each field into a single record string before you store the data to disk (using a GOSUB 9500). Similarly, a subroutine must be written that will accept FR$(F) as a single record string retrieved from the disk and break that string down into the desired individual Data elements.

To prepare the data from each field so that it can be packed into the record string prior to that string's being saved onto disk, each data element must be padded with the appropriate number of blank spaces so that it occupies exactly the maximum number of bytes that you decided on when you were setting up the file's original specifications.

This can be accomplished quite easily for strings. For example, suppose you had decided that NM$, a client's name, would consist of up to 20 characters. The following program line will pad whatever name NM$ represents with enough blanks to provide a total string length of 20 characters.

```
9199 REM SUBROUTINE TO SAVE DATA
     TO DISK
9200 BL$ = "                    "
9300 NM$ = LEFT$(NM$ + BL$, 20)
```

BL$ is defined as a string containing 20 or more blank spaces. This string is concatenated with NM$, and the left 20 characters, which includes all of NM$ along with the required number of additional blanks, is taken and reassigned to NM$.

Lines similar to 9300 must be used for each element of string data that is fielded within your record. Numeric data is handled similarly, with the only requirement being that the number be changed to a string first. For example, along with the name of the client, you might also have included the client's identification number. If these numbers range from 1 to 9999, then you will need a maximum of five bytes (allowing for the sign), and the smaller numbers will need to be padded with blanks. Line 9305 may be used for this situation.

```
9305 CN$ = LEFT$(STR$(CN) + BL$, 5)
```

In this line, the client's number, as CN, is converted to a string using the STR$ function. Since this string may have from 2 to 5 bytes, it needs to be padded with blanks using the same approach that was used in line 9310. If you are really pinched for space, and the sign of a number is not important, you can eliminate it from the string using a Right$ function as follows:

```
9305 CN$ = RIGHT$(LEFT$(STR$(CN)
     + BL$,5),4)
```

Once the data elements have been properly padded, FR$(F) can be formed by concatenating them together, as in line 9310.

```
9310 FR$(F) = NM$ + CN$
```

Of course, F must have been assigned

```
9199 REM SUBROUTINE TO SAVE DATA TO DISK
9200 BL$ = "          25 blanks          "
9210 ON F GOSUB 9300, 9320, 9340
9220 FA = 1: GOSUB 9500
9230 RETURN

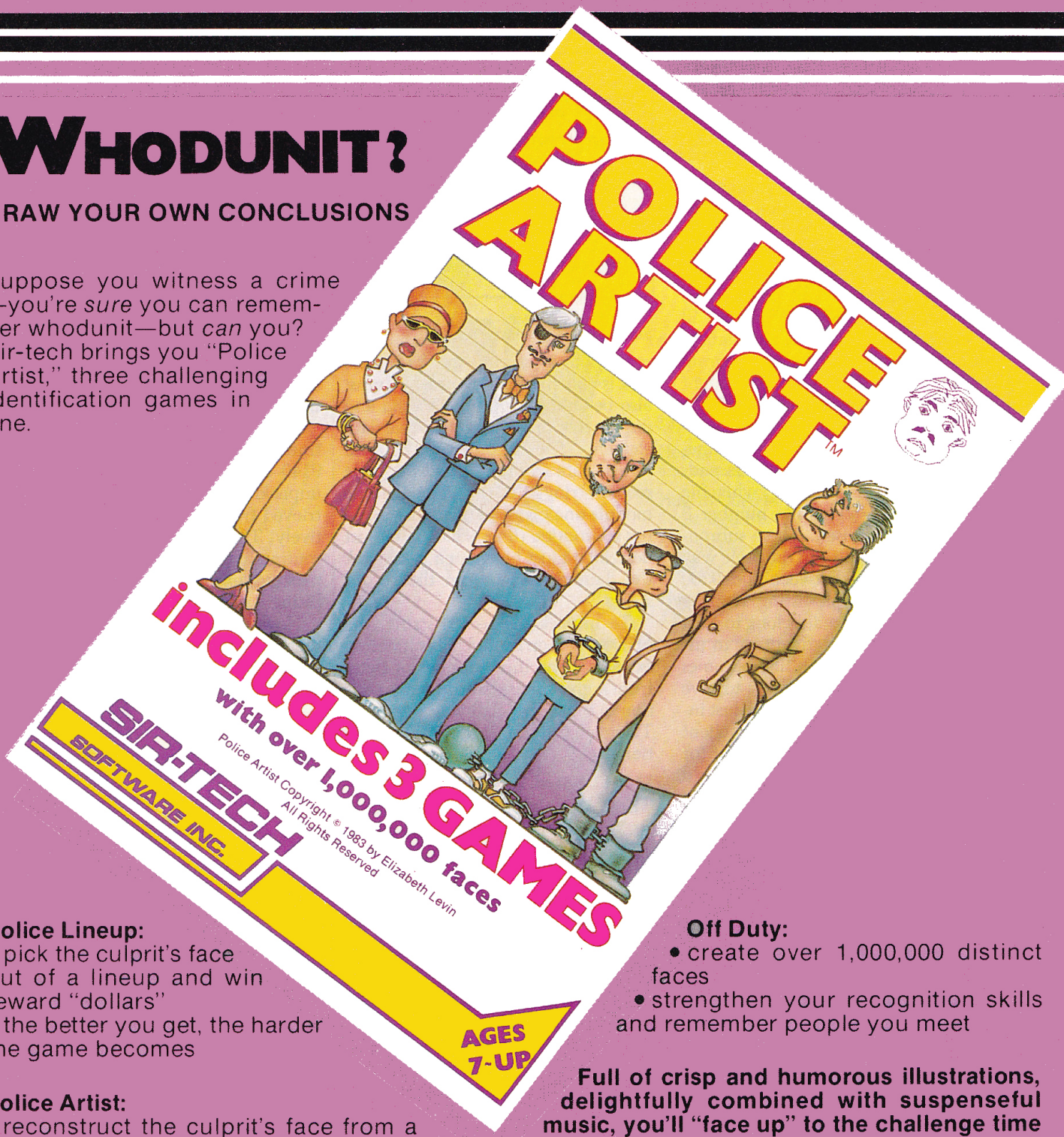
9299 REM RECORD STRING PACKING FOR FILE 1
9300 NM$ = LEFT$(NM$ + BL$, 20)
9305 CN$ = LEFT$(STR$(CN) + BL$, 5)
9310 FR$(F) = NM$ + CN$
9315 RETURN
```

Sample listing 1.

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its appropriate value indicating which file this information is to be associated with.

If the string packing lines listed above are included in a subroutine that is called by a generalized subroutine designed to handle all operations that involve saving data to disk, then a block of your program between lines 9200 and 9399 might look like Sample listing 1.

Two other subroutines must be included (lines 9320–9339 and lines 9340–9359) to take care of the padding and packing of FR$(F) when file number 2 (F = 2) or file number 3 (F = 3) is being used. These subroutines will be handled in the same way as the subroutine between lines 9300 and 9315 in Sample listing 1, using the data elements that belong to each respective file. The advantage to using the generalized routine becomes obvious when you are ready to save your data onto disk. You have just input the name (as NM$) and client number (as CN) for a new client (or edited the information for an old client). You are now ready to save the data to disk as record number 57. The following line in the main program takes care of it all.

```
220 F = 1: FR(F) = 57: GOSUB 9200
```

F selects the specific file you want to store the record in. FR(F) selects the record number to be stored. The GOSUB 9200 sends the program to the "Save Data to Disk" subroutine. Since F = 1, the subroutine between 9300 and 9315 is used to pack FR$(F) with the padded versions of NM$ and CN. FA is then set to 1 so that the subroutine at 9500 knows to store FR$(F) onto the disk.

"The advantage to using the generalized routine becomes obvious when you are ready to save your data to disk."

Serving Suggestions

Of course, storing the data onto disk is only half the picture. We must also be able to retrieve the data and display it or print it as individual data elements. The subroutine at 9500 will return data from the disk as a single record string, FR$(F). A subroutine module analogous to the string packing subroutine (lines 9200–9399) just described must be written to unpack the data elements from the record string.

To unpack the record string, the MID$ function is used. This function extracts a specified number of bytes from a given string starting at a position in that string that you can select. The general form of the MID$ function is:

```
X$ = MID$(A$, A, B)
```

where A$ is the string to be operated on, A is a number that tells where the operation is to take place (that is, how many bytes over from the start of A$ to count before starting to remove characters) and B is a number that specifies how many bytes to remove. For any given data element, B will be the same number that you used above in the string padding subroutine.

If the data item being unpacked is numeric, the VAL function can be used along with the MID$ function to convert that item into its numeric equivalent.

```
8999 REM SUBROUTINE TO RETRIEVE DATA FROM DISK
9000 FA = 0: GOSUB 9500
9010 ON F GOSUB 9100, 9120, 9140
9020 RETURN

9099 REM ROUTINE TO UNPACK DATA FOR FILE 1
9100 NM$ = MID$(FR$(F), 1, 20)
9105 CN = VAL(MID$(FR$(F), 21, 5))
9100 RETURN
```

Sample listing 2.

In order to retrieve data from the disk, set up a general data retrieval subroutine at line 9000. Then write a short unpacking subroutine for each file, using lines 9100 and 9198. This approach is analogous to the one given above for saving data to disk. The lines given in Sample listing 2 could be used with the example that has been presented thoughout this article.

As before, two additional subroutines (lines 9120–9139 and lines 9140–9159) are needed to handle the unpacking process for records retrieved from file 2 and file 3 respectively. The appearance of these subroutines will be analogous to the unpacking subroutine shown in Sample listing 2 (lines 9100–9119).

Now when you want to retrieve the client's name and number from record 86, you will use the following line in your program:

```
250 F = 1: FR(F) = 86: GOSUB 9000
```

On returning from the subroutine, NM$ and CN will be properly defined for use by the program.

Of course, a practical program will have FR(F) determined by an input statement from the keyboard rather than an assignment statement as shown above, or by the value of a loop counter if the file is being searched for a specific record. The important point is simply that the only two items that need to be specified by the main program before executing a GOSUB 9000 to retrieve a record are the file number and the record number. The program does the rest.

The Appointment Calendar

If you are a regular reader of this magazine, you may recall a "Datebook" program listing that I presented in my March article. In that program I used Data statements that had to be written into the program each time a new appointment was to be entered. The program could only handle one week's appointments.

Listing 4 makes up for these deficiencies by providing a "user friendly" program for setting up an appointment calendar that will en-

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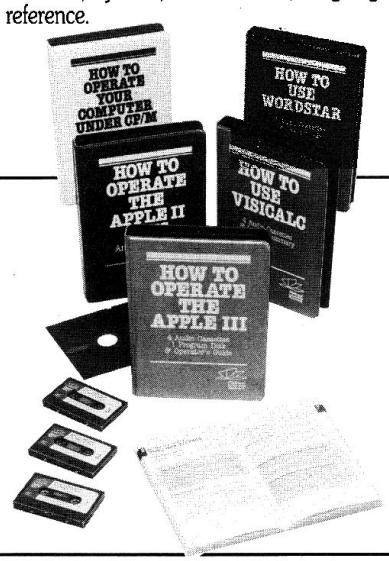
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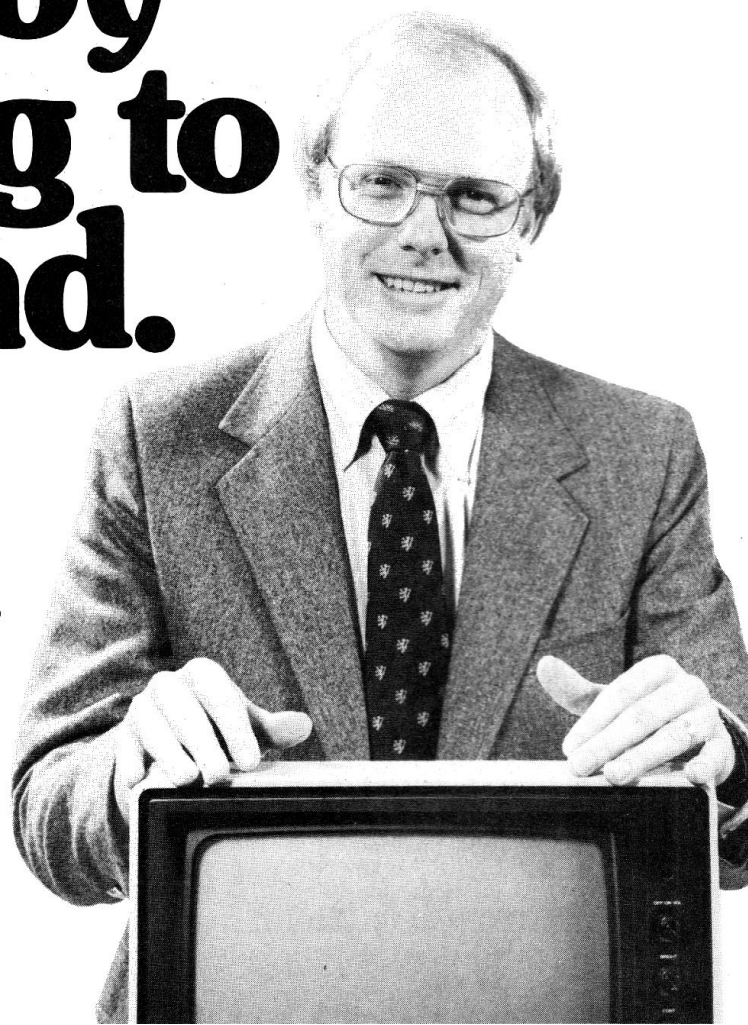
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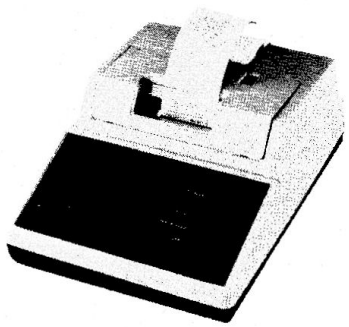
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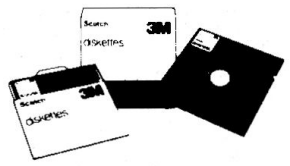
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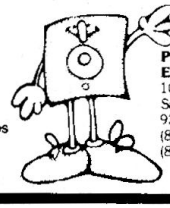
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compass an entire year. Even your secretary, who may know nothing about programming, will be able to use this program.

Each month is treated as a separate random access disk data file. So when you specify a month number in response to the prompt for month, you are actually designating a file number, F, to be used by the random access disk handler routines. Each day is treated as one record that contains 256 bytes. To accommodate an entire year, 96K bytes of storage will be required, so for all practical purposes you will want to devote most or all of a disk to handle your appointments.

This program is perhaps a bit unusual in its file requirements in that all 12 files have the same byte requirements (256) and the data records contained in each file are formatted the same way. This does simplify the packing and unpacking routines, however, since only one subroutine is needed for each of the two functions, even though there are 12

Listing 4. Appointment Calendar program. The main program corresponds to lines 100-180 (see Figure 2), with each major program function being handled as a separate subroutine. Compare this listing with the organizational chart of Figure 1.

```
1 REM APPOINTMENT CALENDAR PROGRAM
2 REM            DEV. BY DAN BISHOP
3 REM                  CUSTOM COMP
10 GOSUB 9400: BL$="                                ": REM 25 BLANKS
19 REM A$(I) CONTAINS APPT. INFO.; T$(I) IS THE TIME.
20 DIM A$(9), T$(9), D$(6)
29 REM READ DAYS OF THE WEEK
30 FOR I=0 TO 6
40     READ D$(I)
50 NEXT I
58 REM FNND(X) DETERMINES THE NUMBER OF DAYS IN A MONTH.
59 REM          IT REQUIRES Y (YEAR) AND M (MONTH NUMBER).
60 DEF FNLY(Z)=(M=2AND(INT(Y/4)=Y/4))*29+(M=2AND(INT(Y/4)()Y/4))*28
61 DEF FNLZ(Z)=(M=4ORM=6ORM=9ORM=11)*30
62 DEF FNLX(Z)=(M=1ORM=3ORM=5ORM=7ORM=8ORM=10ORM=12)*31
63 DEF FNND(Z)= FNLY(Z)+FNLZ(Z)+FNLX(Z)
99 REM *********  MAIN  PROGRAM  *************
100 GOSUB 200:                          REM INPUT DATE
110 IF F=0 OR YR=0 THEN END
120 Y = YR: M = F: GOSUB 500:           REM FIND DAY OF WEEK
130 GOSUB 9000:                         REM GET APPT. PAGE FOR DATE
139 REM REPEAT ... UNTIL Z$="X"
140     GOSUB 1100:                     REM DISPLAY APPT. PAGE
150     GOSUB 1200:                     REM EDIT APPT. PAGE
160 IF Z$()"X" THEN GOSUB 900:GOTO 140:REM REORDER APPTS.
170 IF EF% THEN EF%=0: GOSUB 9200:      REM SAVE TO DISK IF EDITED
180 GOTO 100
198 REM ************************************************************
199 REM SUBROUTINE FOR INPUT OF YEAR, MONTH AND DAY
200 HOME
210 INPUT"WHICH YEAR (EG. 1983) OR 0...";YR
220 IF YR=0 THEN 290
225 IF YR(1983 OR YR)1999 THEN 200
230 INPUT"WHICH MONTH (1-12) OR 0.....";F
240 IF F=0 THEN 290
250 IF (F(1 OR F)12) THEN 200
260 Y = YR: M = F: ND = FNND(Z)
270 PRINT"WHICH DAY ( 1-"ND").....";:INPUTFR(F)
280 IF (FR(F)(1 OR FR(F))ND) THEN 270
290 RETURN
498 REM ************************************************************
499 REM SUBROUTINE THAT DETERMINES DAY OF THE WEEK FROM DATE
500 Y = 1983: X = 0
509 REM UNTIL Y EQUALS CURRENT YEAR DO...
510     IF Y = YR THEN 550
520     X = X + 365 + ( Y/4=INT(Y/4) )
530     Y = Y + 1
540 GOTO 510
550 FOR MM=1 TO 12
560     ND = FNND(Z)
570     FOR D=1 TO ND
580         X = X + 1
590         IF MM=F AND D=FR(F) THEN MM=12: D=ND: X=X-1
600     NEXT D
610 NEXT MM
620 X = INT( (X/7 - INT(X/7) + .05)*7 )
630 RETURN
898 REM ************************************************************
899 REM SUBROUTINE TO SORT APPTS. BY TIME OF DAY
900 FOR I = 0 TO 7
910     FOR J = I+1 TO 8
```

Listing continued.

Listing continued.

```
920       IF T$(J) )= T$(I)    THEN 940
930             GOSUB 1050
940    NEXT J
950 NEXT I
959 REM RELOCATE ALL ENTRIES WITH BLANK TIMES AT END
960 FOR I=0 TO 7
970       IF T$(I)()"      " THEN 1010
980          FOR J=I+1 TO 8
990             IF T$(J)()"      " THEN GOSUB 1050: J=9
1000          NEXT J
1010 NEXT I
1020 RETURN
1048 REM ***************************************************
1049 REM SUBROUTINE TO SWAP APPTS POSITIONS
1050             T$ = T$(J): T$(J) = T$(I): T$(I) = T$
1060             T$ = A$(J): A$(J) = A$(I): A$(I) = T$
1070 RETURN
1098 REM ***************************************************
1099 REM SUBROUTINE TO DISPLAY CALENDAR PAGE
1100 HOME
1110 PRINT F$(F)"  "FR(F)",  "YR" - "D$(X)
1120 PRINT"-------------------------------------"
1130 FOR I=0 TO 8
1150    PRINT I".    "T$(I)" - "A$(I)
1160 NEXT I
1170 PRINT"-------------------------------------"
1180 RETURN
1198 REM ***************************************************
1199 REM SUBROUTINE TO EDIT APPOINTMENT CALENDAR
1200 PRINT"ENTER NUMBER OF ITEM TO EDIT."
1210 PRINT"       (ENTER X TO QUIT)";
1220 INPUT Z$
1230 Z = VAL(Z$)
1240 IF Z$="X" THEN 1340
1250 IF (Z<0 OR Z>8) OR (Z=0 AND Z$()"0") THEN 1200
1260 HOME
1270 EF% = 1
1280 PRINT"NEW ITEM:    TIME..."
1290 PRINT"(USE 24 HR CLOCK; ENTER AS HH.MM)"
1300 PRINT"                    =)       ";: INPUT T$(Z)
1310 IF LEN(T$(Z))=0 THEN T$(Z)="      "
1320 PRINT"              DESCR..  ----------------------"
1330 PRINT"                    =)   ";: INPUT A$(Z)
1340 RETURN
8998 REM ***************************************************
8999 REM SUBROUTINE TO RETRIEVE DATA FROM DISK
9000 FA = 0: GOSUB 9500
9010 GOSUB 9100
9020 RETURN
9099 REM ROUTINE TO UNPACK DATA FROM RECORD STRING FR$(F)
9100 FOR I=0 TO 8
9110    A$(I) = MID$( FR$(F), 25*I+1, 20 )
9120    T$(I) = MID$( FR$(F), 25*I+21, 5 )
9130 NEXT I
9140 IF MID$(FR$(F),226,5) = "12345" THEN 9160
9150       FOR I=0 TO 9: A$(I) = "": T$(I) = "      ": NEXT I
9160 RETURN
9198 REM ***************************************************
9199 REM SUBROUTINE TO STORE DATA ONTO DISK
9200 GOSUB 9300
9210 FA = 1: GOSUB 9500
9220 RETURN
9299 REM SUBROUTINE TO PACK DATA INTO RECORD STRING FR$(F)
9300 FR$(F) = ""
9310 FOR I=0 TO 8
9320    A$(I) = LEFT$( A$(I) + BL$, 20 ):  REM  BL$=25 BLANKS
9330    T$(I) = LEFT$( T$(I) + BL$, 5 )
9340    FR$(F) = FR$(F) + A$(I) + T$(I)
9350 NEXT I
9360 FR$(F) = FR$(F) + "12345"
9370 RETURN
9398 REM ***************************************************
9399 REM SUBROUTINE TO INITIALIZE PROGRAM FROM DATA
9400 READ F
9410 DIM F$(F), FR$(F), FL(F), FR(F)
9420 FOR I=1 TO F
9430      READ F$(I), FL(I)
9440 NEXT I
9450 D$ = CHR$(4)
9460 DB$(0) = "READ ": DB$(1)="WRITE "
9465 BR$="          ": REM 10 BLANKS
9466 BR$=BR$+BR$+BR$+BR$+BR$+BR$:BR$=BR$+BR$+BR$+BR$+BR$+"      ": REM 255 BLANKS
9470 RETURN
9498 REM ***************************************************
9499 REM SUBROUTINE FOR ACCESSING RANDOM ACCESS DISK FILES
9500 DA$ = D$ + "OPEN " + F$(F) + ",L" + STR$(FL(F))
9510 PRINT DA$
9515 ONERR GOTO 9580
9520 DA$ = D$ + DB$(FA) + F$(F) + ",R" + STR$(FR(F))
9530 PRINT DA$

9540 IF FA=0 THEN INPUT FR$(F)
9550 IF FA=1 THEN PRINT FR$(F)
9560 PRINT D$;"CLOSE"
9565 POKE 216,0
9570 RETURN
9579 REM ERROR HANDLING ROUTINE TO ESTABLISH NEW BLANK RECORD
9580 PRINT D$;"CLOSE": FA=1
9582 POKE 216,0
9585 FR$(F)= LEFT$(BR$,FL(F)-1)
```

Listing continued.

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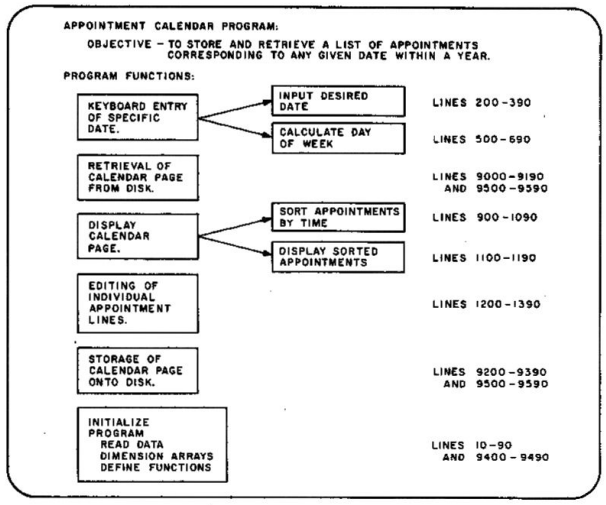


Figure 1. Functional modules for the Appointment Calendar program shown in Listing 4. Each module is represented in the program by a separate subroutine. The line numbers give the specific locations allotted for each subroutine.

Listing continued.

```
9590 GOSUB 9500
9595 GOTO 130
9598 REM ************************************************************
9599 REM RANDOM ACCESS FILE SPECS
9600 DATA 12
9610 DATA JANUARY, 256
9620 DATA FEBRUARY, 256
9630 DATA MARCH, 256
9640 DATA APRIL, 256
9650 DATA MAY, 256
9660 DATA JUNE, 256
9670 DATA JULY, 256
9680 DATA AUGUST, 256
9690 DATA SEPTMBER, 256
9700 DATA OCTOBER, 256
9710 DATA NOVEMBER, 256
9720 DATA DECEMBER, 256
9730 DATA SATURDAY, SUNDAY, MONDAY, TUESDAY
9740 DATA WEDNESDAY, THURSDAY, FRIDAY
```

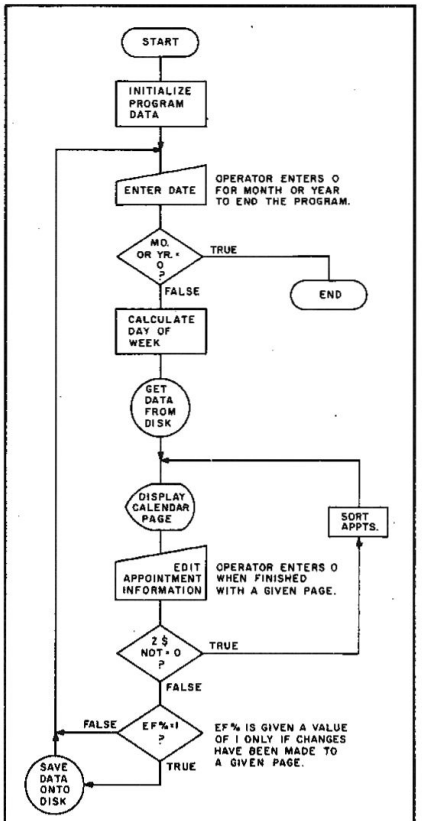


Figure 2. Flowchart for the main program module within the Appointment Calendar program of Listing 4. This flowchart covers only lines 100–180 and shows how the modules from Figure 1 are strung together to make a functioning program.

files. More commonly a separate subroutine would be needed for each file used.

To use the appointment calendar program, you must first call up the page that corresponds to the particular day you are interested in. This is done by providing the year (using all four digits), the month (a number between 1 and 12), and the day when you see the prompts for these items appear on the screen. The computer accounts for the different number of days in each month, including leap year February's. The computer will also calculate the correct day of the week from the above information, so long as the year is between 1983 and 1999. Since the year 2000 is not a leap year (even though is is divisible by 4), you will have to make a program modification to keep the program working properly after February 28, 2000.

With the year, month and date properly entered, the computer will display a calendar page with room for nine entries. The entry positions are numbered from 0 to 8 and you are asked to press a single digit (or the letter X) to quit. If you select blank line, the number you press is of no consequence, because the computer will automatically sort all of your entries according to the time of day (if you use a 24 hour clock!), placing entries having no time entry at the end. On the other hand, if you are changing an old entry, you must press the number that corresponds to that entry in order to write over it.

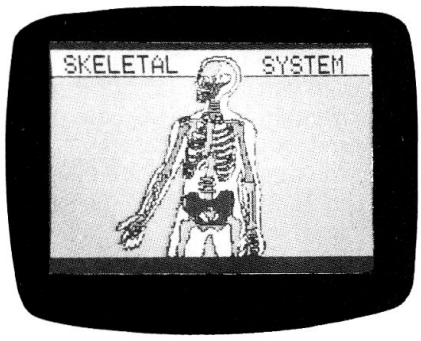
You are now asked to enter the time for the appointment. You may simply press the Return key if you are not entering a time. For instance, you may be entering simple information relating to the day, such as Wife's Birthday. On the other hand, if you are entering a time, be sure to use a 24 hour clock, and enter five characters. The first two must correspond to the hour, such as 09 or 15; the third character may be any allowed separator (colons and commas are not allowed—try a period, single quote, hyphen or slash). The last two characters correspond to the minutes.

Finally you will be asked to enter the description of the appointment. In order to get a full year on a single disk, with nine appointments for each day, the description must be brief. The computer will keep only the first 20 characters that you type in. When this entry is completed, the computer will sort your new entry into the calendar and redisplay the page with the appointments in their proper order. You may now enter another appointment or you may return to the date prompts by pressing the

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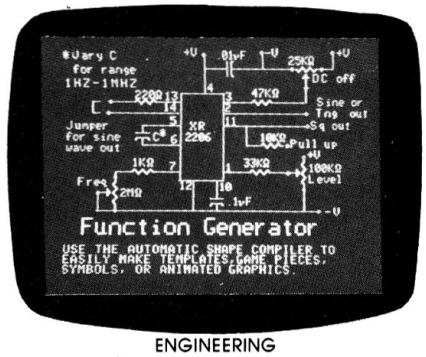


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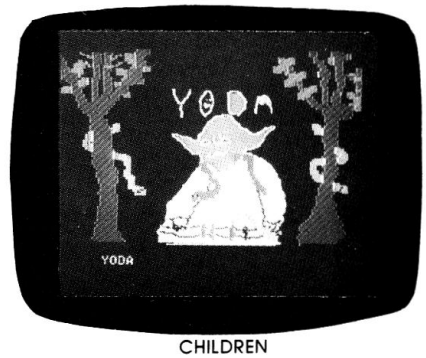




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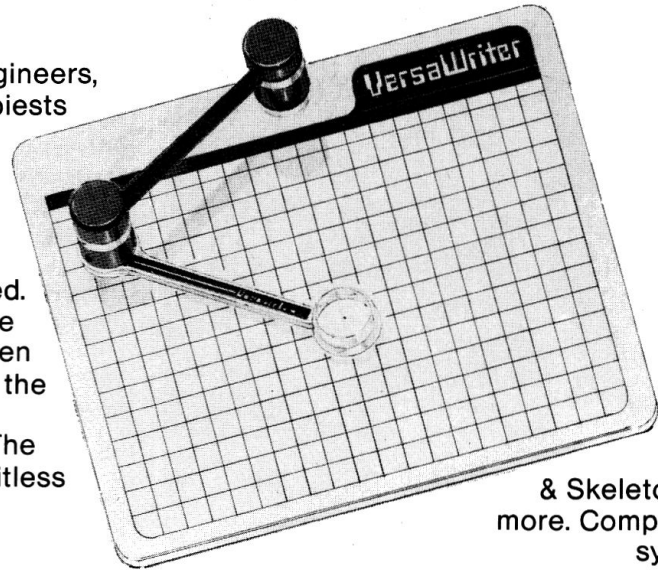


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letter X. To end the program, enter a zero for the year or for the month.

When you first enter a date that has not been used before, the computer will not find a record on the disk for that date. In that event it will write a blank record to disk and reinitialize the program. Type the date a second time and the blank calendar page will appear.

How the Program Works

Figure 1 shows the program analysis chart that depicts each of the functional elements within this program. This chart also lists the line numbers for each function's corresponding subroutine. By modularizing the various functions used by this program, the main program becomes a list of subroutine calls, as can be seen in lines 100–180 of Listing 4 and the flowchart in Figure 2.

The first thing the program does (line 10) is execute the subroutine at line 9400, which dimensions the arrays to be used by our file handler routine and which reads the Data elements that describe the files we are using to the computer. Additional Data elements to be used by the program must follow these file descriptors, as is shown by the names of the days of the week (lines 9730 and 9740), which are read next (lines 30–50). Line 20 dimensions A$, which will hold the descriptions of a single day's appointments, and T$, which holds the corresponding times.

The user-defined functions (lines 60–63) all work together to determine the number of days contained in a specified month for a specified year. After these functions have been defined, the main program begins execution at line 100 with a call to Subroutine 200. This subroutine handles the keyboard entry of the desired year, month and day for a given appointment book page.

Line 110 in the main program will end the program if the value entered for the year or for the month is 0. Otherwise, Subroutine 500 is executed, in which the day of the week that corresponds to the specified date is determined. This is done by calculating the number of days contained between January 1, 1983 (a Saturday), and the specified date. The variable X is returned from this subroutine with a value between 0 and 6, corresponding to a day between Saturday and Friday. Line 620 is essentially a "Modulo" operation.

The main program now tackles the problem of retrieving the desired calendar page from the disk. The values for F and FR(F) have been defined from the date entry subroutine. Thus a simple GOSUB 9000 handles the problem for us. If there have been no entries for this date yet, the error handling subroutine will insert a blank record for this date and restart the program. This clears the Gosub pointer stack. Consequently, in line 9595 of our disk file subroutine, the instruction to use is simply RUN.

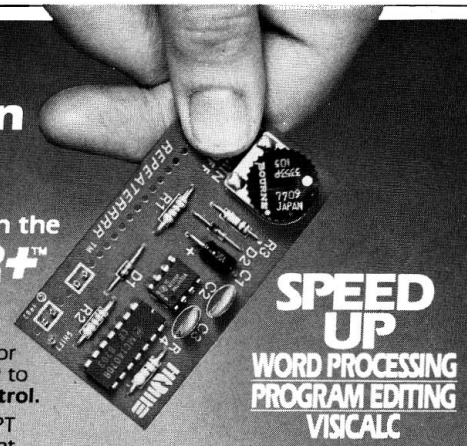
Once a record has been retrieved, then Subroutines 1100 and 1200 are executed in sequence (lines 140–150). Subroutine 1100 handles the display of the appointment calendar page, while Subroutine 1200 presents the user with the opportunity to update any of the fields being displayed. The flag variable, EF$, is used to indicate whether any changes have been made to the calendar. It is set to 1 if there have, and left at 0 if there have not. In either event, the program returns to the main program at line 160.

If Z$ is not an X after returning from Subroutine 1200, then the operator must still wish to work with that page. Subroutine 900 is executed, which simply sorts the entries in the appointment book by time and rearranges this order so that all entries with blanks for a time are placed at the end of the list. Then the main program cycles back to line 140 to redisplay the updated page and await

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further editing.

When the operator has indicated that no further use is needed for a given display (Z$ = "X"), then the main program executes line 170. If any changes have been made to that page (as evidenced by EF$ = 1), then the updated page is stored to disk using Subroutine 9200. If no changes have been made, the program merely cycles back to the date entry point to await instructions to call up another page from the calendar.

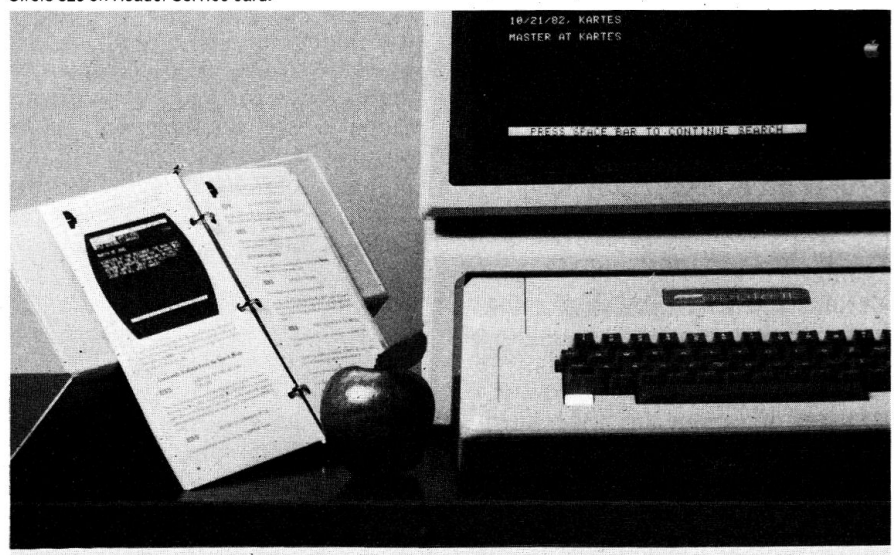
The only basic difference between the data packing and unpacking subroutines used in this program is that, since all 12 data files are using identical records, only one packing subroutine and one unpacking subroutine need be defined to be used for all values of F. In additon to this change, the final 5 bytes of each record, following the nine appointment entries, is the five-character field 12345. This field appears only in records that have had data written to them. A newly initiated record will not have this marker. Consequently, for these new records, all values for appointment descriptors and for times are set equal to blanks to remove any unwanted garbage that might have been brought in from the disk.

Conclusion

It goes without saying that any efficient use of disk files for applications that involve database management operations must ultimately involve random access file handling procedures. If you have avoided random access files merely because they appear to be more complicated than other methods, I hope that this article has served to alleviate those fears. In addition to improving efficiency, by formatting the data fields to specific field lengths (a procedure that is not actually required in Applesoft), you can design screen displays and printed documents more easily.

Next month I plan to begin working with graphics. I will cover some of the fundamental concepts in writing programs that use both low-resolution and high-resolution graphics displays. The following month I will describe a simplified approach to developing and handling shape tables that alleviates much of the drudgery involved when using the method outlined in the Applesoft manual. In the meantime, please write and share your ideas, comments and discoveries with me so that I can pass them on to other readers. The more liberal we become with sharing what we know, the more valuable this magazine becomes to each of us! ■

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The Assembly Advantage

by Randy Hyde

Speedy Integers

Last time I discussed how variables are defined in a SPEED/ASM program. One byte must be reserved for a character variable, two bytes for an integer variable, eight for a floating point variable, and (n + 2) bytes must be reserved for a string variable. Now I'll describe how to perform integer arithmetic using the SPEED/ASM package.

Before describing how to deal with integer values in SPEED/ASM, I think a brief review concerning the declaration of integer variables is in order. As I mentioned last time, SPEED/ASM integers require two bytes of storage in RAM memory. While there are many ways to reserve two bytes of storage for an integer, I prefer to define an integer variable using the ADR pseudo-opcode thus:

<name> ADR 0

where <name> is the variable name with which I wish to reference the integer value. For example, to declare the integer variables I, J and K, I would use the statements:

```
I ADR 0
J ADR 0
K ADR 0
```

Integers on the 6502 consist of two bytes; the first eight bits (byte) comprise the low order byte (L.O. byte) and the second eight bits of the integer comprise the high order byte (H.O. byte). A single byte can hold any numeric value in the range 0. . . 255. Two bytes (taken as an unsigned integer) can be used to represent values in the range 0. . . 65535. The SPEED/ASM package uses a modified form of the binary numbering system called the *two's complement* numbering system. A pure binary numbering system cannot be used to represent negative values so the use of the binary number system is quite restrictive. The two's complement number system divides the unsigned range in half and uses half of the possible values to represent the numbers 0. . . 32767 and the other half of the available values to represent numbers in the range –32768. . . –1. Since SPEED/ASM uses the same two's complement format employed by Basic, SPEED/ASM's numeric range (–32768. . . 32767) is the same as Basic's.

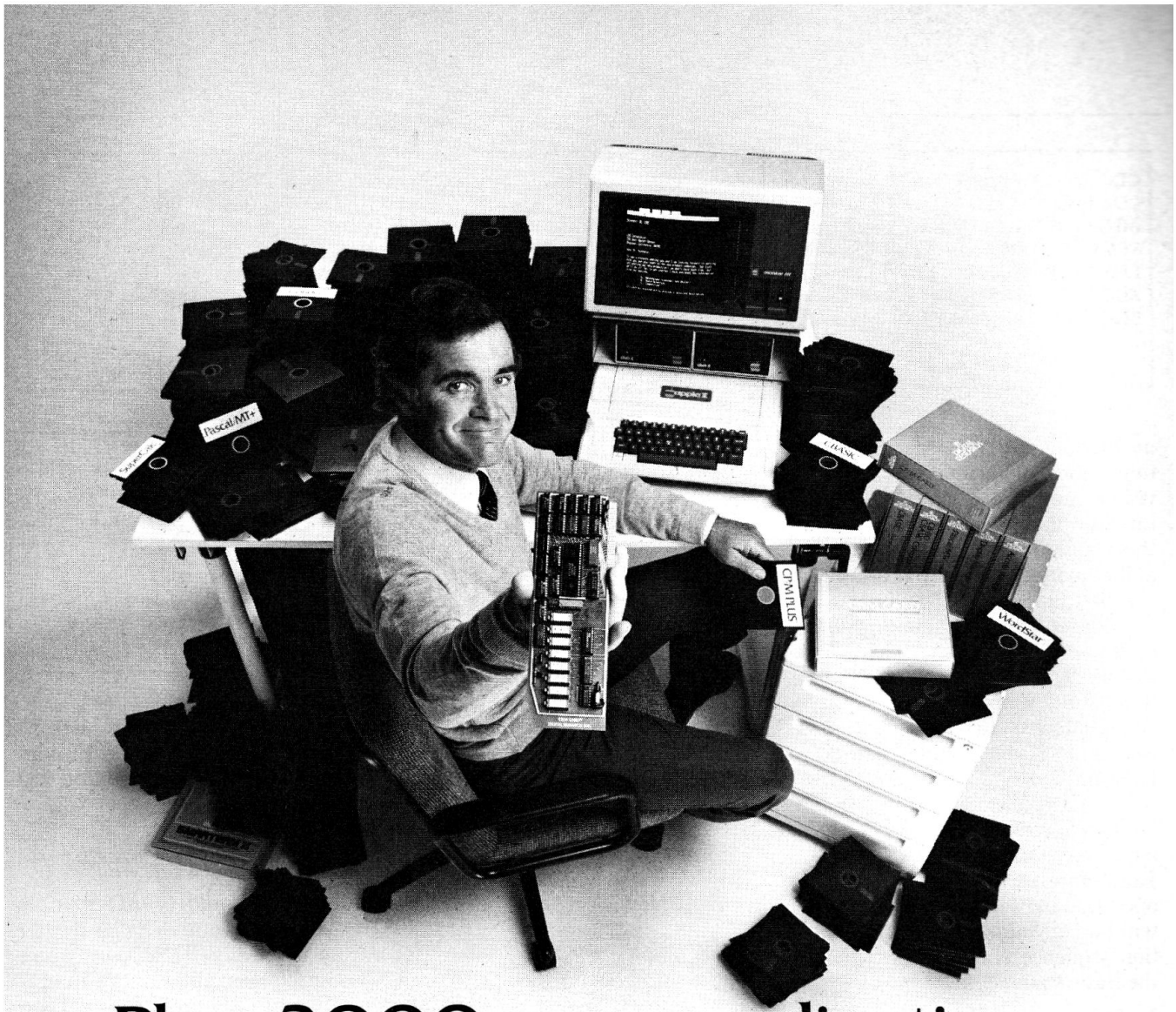
Always remember that SPEED/ASM variables must be defined *outside* the range of your code. That is, during the execution of your program the 6502 must never jump to or fall through to a variable location. The 6502 would extract the data at that location and attempt to execute it as a valid 6502 instruction—usually with undesirable results. A well written SPEED/ASM program will have its variable declarations at the end of the program, after the JMP EXIT instruction (or whatever other method you use to terminate program execution—see Part One of this series). A good format for your SPEED/ASM programs is shown in Example 1.

Once you've defined an integer variable, the next step is to manipulate the data it holds. There are essentially ten integer operations available to the SPEED/ASM programmer: loading a variable with a value, copying the contents of one integer variable to another, the absolute val-

```
;
;
; (Put the SPEED/ASM equates here)
;
EXIT    EQU     $FF69
;
;
        JSR     INIT        ;Always call INIT first.
;
;
; (Your SPEED/ASM program goes here)
;
;
        JMP     EXIT        ;Used to terminate the program
;
;
; Variable declarations go here, eg:
;
I       ADR     0
J       ADR     0
;
; etc.
;
        END                 ;Required by LISA for end of program.
```

Example 1.

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```
CLC         ;Always before an addition
LDA I       ;Add L.O. byte of I to the
ADC J       ;L.O. byte of J and
STA K       ;store sum in L.O. byte of K.
LDA I + 1   ;Add H.O. byte of I to the
ADC J + 1   ;H.O. byte of J and store the
STA K + 1   ;sum in the H.O. byte of K.
```

Example 2.

```
SEC         ;Carry must be set before a subtraction
LDA I       ;Subtract the L.O. byte of J from
SBC J       ;I and store the difference
STA K       ;into the L.O. byte of K.
LDA I + 1   ;Subtract the H.O. byte of J from
SBC J + 1   ;the H.O. byte of I and store the
STA K + 1   ;difference into the H.O. byte of K.
```

Example 3.

ue function (ABS), negation, addition, subtraction, multiplication, division, modulo (remainder) and the random number function. Beyond these computational capabilities, the ability to input and output integers is also desirable.

Addition and subtraction are handled so easily in 6502 machine code that SPEED/ASM doesn't include addition and subtraction routines. If you wanted to add I and J and store the sum in K you would use the code in Example 2.

The CLC (clear carry) instruction *absolutely must* precede the addition sequence. Failure to clear the carry flag before performing the addition operation may result in an intermittent bug in your program. This addition sequence is almost identical to the Basic statement:

```
K = I + J
```

To perform a subtraction in 6502 assembly language (or SPEED/ASM), use the sequence in Example 3. Note that the carry flag must be *set* (using the SEC instruction) before performing the subtract sequence. Failure to set the carry before performing a subtraction may yield unpredictable results. The subtraction sequence above is roughly equivalent to the Basic statement:

```
K = I - J
```

If you need to add a *constant* to an integer variable (instead of adding two integer variables together) the # and / operators can be used to specify constants in the 6502 operand field. The # is used to specify the L.O. byte of an integer constant and the / is used to specify the H.O. byte of an integer constant. If you wanted to add the constant 4369 to the integer variable I and leave the result in K you would use the code in Example 4.

```
CLC
LDA   I
ADC   #4369
STA   K
LDA   I + 1
ADC   /4369
STA   K +
```

Example 4.

This would produce the desired results. If you wanted to use a negative constant, LISA v2.5 requires that you preface the negative value with an exclamation mark. LISA v3.0 imposes no such restriction (see Example 5).

```
CLC
LDA   #!-5639
ADC   J
STA   K
LDA   /!-5639
ADC   J + 1
STA   K + 1
```

Example 5.

Testing for Overflow and Underflow

As I mentioned, the 6502 addition and subtraction operations are only rough approximations of the listed Basic statements. The difference between the assembly-language and Basic statements is in the way Basic checks for overflow or underflow. In Basic, if you attempt to add 32000 to 32000 you will get a ">32767" error. In assembly language you will end up with the value −1536 in variable K, and no error will be reported. When I was learning addition in grade school I was taught that 32000 + 32000 equals 64000, not −1536.

If you can live with a possible overflow or underflow, the above sequences should work just fine. If you need to report an error if overflow occurs, you must check the 6502 overflow flag after performing an addition or subtraction. After an addition or subtraction the 6502 overflow flag will be clear if the result is within range and set if it is out of range. The 6502 BVC (branch if overflow clear) and BVS branch if overflow set) instructions can be used to check for an overflow or underflow condition (see Example 6).

Initializing and Copying Integer Variables

The MOVE and LOAD routines are used to copy and initialize integer variables in a SPEED/ASM program. LOAD lets you initialize an integer variable with an integer constant and MOVE lets you copy the contents of one integer variable into another.

The LOAD command uses the calling sequence:

```
JSR     LOAD
ADR     <value>,<name>
```

This routine copies the two-byte integer <value> into the variable specified by <name>. For example, to load the value 3765 into the variable I you would use the statement:

```
JSR     LOAD
ADR     3765,I
```

To load a negative number into the variable LISA 2.5 users must preface the negative number with the exclamation point (!). To load −438 into the variable I you should use the statement(s):

```
JSR     LOAD
ADR     !-438,I
```

LISA 3.0 users should omit the exclamation mark. These two state-

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```
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;
            CLC
            LDA   I
            ADC   J
            STA   K
            LDA   I+1
            ADC   J+1
            STA   K+1
            BVC   GOODADD          ;If error then
            JSR   PRINT            ;print in error
            BYT   "Error >32767",CR,0   ;message and
            JMP   EXIT             ;quit the program.

GOODADD     ---                    ;Continue here if
            ---                    ;no overflow
            SEC
            LDA   I
            SBC   J
            STA   K
            LDA   I+1
            SBC   J+1
            STA   K+1
            BVC   GOODSUB
            JSR   PRINT
            BYT   "Error< -32768",CR,0
            JMP   EXIT

GOODSUB     ---
            ---
```

Example 6.

Listing 1. SPEED/ASM equate file.

```
08U0                1          TTL "SPEED/ASM Equates"
08U0                2  ;
08U0                3  ********************************
08U0                4  *                              *
08U0                5  *  LISTING ONE: SPEED/ASM equate *
08U0                6  *               file.          *
08U0                7  *                              *
08U0                8  ********************************
08U0                9  ;
08U0               10  ;
08U0               11  ; GENERAL PURPOSE EQUATES
08U0               12  ;
0000               13  FORASAV  EPZ 0
0001               14  FORXSAV  EPZ FORASAV+1
0002               15  FORYSAV  EPZ FORXSAV+1
0003               16  FORZPG   EPZ FORYSAV+1
0005               17  DESTADR  EPZ FORZPG+2
0007               18  PTRADR   EPZ DESTADR+2
0009               19  ISIMMED  EPZ PTRADR+2
000A               20  OP       EPZ ISIMMED+1
000C               21  MAXLEN   EPZ OP+2
000D               22  VALUE    EPZ MAXLEN+1
000F               23  DIGIT    EPZ VALUE+2
0010               24  LEAD0    EPZ DIGIT+1
0011               25  JMPADR   EPZ LEAD0+1
0013               26  COUNT    EPZ JMPADR+2
0014               27  GOTLN    EPZ COUNT+1
0015               28  LINEINDX EPZ GOTLN+1
0016               29  SIGN     EPZ LINEINDX+1
0017               30  ACL      EPZ SIGN+1
0018               31  ACH      EPZ ACL+1
0019               32  XTNDL    EPZ ACH+1
001A               33  XTNDH    EPZ XTNDL+1
001B               34  AUXL     EPZ XTNDH+1
001C               35  AUXH     EPZ AUXL+1
0800               36  ;
0033               37  PROMPT   EPZ $33
004E               38  RNDL     EPZ $4E
004F               39  RNDH     EPZ $4F
0100               40  STACK    EQU $100
0200               41  INPUT    EQU $200
0800               42  ;
0800               43  ;
```

Listing continued.

ments are comparable to the Basic statements:

I = 3765

and

I = – 438

respectively. Please note that the # and / operators are not required before the constant values. This is an unfortunate inconsistency, so you should take extra care to avoid either placing the # or / symbols here, or leaving the # and / symbols out of the operand field of the 6502 LDA or other arithmetic instruction. Remember, the LOAD routine is used to load a *constant* value into an integer variable. If you use a variable name as the first operand to the LOAD routine, the *address* of that variable, not its current contents, will be loaded into the destination variable.

The MOVE routine copies the *contents* of one integer variable into another. The MOVE command uses the syntax:

```
JSR     MOVE
ADR     <name1>,<name2>
```

MOVE copies the contents of <name1> *into* <name2>. So if you wanted to copy the contents of variable J into variable I you would use the statement:

```
JSR     MOVE
ADR     J,I
```

This is comparable to the Basic statement:

I = J

Always remember that MOVE copies the *contents* of an integer variable into another variable. If you use a constant as the first operand (or second operand for that matter), MOVE will simply go to the address in memory specified by that constant, get the two bytes, and store them into the destination variable.

I should point out that SPEED/ASM does very little type and range checking. MOVE and LOAD simply move values around. They don't care if you're actually dealing with integer variables. They store two bytes into the address you specify regardless of whether the variable is a character, integer, floating point, string var-

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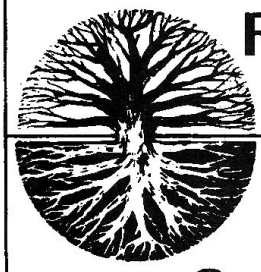
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Listing continued.

```
0000            44  FALSE    EQU 0
0001            45  TRUE     EQU 1
008D            46  CR       EQU $8D
0800            47  ;
0800            48  ;
0800            49  ; "IF" STATEMENT EQUATES
0800            50  ;
00BD            51  EQ       EQU "="
00A3            52  NE       EQU "#"
00BE            53  GT       EQU ">"
00BC            54  LT       EQU "<"
BDBE            55  GE       EQU ">"|"="*256
BDBC            56  LE       EQU "<"|"="*256
0800            57  ;
0800            58  ;
0800            59  ;
0800            60  ;
0800            61  ;
0800            62  ;
0800            63  ;
0800            64  ; SPEED/ASM ENTRY POINTS
0800            65  ;
0800            66  ;
0800            67  ;
0800            68  ; NOTE: THE EQUATE OF PUTC MUST
0800            69  ; BE CHANGED IF YOU RELOCATE
0800            70  ; SPEED/ASM TO SOME LOCATION
0800            71  ; OTHER THAN $7800
0800            72  ;
7800            73  PUTC     EQU $7800
7803            74  GETC     EQU PUTC+3
7806            75  SAGL     EQU GETC+3          ;FOR USE BY S/A ONLY- SEE DOC.
7809            76  SAPC     EQU SAGL+3          ; "   "   "  "   "    "   "
780C            77  HOME     EQU SAPC+3          ;HOME AND CLEAR
780F            78  READLN   EQU HOME+3
7812            79  INIT     EQU READLN+3
7815            80  FOR      EQU INIT+3
7818            81  FOR0     EQU FOR+3
781B            82  NEXT     EQU FOR0+3
781E            83  IFI      EQU NEXT+3
7821            84  IFI0     EQU IFI+3
7824            85  IFS      EQU IFI0+3
7827            86  IFS0     EQU IFS+3
782A            87  MOVE     EQU IFS0+3
782D            88  LOAD     EQU MOVE+3
7830            89  MOVS     EQU LOAD+3
7833            90  LDSTR    EQU MOVS+3
7836            91  PRINT    EQU LDSTR+3
7839            92  PRTSTR   EQU PRINT+3
783C            93  PRTINT   EQU PRTSTR+3
783F            94  RDSTR    EQU PRTINT+3
7842            95  RDINT    EQU RDSTR+3
7845            96  ONXGOTO  EQU RDINT+3
7848            97  CASE     EQU ONXGOTO+3
784B            98  CASEI    EQU CASE+3
784E            99  INSET    EQU CASEI+3
7851           100  NOTINSET EQU INSET+3
7854           101  ABS      EQU NOTINSET+3
7857           102  NEG      EQU ABS+3
785A           103  MUL      EQU NEG+3
785D           104  DIV      EQU MUL+3
7860           105  MOD      EQU DIV+3
7863           106  RND      EQU MOD+3
7866           107  SUBSTR   EQU RND+3
7869           108  INDEX    EQU SUBSTR+3
786C           109  LENGTH   EQU INDEX+3
786F           110  CONCAT   EQU LENGTH+3
7872           111  GETWZPG  EQU CONCAT+3        ;USED BY SPEED/ASM
7875           112  RDFP     EQU GETWZPG+3
7878           113  PRTE     EQU RDFP+3
787B           114  PRTF     EQU PRTE+3
787E           115  FADD     EQU PRTF+3
7881           116  FSUB     EQU FADD+3
7884           117  FMUL     EQU FSUB+3
7887           118  FDIV     EQU FMUL+3
788A           119  FLT      EQU FDIV+3
788D           120  FIX      EQU FLT+3
7890           121  FNEG     EQU FIX+3
7893           122  FADDIN   EQU FNEG+3
7896           123  FSUBIN   EQU FADDIN+3
7899           124  FTIMES   EQU FSUBIN+3
789C           125  FINTO    EQU FTIMES+3
789F           126  IFF      EQU FINTO+3
78A2           127  MOVFP    EQU IFF+3
0800           128  ;
0800           129          END
```

Listing continued.

iable, or even a 6502 instruction. Therefore you should take care that the destination operand of the LOAD routine and both operands of the MOVE routine are the names of properly defined integer variables in your program.

The Absolute Value and Negation Routines

SPEED/ASM provides two routines for negating and calculating the absolute value of an integer variable. The ABS routine (see Listing 1 for the equate for ABS) is invoked using the calling sequence:

```
JSR     ABS
ADR     <name>
```

This routine will take the variable whose name appears after the ADR pseudo-opcode, compute its absolute value, and store the absolute value back into the variable. This routine performs the same function as the Basic statement:

```
I = ABS(I)
```

Upon return from the ABS routine the overflow flag will be clear if the absolute value function was performed properly. If the user attempted to take the absolute value of −32768 (an error condition) then the overflow flag will be returned set. You can use the BVC and BVS instructions to test for this error condition.

The SPEED/ASM negate routine is used like the ABS routine; the only difference is that the sign is inverted with the negate routine instead of always returning a positive value (as with the ABS function). If the integer variable was negative, the NEG routine will make it positive. If the variable was positive, NEG will make it negative. NEG uses the calling sequence:

```
JSR     NEG
ADR     <name>
```

and is equivalent to the Basic statement:

```
I = -I
```

Since ABS and NEG operate on the variable *in place*, you may want to use the MOVE routine to copy the variable into another location before

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Listing continued.

```
SYMBOL TABLE SORTED ALPHABETICALLY

ABS      7854  ACH      0018  ACL      0017  AUXH     001C  AUXL     001B
CASE     7848  CASEI    784B  CONCAT   786F  COUNT    0013  CR       008D
DESTADR  0005  DIGIT    000F  DIV      785D  EQ       00BD  FADD     787E
FADDTN   7893  FALSE    0000  FDIV     7887  FINTO    789C  FIX      788D
FLT      788A  FMUL     7884  FNEG     7890  FOR      7815  FOR0     7818
FORASAV  0000  FORXSAV  0001  FORYSAV  0002  FORZPG   0003  FSUB     7881
FSUBTN   7896  FTIMES   7899  GE       BDBE  GETC     7803  GETWZPG  7872
GOTLN    0014  GT       00BE  HOME     780C  IFF      789F  IFI      781E
IFI0     7821  IFS      7824  IFS0     7827  INDEX    7869  INIT     7812
INPUT    0200  INSET    784E  ISIMMED  0009  JMPADR   0011  LDSTR    7833
LE       BDBC  LEAD0    0010  LENGTH   786C  LINEINDX 0015  LOAD     782D
LT       00BC  MAXLEN   000C  MOD      7860  MOVE     782A  MOVFP    78A2
MOVS     7830  MUL      785A  NE       00A3  NEG      7857  NEXT     781B
NOTINSET 7851  ONXGOTO  7845  OP       000A  PRINT    7836  PROMPT   0033
PRTE     7878  PRTF     787B  PRTINT   783C  PRTSTR   7839  PTRADR   0007
PUTC     7800  RDFP     7875  RDINT    7842  RDSTR    783F  READLN   780F
RND      7863  RNDH     004F  RNDL     004E  SAGL     7806  SAPC     7809
SIGN     0016  STACK    0100  SUBSTR   7866  TRUE     0001  VALUE    000D
XTNDH    001A  XTNDL    0019

SYMBOL TABLE SORTED BY ADDRESS

FORASAV  0000  FALSE    0000  TRUE     0001  FORXSAV  0001  FORYSAV  0002
FORZPG   0003  DESTADR  0005  PTRADR   0007  ISIMMED  0009  OP       000A
MAXLEN   000C  VALUE    000D  DIGIT    000F  LEAD0    0010  JMPADR   0011
COUNT    0013  GOTLN    0014  LINEINDX 0015  SIGN     0016  ACL      0017
ACH      0018  XTNDL    0019  XTNDH    001A  AUXL     001B  AUXH     001C
PROMPT   0033  RNDL     004E  RNDH     004F  CR       008D  NE       00A3
LT       00BC  EQ       00BD  GT       00BE  STACK    0100  INPUT    0200
PUTC     7800  GETC     7803  SAGL     7806  SAPC     7809  HOME     780C
READLN   780F  INIT     7812  FOR      7815  FOR0     7818  NEXT     781B
IFI      781E  IFI0     7821  IFS      7824  IFS0     7827  MOVE     782A
LOAD     782D  MOVS     7830  LDSTR    7833  PRINT    7836  PRTSTR   7839
PRTINT   783C  RDSTR    783F  RDINT    7842  ONXGOTO  7845  CASE     7848
CASEI    784B  INSET    784E  NOTINSET 7851  ABS      7854  NEG      7857
MUL      785A  DIV      785D  MOD      7860  RND      7863  SUBSTR   7866
INDEX    7869  LENGTH   786C  CONCAT   786F  GETWZPG  7872  RDFP     7875
PRTE     7878  PRTF     787B  FADD     787E  FSUB     7881  FMUL     7884
FDIV     7887  FLT      788A  FIX      788D  FNEG     7890  FADDTN   7893
FSUBTN   7896  FTIMES   7899  FINTO    789C  IFF      789F  MOVFP    78A2
LE       BDBC  GE       BDBE
```

```
TEMP = (Y MOD Z)
TEMP = TEMP * X
TEMP = TEMP + 2
TEMP = X/TEMP
TEMP1 = J + 3
TEMP = TEMP1 * TEMP
I = TEMP - 55
```

Example 7.

calling the ABS or NEG routines. For instance, if you wanted to perform the Basic instruction,

I = ABS(J)

using the SPEED/ASM statements,

```
JSR     ABS
ADR     J
JSR     MOVE
ADR     J,I
```

does not perform the same operation. It leaves the absolute value of J in both I and J. While in this simple example I easily could have moved the data into I and then taken the absolute value of I, this would be impossible in more complex situations. To handle situations like this, simply move J into some temporary location, take the absolute value of that location, then operate on the data in this temporary location as you wish.

The Multiplication, Division and Modulo Functions

The 6502 doesn't support the multiplication, division and modulo (remainder) operations within its instruction set. To make up for the lack of these instructions in the 6502 instruction set, the SPEED/ASM package provides three routines to perform these operations for you: The MUL, DIV and MOD routines. All three routines use the same format and calling sequence. The calling sequence is:

```
JSR  MUL      ;Or DIV Or MOD
ADR  <IVAR1>,<IVAR2>,<IVAR3>
```

```
JSR     MOD
ADR     Y,Z,TEMP

JSR     MUL
ADR     TEMP,X,TEMP

CLC
LDA     TEMP
ADC     #2
STA     TEMP
LDA     TEMP + 1
ADC     /2
STA     TEMP + 1

JSR     DIV
ADR     X,TEMP,TEMP

CLC
LDA     J
ADC     #3
STA     TEMP1
LDA     J + 1
ADC     /3
STA     TEMP1 + 1

JSR     MUL
ADR     TEMP,TEMP1, TEMP

SEC
LDA     TEMP
SBC     #55
STA     I
LDA     TEMP + 1
SBC     /55
STA     I + 1
```

Example 8.

This performs the operation:

"<IVAR3> = <IVAR1> * <IVAR2>"

If the division or modulo operation is called, then the operation performed is

"<IVAR3> = <IVAR1>/<IVAR2>"

or

"<IVAR3> = <IVAR1>MOD<IVAR2>"

The 6502 overflow flag is returned set if overflow occurred while performing a multiplication or if a division by zero occurred during the execution of the DIV or MOD routines. Unless you are quite sure that overflow or underflow will not occur, you should always follow a call to MUL, DIV or MOD with a BVC or BVS instruction to test the validity of the result.

Converting Complex Equations to The SPEED/ASM Format

The arithmetic routines (with the exception of the ABS and NEG routines) all require exactly *three* parameters. Basic, on the other hand, allows a rich variety of operations within a single statement. In Basic you could type:

```
I = (J+3)*(X/(2+X*(Y MOD Z))) - 55
```

Such a statement *cannot* be translated to a single statement in SPEED/ASM. Rather, the statement is broken down into the sequence of binary operations that make up this equation and the individual operations are handled by calls to SPEED/ASM routines. The previous equation would be broken down to the operations given in Example 7. This code would be converted to the SPEED/ASM statements in Example 8. For purposes of clarity, the tests for overflow were omitted from this code. But it should help demonstrate how you translate a Basic expression into a sequence of SPEED/ASM routine calls.

The Random Number Function RND

The SPEED/ASM package provides a function that returns a random number every time it's called. The calling sequence is:

```
JSR   RND
ADR   <IVAR>
```

When ever RND is called it stuffs a pseudo-random number in the range 0...32767 and stores it in the variable that follows the JSR. If you wish to generate a random number in the range 0...n then call the random number generator and use the MOD routine. For example, to get a number in the range 0...25 you should use the code given in Example 9.

```
JSR     LOAD
ADR     26,TEMP
JSR     RND
ADR     RNDVAL
JSR     MOD
ADR     RNDVAL,TEMP,RNDVAL
```

Example 9.

Note that the mod of RNDVAL and 26 was taken. This produces a value in the range of 0...25.

Performing I/O in SPEED/ASM

Before discussing integer I/O in SPEED/ASM, I should first introduce character I/O, since numeric I/O is dependent upon character I/O. Five routines are associated with character I/O in SPEED/ASM: GETC, PUTC, READLN, HOME and INIT.

The INIT routine, as I've already mentioned, *must* be called before calling any SPEED/ASM routines. In

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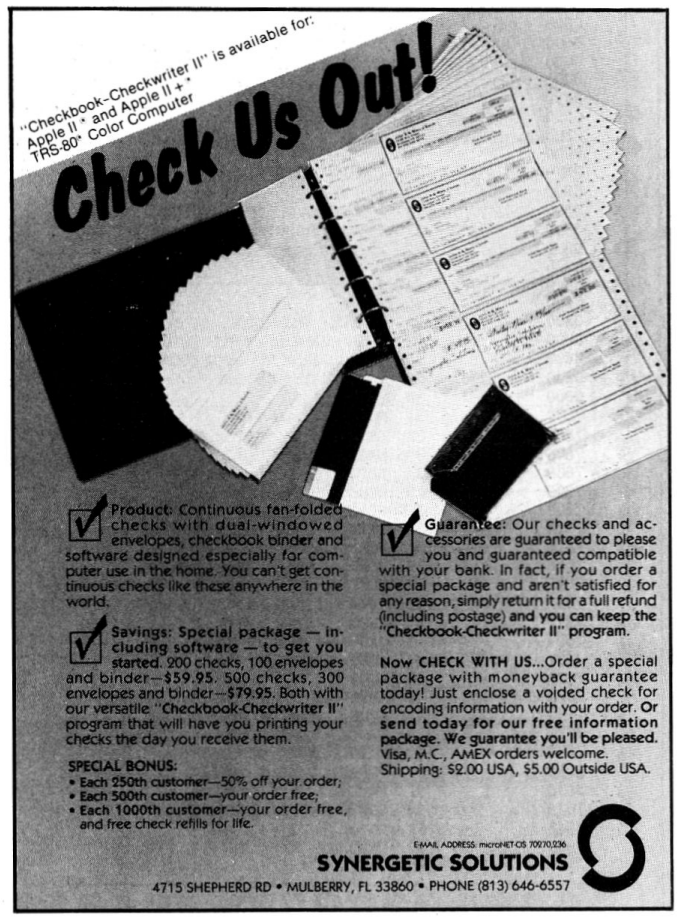
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```
ENTRNUM     JSR     READLN
            JSR     RDINT
            ADR     J
            BVC     GOODNUM
;
            CMP     #0
            BEQ     BADNUM
            BMI     RANGERR
;
;Must be one at this point
;
BADNUM      JSR     PRINT
            BYT     "Bad character in number, re-enter",CR,0
            JMP     ENTRNUM
;
RANGERR     JSR     PRINT
            BYT     "Value out of range, re-enter",CR,0
            JMP     ENTRNUM
;
;
GOODNUM     ---     ;Continue processing here
```

Example 10.

Listing 2. SPEED/ASM demo program.

```
08U0              1          TTL "SPEED/ASM Demo"
08U0              2 ;
08U0              3 ***********************************
08U0              4 *                                 *
08U0              5 *  Listing Two: SPEED/ASM demo    *
08U0              6 *               program.          *
08U0              7 *                                 *
08U0              8 ***********************************
08U0              9 ;
08U0             10 ;
08U0             11 ;
0000             12 FALSE    EQU 0
0001             13 TRUE     EQU 1
008D             14 CR       EQU $8D
08U0             15 ;
08U0             16 ;
08U0             17 ;
08U0             18 ;
08U0             19 ;
08U0             20 ; SPEED/ASM ENTRY POINTS
08U0             21 ; (Only the equates necessary for
08U0             22 ;  this demo are included.)
08U0             23 ;
08U0             24 ;
08U0             25 ;
08U0             26 ; NOTE: THE EQUATE OF PUTC MUST
08U0             27 ; BE CHANGED IF YOU RELOCATE
08U0             28 ; SPEED/ASM TO SOME LOCATION
08U0             29 ; OTHER THAN $7800
08U0             30 ;
7800             31 PUTC     EQU $7800
7803             32 GETC     EQU PUTC+3
7806             33 SAGL     EQU GETC+3          ;FOR USE BY S/A ONLY- SEE DOC.
7809             34 SAPC     EQU SAGL+3          ; "   "   "   "   "   "   "
780C             35 HOME     EQU SAPC+3          ;HOME AND CLEAR
780F             36 READLN   EQU HOME+3
7812             37 INIT     EQU READLN+3
7815             38 FOR      EQU INIT+3
7818             39 FOR0     EQU FOR+3
781B             40 NEXT     EQU FOR0+3
781E             41 IFI      EQU NEXT+3
7821             42 IFI0     EQU IFI+3
7824             43 IFS      EQU IFI0+3
782/             44 IFS0     EQU IFS+3
782A             45 MOVE     EQU IFS0+3
782D             46 LOAD     EQU MOVE+3
7830             47 MOVS     EQU LOAD+3
7833             48 LDSTR    EQU MOVS+3
7836             49 PRINT    EQU LDSTR+3
7839             50 PRTSTR   EQU PRINT+3
783C             51 PRTINT   EQU PRTSTR+3
783F             52 RDSTR    EQU PRTINT+3
7842             53 RDINT    EQU RDSTR+3
7845             54 ONXGOTO  EQU RDINT+3
```

Listing continued.

particular it must be called before performing any I/O routines since several pointers and counters used by the I/O package are initialized by INIT. Failing to call INIT before performing an I/O operation may result in garbled data.

HOME is used to clear the screen and position the cursor in the upper left corner. This routine is included in the SPEED/ASM package to obtain a certain amount of machine independence. By placing this jump in the SPEED/ASM code (instead of the user program), it will have to be changed in only one location if you want to move the program to a computer other than the Apple II. Versions of SPEED/ASM will eventually be available for the Atari, PET, VIC and other 6502 computers, allowing you to easily move a program from one computer to another. HOME's purpose is to help minimize the machine dependent code.

All input from the system console is handled *line by line.* Any time you read a character, number or string from the keyboard, the SPEED/ASM routines will read the data from the current line input buffer. If the buffer is empty, the user is prompted to enter a new line from the keyboard. This works fine until you prompt the user for some input (expecting him to enter a new line from the keyboard) and the SPEED/ASM package uses the last few characters on the previous line as the input. To insure that the next input performed takes its data from the beginning of a new input line, you should call the READLN (read a line) routine to force the user to enter a new line of data. READLN will wait until the user types in a complete line of text and then it will continue execution with the next statement following the call to the READLN routine.

The GETC routine reads a single character from the current line buffer and returns it in the 6502 accumulator. If the line buffer is empty, a new line is read from the keyboard and GETC returns the first character on that line. I must point out that if there are characters in the input line buffer the keyboard *will not* be read.

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Listing continued.

```
7848                    55  CASE      EQU ONXGOTO+3
784B                    56  CASEI     EQU CASE+3
784E                    57  INSET     EQU CASEI+3
7851                    58  NOTINSET  EQU INSET+3
7854                    59  ABS       EQU NOTINSET+3
7857                    60  NEG       EQU ABS+3
785A                    61  MUL       EQU NEG+3
785D                    62  DIV       EQU MUL+3
7860                    63  MOD       EQU DIV+3
7863                    64  RND       EQU MOD+3
0800                    65  ;
0800                    66  ;
0800                    67  ;
0800                    68  ; Apple monitor equates:
0800                    69  ;
FF69                    70  EXIT      EQU $FF69          ;Address to quit S/A.
0800                    71  ;
0800                    72  ;
0800                    73  ;
0800                    74  ************************************
0800                    75  ;
0800                    76  ;
0800                    77  ; NOTE: INIT must be called before
0800                    78  ; any other SPEED/ASM routine.
0800                    79  ;
0800 20 12 78           80  START     JSR INIT
0803                    81  ;
0803                    82  ;
0803                    83  ; The following code loads 10 into
0803                    84  ; "I" and 54 into "J" then computes
0803                    85  ; their sum, difference, product,
0803                    86  ; quotient, and remainder.
0803                    87  ;
0803 20 2D 78           88          JSR LOAD
0806 0A 00 12           89          ADR 10,I
0809 0B
080A 20 2D 78           90          JSR LOAD
080D 36 00 14           91          ADR 54,J
0810 0B
0811                    92  ;
0811                    93  ; Compute the sum:
0811                    94  ;
0811 18                 95  LOOP      CLC                ;Always CLC before an addition.
0812 AD 12 0B           96          LDA I
0815 6D 14 0B           97          ADC J
0818 8D 16 0B           98          STA SUM
081B AD 13 0B           99          LDA I+1
081E 6D 15 0B          100          ADC J+1
0821 8D 17 0B          101          STA SUM+1
0824 70 69             102          BVS OVERFLOW       ;Check for >32767.
0826                   103  ;
0826                   104  ; Calculate the difference:
0826                   105  ;
0826 38                106          SEC                ;Always SEC before a subtraction
0827 AD 12 0B          107          LDA I
082A ED 14 0B          108          SBC J
082D 8D 1C 0B          109          STA DIFFRNCE
0830 AD 13 0B          110          LDA I+1
0833 ED 15 0B          111          SBC J+1
0836 8D 1D 0B          112          STA DIFFRNCE+1
0839 70 54             113          BVS OVERFLOW
083B                   114  ;
083B                   115  ; Calculate the product:
083B                   116  ;
083B 20 5A 78          117          JSR MUL
083E 12 0B 14          118          ADR I,J,PRODUCT
0841 0B 18 0B
0844 70 49             119          BVS OVERFLOW
0846                   120  ;
0846                   121  ; Calculate the quotient
0846                   122  ;
0846 20 5D 78          123          JSR DIV
0849 14 0B 12          124          ADR J,I,QUOTIENT   ;J/I, not I/J
084C 0B 1A 0B
084F 70 3E             125          BVS OVERFLOW
0851                   126  ;
0851                   127  ; Calculate the remainder
0851                   128  ;
0851 20 60 78          129          JSR MOD
0854 14 0B 12          130          ADR J,I,REMANDR
0857 0B 1E 0B
085A 70 33             131          BVS OVERFLOW
085C                   132  ;
085C                   133  ;
085C                   134  ; Generate a couple of random numbers
085C                   135  ;
085C 20 63 78          136          JSR RND
085F 20 0B             137          ADR RANDOM1
0861 20 54 78          138          JSR ABS
0864 20 0B             139          ADR RANDOM1
0866 70 27             140          BVS OVERFLOW
0868                   141  ;
0868 20 63 78          142          JSR RND
```

Listing continued.

Instead, the next available character in the input buffer will be returned in the 6502 accumulator. If you need to read the character from the keyboard, always call READLN before calling GETC.

The final character I/O routine is the PUTC routine. PUTC takes the character in the 6502 accumulator and outputs it to the console screen. One nice feature of the PUTC routine is that it will automatically convert lowercase to uppercase if the end user of your program cannot display lowercase on his Apple. If your system has a lowercase adapter, like the Lazer MicroSystems' Lower Case + Plus and Keyboard + Plus modules, then you can write your SPEED/ASM programs using easy-to-read lowercase without having to worry about incompatibility problems.

The READLN, GETC and PUTC routines are *primitive* routines. All other I/O routines can be synthesized from these three subprograms. When I talk about character operations we'll return to the discussion of the GETC and PUTC routines.

Using PRINT to Print String Literals

I've already used the SPEED/ASM PRINT routine in several examples. A formal definition of the PRINT routine will help explain its use in your SPEED/ASM programs.

The PRINT routine is used to print a sequence of ASCII characters to the Apple's video screen. This routine prints every character following the JSR PRINT instruction up to, but not including, a zero terminating byte. Upon encountering a zero byte, the PRINT routine terminates output, and control is returned to the 6502 instruction that follows the zero byte.

PRINT is useful for printing messages, prompts and other string literal output. PRINT does not automatically eject a carriage return after the string is printed. If you wish to output a carriage return you must explicitly include the ASCII code for the carriage return in your output string; i.e.,

```
JSR   PRINT
BYT   "STRING followed by Return",CR,0
```

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Listing continued.

```
086B 22 0B      143           ADR RANDOM2
086D 20 54 78   144           JSR ABS
0870 22 0B      145           ADR RANDOM2
0872 70 1B      146           BVS OVERFLOW
0874 20 5/ 78   147           JSR NEG
0877 22 0B      148           ADR RANDOM2
0879 70 14      149           BVS OVERFLOW
087B            150 ;
087B 20 63 78   151           JSR RND
087E 24 0B      152           ADR RANDOM3
0880 20 57 78   153           JSR NEG
0883 24 0B      154           ADR RANDOM3
0885 70 08      155           BVS OVERFLOW
0887            156 ;
0887 20 63 78   157           JSR RND
088A 26 0B      158           ADR RANDOM4
088C 4C A9 08   159           JMP PRINUMS
088F            160 ;
088F 20 36 78   161 OVERFLOW  JSR PRINT
0892 8D 8D CF   162           BYT CR,CR,"Overflow occured",CR,0
0895 F6 E5 F2
0898 E6 EC EF
089B F7 A0 EF
089E E3 E3 F5
08A1 F2 E5 E4
08A4 8D 00
08A6 4C 69 FF   163           JMP EXIT
08A9            164 ;
08A9            165 ;
08A9            166 ;
08A9            167 ; Print the sum:
08A9            168 ;
08A9 20 36 78   169 PRINUMS   JSR PRINT
08AC C9 BD A0   170           BYT "I= ",0
08AF 00
08B0 20 3C 78   171           JSR PRTINT
08B3 12 0B      172           ADR I
08B5 20 36 78   173           JSR PRINT
08B8 8D CA BD   174           BYT CR,"J= ",0
08BB A0 00
08BD 20 3C 78   175           JSR PRTINT
08C0 14 0B      176           ADR J
08C2            177 ;
08C2 20 36 78   178           JSR PRINT
08C5 8D D4 E8   179           BYT CR,"The sum is ",0
08C8 E5 A0 F3
08CB F5 ED A0
08CE E9 F3 A0
08D1 00
08D2 20 3C 78   180           JSR PRTINT
08D5 16 0B      181           ADR SUM
08D7            182 ;
08D7            183 ; Print the difference:
08D7            184 ;
08D7 20 36 78   185           JSR PRINT
08DA 8D D4 E8   186           BYT CR,"The difference (I-J) is ",0
08DD E5 A0 E4
08E0 E9 E6 E6
08E3 E5 F2 E5
08E6 EE E3 E5
08E9 A0 A8 C9
08EC AD CA A9
08EF A0 E9 F3
08F2 A0 00
08F4 20 3C 78   187           JSR PRTINT
08F7 1C 0B      188           ADR DIFFRNCE
08F9            189 ;
08F9            190 ; Print the product:
08F9            191 ;
08F9 20 36 78   192           JSR PRINT
08FC 8D D4 E8   193           BYT CR,"The product is ",0
08FF E5 A0 F0
0902 F2 EF E4
0905 F5 E3 F4
0908 A0 E9 F3
090B A0 00
090D 20 3C 78   194           JSR PRTINT
0910 18 0B      195           ADR PRODUCT
0912            196 ;
0912            197 ; Print the quotient
0912            198 ;
0912 20 36 78   199           JSR PRINT
0915 8D D4 E8   200           BYT CR,"The quotient (J/I) is ",0
```

Listing continued.

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Listing continued.

```
0918 E5 A0 F1
091B F5 EF F4
091E E9 E5 EE
0921 F4 A0 A8
0924 CA AF C9
0927 A9 A0 E9
092A 00
092D 20 3C 78   201          JSR PRTINT
0930 1A 0B      202          ADR QUOTIENT
0932            203  ;
0932            204  ; Print the remainder:
0932            205  ;
0932 20 36 78   206          JSR PRINT
0935 8D D4 E8   207          BYT CR,"The remainder (J mod I) is ",0
0938 E5 A0 F2
093B E5 ED E1
093E E9 EE E4
0941 E5 F2 A0
0944 A8 CA A0
0947 ED EF E4
094A A0 C9 A9
094D A0 E9 F3
0950 A0 00
0952 20 3C 78   208          JSR PRTINT
0955 1E 0B      209          ADR REMANDR
0957            210  ;
0957            211  ; Print the random numbers:
0957            212  ;
0957 20 36 78   213          JSR PRINT
095A 8D D4 E8   214          BYT CR,"The random numbers are:"
095D E5 A0 F2
0960 E1 EE E4
0963 EF ED A0
0966 EE F5 ED
0969 E2 E5 F2
096C F3 A0 E1
096F F2 E5 BA
0972 8D D2 E1   215          BYT CR,"Random1: ",0
0975 EE E4 EF
0978 ED B1 BA
097B A0 00
097D 20 3C 78   216          JSR PRTINT
0980 20 0B      217          ADR RANDOM1
0982 20 36 78   218          JSR PRINT
0985 8D D2 E1   219          BYT CR,"Random2: ",0
0988 EE E4 EF
098B ED B2 BA
098E A0 00
0990 20 3C 78   220          JSR PRTINT
0993 22 0B      221          ADR RANDOM2
0995 20 36 78   222          JSR PRINT
0998 8D D2 E1   223          BYT CR,"Random3: ",0
099B EE E4 EF
099E ED B3 BA
09A1 A0 00
09A3 20 3C 78   224          JSR PRTINT
09A6 24 0B      225          ADR RANDOM3
09A8 20 36 78   226          JSR PRINT
09AB 8D D2 E1   227          BYT CR,"Random4: ",0
09AE EE E4 EF
09B1 ED B4 BA
09B4 A0 00
09B6 20 3C 78   228          JSR PRTINT
09B9 26 0B      229          ADR RANDOM4
09BB            230  ;
09BB            231  ;
09BB            232  ; Demonstrate the MOVE subroutine
09BB            233  ;
09BB 20 36 78   234          JSR PRINT
09BE 8D 8D C3   235          BYT CR,CR,"Current contents of I is ",0
09C1 F5 F2 F2
09C4 E5 EE F4
09C7 A0 E3 EF
09CA EE F4 E5
09CD EE F4 F3
09D0 A0 EF E6
09D3 A0 C9 A0
09D6 E9 F3 A0
09D9 00
09DA 20 3C 78   236          JSR PRTINT
09DD 12 0B      237          ADR I
09DF 20 36 78   238          JSR PRINT
09E2 8D C3 F5   239          BYT CR,"Current contents of J is ",0
09E5 F2 F2 E5
09E8 EE F4 A0
09EB E3 EF EE
09EE F4 E5 EE
09F1 F4 F3 A0
09F4 EF E6 A0
09F7 CA A0 E9
09FA F3 A0 00
09FD 20 3C 78   240          JSR PRTINT
```

Listing continued.

Note that CR was used instead of the actual code for carriage return ($8D). CR is a symbol, defined in the SPEED/ASM equates, which is replaced by the value $8D.

Since PRINT will print all characters up to the terminating zero byte, multiple lines can be output using a single call to the PRINT subroutine. Simply separate each line with a carriage return and PRINT will output the text on several lines:

```
JSR     PRINT
BYT     "This is the first line,
        and it is follwed by",CR
BYT     "this second line.",CR,0
```

Other than improving the readability of the program, the separate lines need not appear on separate source lines as in this example. The second string could have immediately followed the CR on the first line. This type of coding, however, is not recommended because it makes the source file much harder to read.

Performing Integer I/O In SPEED/ASM

Operating on integer values is one of the primary functions you will do in SPEED/ASM. However, these operations are almost useless unless you can communicate the results of these operations to the world outside the computer. Two routines are provided in the SPEED/ASM package to facilitate integer I/O: RDINT (read an integer) and PRTINT (print an integer).

Printing an integer using the PRTINT routine is easy—just follow the JSR PRTINT with the address of the integer you want to print. For example, if you wanted to print the contents of the integer variable I onto the Apple's video screen you would use the statement(s):

```
JSR     PRTINT
ADR     I
```

and the contents of I would be displayed for you. In the next installation of this series I will discuss how to format this output to create a pretty listing.

The RDINT routine is a little more complicated to use than the PRTINT routine because there is the possibility that an error condition might oc-

Listing continued.

```
0A00 14 0B      241          ADR J
0A02            242  ;
0A02 20 2A 78   243          JSR MOVE
0A05 12 0B 14   244          ADR I,J
0A08 0B
0A09            245  ;
0A09 20 36 78   246          JSR PRINT
0A0C 8D CE EF   247          BYT CR,"Now I contains ",0
0A0F F7 A0 C9
0A12 A0 E3 EF
0A15 EE F4 E1
0A18 E9 EE F3
0A1B A0 00
0A1D 20 3C 78   248          JSR PRTINT
0A20 12 0B      249          ADR I
0A22 20 36 78   250          JSR PRINT
0A25 8D E1 EE   251          BYT CR,"and J contains ",0
0A28 E4 A0 CA
0A2B A0 E3 EF
0A2E EE F4 E1
0A31 E9 EE F3
0A34 A0 00
0A36 20 3C 78   252          JSR PRTINT
0A39 14 0B      253          ADR J
0A3B            254  ;
0A3B            255  ;
0A3B            256  ; Ask the user if he wants to re-run
0A3B            257  ; the program with user input.
0A3B            258  ;
0A3B            259  ;
0A3B 20 36 78   260  RERUN   JSR PRINT
0A3E 8D 8D C4   261          BYT CR,CR,"Do you wish to re-run this",CR
0A41 EF A0 F9
0A44 EF F5 A0
0A47 F7 E9 F3
0A4A E8 A0 F4
0A4D EF A0 F2
0A50 E5 AD F2
0A53 F5 EE A0
0A56 F4 E8 E9
0A59 F3 8D
0A5B F0 F2 EF   262          BYT "program (Y/N)? ",0
0A5E E7 F2 E1
0A61 ED A0 A8
0A64 D9 AF CE
0A67 A9 BF A0
0A6A 00
0A6B 20 03 78   263          JSR GETC
0A6E 29 DF      264          AND #$DF            ;Convert Lower case to Upper case
0A70 20 00 78   265          JSR PUTC
0A73 C9 CE      266          CMP #"N"
0A75 D0 03      267          BNE >1
0A77 4C 69 FF   268          JMP EXIT
0A7A            269  ;
0A7A C9 D9      270  ^1      CMP #"Y"
0A7C D0 BD      271          BNE RERUN
0A7E            272  ;
0A7E            273  ;
0A7E            274  ; If so, get new values for I and J
0A7E            275  ;
0A7E            276  ;
0A7E 20 36 78   277  BADNUM1 JSR PRINT
0A81 8D         278          BYT CR
0A82 C5 EE F4   279          BYT "Enter a new value for I:",0
0A85 E5 F2 A0
0A88 E1 A0 EE
0A8B E5 F7 A0
0A8E F6 E1 EC
0A91 F5 E5 A0
0A94 E6 EF F2
0A97 A0 C9 BA
0A9A 00
0A9B 20 0F 78   280          JSR READLN
0A9E 20 42 78   281          JSR RDINT
0AA1 12 0B      282          ADR I
0AA3 50 21      283          BVC GOODNUM1
0AA5 20 36 78   284          JSR PRINT
0AA8 8D C5 F2   285          BYT CR,"Error in entry, re-enter",CR,0
0AAB F2 EF F2
0AAE A0 E9 EE
0AB1 A0 E5 EE
0AB4 F4 F2 F9
0AB7 AC A0 F2
0ABA E5 AD E5
0ABD EE F4 E5
0AC0 F2 8D 00
0AC3 4C 7E 0A   286          JMP BADNUM1
0AC6            287  ;
0AC6 20 36 78   288  GOODNUM1 JSR PRINT
0AC9 8D C5 EE   289          BYT CR,"Enter a new value for J:",0
0ACC F4 E5 F2
0ACF A0 E1 A0
```

Listing continued.

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Listing continued.

```
0AD2 EE E5 F7
0AD5 A0 F6 E1
0AD8 EC F5 E5
0ADB A0 B6 EF
0ADE F2 A0 CA
0AE1 BA 00
0AE3 20 0F 78    290          JSR READLN
0AE6 20 42 78    291          JSR RDINT
0AE9 14 0B       292          ADR J
0AEB 50 22       293          BVC >0
0AED 20 36 78    294          JSR PRINT
0AF0 8D C2 E1    295          BYT CR,"Bad value for J, re-enter",CR,0
0AF3 B4 A0 F6
0AF6 E1 EC F5
0AF9 E5 A0 B6
0AFC EF F2 A0
0AFF CA AC A0
0B02 F2 E5 AD
0B05 E5 EE F4
0B08 E5 F2 8D
0B0B 00
0B0C 4C C6 0A    296          JMP GOODNUM1
0B0F             297 ;
0B0F 4C 11 08    298 ^0       JMP LOOP
0B12             299 ;
0B12             300 ;
0B12             301 ;
0B12             302 ;
0B12             303 ;
0B12             304 ;
0B12             305 ;
0B12             306 ;
0B12             307 **********************************
0B12             308 ;
0B12             309 ; Variable declarations:
0B12             310 ;
0B12             311 ; The following variables are all
0B12             312 ; integers.  So they are declared
0B12             313 ; with the ADR pseudo opcode to
0B12             314 ; reserve two bytes for each integer.
0B12             315 ;
0B12             316 ;
0B12 00 00       317 I        ADR 0
0B14 00 00       318 J        ADR 0
0B16             319 ;
0B16 00 00       320 SUM      ADR 0
0B18 00 00       321 PRODUCT  ADR 0
0B1A 00 00       322 QUOTIENT ADR 0
0B1C 00 00       323 DIFFRNCE ADR 0
0B1E 00 00       324 REMAINDR ADR 0
0B20 00 00       325 RANDOM1  ADR 0
0B22 00 00       326 RANDOM2  ADR 0
0B24 00 00       327 RANDOM3  ADR 0
0B26 00 00       328 RANDOM4  ADR 0
0B28             329 ;
0B28             330          END

***** END OF ASSEMBLY

]brun sort

BRUN SORT
SYMBOL TABLE SORTED ALPHABETICALLY

  ABS      7854  BADNUM1  0A7E  CASE     7848  CASEI    784B  CR       008D
  DIFFRNCE 0B1C  DIV      785D  EXIT     FF69  FALSE    0000  FOR      7815
  FOR0     7818  GETC     7803  GOODNUM1 0AC6  HOME     780C  I        0B12
  IFI      781E  IFI0     7821  IFS      7824  IFS0     7827  INIT     7812
  INSET    784E  J        0B14  LDSTR    7833  LOAD     782D  LOOP     0811
  MOD      7860  MOVE     782A  MOVS     7830  MUL      785A  NEG      7857
  NEXT     781B  NOTINSET 7851  ONXGOTO  7845  OVERFLOW 088F  PRINT    7836
  PRODUCT  0B18  PRTINT   783C  PRINUMS  08A9  PRTSTR   7839  PUTC     7800
  QUOTIENT 0B1A  RANDOM1  0B20  RANDOM2  0B22  RANDOM3  0B24  RANDOM4  0B26
  RDINT    7842  RDSTR    783F  READLN   780F  REMAINDR 0B1E  RERUN    0A3B
  RND      7863  SAGL     7806  SAPC     7809  START    0800  SUM      0B16
  TRUE     0001

SYMBOL TABLE SORTED BY ADDRESS

  FALSE    0000  TRUE     0001  CR       008D  START    0800  LOOP     0811
  OVERFLOW 088F  PRINUMS  08A9  RERUN    0A3B  BADNUM1  0A7E  GOODNUM1 0AC6
  I        0B12  J        0B14  SUM      0B16  PRODUCT  0B18  QUOTIENT 0B1A
  DIFFRNCE 0B1C  REMAINDR 0B1E  RANDOM1  0B20  RANDOM2  0B22  RANDOM3  0B24
  RANDOM4  0B26  PUTC     7800  GETC     7803  SAGL     7806  SAPC     7809
  HOME     780C  READLN   780F  INIT     7812  FOR      7815  FOR0     7818
  NEXT     781B  IFI      781E  IFI0     7821  IFS      7824  IFS0     7827
  MOVE     782A  LOAD     782D  MOVS     7830  LDSTR    7833  PRINT    7836
  PRTSTR   7839  PRTINT   783C  RDSTR    783F  RDINT    7842  ONXGOTO  7845
  CASE     7848  CASEI    784B  INSET    784E  NOTINSET 7851  ABS      7854
  NEG      7857  MUL      785A  DIV      785D  MOD      7860  RND      7863
  EXIT     FF69
```

Listing continued.

cur. The RDINT routine expects the user to type a valid numeric integer which takes the form:

1) Any number of leading blanks, commas or carriage returns, followed by
2) An optional minus sign, followed by
3) One to five digits forming a value in the range 0...32767, followed by
4) A space, comma or carriage return.

If the numeric string is of the proper format then SPEED/ASM will store the value into the integer variable whose address follows the JSR; e.g.,

```
JSR     RDINT
ADR     J
```

will read an integer variable from the line input buffer (reading a new line if necessary) and store the numeric value into J.

If an input error occurs, then the V flag will be returned set so you can use the BVS or BVC instruction to test for the error condition. Three error conditions can be returned in the 6502 accumulator. If the overflow flag is set, then the accumulator contains zero if the last character of the number wasn't a space, comma or carriage return. This error condition can be considered optional. If you want to allow characters other than space, comma and carriage return at the end of a number, you can ignore this error.

If the overflow flag is set and the accumulator contains one, the first character of the number was not a valid digit or minus sign. All preceding spaces, commas and carriage returns were stripped before the failure to obtain a digit or minus sign was detected. This is a definite error and your program should prompt the user to re-enter the data.

If the overflow flag was set and the accumulator contained $8D, the value entered by the user was greater than 32767 or less than −32768. Obviously this number must be re-entered by the user. A program that would prompt the user to re-enter on an entry error is shown in Example 10.

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Listing continued.

```
DOES YOUR APPLE SUPPORT LOWER CASE
DISPLAY? (Y/N):

I= 10
J= 54
The sum is 64
The difference (I-J) is -44
The product is 540
The quotient (J/I) is 5
The remainder (J mod I) is 4
The random numbers are:
Random1: 11979
Random2: -28681
Random3: 3539
Random4: 31519

Current contents of I is 10
Current contents of J is 54
Now I contains 10
and J contains 10

Do you wish to re-run this
program (Y/N)? Y

Enter a new value for I:25

Enter a new value for J:36
I= 25
J= 36
The sum is 61
The difference (I-J) is -11
The product is 900
The quotient (J/I) is 1
The remainder (J mod I) is 11
The random numbers are:
Random1: 30641
Random2: -6027
Random3: 25673
Random4: 14189

Current contents of I is 25
Current contents of J is 36
Now I contains 25
and J contains 25

Do you wish to re-run this
program (Y/N)? Y

Enter a new value for I:59

Enter a new value for J:22
I= 59
J= 22
The sum is 81
The difference (I-J) is 37
The product is 1298
The quotient (J/I) is 0
The remainder (J mod I) is 22
The random numbers are:
Random1: 26303
Random2: -20411
Random3: -5287
Random4: -1347

Current contents of I is 59
Current contents of J is 22
Now I contains 59
and J contains 59

Do you wish to re-run this
program (Y/N)? N
```

I have included additional examples in Listing 2.

Looking Forward

So far the examples have been rather trivial since the SPEED/ASM routines presented thus far haven't included the necessary looping, conditional, and transfer of control routines. Next time I'll start discussing program control structures so that you will be able to start writing fairly complex programs. See ya next time! ■

Note: SPEED/ASM and LISA v2.5 are available from Sierra On-Line, 209-683-6858. These programs are also available at your local dealer.

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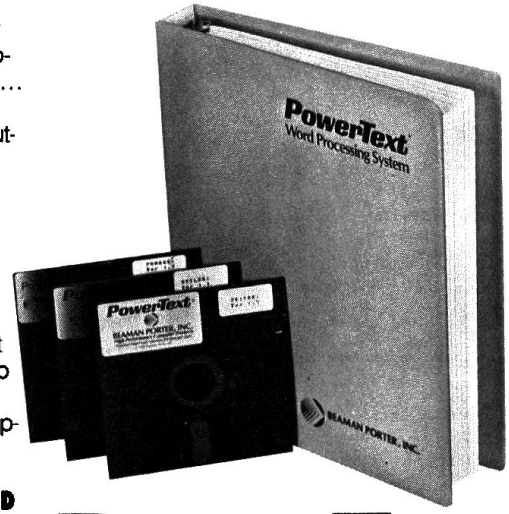
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Blaising Bibliographies
Part II

Compiling information sources into an organized list can drive a writer to wrack and ruin. This article, the second in a three-part series, continues the discussion of using Pascal text editing to overcome the bibliography blues.

by James R. Florini

March's issue of *inCider* included my REFCITED program, which finds all reference citations (in the "name, year" format) in any Pascal textfile. The analysis has been an important aid to my writing for the last two years. However, it becomes much more useful when it is coupled with two more programs: ENTERREF, which prepares the files of citations used frequently in my writing, and REFPRINT, which prints out the complete formatted bibliography using the Citelist.Text file to specify the citations to be listed.

I use the system in the following way. Whenever I cite a paper for the first time, I use Enterref to enter the complete citation on master disks (for which I keep at least *two* backups at all times!); two disks hold about 450 listings, which should be enough for all but the most dedicated scholars. My students also make entries when they are writing papers (or dissertations) on related subjects.

Whenever a manuscript is completed, I analyze it with the Refcited program to get a list of citations. Using that list, I then run the Refprint program (to appear in the next issue of *inCider*) to print the completed bibliography and store it as a textfile. The whole thing is virtually automatic; all I need do is specify the files to be analyzed, change disks between the analyzing and printing programs, and make a few formatting choices in response to prompts from the Apple.

This month's program is a rather unexciting but absolutely essential part of the system. Without the listings formed using Enterref, you can't get a

```
        EXAMPLES OF FORMAT IN WHICH REFERENCE CITATIONS ARE ENTERED
                        (USING THE ENTERREF PROGRAM)

     KEY:   Fry, 1979
AUTHORS1:   Fry, F. F.
AUTHORS2:
    YEAR:   1979
  TITLE1:   A Short Paper on Important Things
  TITLE2:
  TITLE3:
 JOURNAL:   Essential Information
  VOLUME:   1
   PAGES:   1-4

     KEY:   Fink et al., 1974
AUTHORS1:   Fink, F. F., Anderson, A. A., Smith, S. S., Jonson, J. J., Jones, J
 J. J.
AUTHORS2:   Clark, C. C., Thomas, T. T., Williams, W. w., and James, J. J.
    YEAR:   1974
  TITLE1:   One of Those Reports with an Absolutely Incredibly Long Title Which
Tells You
  TITLE2:   a Great Deal More than You Want to Know about the Article: All Poss
ible
  TITLE3:   Considerations of All Possible Aspects of the Subject
 JOURNAL:   J. Nonsuccinct Reports
  VOLUME:   111
   PAGES:   1-10


   THESE CITATIONS WOULD BE PRINTED OUT IN A FORMAT SIMILAR TO THOSE BELOW:

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Clark, C. C., Thomas, T. T., Williams, W. W., and James, J. J.  One of Those
Reports with an Absolutely Incredibly Long Title which Tells You a Great Deal
More than You Want to Know about the Article: All Possible Considerations of
All Possible Aspects of the Subject.  J. Nonsuccinct Reports.  111: 1-10,
1974.
```

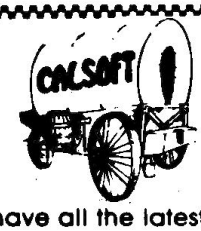
Figure 1. Reference citation format.

Address correspondence to Dr. James R. Florini, Biology Dept., Syracuse University, Syracuse, NY 13210.

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Listing.
ENTERREF.

```
(I$V-I)  (Necessary to let ENTER_ONE work on various lengths of  strings)
PROGRAM ENTERREF;
(By Dr. J. R. Florini, Biology Dept., Syracuse University)
(This program forms files of reference citations to be used with REFPRINT to
 print out bibliographies.)
CONST  (These are for the Apple screen; consoles require different values.)
   SCREENCLEAR=12; HOME=19;
TYPE
   RIGHTSET = SET OF CHAR;
   REFERENCE = RECORD   (NOTE -IT IS ESSENTIAL THAT THESE STRING LENGTHS)
      KEY: STRING;                    (NOT BE CHANGED!!!!)
      BOOK: BOOLEAN;
      AUTHORS1: STRING;
      AUTHORS2: STRING;
      YEAR: STRING [6];
      TITLE1: STRING;
      TITLE2: STRING;
      TITLE3: STRING;
      JOURNAL: STRING;
      VOL: STRING [4];
      PAGES: STRING [15];
   END;
VAR
   FOUND, EMPTY, OK: BOOLEAN;
   RECNUM: INTEGER;
   CHOICE: CHAR;
   INITIAL: STRING[1];
   TEST, CITATION, FILENAME: STRING;
   PRINTOUT: TEXT;
   SOURCEFILE: FILE OF REFERENCE;

(These first procedures are a group of handy utilities frequently used )
PROCEDURE CLEAR_SCREEN;
BEGIN
  WRITE (CHR(SCREENCLEAR), CHR(HOME));
  WRITELN ('MEMORY AVAILABLE IS ':35,MEMAVAIL,' WORDS.');
  WRITELN; WRITELN
END;

PROCEDURE GET_RECORD;
BEGIN
  SEEK (SOURCEFILE, RECNUM); GET (SOURCEFILE)
END;

PROCEDURE PUT_AWAY;
BEGIN
  SEEK (SOURCEFILE, RECNUM); PUT (SOURCEFILE)
END;

FUNCTION VAL (ENTRY: STRING): INTEGER;  (Avoid problems with numeric entries)
VAR I, TEMP: INTEGER;
   DIGIT: STRING[1];
BEGIN
  TEMP:=0; IF LENGTH (ENTRY)=0 THEN VAL:=0 ELSE
  BEGIN
    FOR I:=1 TO LENGTH (ENTRY) DO
    BEGIN
      DIGIT:=' '; DIGIT[1]:=ENTRY[I]; TEMP:=10*TEMP + POS (DIGIT,'123456789');
    END;
    IF TEMP < 0 THEN TEMP:=0;  (used only for positive record numbers here)
    VAL:=TEMP;
  END;
END;  (VAL)

FUNCTION GET_CHAR (FIRST, SECOND: STRING; OKCHAR: RIGHTSET): CHAR;
(This function avoids "out of bounds" responses)
VAR RESPONSE: CHAR;
BEGIN
  REPEAT
    WRITE (FIRST); IF SECOND<>'' THEN
    BEGIN
      WRITELN; WRITE (SECOND);
    END;
    READ (RESPONSE); WRITELN; IF RESPONSE=CHR(27) THEN EXIT (PROGRAM);
    IF RESPONSE IN ['a'..'z'] THEN RESPONSE:=CHR(ORD(RESPONSE)-32); (Capitalize)
    IF NOT (RESPONSE IN OKCHAR) THEN WRITELN (CHR(7),
       '"',RESPONSE,'" IS NOT AN APPROPRIATE RESPONSE.'); WRITELN;
  UNTIL RESPONSE IN OKCHAR;
  GET_CHAR:=RESPONSE;
END;  (GET-CHAR)

(Now some more specialized procedures important in THIS program)
PROCEDURE SEARCH_FILE (VAR REF:REFERENCE);
BEGIN
  RECNUM:=RECNUM+1; GET_RECORD; TEST:=SOURCEFILE^.KEY;
  WRITELN ('Citation is ',TEST,' in record #',RECNUM)
END;

PROCEDURE SHOW_REF;
BEGIN
  WRITELN ('This is record #',RECNUM,' in file ',FILENAME,':');
  WRITELN; WITH SOURCEFILE^ DO
  BEGIN
    IF KEY='XXXXX' THEN
    BEGIN
      WRITELN ('Record #',RECNUM,' is empty.');
      EMPTY:=TRUE; OK:=TRUE; EXIT (SHOW_REF);
    END;
    EMPTY:=FALSE; WRITELN ('KEY:    ':13,KEY);
    WRITELN ('AUTHORS1:   ':13, AUTHORS1);
    IF AUTHORS2 <> '' THEN WRITELN ('AUTHORS2:   ':13, AUTHORS2);
    WRITELN ('YEAR:   ':13, YEAR);
    WRITELN ('TITLE1:   ':13,. TITLE1);
      IF TITLE2 <> '' THEN WRITELN ('TITLE2:   ':13,TITLE2);
      IF TITLE3 <> '' THEN WRITELN ('TITLE3:   ':13,TITLE3);
```

Listing continued.

bibliography printout. I have included as Figure 1 an example of the kind of data you might enter and store; it would be relatively easy to modify the program to print out all the listings in this sort of format, but I'll leave that kind of expansion for you to do. The program's long enough as it is!

Before you type in Enterref, take a careful look at the structure of the major data type, the *reference* record. It fits well the kinds of biological papers I usually cite, but you may want to make revisions for your own purposes. String variables take up a lot of space, and, if you need fewer or shorter lines, you can increase the number of records per disk by decreasing or deleting some of the elements of the records. On the other hand, you most certainly *don't* want to discover that you haven't allowed enough space and have to change the record format after a few hundred entries have been made. A little thought now can save a lot of anguish later—but that's always the case in writing a program.

How It Works

Now refer to the Enterref listing. Reading from the end (as always in Pascal), the program starts by providing a brief menu of choices, and uses Get_Char to restrict input to the acceptable replies. If you added the Entries unit (from the January 1983 issue of *inCider*) to your system library, you can substitute USES ENTRIES; for the Val and Get_Char functions. But, if you do, remember to use ROUND (VALUE(ENTRY)) for VAL (ENTRY); the more extensive function in the Library Unit returns a real, rather than an integer, number.

Depending on the initial choice made, the program prompts for a citation to be entered. I'm rather fond of the approach in Choose_Record; it allows the user to make a choice and enter information at the same time. All the files are designated by the initial letters of the first author's name, which keeps everything short but clear.

Get_File searches through all possible disk locations for the desired file (it really doesn't take long), and then provides an opportunity to insert a different disk or to form a new file if necessary. It is essential to set aside a specific

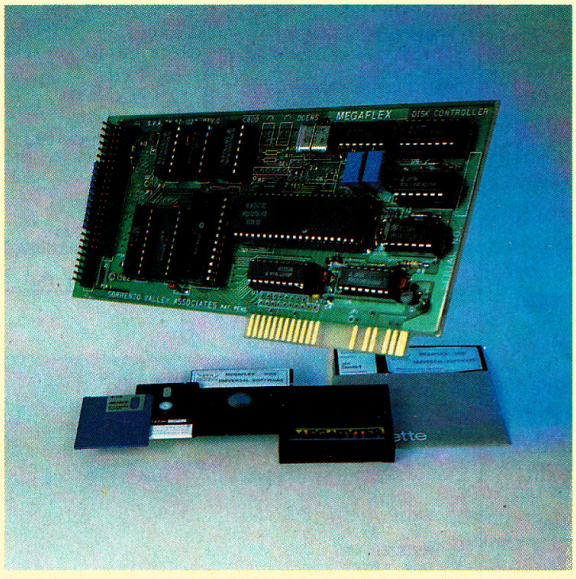
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amount of space in the form of empty files. Otherwise fatal I/O errors will occur when more records are added to the end of a file in a reasonably full disk. Just how many records should be set aside for each letter? There is some guesswork involved here, but it's obvious there will be more names starting with S than with Z.

For both new entries and corrections, the Enter_One function is used. It is adapted from the Readit procedure on page 143 of Bowles' *Beginner's Guide for the UCSD Pascal System*. It may seem a bit strange to use a function returning a Boolean variable to enter a string into a record, but it provides a very convenient way to avoid skipping through a bunch of items if they are going to remain empty. To make sure there are no out-of-range errors, the maximum length of each entry is specified, and each entry appears in an appropriate blank. This should make things easy for the user.

When each record is completed, there is an opportunity to correct any errors and then further entries are solicited. If there are none, the program terminates by clearing the screen.

Next Time

In my next article I'll discuss Refprint, the program that prints out the final bibliography. It does it in five different formats! ■

Listing continued.

```
    IF BOOK THEN WRITELN ('PUBLISHER:   ':13,JOURNAL) ELSE
    BEGIN
      WRITELN ('JOURNAL:   ':13, JOURNAL);
      WRITELN ('VOL:   ':13, VOL); WRITELN ('PAGES:   ':13, PAGES);
    END;
  END;
END; {SHOW-REF}

PROCEDURE LINE_UP (SIZE:INTEGER);
VAR I: INTEGER;
BEGIN
  CLEAR_SCREEN; SHOW_REF;
  GOTOXY (0,21); FOR I:=1 TO SIZE DO WRITE ('_'); GOTOXY (0,21)
END;  {LINE UP}

FUNCTION ENTER_ONE(SIZE: INTEGER; ITEM: STRING; VAR NEWITEM: STRING): BOOLEAN;
VAR ENTRY: STRING;
BEGIN
  LINE_UP (SIZE); GOTOXY (0,18);
  WRITELN ('Enter ',ITEM,'; do NOT exceed indicated spaces.  Enter');
  WRITELN
   ('"Q" to quit, "E" to erase this item, or <RETURN> to skip without change.');
  GOTOXY (0,21); READLN (ENTRY); ENTER_ONE:=TRUE;
  IF ENTRY='' THEN EXIT (ENTER_ONE) ELSE
  BEGIN
    IF (ENTRY='Q') OR (ENTRY='q') THEN ENTER_ONE:=FALSE ELSE
       IF (ENTRY='E') OR (ENTRY = 'e') THEN NEWITEM:='' ELSE
    NEWITEM:=ENTRY
  END;
END; {FUNCTION ENTER_ONE}

PROCEDURE ZERO_REF (VAR REF:REFERENCE);
BEGIN
  WITH REF DO
  BEGIN
    KEY:='XXXXX'; BOOK:=FALSE; AUTHORS1:=''; AUTHORS2:=''; YEAR:='';
    TITLE1:=''; TITLE2:=''; TITLE3:=''; JOURNAL:='';VOL:=''; PAGES:=''
  END;
END;  {ZERO-REF}

PROCEDURE CHANGE_REF; FORWARD;
{To allow changes if CHECK_IT calls for them}

PROCEDURE CHECK_IT;
BEGIN
  CLEAR_SCREEN;
  GET_RECORD; SHOW_REF; IF EMPTY THEN EXIT (CHECK_IT); WRITELN;
  OK:=GET_CHAR ('Is this correct? (Y or N).  If not, you can correct it. ',
  '',['Y','N'])='Y';
  IF NOT OK THEN CHANGE_REF;
END;

PROCEDURE END_IT;
BEGIN
  PUT_AWAY; REPEAT CHECK_IT UNTIL OK; PUT_AWAY;
END;  {END_IT}
PROCEDURE GET_FILE;
VAR OPENED: BOOLEAN;

  PROCEDURE OPEN_FILE (VOL: STRING);
  BEGIN
    FILENAME:=CONCAT(VOL,INITIAL);
    {$I-} RESET (SOURCEFILE,FILENAME); OPENED:=IORESULT=0; {$I+}
    IF OPENED THEN
    BEGIN
      WRITELN ('File ',FILENAME,' opened for entry.'); EXIT (GET_FILE);
    END;
  END;  {OPEN-FILE}

  PROCEDURE MAKE_NEWFILE;
  VAR ENTRY, PREFIX: STRING[8];
      NUMBER: INTEGER;
  BEGIN
    WRITELN; WRITELN ('On what diskette do you want the new file?');
    WRITELN (' (Enter volume number AND ":" or volume name AND ":")');
    READLN (PREFIX);
    FILENAME:=CONCAT (PREFIX, INITIAL); REWRITE (SOURCEFILE,FILENAME);
    WRITE ('How many records are to be set aside for initial ',INITIAL,'?');
    READLN (ENTRY); NUMBER:=VAL (ENTRY)-1; {allow for Record #0, too}
    FOR RECNUM:=0 TO NUMBER DO
    BEGIN
      GET_RECORD; ZERO_REF (SOURCEFILE^); PUT_AWAY;
    END;
    CLOSE(SOURCEFILE, LOCK); RESET (SOURCEFILE, FILENAME);  {avoid disasters}
    WRITELN ('A file entitled ',FILENAME,' has been prepared.');
  END;  {MAKE-NEWFILE}

BEGIN  {GET-FILE}
  {$I-} CLOSE (SOURCEFILE,LOCK); {$I+}  {Avoids stop when file not closed}
  OPENED:=FALSE; OPEN_FILE ('#10:'); IF NOT OPENED THEN OPEN_FILE('#5:');
  IF NOT OPENED THEN OPEN_FILE('#4:'); IF NOT OPENED THEN OPEN_FILE('#11:');
  IF NOT OPENED THEN OPEN_FILE('#9:');
  IF NOT OPENED THEN
  BEGIN
    GOTOXY (0, 15);
    WRITELN ('There is no file for ',INITIAL,' currently available.');
    WRITELN;
    CASE GET_CHAR ('R)eplace one of the diskettes? or S)tart a new file?',
      '',['S','R']) OF
      'R': BEGIN
             WRITELN ('Insert the correct diskette and press <RETURN>');
             READLN; GET_FILE;    {An example of recursion in Pascal}
           END;
      'S': MAKE_NEWFILE;
    END;  {CASE}
```

Listing continued.

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Listing continued.

```
    END;  {NOT OPENED}
END;  {GET-FILE}

{The following are the two major procedures in this program}
PROCEDURE CHANGE_REF;
VAR ENTRY: STRING;

  PROCEDURE REMOVE_ONE;
  BEGIN
    IF EMPTY THEN EXIT (REMOVE_ONE);
    IF CHOICE = 'E' THEN
    WITH SOURCEFILE^ DO
    BEGIN
      CLEAR_SCREEN; WRITE (CHR(7)); SHOW_REF; WRITELN;
      IF GET_CHAR ('Do you REALLY want to remove this reference?','',
        ['Y','N'])='Y' THEN
      BEGIN
        ZERO_REF (SOURCEFILE^); PUT_AWAY;
        WRITELN ('Reference ',initial,': #',recnum,' has been removed.');
        OK:=TRUE; EXIT (CHANGE_REF);
      END;
    END;
  END;  {REMOVE-ONE}

  PROCEDURE FINISH_IT;
  BEGIN
    REPEAT END_IT UNTIL OK; EXIT (CHANGE_REF);
  END;

  PROCEDURE CONTINUE_CHANGES;  {AVOIDS "PROCEDURE TOO LONG"}
  BEGIN
    WITH SOURCEFILE^ DO
    BEGIN
      IF NOT BOOK THEN
      BEGIN
        WRITELN ('OLD JOURNAL = ',JOURNAL);
        IF NOT ENTER_ONE (80, 'NEW JOURNAL',JOURNAL) THEN FINISH_IT;
        WRITELN; WRITELN ('OLD VOLUME = ', VOL);
        IF NOT ENTER_ONE (4, 'NEW VOLUME',VOL) THEN FINISH_IT;
        WRITELN; WRITELN ('OLD PAGES = ',PAGES);
        IF NOT ENTER_ONE (15, 'NEW PAGES', PAGES) THEN FINISH_IT
      END ELSE
      BEGIN
        WRITELN ('OLD PUBLISHER = ',JOURNAL);
        IF NOT ENTER_ONE(80,'NEW PUBLISHER & CITY',JOURNAL) THEN FINISH_IT;
      END;
    END;  {WITH SOURCEFILE^ DO}
  END;  {CONTINUE-CHANGES}

  PROCEDURE UPDATE_KEY; {Make CERTAIN year and key agree}
  VAR DATE: INTEGER;
  BEGIN
    WITH SOURCEFILE^ DO
    BEGIN
      DATE:=POS('19',KEY); IF DATE<>0 THEN
      BEGIN
        DELETE (KEY, DATE,4); INSERT (YEAR,KEY,DATE);
      END ELSE KEY:=CONCAT (KEY,', ',YEAR);

    END;
  END;

  PROCEDURE CHOOSE_RECORD;
  VAR ENTRY: STRING[2];
      RESPONSE: STRING;
  BEGIN  {This algorithm lets the computer find things with minimal entries
          from the user - the way things SHOULD be!}
    WRITELN; WRITELN
    ('Find the record on the basis of its Number or the Citation?');
    WRITELN
   ('If Number, then enter the first letter of the record which contains the');
    WRITELN
    ('record; if Citation, enter it in the usual "name, year" format.');
    READLN (RESPONSE);
    IF LENGTH (RESPONSE)=1 THEN
    BEGIN
      WRITE ('What record number in file ',RESPONSE,' is to be changed? ');
      READLN (ENTRY); RECNUM:=VAL(ENTRY);
      INITIAL:=RESPONSE; GET_FILE; GET_RECORD
    END ELSE
    BEGIN
      CITATION:=RESPONSE; INITIAL:=COPY(CITATION,1,1); GET_FILE; RECNUM:=-1;
      REPEAT SEARCH_FILE (SOURCEFILE^) UNTIL (TEST=CITATION) OR EOF(SOURCEFILE);
      IF EOF(SOURCEFILE) THEN
        WRITELN ('There is no reference stored for citation ', CITATION,'.');
    END;
  END;  {CHOOSE-RECORD}

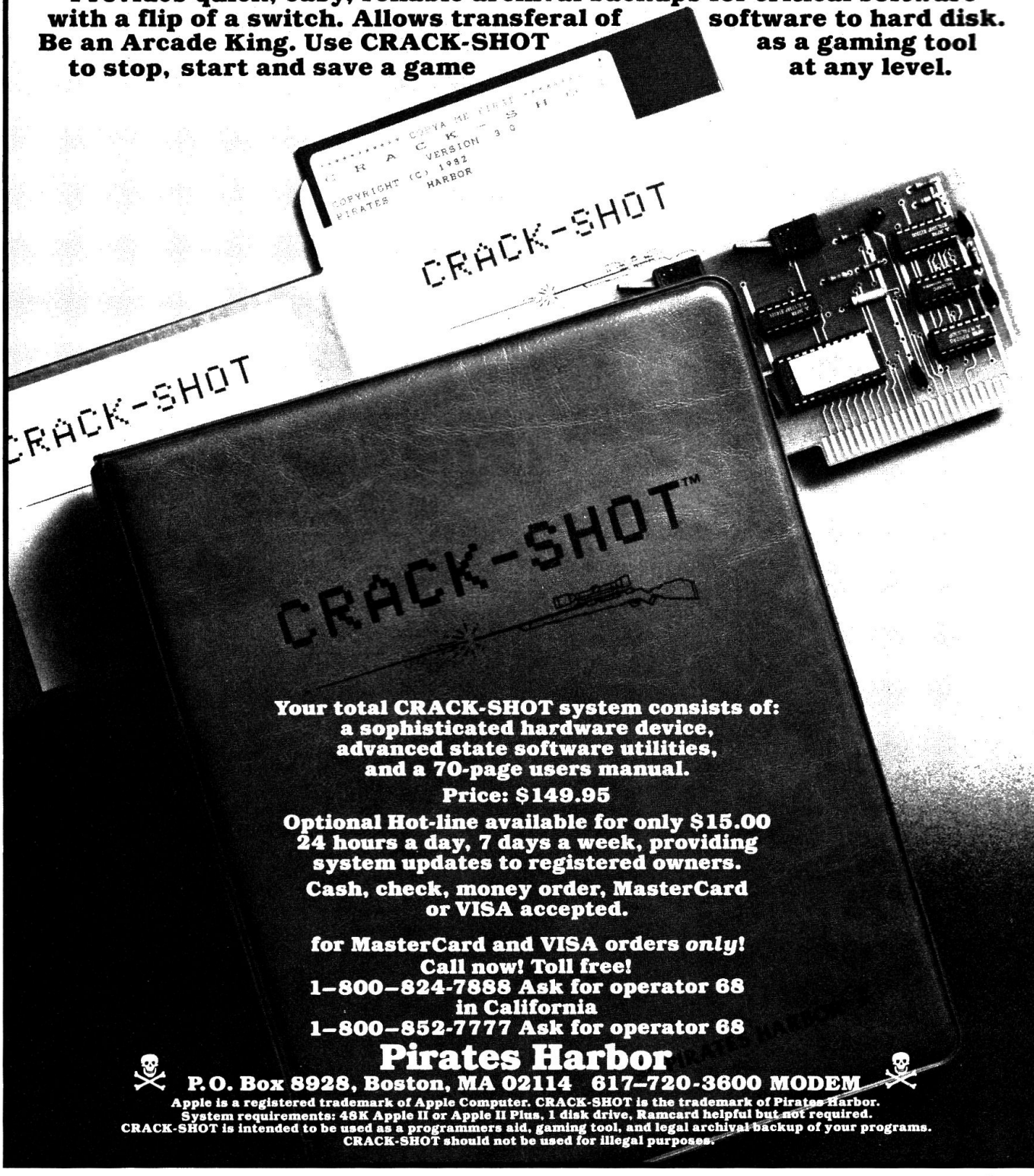
BEGIN                {MAIN CHANGE REF}
  IF NOT FOUND THEN CHOOSE_RECORD; CLEAR_SCREEN; SHOW_REF; WRITELN; WRITELN;
  WITH SOURCEFILE^ DO
  BEGIN
    CHOICE:=GET_CHAR('Enter "E" if this record is to be erased.',
      '( <SPACE> to continue corrections.)',['E',' ','Q']); REMOVE_ONE;
    IF CHOICE='Q' THEN FINISH_IT;
    BOOK:=GET_CHAR('Is this a book? ','',['Y','N'])='Y';
    WRITELN; WRITELN ('OLD KEY = ', KEY);
      IF NOT ENTER_ONE (80,'NEW KEY',KEY) THEN FINISH_IT;
    YEAR:=COPY(KEY, LENGTH(KEY)-3, 4);
    WRITELN; WRITELN ('OLD AUTHORS 1 = ',AUTHORS1);
      IF NOT ENTER_ONE (80,'NEW AUTHORS 1',AUTHORS1) THEN FINISH_IT;
    WRITELN; WRITELN ('OLD AUTHORS 2 = ',AUTHORS2);
      IF NOT ENTER_ONE (80, 'NEW AUTHORS 2',AUTHORS2) THEN FINISH_IT;
    WRITELN; WRITELN  ('OLD YEAR = ', YEAR);
      IF NOT ENTER_ONE (6,'NEW YEAR',YEAR) THEN FINISH_IT;
    UPDATE_KEY;
```

Listing continued.

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Listing continued.

```
    WRITELN; WRITELN ('OLD TITLE 1 = ',TITLE1);
      IF NOT ENTER_ONE (80,'NEW TITLE 1',TITLE1) THEN FINISH_IT;
    WRITELN; WRITELN ('OLD TITLE 2 = ',TITLE2);
      IF NOT ENTER_ONE (80, 'NEW TITLE 2',TITLE2) THEN FINISH_IT;
    WRITELN; WRITELN ('OLD TITLE 3 = ',TITLE3);
      IF NOT ENTER_ONE (80, 'NEW TITLE 3',TITLE3) THEN FINISH_IT;
    CONTINUE_CHANGES;    {Split changes into two parts to keep < 1200 words}
    END;  {WITH...}
    REPEAT END_IT UNTIL OK; CLOSE (SOURCEFILE, LOCK);
  END;  {CHANGE-REF}

  PROCEDURE NEW_REF (VAR REF:REFERENCE);

    PROCEDURE FINISH_NEW;
    BEGIN
     ,END_IT; IF NOT OK THEN CHANGE_REF;
    END;
  BEGIN
     REPEAT
       CLEAR_SCREEN; WRITELN ('<RETURN> SKIPS ITEMS WITH NO CHANGE;');
       WRITELN ('"Q" BY ITSELF SKIPS THE REST OF THIS REFERENCE.');
       WITH REF DO
       BEGIN
         KEY:=CITATION;
         YEAR:=COPY(KEY, LENGTH(KEY)-3, 4);
         BOOK:=GET_CHAR ('Is this a book? ','',['Y','N'])='Y';
         IF NOT ENTER_ONE(80, 'FIRST LINE OF AUTHORS:',AUTHORS1) THEN FINISH_NEW;
         IF NOT ENTER_ONE(80, 'SECOND LINE OF AUTHORS:',AUTHORS2) THEN FINISH_NEW;
         IF NOT ENTER_ONE(80, 'FIRST LINE OF TITLE:',TITLE1) THEN FINISH_NEW;
         IF NOT ENTER_ONE(80, 'SECOND LINE OF TITLE:',TITLE2) THEN FINISH_NEW;
         IF NOT ENTER_ONE(80, 'THIRD (AND LAST) LINE OF TITLE:',TITLE3)
             THEN FINISH_NEW;
         IF NOT BOOK THEN
         BEGIN
         IF NOT ENTER_ONE (80, 'JOURNAL NAME:',JOURNAL) THEN FINISH_NEW;
           IF NOT ENTER_ONE (4, 'VOLUME:',VOL) THEN FINISH_NEW;
           IF NOT ENTER_ONE (15,'PAGES:',PAGES) THEN FINISH_NEW
         END ELSE
           IF NOT ENTER_ONE (80,'PUBLISHER & CITY',JOURNAL) THEN FINISH_NEW;
       END;
       FINISH_NEW;
     UNTIL OK
  END;  {NEW_REF}
  PROCEDURE ADD_REF (VAR REF:REFERENCE);
  VAR CHOICE: CHAR;
  BEGIN
    RECNUM :=-1;  {To start with record number 0 when incremented}
    REPEAT SEARCH_FILE(SOURCEFILE^) UNTIL (TEST = CITATION) OR
      (COPY (TEST,1,2) = 'XX') OR (TEST = '') OR EOF (SOURCEFILE);
    IF EOF (SOURCEFILE) THEN
    BEGIN
      WRITELN ('THERE ARE NO MORE SPACES AVAILABLE IN FILE ',FILENAME,'.');
      EXIT (ADD_REF)
    END; FOUND:=TRUE;
    IF (COPY (TEST,1,2) = 'XX') OR (TEST = '') THEN NEW_REF (SOURCEFILE^)
      ELSE IF TEST=CITATION THEN  {a previous record with this key}
    BEGIN
      CLEAR_SCREEN; WRITELN (CHR(7), CITATION,' is ALREADY PRESENT.');
      SHOW_REF; WRITELN;
      CASE GET_CHAR('Do you want to (C)hange it, (Q)uit with no change,',
        'or (A)dd another reference for this citation? ',['C','Q','A']) OF
      'Q': BEGIN END_IT; EXIT (ADD_REF); END;
      'C': CHANGE_REF;
      'A': BEGIN
             REPEAT SEARCH_FILE (SOURCEFILE^) UNTIL (COPY (TEST,1,2) = 'XX')
               OR (TEST = '');
             NEW_REF (SOURCEFILE^)
           END;
      END;  {CASE}
    END;  {KEY=CITATION}
  END;  {ADD_REF}
  PROCEDURE ENTER_CITATION;
  BEGIN
    REPEAT
      CLEAR_SCREEN;
      WRITELN ('Type the citation (name, year format) to be entered.');
      WRITELN ('Press <RETURN> with no entry to exit this part.');
      READLN (CITATION);
      IF CITATION <>'' THEN
      BEGIN
        INITIAL:=COPY(CITATION,1,1); GET_FILE; RECNUM:=-1;
        ADD_REF (SOURCEFILE^); WRITE ('For the next entry, ')
      END;
      WRITELN; CLOSE (SOURCEFILE, LOCK);
    UNTIL CITATION = ''
  END;

  BEGIN {MAIN PROGRAM}
     REPEAT
       CLEAR_SCREEN; FOUND:=FALSE;
       WRITELN ('Which of the following is to be done?');
       WRITELN ('     1.  (E)nter a new reference listing.');
       WRITELN ('     2.  (C)hange or remove a reference now on the diskette.');
       WRITELN ('     3.  (Q)uit this program.');
       CHOICE:=GET_CHAR(' Enter the number or letter you choose. ','',
          ['1'..'3','E','C','Q']);
       CASE CHOICE OF
         '1', 'E': ENTER_CITATION;
         '2', 'C': CHANGE_REF;
       END;  {CASE STATEMENT}
     UNTIL CHOICE IN ['3','Q'];
     CLEAR_SCREEN
  END.
```

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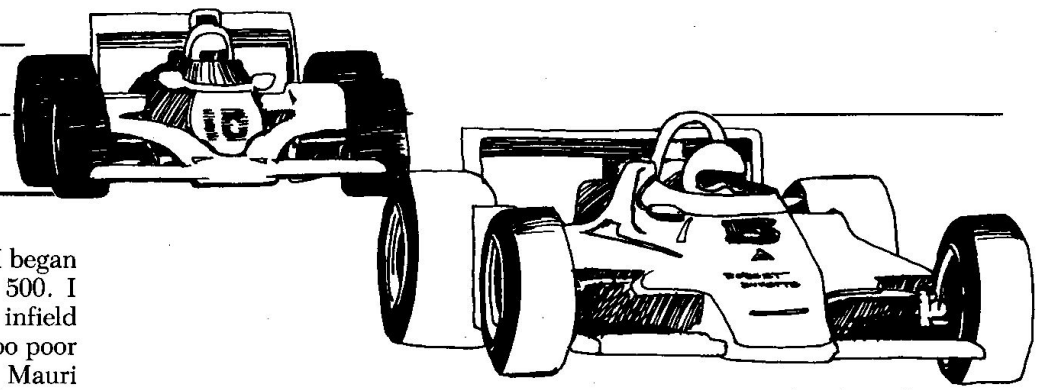
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Indy

After the big race when the engines are silent and the crowd has gone home, you'll still have your lap charts to remind you.

by Earl Johnson



It's been over 30 years since I began following the Indianapolis 500. I can remember standing at the infield fence under the broiling sun, too poor to buy a Coke, and watching Mauri Rose sail to victory. Ten years later, I had progressed to the grandstands with a cooler of beer at my feet.

Somewhere along the line, I began keeping lap charts. I found that charting the race was almost as much fun as watching it. The charts kept me on top of things and created a special history. Years went by and I moved to the West Coast, but though I no longer attended the race, I kept up with my annual charting, glued to the radio on race morning.

Using my Apple to chart the 500 was in my mind the day I brought it home from the store. Thus, Indy (see program listing) was written and used for the first time in 1981. It works fine.

While Indy is specific for the Indianapolis auto race, it could be adapted easily for other types of races. For instance, you could modify it to score your local marathon run. Using data statements for the entry listings is a natural here, providing considerable speed and flexibility.

The program may look long, but is virtually all single statement lines. You can shorten it by omitting the remarks lines, although obviously I firmly believe in liberally salting your programming with remarks. They are helpful in locating things you'll want to change sometime, especially in a program you may not get around to modifying until next year's race.

Program Operation

Indy won't do you much good without a printer in your system. Its main function is to produce printed lap charts. If you don't have a printer and can't get access to one, you'd better skip this program.

Let's go into the menu functions:

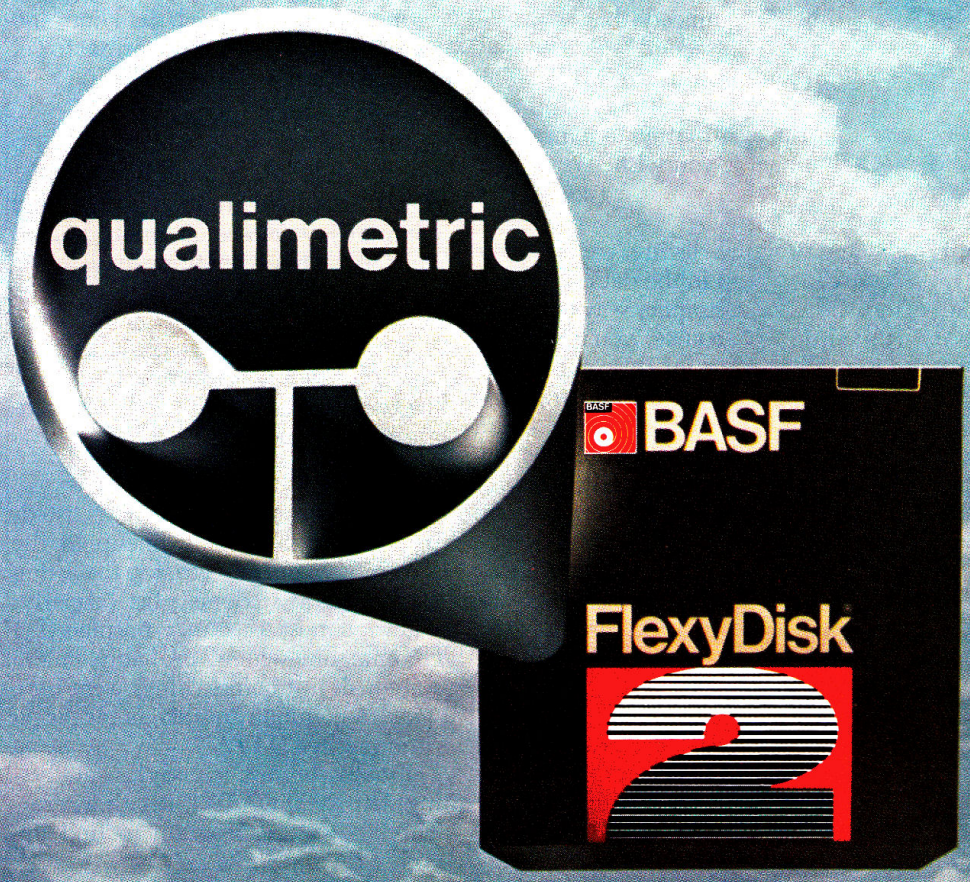
1) *Enter lap rundown and race speeds:* During the race, car positions are run down by car number (not by driver). A rundown gives positions of the first 10–15 cars. Rundowns are usually given on the first and fourth lap, and then after every tenth lap (25 miles) of the race. Sometimes things get hectic and the rundowns are delayed. The broadcasters try to catch up any missed rundowns when the race is running under the yellow caution flag. Available speeds for these rundowns are usually given as well—both the present speed and the previous record speed.

I jot the car numbers down on scratch paper as they are run down. The reason for this is that sometimes the announcer will make a mistake and these rundowns are usually done so fast that you don't have time to back up and correct a computer entry. Then I enter the numbers. Sometimes lap speeds are omitted, so the program allows you the option of entering these or not.

Pressing return will print these numbers, formatted in a line across your page. Usually only the first ten to 15 front runners are given in each rundown. As the program is written, ten positions will fit fine on normal-width paper. Removing the semicolon at the end of line 310 will let you list 15. You could rewrite line 330 so the positional numbering is omitted, and thus get the entire field on standard-width paper. Unfortunately, positions for the entire field are not given often enough to make charting them meaningful.

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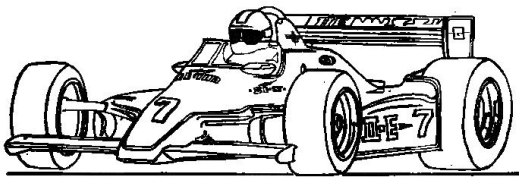
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Maybe they could use an Apple in the broadcast booth.

When information is entered for successive ten-lap rundowns, it is printed beneath the previous entry. At the conclusion of the race, the car numbers can be connected by lines down the page. This gives a complete picture of the race, graphically showing who was the hotshot driver this year, the best position your favorite attained, and so on.

2) *Enter text comments:* As the race progresses, you may want to enter text comments to be printed to your chart. You might use this function to note the reason a car dropped out of the race or to describe an accident. You also might want to enter the interval between cars 1 and 2, so it will be handy for comparison following pit stops. Or you just might want to update something entered earlier. You are asked for the lap number for the comment.

3) *Car and driver information:* This function accesses a submenu that will display the driver of any car on the screen. You may also display or print the entire starting lineup.

4) *Enter cars out of the race:* On occasion the cars that are no longer running will be announced, more or less in the order in which they went out. Jot this information down and enter it. You may elect to skip this part, but I find it gives me a good idea of how things are going to wind up. This is one of the facets of the broadcast I wish were done more often.

5) *Convert seconds/lap to MPH:* It is sometimes announced that a car is turning, say, 45-second laps. You may quickly convert this to MPH. This function is a screen display. You may transfer the information to paper via a text comment if you wish.

Data Entry

The program listing contains the 1981 race lineup in the data. I include it to show the customary way to format the entries. Of course, you'll want to enter information for this year's race.

Newspapers print the starting lineup, usually in the format shown. Begin checking them a week before race day so you can enter the data at your leisure. Make sure the car numbers are provided in the paper you buy—some omit them. You should further check the numbers as they are given in the prerace broadcast to be sure they are correct.

There are 33 cars in the race. You are allowed four data fields per entry. The first must be the car number. The second must be the driver's name. The third is customarily the builder/engine-type and the fourth the qualifying speed for the race. You may change the information in the third and fourth fields if you have a better way, but the car number and driver must be first and second for proper program function.

Be careful about comma separators when entering data statements. You must use exactly three commas separating four fields in each data line—no more, no less—unless you format to get around this. For instance:

```
7110 DATA 1,RICK MEARS,"PENSKE-
FORD,8 CYLINDER",207.004
```

is a four-field data statement because the third field (and its included comma) is enclosed in quote marks. Your Apple reads anything in quotes as a string.

Conversely, you can cut the data lines back to just car number and driver by adding commas to the end of the two fields so the Apple thinks there are four. For instance:

```
7110 DATA 1,RICK MEARS,,
```

When you've got all the cars listed, try listing the starting lineup to the screen. Use control-C to stop the listing as desired. It if doesn't list properly, you've almost certainly misplaced a comma somewhere, probably in the statement just before things went haywire. A common mistake is placing a comma after DATA.

Finally, be sure to end the data listing with 8000 DATA 0 (that's a zero). This allows the program to find the end of the data.

You will want to play with the program a bit before race day to get the hang of it. But once it's running, your only problem if you live on the West Coast is getting up for the 8:30 AM broadcast. Hope you like it. ■

Program listing. Indy lap chart program.

```
10  REM **********************
20  REM *    *** INDY ***     *
30  REM * LAP CHART PROGRAM  *
40  REM *  BY EARL JOHNSON   *
50  REM *  MEDFORD, OREGON   *
60  REM **********************
70  REM

100  TEXT : HOME : NORMAL : CLEAR

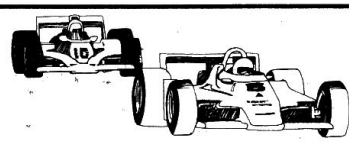
110  DIM T(33): DIM N(33)
120  GOSUB 520: REM  GO TO MENU
130  REM
140  REM

        CAR POSITIONS

150  REM

160  GOSUB 2000
170  PRINT "RUNDOWN FOR LAP # ";:
      INPUT L
180 N = 1
190  PRINT : PRINT "ENTER CAR # -
      ENTER 0 WHEN DONE"
200  PRINT "POSITION ";N;: INPUT
     X
210 T(N) = X
220  IF X = 0 THEN 240
230 N = N + 1: GOTO 200
240  PRINT "DONE FOR ";N - 1;" IT
     EMS"
250  PRINT : PRINT "DO YOU HAVE A
     VERAGE SPEEDS TO RECORD IN T
     HIS RUNDOWN ";: INPUT A$
260  IF A$ = "Y" THEN  GOSUB 400
```

Listing continued.



Listing continued.

```
270  PRINT : INPUT "HIT RETURN FO
     R PRINTOUT ";GO$: GOSUB 820
280  REM
290  REM

          PROGRAM PROCESSING

300  REM
310  PRINT : PRINT "*** POSITIONS
      FOR LAP # ";L;"  ";
320  FOR M = 1 TO N - 1
330  PRINT "(";M;") ";T(M);" ";: NEXT

340  PRINT
350  IF A$ <  > "Y" THEN  PRINT "
     (SPEED INFORMATION NOT AVAIL
     ABLE AT THIS ENTRY)"
360  GOSUB 490
370  GOSUB 850
380  GOTO 100
390  END
400  REM
410  REM

          SPEED INFO

420  REM
430  PRINT : INPUT "ENTER NEW RAC
     E AVERAGE ";NS
440  PRINT : INPUT "ENTER OLD RAC
     E AVERAGE ";OS
450  PRINT : INPUT "PREVIOUS RECO
     RD YEAR ";YR
460  LET RS = NS - OS
470  LET RS = ( INT (100 * (RS +
     .005))) / 100: REM  ROUND OF
     F DECIMAL FIGURE TO 2 PLACES

480  RETURN
490  IF NS > OS THEN  PRINT "NEW
     RECORD OF ";NS;" BETTERS OLD
      RECORD OF ";OS;" SET IN ";Y
     R;" BY ";RS;" MPH"
500  IF NS < OS THEN  PRINT "RACE
      SPEED OF ";NS;" IS BELOW RE
     CORD OF ";OS;" SET IN ";YR;"
      BY ";RS;" MPH"
510  RETURN
520  REM
530  REM

          MENU

540  REM
550  VTAB 4: HTAB 10: PRINT "SELE
     CT FROM:"
560  PRINT : PRINT
570  PRINT "1 - ENTER LAP RUNDOWN
      AND RACE SPEEDS"
580  PRINT : PRINT "2 - ENTER TEX
     T COMMENTS"
590  PRINT : PRINT "3 - CAR & DRI
     VER INFORMATION"
600  PRINT : PRINT "4 - ENTER CAR
     S OUT OF THE RACE"
610  PRINT : PRINT "5 - CONVERT S
```

Listing continued.

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Listing continued.

```
      ECONDS/LAP TO MPH"
620   PRINT : PRINT "6 - END PROGR
      AM"
630   PRINT : INPUT "WHICH NUMBER
      ";Y
640   IF Y < 1 OR Y > 6 THEN  PRINT
      : PRINT "BETWEEN 1 AND 6, PL
      EASE": GOTO 630
650   IF Y = 1 THEN  RETURN
660   IF Y = 2 THEN  GOSUB 2000
670   IF Y = 3 THEN 1230
680   IF Y = 4 THEN  GOSUB 2000: GOTO
      870
690   IF Y = 5 THEN 1080
700   IF Y = 6 THEN 390
710   REM
720   REM

            TEXT COMMENTS


730   REM
740   INPUT "LAP NUMBER FOR THIS N
      OTE: ";LAP$
750   PRINT : PRINT "ENTER TEXT --
       (UNDER 2 SCREEN LINES FOR 8
      0 COLUMN PAPER)"
755   PRINT : PRINT "(DO NOT USE C
      OMMAS OR COLONS)"
760   PRINT : INPUT T$: GOSUB 820
770   PRINT "NOTE ON ";
780   PRINT "LAP ";LAP$;":  ";: PRINT
      T$
790   GOSUB 850
800   REM

      PRINTER ON/OFF


810   GOTO 100
820 D$ =  CHR$ (4): REM  CTRL D
830   PRINT D$;"PR#1": REM  PRINTE
      R ON
840   RETURN
850   PRINT D$;"PR#0": REM    RETU
      RN TO SCREEN
860   RETURN
870   REM
880   REM

         CARS OUT

890   REM
900   GOSUB 2000
910   PRINT "CARS OUT OF THE RACE:
      "
920   PRINT : INPUT "ENTER LAP # F
      OR THIS REPORT ";Y
930 N = 1
940   PRINT : PRINT "ENTER CAR #'S
       - ENTER (0) WHEN DONE"
950   PRINT "POSITION ";(34 - N);:
       INPUT X
960 T(N) = X
970   IF X = 0 THEN 1000
980 N = N + 1
990   GOTO 950
1000   PRINT : PRINT "LIST COMPLET
      E FOR LAP # ";Y
1010   PRINT : INPUT "HIT RETURN F
      OR PRINTOUT ";GO$
1020   GOSUB 820
1030   PRINT "CARS OUT OF RACE ON
      LAP # ";Y;"  "
1040   FOR M = 1 TO N - 1
1050   PRINT "(";34 - M;") ";T(M);
      "  ";: NEXT
1060   PRINT
1070   GOSUB 850: GOTO 100
1080   REM
1090   REM

         LAP SPEED

1100   REM  (FOR 2.5 MILES/LAP)
1110   REM
1120   GOSUB 2000
1130   HTAB 8
1140   PRINT "LAP SPEED CALCULATOR
      "
1150   PRINT
1160   PRINT : INPUT "ENTER SECOND
      S PER LAP ";SEC
1170 SP = 2.5 * 3600 / SEC
1180   LET SP = ( INT (1000 * (SP +
      .005))) / 1000: REM  ROUND O
      FF DECIMAL TO 3 PLACES
1190   PRINT : PRINT SEC;" SECONDS
       EQUALS ";SP;" MPH"
1200   PRINT : INPUT "ANOTHER CALC
      ULATION (Y/N)";A$
1210   IF A$ = "Y" THEN 1150
1220   GOTO 100
1230   REM
1240   REM

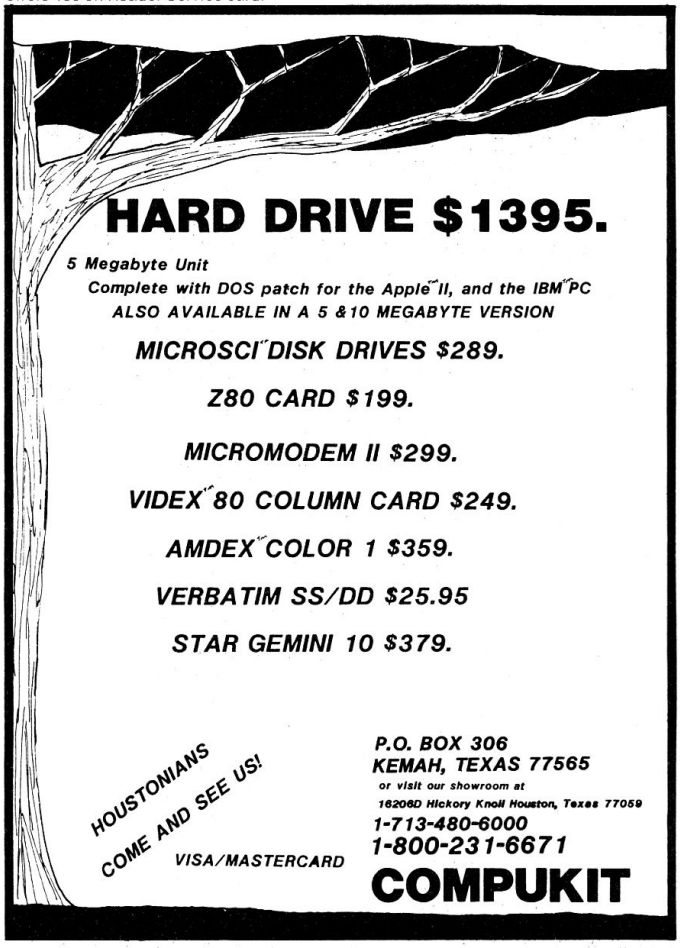
        CAR & DRIVER DATA


1250   REM
1260   REM
1270 M = 34
1280   GOSUB 2000
1290   PRINT  TAB( 12)"STARTING LI
      NE-UP"
1300   PRINT : PRINT "WOULD YOU LI
      KE...."
1310   PRINT : PRINT "1 - THE DRIV
      ER OF A PARTICULAR CAR"
1320   PRINT : PRINT "2 - PRINTOUT
       OF THE STARTING LINE-UP"
1330   PRINT : PRINT "3 - DISPLAY
      STARTING LINE-UP"
1340   PRINT : PRINT "4 - RETURN T
      O MAIN MENU"
1350   PRINT : INPUT A
1360   IF A = 1 THEN 1560
1370   IF A = 2 THEN 1410
1380   IF A = 3 THEN 1420
1390   IF A = 4 THEN 100
1400   IF A < 1 OR A > 4 THEN  PRINT
      "BETWEEN 1 AND 4, PLEASE": GOTO
      1350
1410   GOSUB 820: GOSUB 1440: GOSUB
      850: GOTO 1230
1420   GOSUB 1440: PRINT : INPUT "
      HIT RETURN TO CONTINUE ";GO$
      : GOTO 1230
1430   REM
1440   REM

       START FIELD DISPLAY
```

Listing continued.

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Listing continued.

```
1450  REM
1460  FOR I = 1 TO M: FOR J = 1 TO
      3
1470  READ CA: IF CA = 0 THEN 153
      0
1490  READ DRIVER$,CARTYPE$,SPEED
      $
1500  PRINT I;")";"      CAR# ";
1510  PRINT CA;"  ";DRIVER$;"  ";
      CARTYPE$;"  ";SPEED$
1520 I = I + 1: NEXT J: PRINT : PRINT
      :I = I - 1: NEXT I
1530  RESTORE : RETURN
1540  REM

      INDIVIDUAL CARS

1550  REM
1560  GOSUB 2000
1570  INPUT "DRIVER FOR WHAT CAR
      # ";X
1580  PRINT : PRINT
1590  FOR I = 1 TO M
1600  READ CA
1610  IF CA = 0 THEN 1710
1620  READ DRIVER$,CARTYPE$,SPEED
      $
1630  IF CA <  > X THEN 1700
1640  PRINT "CAR # ";CA;" IS A ";
      CARTYPE$
1650  PRINT : PRINT "DRIVER: ";DR
      IVER$
1660  PRINT : PRINT "QUALIFIED AT
      ";SPEED$
1670  PRINT : PRINT "STARTED IN P
      OSITION # ";I
1680  PRINT : PRINT
1690  GOTO 1720
1700  NEXT I
1710  PRINT : PRINT "CAR # ";X;"
      IS NOT ENTERED"
1720  PRINT : INPUT "HIT RETURN T
      O CONTINUE ";GO$
1730  RESTORE : GOTO 1230
2000  REM
2010  REM       CLEAR SCREEN
2020  REM
2030  HOME : VTAB 6: RETURN
7000  REM
7010  REM

        DATA PROGRAM

7020  REM
7030  REM  DATA ENTRIES MUST BE E
      NTERED IN PROPER SYNTAX AND
      IN QUALIFYING ORDER
7040  REM  USE FORM OF CAR#,DRIVE
      R,CAR OWNER & TYPE, QUAL SPE
      ED
7050  REM  THERE IS NO COMMA FOLL
      OWING 'DATA' -- 3 COMMAS SEP
      ARATE THE 4 FIELDS/LINE
7060  REM  STARTING LINEUPS ARE I
      N MOST NEWSPAPERS A DAY OR T
      WO BEFORE THE RACE
7070  REM  CHECK YOUR DATA ENTRIE
      S BY LISTING ALL CARS TO YOU
      R CRT
7080  REM  THE PROGRAM ALLOWS 33
      DATA ENTRIES PLUS A "DATA 0"
       STATEMENT (LINE 8000)
7090  REM

      DATA ENTRIES FOLLOW


7100  REM
7110  DATA  1,RICK MEARS,PENSKE-F
      ORD,207.004
7120  DATA  4,KEVIN COGAN,PENSKE-
      FORD,204.082
7130  DATA  14,A.J. FOYT,MARCH-CO
      SWORTH,203.332
7140  DATA  40,M. ANDRETTI,WILDCA
      T-COSWORTH,203.172
7150  DATA  20,G. JOHNCOCK,WILDCA
      T-COSWORTH,201.884
7160  DATA  94,B. WHITTINGTON,MAR
      CH-COSWORTH,201.658
7170  DATA  7,T.SNEVA,MARCH-COSWO
      RTH,201.027
7180  DATA 91,D.WHITTINGTON,MARCH
      -COSWORTH,200.725
7190  DATA 25,D.ONGAIS,INERSCOPE-
      COSWORTH,199.148
7200  DATA 3,P.CARTER,MARCH-COSWO
      RTH,198.950
7210  DATA 12,CHIP GANASSI,WILDCA
      T-COSWORTH,197.704
7220  DATA 5,J.RUTHERFORD,CHAPPAR
      AL-COSWORTH,197.066
7230  DATA 53,DANNY SULLIVAN,MARC
      H COSWORTH,196.292
7240  DATA 28,HERM JOHNSON,EAGLE-
      CHEVY,195.929
7250  DATA 52,HECTOR REBAQUE,MARC
      H-COSWORTH,195.684
7260  DATA 10,AL UNSER,LONGHORN-C
      OSWORTH,195.567
7270  DATA 19,BOBBY RAHAL,MARCH-C
      OSWORTH,194.700
7280  DATA  30,HOWDY HOLMES,MARCH
      -COSWORTH,194.468
7290  DATA 31,ROGER MEARS,PENSKE-
      COSWORTH,194.154
7300  DATA 21,GEOFF BRABHAM,MARCH
      -COSWORTH,198.906
7310  DATA 75,D.FIRESTONE,EAGLE-M
      ILODON,197.217
7320  DATA  68,MICHAEL CHANDLER,E
      AGLE-CHEVY,198.042
7330  DATA 95,DALE WHITTINGTON,MA
      RCH-COSWORTH,197.694
7340  DATA 42,JIM HICKMAN,MARCH-C
      OSWORTH,196.217
7350  DATA 34,J.PARSONS,MARCH-COS
      WORTH,195.929
7360  DATA 35,G.SNIDER,MARCH-COSW
      ORTH,195.493
7370  DATA  16,TONY BETTENHAUSEN,
      MARCH-COSWORTH,195.429
7380  DATA 69,J.SNEVA,MARCH-COSWO
      RTH,195.270
7390  DATA 39,CHET FILLIP,EAGLE-C
      OSWORTH,194.879
7400  DATA 8,GARY BETTENHAUSEN,LI
      GHTNING-OFFY,195.673
7410  DATA 56,T.BIGELOW,PENSKE-CH
      EVY,194.784
7420  DATA 66,PETE HALSMER,EAGLE-
      CHEVY,194.595
7430  DATA 55,JOSELE GARZA,MARCH-
      COSWORTH,194.500
8000  DATA  0
```



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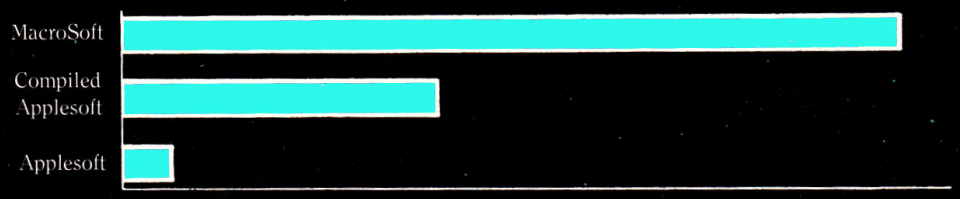
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Solving Problems With Logo

Part II

Here's your chance to put what you learned last month to practical use. Logo is not just for kids!

by Greg Stone

Program listing. Average.sort, an averaging and sorting routine.

```
TO AVERAGE.SORT
SET.START
INSTRUCTIONS
DO.WORK
NEW.ORDER
END


TO SET.START
MAKE "L.ID []
MAKE "L.AVG []
MAKE "L.SORT []
MAKE "CNT.2 1
MAKE "ID 0
END


TO INSTRUCTIONS
PRINT []
PRINT []
PRINT [THIS PROGRAM TAKES A LIST OF SCORES,]
PRINT [THEN PRINTS THE PERSON'S NAME OR]
PRINT [NUMBER, ALL THE SCORES, THE TOTAL]
PRINT [SCORE, AND AVERAGE SCORE. AFTER THIS]
PRINT [IS DONE FOR EACH INDIVIDUAL, THE LIST]
PRINT [IS SORTED FROM HIGN TO LOW AND THE]
PRINT [RANK, AVERAGE, AND IDENITIFICATION ARE]
PRINT [PRINTED IN A NEW LIST.]
PRINT []
PRINT [WHEN ALL NAMES AND SCORES HAVE BEEN]
PRINT [ENTERED, TYPE "X" WHEN PROMPTED FOR]
PRINT [CANDIDATE'S NAME OR NUMBER TO SIGNAL]
PRINT [THE SORT ROUTINE.]
PRINT []
PRINT [PRINTER MUST BE TURNED ON TO RUN THIS]
PRINT [PROGRAM.]
PRINT []
PRINT [- - - - - - - - - - - - - - - - - - - -]
END

TO DO.WORK
GET.INFO
IF :ID = [X] [STOP]
AVERAGE
ROUND.100
DISPLAY
STORE
DO.WORK
END


TO GET.INFO
PRINT [WHAT IS CANDIDATE'S IDENTIFICATION]
PRINT [NAME OR NUMBER ?]
MAKE "ID READLIST
IF :ID = [X] [STOP]
PRINT [WHAT ARE THE SCORES?]
MAKE "SCR READLIST
END
```

Listing continued.

How do you total, average and sort the scores of dozens of job candidates? One way is with a calculator and paper. But this can be a laborious process with many opportunities for error. The computer can eliminate much of the labor, reduce the chances for error, and provide printouts. Besides, it provides a perfect opportunity to try out the Logo Bubble.sort routine, described last month, on a real project.

In addition, tackling this project will develop a few Apple Logo procedures you might want to make part of your library even if you don't need the whole program. One of the bonuses of breaking the program into a collection of brief procedures is that each of these form independent units that can have many other applications.

The total program (see listing) should serve as a guide for creating similar applications, such as a teacher's gradebook.

Here's what we start with:

1. Forty candidates for an important position.
2. Each candidate is reviewed by each member of a 19-person committee and ranked on a scale of 0–5.
3. Candidates are identified only by a code number.

Address correspondence to Greg Stone, 1346 Drift Road, Westport, MA 02790.

Listing continued.

```
TO AVERAGE
MAKE "CNT (COUNT :SCR)
MAKE "TOTL ADD :SCR
MAKE "AVG :TOTL / :CNT
END


TO ROUND.100
MAKE "AVG :AVG * 100
MAKE "AVG ROUND :AVG
MAKE "AVG :AVG / 100
END


TO ADD :X
IF :X = [] [OUTPUT 0]
OUTPUT SUM FIRST :X ADD BUTFIRST :X
END


TO DISPLAY
.PRINTER 9
TYPE :ID TAB TYPE :SCR TAB TAB TYPE :TOTL TAB PRINT :AVG
PRINT []
PRINT [- - - - - - - - - - - - - - - - - - -]
.PRINTER 0
END


TO TAB
TYPE CHAR 32
IF (REMAINDER FIRST CURSOR 8) > 0 [TAB]
END


TO STORE
MAKE "L.ID LPUT :ID :L.ID
MAKE "L.AVG LPUT :AVG :L.AVG
MAKE "L.SORT LPUT :AVG :L.SORT
END


TO NEW.ORDER
MAKE "L.SORT LPUT -99999 :L.SORT
SORT
HEAD
COMPARE
END


TO SORT
MAKE "CNT.1 0
TRY
MAKE "L.SORT SENTENCE (BUTFIRST :L.SORT) (ITEM 1 :L.SORT)
IF :CNT.1 > 0 [SORT]
END


TO TRY
TEST ITEM 1 :L.SORT < ITEM 2 :L.SORT
IFTRUE [EXCHANGER]
IFFALSE [MAKE "L.SORT SENTENCE (BUTFIRST :L.SORT) (ITEM 1 :L.SORT)]
IF ITEM 1 :L.SORT > -99999 [TRY]
END


TO EXCHANGER
MAKE "L.SORT (SENTENCE (ITEM 1 :L.SORT) (BUTFIRST BUTFIRST :L.SORT) (ITEM 2 :L.SORT))
MAKE "CNT.1 :CNT.1 + 1
END


TO HEAD
.PRINTER 9
PRINT []
PRINT [- - - - - - - - - - - -]
TYPE [RANK] TAB TYPE [AVG] TAB PR [ID]
PRINT []
.PRINTER 0
END



TO COMPARE
IF :L.AVG = [] [STOP]
TEST FIRST :L.SORT = FIRST :L.AVG
IFTRUE [DISPLAY.2 NEXT.TRY COMPARE]
IFFALSE [FLIP COMPARE]
END


TO FLIP
MAKE "L.ID LPUT FIRST :L.ID :L.ID
MAKE "L.ID BUTFIRST :L.ID
MAKE "L.AVG LPUT FIRST :L.AVG :L.AVG
MAKE "L.AVG BUTFIRST :L.AVG
END


TO DISPLAY.2
.PRINTER 9
TYPE :CNT.2 TAB TYPE FIRST :L.SORT TAB PRINT FIRST :L.ID
.PRINTER 0
END


TO NEXT.TRY
MAKE "CNT.2 :CNT.2 + 1
MAKE "L.ID BUTFIRST :L.ID
MAKE "L.AVG BUTFIRST :L.AVG
MAKE "L.SORT BUTFIRST :L.SORT
END
```

Listing continued.

Here's what we want:

1. A printed sheet which shows each candidate's name or number, the scores he or she received from each committee member, the total score, and the average score rounded to the nearest hundredth.

2. A summary ranking by highest score showing the ranking, the average score (rounded to the hundredths place), and the candidate's identification number.

The program Average.sort gets us from here to there by way of 20 procedures, three of which you'll recognize as being the heart of last month's sort routine.

```
TO AVERAGE.SORT
SET.START
INSTRUCTIONS
DO.WORK
NEW.ORDER
END
```

Average.sort is also the name of the main procedure and it starts with a couple of self-explanatory routines. The first, Set.start, zeros a few variables and provides some empty lists we'll fill later. The next, Instructions, prints directions for the user. (This may seem like an unnecessary typing exercise especially if you will be the person using the program. However, I find that I have a remarkable capacity for forgetting a program once it's been on a disk a few weeks without use, so a little time spent now saves frustration later.)

The third and fourth procedures called by Average.sort are Do.work and New.order. They are the main subdivisions of the program. Do.work gets the numbers, adds and averages them, prints out the results, and stores them for sorting. New.order does the actual sorting and prints out a summary, sorted result.

```
TO DO.WORK
GET.INFO
IF :ID = [X] [STOP]
AVERAGE
ROUND.100
DISPLAY
STORE
DO.WORK
END
```

Let's walk through Do.work then, seeing exactly what each procedure does. The first procedure called is

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Listing continued.

```
?AVERAGE.SORT


THIS PROGRAM TAKES A LIST OF SCORES,
THEN PRINTS THE PERSON'S NAME OR
NUMBER, ALL THE SCORES, THE TOTAL
SCORE, AND AVERAGE SCORE. AFTER THIS
IS DONE FOR EACH INDIVIDUAL, THE LIST
IS SORTED FROM HIGN TO LOW AND THE
RANK, AVERAGE, AND IDENITIFICATION ARE
PRINTED IN A NEW LIST.

WHEN ALL NAMES AND SCORES HAVE BEEN
ENTERED, TYPE "X" WHEN PROMPTED FOR
CANDIDATE'S NAME OR NUMBER TO SIGNAL
THE SORT ROUTINE.

PRINTER MUST BE TURNED ON TO RUN THIS
PROGRAM.

- - - - - - - - - - - - - - - - - - -
WHAT IS CANDIDATE'S IDENTIFICATION
NAME OR NUMBER ?
STONE,GREG
WHAT ARE THE SCORES?
1 2 3 4 5 6 7 8 9 0 -10
STONE,GREG      1 2 3 4 5 6 7 8 9 0 -10          35      3.18

- - - - - - - - - - - - - - - - - - -
ROGER.JONES     0 9 8 7 6 5 4 3 2 1 0 9          54      4.5

- - - - - - - - - - - - - - - - - - -
1,234   12 123 1245 9876 -4500 9 8 7 6 5 4 3 2 1        6801    485.79

- - - - - - - - - - - - - - - - - - -

- - - - - - - - - - - -
RANK    AVG     ID

1       485.79  1,234
2       4.5     ROGER.JONES
3       3.18    STONE,GREG
```

Get.info, which, not too surprisingly, collects the necessary information from the user.

Incidentally, someone once complained that he couldn't understand why Apple Logo has no provision for remarks. Remarks are useful, but in Logo the trick is to keep procedures short and their names as descriptive as possible. The same can be said for variables. A little time spent trying to give procedures and variables descriptive (but brief) names will save hours when two months later you come back to your program and try to figure out what it does and why.

```
TO GET.INFO
PRINT [WHAT IS CANDIDATE'S IDEN-
  TIFICATION]
PRINT [NAME OR NUMBER ?]
MAKE "ID READLIST
IF :ID = [X][STOP]
PRINT [WHAT ARE THE SCORES?]
MAKE "SCR READLIST
END
```

The purpose of Get.info is to have the user input for each candidate first a name or number, and then the list of votes. The print statements just provide a prompt for the user and the Logo primitive Readlist collects the information entered and saves it as a list.

Get.info also contains the stop code X. If this is entered the procedure stops and control is returned to the calling procedure, Do.work. If you had entered this stop code it would mean you were ready to move directly to the sorting section of the program, so the same stop code is repeated in Do.work. (If it wasn't included in Do.work that procedure would go indefinitely.)

But that's getting ahead of the process. Let's assume we have not entered a stop code, but some valid data. Get.info gives us a candidate's identification number held in the variable ID, and all of the scores (or votes, if you like) held in the variable SCR. Once we have these, control moves to the next procedure in Do.work, Average.

```
TO AVERAGE
MAKE "CNT (COUNT :SCR)
MAKE "TOTL ADD :SCR
MAKE "AVG :TOTL / :CNT
END
```

Average does three things. Using the primitive Count, it notes the number of items in the list SCR, adds up the list and stores the result in the variable TOTL, and it divides the total by the count of the list to get an average. In doing this it calls another useful little procedure that could be used to give you a total for any list of numbers, Add.

```
TO ADD :X
IF :X = [ ] [OUTPUT 0]
OUTPUT SUM FIRST :X ADD BUTFIRST :X
END
```

The Logo primitive Sum will take a variable number of inputs and add them, but it can't handle a list. If you said SUM :SCR, it would reply with the error message SUM DOESN'T LIKE [1 2 3] AS AN INPUT. (Of course this message would vary with the content of the list.) The problem then is how to get the numbers out of the list so Sum can do its work. The path chosen here is a recursive procedure that keeps pulling the first number out of the list to use with Sum, and then shortening the list by using all but the first number next time.

The first line in Add completes the process by allowing Sum to have an input, 0, even when the list is empty. When this business is completed the Output command hands the result back to the procedure that asked for it, Average, where it is saved under the variable, TOTL.

There is one minor concern to address. Average tends to carry a number out several more decimal places than needed, so a procedure is included to round to the hundredths' place. Logo has a primitive, Round, which rounds any number to the nearest integer.

```
TO ROUND.100
MAKE "AVE :AVG * 100
MAKE "AVE ROUND :AVG
MAKE "AVG :AVG / 100
END
```

Round.100 is easiest to understand by watching what it does to a number. When you're developing or trying to understand Logo procedures it's frequently helpful to modify them by introducing print statements at key points. To see Round.100 at work add Print :avg after each line, then at command level type this:

```
MAKE "AVG 3.52447
```

Then ask for ROUND.100 and you will see this:

```
352.447
353
3.53
```

Why? Because the first line takes :AVG (3.52477) and multiplies it by 100 (352.477). The next line rounds this to the nearest integer (353), and the last line divides it by 100 (3.53).

Obviously it would be equally easy to round to the tenths or thousandths place and I suggest you write procedures for all three and store them on a Logo library disk.

Now back to the real business at hand. When Get.info, Average, and

Round.100 have completed their work we have four useful pieces of information stored in free variables for display to draw upon.

```
TO DISPLAY
.PRINTER 9 ·
TYPE :ID TAB TYPE :SCR TAB TAB TYPE
  :TOTL TAB PRINT :AVG
PRINT [ ]
PRINT [----------]
.PRINTER 0
END
```

Display turns on the printer and types out the candidate's identification number, the scores, the total and the average. The last line turns off the printer. **Warning:** If you have no printer, take these printer commands, and the one in Display.2 out of the program. Logo will crash if there is no printer plugged into the designated slot number. (We specify Slot 9 here because this copies text to the screen while it is being printed out. When Logo sees the 9, it subtracts 8 to find the printer slot. We are assuming here that the printer is in Slot 1.)

With the printing of the first line we've completed our first task. All that is required is to make Do.work recursive so it repeats the process for each candidate. If you have sharp eyes, however, you've noticed two things. There's a word in Display, Tab, which is not a Logo primitive. There's also one more procedure in Do.work, Store. Tab can be found in the *Apple Logo Reference Manual*. Tab stops are located in every eighth column and it "tabs" over to the next tab stop. Store is more important. It provides the transition to the next section of the program. Before you get into it you might want to review what we've done so far.

The basic problem Store addresses is how to keep a candidate's identification number (or name) and average associated while sorting is done so that they can be linked when the sort is finished. One solution is to create parallel lists, then put the informaton to be sorted in a third list. That's the process used here.

```
TO STORE
MAKE "L.ID LPUT :ID :L.ID
MAKE "L.AVG LPUT :AVG :L.AVG
MAKE "L.SORT LPUT :AVG :L.SORT
END
```

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Here's where the LPUT command really gets a workout. LPUT puts the object it works on at the end of a list. In Store the important point is it's creating two parallel lists, one containing the candidate's name or number, and the other the average score for that candidate. Each time Store is called a new identification and average get placed at the end of their respective lists. The second important thing happening here is the same averages are also being saved in a third list (L.sort), which will be sorted.

When the first candidate's name and score are thus neatly stored, the procedure Do.work calls itself and goes back and gets the information about the next candidate. It calculates a total and average, prints out the candidate's number, the scores, total and average, and then stores the essential items. This recursion goes on until it sees the stop code, X.

When that happens, any time Stop is encountered, control is returned to the program that called it. In this case, Do.work was called by the main procedure, Average.list, so we go back there and find we are at the last line. (The program picks up where it left off.) So Average.list calls New.order, which gets the sorting done and prints the results.

```
TO NEW.ORDER
MAKE "L.SORT LPUT -99999 :L.SORT
SORT
HEAD
COMPARE
END
```

In last month's Bubble.sort we instructed the user to introduce a stop code. Here that stop code is introduced by the first line of New.order, which makes -99999 the last number in the list L.sort. (It's minus 99999 because the sort routine has been altered slightly to sort from highest to lowest rather than lowest to highest.)

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The next line calls Sort. These procedures are taken straight from last month's program, so we won't examine them here. You will find that names of variables have been changed to conform with this program, so if you have the program saved you'll want to make those changes in it. Also check signs on stop codes and the "greater than" and "less than" symbols to make sure they conform with the program.

If you are going to enter this program, the easiest way to start is to first load Bubble.sort (assuming you have it), then erase all except Sort, Try and Exchanger from your workspace. Now edit these three to conform with what is published this month, then type in the rest of this program. Save the entire workspace under the heading Average.sort, or whatever name will help you remember what it does.

When Sort finishes its work, control returns to New.order which calls Head. All this does is provide a cosmetic heading for the printout to follow and is self-explanatory.

```
TO HEAD
.PRINTER 9
PRINT [ ]
PRINT [----------]
TYPE [RANK] TAB TYPE [AVG] TAB PR [ID]
PRINT [ ]
.PRINTER 0
END
```

This and the other printing routines (Display, and Display.2) do illustrate the difference between the Logo primitives Type and Print. These both print what follows, but Print is followed by an automatic carriage return while Type lets you stay on the same line.

The next procedure New.order calls is Compare, which compares the sorted list with the two parallel lists of averages and identification created in Store.

```
TO COMPARE
IF :L.AVG = [ ] [STOP]
TEST FIRST :L.SORT = FIRST :L.AVG
IFTRUE [DISPLAY.2 NEXT.TRY COMPARE]
IFFALSE [FLIP COMPARE]
END
```

The first line stops the program once the lists are empty. The next line is the heart of the process. It runs a test to see if the first number in the sorted list is the same as the first number in the list of averages. If this test proves false, then Flip is called.

"That's it—perhaps a little complex in its entirety, but simple in any given procedure."

```
TO FLIP
MAKE "L.ID LPUT FIRST :L.ID :L.ID
MAKE "L.ID BUTFIRST :L.ID
MAKE "L.AVG LPUT FIRST :L.AVG :L.AVG
MAKE "L.AVG BUTFIRST :L.AVG
END
```

Flip works on the parallel lists containing the name (or number) and the averages. It "flips" a copy of the first item in each list to the end of its respective list using LPUT. If you let it stop there, however, you would simply have the same content at the start and finish of each list, so you have to create a new list that is the Butfirst of the old list (all but the first item of the old list).

Control then returns to Compare. (This is accomplished by the second instruction under IFFALSE in Compare.) All that happened is that the first item has been moved to the back of the bus in the parallel lists so we can now compare the first item in the sorted list of averages with what was originally the second item in the original list of averages. The parallel lists keep scrolling forward in this manner until a match is found; when that happens the instructions under IF TRUE are carried out.

The first of these prints out the result through the straightforward Display.2.

```
TO DISPLAY.2
.PRINTER 9
TYPE :CNT.2 TAB TYPE FIRST :L.SORT
  TAB PRINT FIRST :L.ID
.PRINTER 0
END
```

It first prints a rank with CNT.2. (Set.start sets this counter at 1 at the beginning of the program.) The next thing it asks for is the first item in the sorted list. Since the list is sorted high-to-low this will be the highest score. But who does it belong to? Since the list containing the names (or numbers of candidates has been moving on a parallel track with the original list of averages, all we need is the first item of L.ID.

At work this process might look like this:

Three lists when sorting is finished:

:L.ID	Kaput	Smith	Jones
:L.AVG	23.55	25.09	50.25
:L.SORT	50.25	25.09	23.55

After first test in Compare proves false:

:L.ID	Smith	Jones	Kaput
:L.AVG	25.09	50.25	23.55
:L.SORT	50.25	25.09	23.55

After second test in Compare proves false:

:L.ID	Jones	Kaput	Smith
:L.AVG	50.25	23.55	25.09
:L.SORT	50.25	25.09	23.55

Now there's a numerical match between the FIRST :L.SORT and FIRST :L.AVG, so Display.2 prints:

```
1 50.25 Jones
```

Obviously, that doesn't finish the job. Note that in Compare if something is true, the procedure Next.try is called before going back to Compare once more.

```
TO NEXT.TRY
MAKE "CNT.2 :CNT.2 + 1
MAKE "L.ID BUTFIRST :L.ID
MAKE "L.AVG BUTFIRST :L.AVG
MAKE "L.SORT BUTFIRST :L.SORT
END
```

Since Next.try will be called only when a match is found and after it is printed, the first thing to do is increment the counter that keeps track of the ranking. The next three lines take each of our lists and chop off the first item. By dropping items like this after they have been printed, we avoid the problem of identical scores. (If this weren't done, identical scores would all go to the credit of the first person whose name was associated with the score.)

That's it—perhaps a little complex in its entirety, but simple in any given procedure. Of course the program has its limitations. You may get an "out of space" message in Logo if you put more than 25 scores in for a single candidate. Similarly, as noted last month, the bubble sorting routine is relatively slow, so if you have more than 40 candidates, it's best to use some other program. Within these limitations it should function fine. ■

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EPROM Edification
Part II

Here's the program you've been waiting for. Now you can read EPROMs into Apple memory, so copies are yours when needed.

by Joe Magee

In March I presented an EPROM programmer that could do only one thing: program a 2516-type EPROM. This month, I describe a few simple additions that will allow reading (and thus copying) an EPROM as well as programming. Also, the software from the last article has been updated to handle the read function and is presented here (see the program listing).

The hardware modifications consist of adding 3 ICs (U7, U8, and U9). U7, a 74LS08, is used to improve resetting the programmer. The original hardware had no power-on-reset capability; the only way to ensure that the power to the EPROM socket was off was to issue a reset from software. The new scheme will reset the programmer any time the Apple is reset, as well as from within the program.

In Part 1, five of the eight possible decodes from U3 were used. To implement the read capability, the last three decodes are used.

Function 6, address 5, is used to toggle between the PROM write and read condition. When reset occurs, the programmer is put in the program mode. When toggled into the read

Listing. Updated EPROM programmer driver.

```
                        1000 *
                        1010 * EPROM PROGRAMMER DRIVER
                        1020 *
                        1030 * THIS PROGRAM IS TO DRIVE THE UPDATED EPROM
                        1040 * PROGRAMMER.  IT WILL READ AS WELL AS PROGRAM
                        1050 * EPROMS.  IT FUNCTIONS WITH ONLY TMS 2516 TYPE EPROMS.
                        1060 *
                        1070 * JOE MAGEE
                        1080 * P. O. BOX 614337
                        1090 * IRVING, TEXAS 75061
                        1100 *
C080-                   1110 RESET  .EQ $C080    RESET PROGRAMMER
C081-                   1120 BMPADR .EQ $C081    BUMP ROM ADR
C082-                   1130 RELAY  .EQ $C082    TOGGLE RELAY
C083-                   1140 PGM    .EQ $C083    TOGGLE PGM PIN
C084-                   1150 DATA   .EQ $C084    STORE DATA IN LATCH
C085-                   1160 RDENBL .EQ $C085    ENABLE READ FUNCTION
C086-                   1170 WRENBL .EQ $C086    ENABLE WRITE FUNCTION
C087-                   1180 PRMDAT .EQ $C087    READ EPROM DATA
FDF0-                   1190 COUT1  .EQ $FDF0    CHAR TO SCREEN ROUTINE
FF69-                   1200 MONITR .EQ $FF69    MONITOR RETURN POINT
FC58-                   1210 CLEAR  .EQ $FC58    CLEAR SCREEN ROUTINE
FD0C-                   1220 RDKEY  .EQ $FD0C    GET KEY STROKE
FDDA-                   1230 PRBYTE .EQ $FDDA    PRINT ACCUMULATOR IN HEX
000D-                   1240 CR     .EQ $0D      ASCII CARRIAGE RETURN
0003-                   1250 ETX    .EQ $03      ASCII END OF TX
0007-                   1260 BELL   .EQ $07      ASCII BELL
0031-                   1270 ONE    .EQ $31      ASCII ONE
0032-                   1280 TWO    .EQ $32      ASCII TWO
0033-                   1290 THREE  .EQ $33      ASCII THREE
0000-                   1300 PRTPTR .EQ $00      PRINT STRING POINTER
0002-                   1310 BUFFER .EQ $02      POINTER TO MEM BUFFER
0004-                   1320 SLOT   .EQ $04      SLOT NUMBER
0005-                   1330 COUNT  .EQ $05      DELAY COUNT
1010-                   1340 SCASMB .EQ $1010    ENTRY POINT FOR SC ASSEMBLER
                        1350        .OR $8000    START LOC
                        1360        .TF NEWPROMOBJ2
8000-                   1370 START  .EQ *        START OF PROGRAMMER
8000- 20 42 81          1380        JSR BANNER   PRINT SCREEN HEADING
8003- AD 67 81          1390        LDA GETSLT   MESSAGE ADR HI
8006- 85 00             1400        STA PRTPTR   SAVE
8008- AD 68 81          1410        LDA GETSLT+1 MESSAGE ADR LO
800B- 85 01             1420        STA PRTPTR+1 SAVE
800D- 20 14 81          1430        JSR PRINT    PRINT MESSAGE
8010- 20 0C FD          1440        JSR RDKEY    GET INPUT DATA
8013- 20 F0 FD          1450        JSR COUT1    ECHO IT
8016- 29 7F             1460        AND #$7F     MASK OFF MSB
```

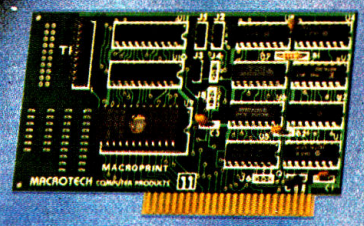
Listing continued.

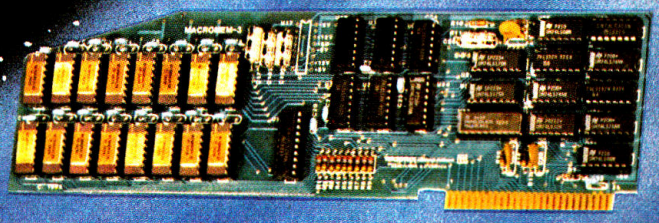
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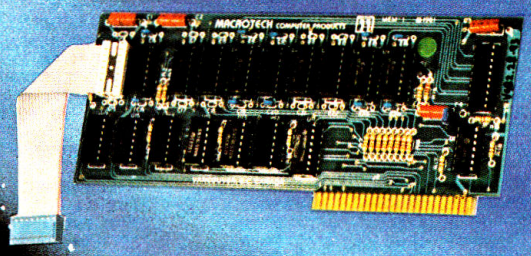
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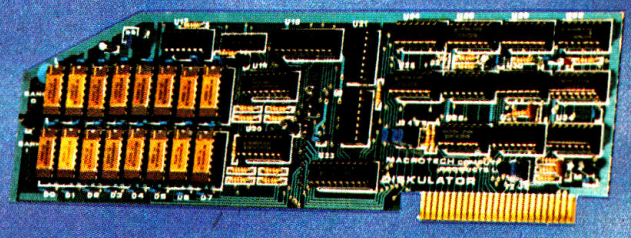
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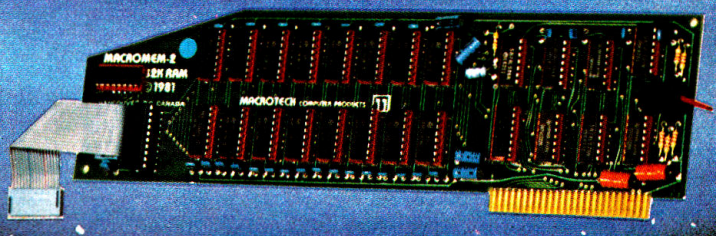












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Listing continued.

```
8018- C9 38     1470         CMP #$38      A GOOD NUMBER?
801A- 10 E4     1480         BPL START     IF NOT GOOD, START OVER
801C- 29 0F     1490         AND #$0F      MASK ASCII PORTION
801E- 0A        1500         ASL           SHIFT TO LEFT HALF
801F- 0A        1510         ASL
8020- 0A        1520         ASL
8021- 0A        1530         ASL
8022- AA        1540         TAX           PUT IN INDEX
8023- 85 04     1550         STA SLOT      SAVE IT
8025-           1560 DONE    .EQ *         COME HERE WHEN FINISHED
8025- BD 80 C0  1570         LDA RESET,X   RESET PROGRAMMER
8028-           1580 CHOOSE  .EQ *         CHOOSE FUNCTION
8028- 20 42 81  1590         JSR BANNER    PRINT SCREEN HEADING
802B- AD A8 81  1600         LDA CHOICE    GET MSG ADR LOW
802E- 85 00     1610         STA PRTPTR    PUT IN PRINT POINTER
8030- AD A9 81  1620         LDA CHOICE+1  GET MSG ADR HI
8033- 85 01     1630         STA PRTPTR+1  PUT IN PRINT POINTER
8035- 20 14 81  1640         JSR PRINT     PRINT CHOICE MESSAGE
8038- 20 0C FD  1650         JSR RDKEY     GET OPERATOR INPUT
803B- 29 7F     1660         AND #$7F      MASK OFF MSB
803D- C9 31     1670         CMP #ONE      IS IT A 1?
803F- D0 03     1680         BNE CK2       NOT ONE, CHECK FOR 2
8041- 4C E3 80  1690         JMP READ      WAS A 1, GO TO READ SECTION
8044-           1700 CK2     .EQ *         CARRY ON WITH INPUT CHECK
8044- C9 32     1710         CMP #TWO      IS IT A 2?
8046- F0 07     1720         BEQ PROG      YES, GO PROGRAM AN EPROM
8048- C9 33     1730         CMP #THREE    IS IT A 3?
804A- D0 DC     1740         BNE CHOOSE    NO, ILLEGAL INPUT, REDO
804C- 4C 10 10  1750         JMP SCASMB    EXIT TO ASSEMBLER
804F-           1760 PROG    .EQ *         PROGRAM AN EPROM
804F- 20 53 81  1770         JSR PUTIN     HAVE OPERATOR PUT EPROM IN SOCKET
8052- BD 82 C0  1780         LDA RELAY,X   TOGGLE RELAY
8055- A9 64     1790         LDA #100      SET UP 100MS WAIT
8057- 20 2B 81  1800         JSR WAIT      WAIT
805A- A9 00     1810         LDA #00       INIT BUFFER POINTER
805C- 85 02     1820         STA BUFFER    SAVE IT
805E- A9 08     1830         LDA #08       BUFFER STARTS AT $800
8060- 85 03     1840         STA BUFFER+1  SAVE IT
8062- A0 00     1850         LDY #00       INIT INDEX
8064-           1860 GETDTA  .EQ *         PROGRAM LOOP
8064- B1 02     1870         LDA (BUFFER),Y GET DATA
8066- 9D 84 C0  1880         STA DATA,X    PUT IN LATCH
8069- BD 83 C0  1890         LDA PGM,X     TOGGLE PROGRAM PIN
806C- A9 32     1900         LDA #50       SET UP 50 MS WAIT
806E- 20 2B 81  1910         JSR WAIT      WAIT
8071- BD 83 C0  1920         LDA PGM,X     TOGGLE PGM PIN
8074- BD 85 C0  1930         LDA RDENBL,X  ENABLE READ MODE
8077- BD 87 C0  1940         LDA PRMDAT,X  GET PROM DATA
807A- D1 02     1950         CMP (BUFFER),Y COMPARE WITH EXPECTED DATA
807C- D0 14     1960         BNE WRERR     IF NO MATCH, GO PRINT ERROR REPORT
807E- BD 86 C0  1970         LDA WRENBL,X  ENABLE WRITE MODE
8081- BD 81 C0  1980         LDA BMPADR,X  BUMP PROM ADR
8084- C8        1990         INY           INCREMENT INDEX
8085- D0 DD     2000         BNE GETDTA    IF NOT 256, THEN CONTINUE
8087- A5 03     2010         LDA BUFFER+1  GET CURRENT POINTER
8089- C9 0F     2020         CMP #$0F      CHECK FOR LAST PAGE ($F00)
808B- F0 98     2030         BEQ DONE      IF LAST PAGE AND Y=256, THEN DONE
808D- E6 03     2040         INC BUFFER+1  BUMP PAGE
808F- 4C 64 80  2050         JMP GETDTA    DO NEXT BYTE
8092-           2060 WRERR   .EQ *         WRITE VERIFY ERROR
8092- AD 1C 82  2070         LDA WRMSG     WRITE ERROR MSG ADR LO
8095- 85 00     2080         STA PRTPTR    PUT IN PRINT POINTER
8097- AD 1D 82  2090         LDA WRMSG+1   WRITE ERROR MSG ADR HI
809A- 85 01     2100         STA PRTPTR+1  PUT IN PRINT POINTER
809C- 20 14 81  2110         JSR PRINT     PRINT FIRST PART OF ERROR REPORT
809F- A5 03     2120         LDA BUFFER+1  GET CURRENT PAGE NUMBER
80A1- 20 DA FD  2130         JSR PRBYTE    PRINT PAGE NUMBER
80A4- 98        2140         TYA           CURRENT BYTE IN PAGE TO A
80A5- 20 DA FD  2150         JSR PRBYTE    PRINT ROM ADDRESS LOW
80A8- AD 36 82  2160         LDA ROMMSG    ROM DATA PREFIX LO
80AB- 85 00     2170         STA PRTPTR    PUT IN PRINT POINTER
80AD- AD 37 82  2180         LDA ROMMSG+1  ROM DATA PREFIX HI
80B0- 85 01     2190         STA PRTPTR+1  PUT IN PRINT POINTER
80B2- 20 14 81  2200         JSR PRINT     PRINT ROM DATA PREFIX
80B5- BD 87 C0  2210         LDA PRMDAT,X  GET PROM DATA
80B8- 20 DA FD  2220         JSR PRBYTE    PRINT IT
80BB- AD 3F 82  2230         LDA BFRMSG    GET BUFFER DATA PREFIX
80BE- 85 00     2240         STA PRTPTR    PUT IN PRINT POINTER
80C0- AD 40 82  2250         LDA BFRMSG+1  GET BUFFER DATA PREFIX HI
80C3- 85 01     2260         STA PRTPTR+1  PUT IN PRINT POINTER
80C5- 20 14 81  2270         JSR PRINT     PRINT BUFFER DATA PREFIX
80C8- B1 02     2280         LDA (BUFFER),Y GET BUFFER DATA
80CA- 20 DA FD  2290         JSR PRBYTE    PRINT BUFFER DATA
80CD- AD 49 82  2300         LDA RESMSG    RESTART MESSAGE
80D0- 85 00     2310         STA PRTPTR    PUT IN PRINT POINTER
80D2- AD 4A 82  2320         LDA RESMSG+1  RESTART MESSAGE ADR HI
80D5- 85 01     2330         STA PRTPTR+1  PUT IN PRINT POINTER
80D7- 20 14 81  2340         JSR PRINT     PRINT MESSAGE
80DA- BD 80 C0  2350         LDA RESET,X   TURN OFF PROGRAM VOLTAGE
80DD- 20 0C FD  2360         JSR RDKEY     WAIT FOR OPERATOR TO CONTINUE
80E0- 4C 25 80  2370         JMP DONE      GO DO NEXT SELECTION
80E3-           2380 READ    .EQ *         READ EPROM INTO MEMORY
80E3- 20 53 81  2390         JSR PUTIN     PUT EPROM IN SOCKET
80E6- A9 00     2400         LDA #00       INIT BUFFER POINTER
80E8- 85 02     2410         STA BUFFER    LOW HALF
80EA- A9 08     2420         LDA #08       BUFFER AT $800
80EC- 85 03     2430         STA BUFFER+1  UPPER HALF
80EE- A0 00     2440         LDY #00       INIT INDEX
```

Listing continued.

Listing continued.

```
80F0- BD 85 C0 2450         LDA RDENBL,X ENABLE READ FUNCTION
80F3- BD 82 C0 2460         LDA RELAY,X  TOGGLE (TURN ON) RELAY
80F6- A9 64    2470         LDA #100     SET UP 100 MS WIAT
80F8- 20 2B 81 2480         JSR WAIT     WAIT FOR RELAY
80FB-          2490 RLOOP   .EQ *        READ DATA LOOP
80FB- BD 87 C0 2500         LDA PRMDAT,X GET EPROM DATA
80FE- 91 02    2510         STA (BUFFER),Y PUT IN MEMORY BUFFER
8100- BD 81 C0 2520         LDA BMPADR,X BUMP EPROM ADDRESS COUNTER
8103- C8       2530         INY          BUMP BUFFER INDEX
8104- D0 F5    2540         BNE RLOOP    DO NEXT BYTE
8106- A5 03    2550         LDA BUFFER+1 GET BUFFER POINTER HIGH
8108- C9 0F    2560         CMP #$0F     CHECK FOR LAST PAGE
810A- D0 03    2570         BNE RLCONT   IF NOT LAST PAGE, CONTINUE
810C- 4C 25 80 2580         JMP DONE     LAST PAGE, EXIT
810F-          2590 RLCONT  .EQ *        CONTINUE DATA LOOP
810F- E6 03    2600         INC BUFFER+1 BUMP TO NEXT PAGE
8111- 4C FB 80 2610         JMP RLOOP    DO NEXT BYTE
8114-          2620 PRINT   .EQ *        PRINT MESSAGE ROUTINE
8114- 48       2630         PHA          SAVE A
8115- 98       2640         TYA          GET Y
8116- 48       2650         PHA          SAVE Y
8117- A0 00    2660         LDY #00      INIT INDEX
8119-          2670 PRLOOP  .EQ *        PRINT CHAR LOOP
8119- B1 00    2680         LDA (PRTPTR),Y GET DATA
811B- C9 03    2690         CMP #03      END?
811D- F0 08    2700         BEQ PRDONE   YES, EXIT
811F- 09 80    2710         ORA #$80     NO, SET MSB
8121- 20 F0 FD 2720         JSR COUT1    PUT ON SCREEN
8124- C8       2730         INY          BUM INDEX
8125- D0 F2    2740         BNE PRLOOP   PRINT 256 CHARS MAX
8127-          2750 PRDONE  .EQ *        PRINTING FINISHED
8127- 68       2760         PLA          GET Y
8128- A8       2770         TAY          PUT IN Y
8129- 68       2780         PLA          GET A
812A- 60       2790         RTS          RETURN
812B-          2800 WAIT    .EQ *        WAIT X MILLISECONDS
812B- 85 05    2810         STA COUNT    SAVE WAIT COUNT
812D- 48       2820         PHA          SAVE A
812E- 8A       2830         TXA          GET X
812F- 48       2840         PHA          SAVE X
8130- 98       2850         TYA          GET Y
8131- 48       2860         PHA          SAVE Y
8132- A6 05    2870         LDX COUNT    GET MS COUNT
8134-          2880 WLOOP1  .EQ *        OUTER LOOP
8134- A0 CC    2890         LDY #$CC     GET COUNT FOR 1 MS
8136-          2900 WLOOP2  .EQ *          INNER LOOP
8136- 88       2910         DEY          DECREMENT 1 MS COUNT
8137- D0 FD    2920         BNE WLOOP2   KEEP UP FOR 1 MS
8139- CA       2930         DEX          DEC COUNT
813A- D0 F8    2940         BNE WLOOP1   DECREMENT TOTAL COUNT
813C- 68       2950         PLA          GET Y
813D- A8       2960         TAY          PUT IN Y
813E- 68       2970         PLA          GET X
813F- AA       2980         TAX          PUT IN X
8140- 68       2990         PLA          GET A
8141- 60       3000         RTS          RETURN
8142-          3010 BANNER  .EQ *        PRINT SCREEN HEADING
8142- 20 58 FC 3020         JSR CLEAR    CLEAR SCREEN
8145- AD FC 81 3030         LDA HDNG     HEADING ADR LO
8148- 85 00    3040         STA PRTPTR   PUT IN POINTER
814A- AD FD 81 3050         LDA HDNG+1   HEADING ADR HI
814D- 85 01    3060         STA PRTPTR+1 PUT IN POINTER
814F- 20 14 81 3070         JSR PRINT    PRINT HEADING
8152- 60       3080         RTS          RETURN
8153-          3090 PUTIN   .EQ *        PUT EPROM INTO SOCKET ROUTINE
8153- 20 42 81 3100         JSR BANNER   CLEAR SCREEN AND PRINT HEADING
8156- AD 77 81 3110         LDA STRMSG   START MESSAGE ADR LO
8159- 85 00    3120         STA PRTPTR   PUT IN PRINT POINTER
815B- AD 78 81 3130         LDA STRMSG+1 START MESSAGE ADR HI
815E- 85 01    3140         STA PRTPTR+1 PUT IN PRINT POINTER
8160- 20 14 81 3150         JSR PRINT    PRINT SOCKET MESSAGE
8163- 20 0C FD 3160         JSR RDKEY    WAIT FOR KEYSTROKE
8166- 60       3170         RTS          RETURN AFTER KEYSTROKE
8167-          3180 GETSLT  .EQ *        GET SLOT # MSG
8167- 69 81    3190         .DA GETSLT+2 POINTER TO STRING
8169- 53 4C 4F
816C- 54 20 4E
816F- 55 4D 42
8172- 45 52 3D
8175- 3F       3200         .AS "SLOT NUMBER=?"
8176- 03       3210         .DA #ETX
8177-          3220 STRMSG  .EQ *        START PROGRAMMING MSG
8177- 79 81    3230         .DA STRMSG+2
8179- 50 4C 41
817C- 43 45 20
817F- 32 35 31
8182- 36 20 49
8185- 4E 20 53
8188- 4F 43 4B
818B- 45 54 2E 3240         .AS "PLACE 2516 IN SOCKET."
818E- 0D       3250         .DA #CR
818F- 50 52 45
8192- 53 53 20
8195- 41 4E 59
8198- 20 4B 45
819B- 59 20 54
819E- 4F 20 53
81A1- 54 41 52
```

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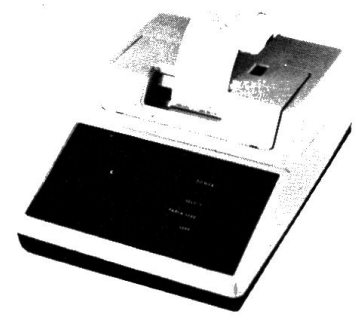
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"Adding read capability is fairly simple and should take less time than building the original circuit."

Listing continued.

```
81A4- 54 2E     3260         .AS "PRESS ANY KEY TO START."
81A6- 03        3270         .DA #ETX
81A7- 07        3280         .DA #BELL
81A8-           3290 CHOICE  .EQ *         CHOOSE FUNCTION MESSAGE
81A8- AA 81     3300         .DA CHOICE+2
81AA- 20 20 20
81AD- 20 20 20
81B0- 45 4E 54
81B3- 45 52 20
81B6- 54 4F     3310         .AS "      ENTER TO"
81B8- 0D        3320         .DA #CR
81B9- 20 20 20
81BC- 20 20 20
81BF- 20 20 31
81C2- 20 20 20
81C5- 52 45 41
81C8- 44 20 45
81CB- 50 52 4F
81CE- 4D        3330         .AS "         1   READ EPROM"
81CF- 0D        3340         .DA #CR
81D0- 20 20 20
81D3- 20 20 20
81D6- 20 20 32
81D9- 20 20 20
81DC- 50 52 4F
81DF- 47 52 41
81E2- 4D 20 45
81E5- 50 52 4F
81E8- 4D        3350         .AS "         2   PROGRAM EPROM"
81E9- 0D        3360         .DA #CR
81EA- 20 20 20
81ED- 20 20 20
81F0- 20 20 33
81F3- 20 20 20
81F6- 45 58 49
81F9- 54        3370         .AS "         3   EXIT"
81FA- 07        3380         .DA #BELL
81FB- 03        3390         .DA #ETX
81FC-           3400 HDNG    .EQ *         SCREEN HEADING
81FC- FE 81     3410         .DA HDNG+2
81FE- 20 20 20
8201- 20 20 20
8204- 20 20 20
8207- 20 20 20
820A- 32 35 31
820D- 36 20 50
8210- 52 4F 47
8213- 52 41 4D
8216- 4D 45 52  3420         .AS "             2516 PROGRAMMER"
8219- 0D        3430         .DA #CR
821A- 0D        3440         .DA #CR
821B- 03        3450         .DA #ETX
821C-           3460 WRMSG   .EQ *         WRITE VERIFY ERROR
821C- 1E 82     3470         .DA WRMSG+2
821E- 0D        3480         .DA #CR
821F- 0D        3490         .DA #CR
8220- 56 45 52
8223- 49 46 59
8226- 20 45 52
8229- 52 4F 52  3500         .AS "VERIFY ERROR"
822C- 0D        3510         .DA #CR
822D- 41 44 44
8230- 52 45 53
8233- 53 3D     3520         .AS "ADDRESS="
8235- 03        3530         .DA #ETX
8236-           3540 ROMMSG  .EQ *         ROM DATA PREFIX
8236- 38 82     3550         .DA ROMMSG+2
8238- 2C 20 52
823B- 4F 4D 3D  3560         .AS ", ROM="
823E- 03        3570         .DA #ETX
823F-           3580 BFRMSG  .EQ *         BUFFER DATA PREFIX
823F- 41 82     3590         .DA BFRMSG+2
8241- 2C 20 42
8244- 46 52 3D  3600         .AS ", BFR="
8247- 07        3610         .DA #BELL
8248- 03        3620         .DA #ETX
8249-           3630 RESMSG  .EQ *         RESTART MESSAGE
8249- 4B 82     3640         .DA RESMSG+2
824B- 0D        3650         .DA #CR
824C- 0D        3660         .DA #CR
824D- 50 52 45
8250- 53 53 20
8253- 41 4E 59
8256- 20 4B 45
8259- 59 20 54
825C- 4F 20 43
825F- 4F 4E 54
8262- 49 4E 55
8265- 45        3670         .AS "PRESS ANY KEY TO CONTINUE"
8266- 03        3680         .DA #ETX
                3690         .EN
```

mode, U5 is disabled. This will leave the output of U5 in the tristate mode so as not to interfere with the data bus drivers on the 2516 EPROM.

Function 7 is used to go into the program mode unconditionally. Program mode can be set up three ways: by reading (or writing) to address 6 ($C0X6), resetting the Apple, or toggling function 6 while in the read mode. Writing to address 6 causes U3 pin 9 to pulse low, which causes U7 pin 6 to pulse low, which clears U8, making U8 pin 5 go low. U8 pin 5 being low enables U5 through U5 pin 1, the output driver enable pin.

Function 8 reads EPROM data. Reading address 7 ($C0X7) causes U6 pin 20 and U9 pin 1 to pulse low. This enables EPROM data at the current address onto the inputs of U9, and the inputs of U9 are enabled onto the Apple data bus.

Thus, adding read capability to the EPROM programmer hardware is fairly simple and should take less time than the day required to build the original circuit.

Software Enhancements

I made some software improvements to utilize the improved hardware. The program still requires the slot number, but another choice must be made: READ or PROGRAM.

The read portion starts at label READ. After the EPROM is in the socket, read mode is enabled and power applied to the device. A loop similar to the write loop is used to get EPROM data and send it to the buffer rather than taking it from the buffer.

Now that a PROM can be read, I've added a verify function to the write loop. PROM data is read and compared with the buffer data after each write. This adds almost no time to the program loop.

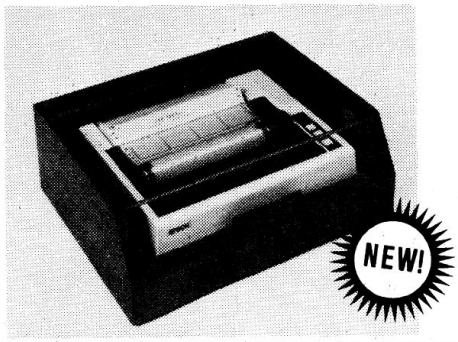
Two new subroutines have been added. BANNER is used to clear the screen and print a heading across the top followed by two carriage returns. PUTIN is used to print a message to the screen requesting that the EPROM be placed in its socket.

Other Changes

The dc-to-dc converter has been changed to an Elpac CL-3803 (or CL-3804). The Elpac is easier to ob-

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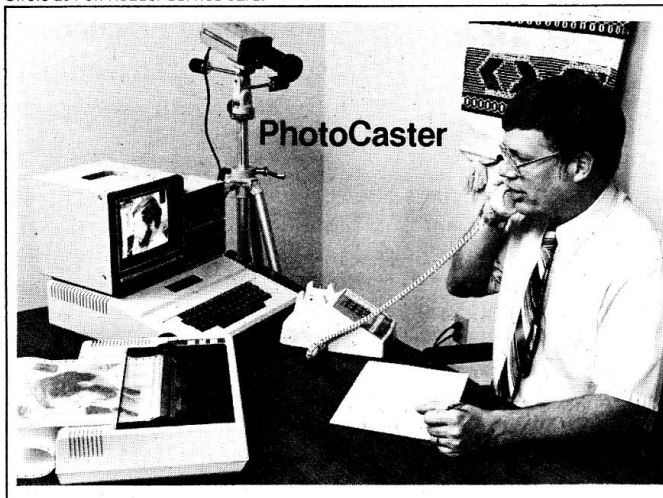
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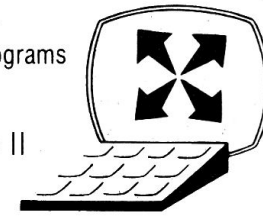
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"Additional functions can be added from software, such as buffer comparison with an EPROM, and selective reading of any particular EPROM location."

tain than my previous choice. However, it has a 28 V output. Since 28 V is too high, a resistor and zener diode circuit was designed to drop the voltage to an acceptable value.

The dc-to-dc converter draws more current than the previous reed relay could handle. A new relay has been included along with a new driver IC to supply the extra coil current.

Note that during operation this board puts a substantial load on the Apple 5 V power supply. You should consider removing any unnecessary boards in the I/O slots while programming EPROMs.

Other Improvements

Additional functions can be added from software, such as buffer comparison with an EPROM, and selective reading (or writing) of any particular EPROM location. These capabilities exist in the hardware and the basic software has been provided.

You can get copies of the source and object programs for both projects by sending $7.95 to the author. (Texas residents add 5 percent sales tax.) Software will be provided on disk. By the time this goes to print a supply of assembled units should be available. ■

Symbol table.

```
8142- BANNER
0007- BELL
823F- BFRMSG
C081- BMPADR
0002- BUFFER
81A8- CHOICE
8028- CHOOSE
8044- CK2
FC58- CLEAR
0005- COUNT
FDF0- COUT1
000D- CR
C084- DATA
8025- DONE
0003- ETX
8064- GETDTA
8167- GETSLT
81FC- HDNG
FF69- MONITR
0031- ONE
C083- PGM
FDDA- PRBYTE
8127- PRDONE
8114- PRINT
8119- PRLOOP
C087- PRMDAT
804F- PROG
0000- PRTPTR
8153- PUTIN
C085- RDENBL
FD0C- RDKEY
80E3- READ
C082- RELAY
C080- RESET
8249- RESMSG
810F- RLCONT
80FB- RLOOP
8236- ROMMSG
1010- SCASMB
0004- SLOT
8000- START
8177- STRMSG
0033- THREE
0032- TWO
812B- WAIT
8134- WLOOP1
8136- WLOOP2
C086- WRENBL
8092- WRERR
821C- WRMSG

:PR#0
```

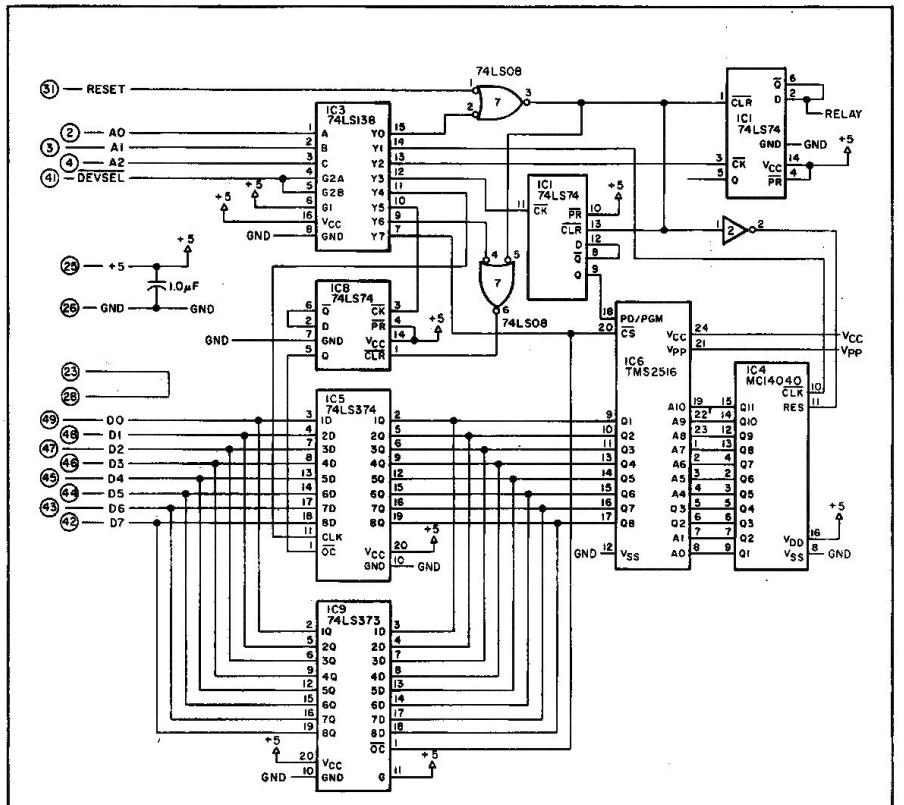


Figure 1a. Relay, dc-to-dc converter.

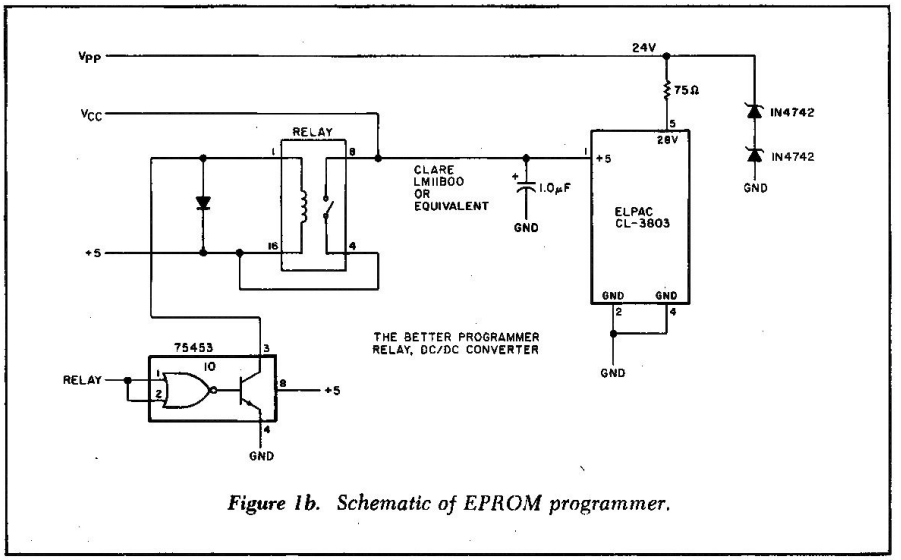
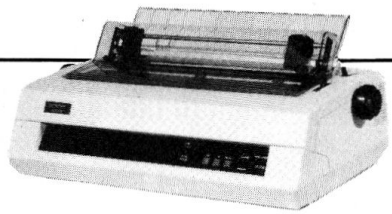


Figure 1b. Schematic of EPROM programmer.

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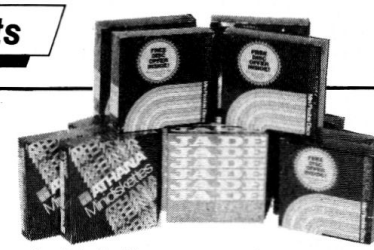
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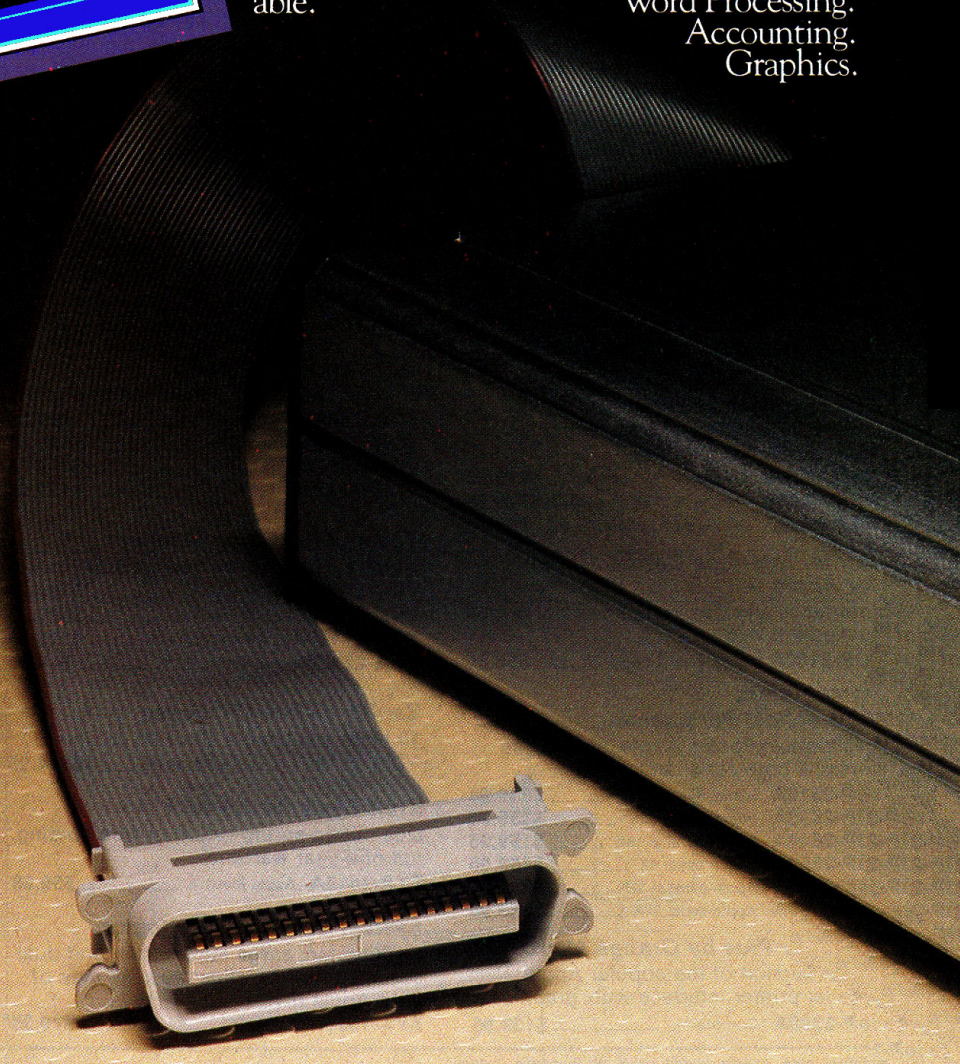
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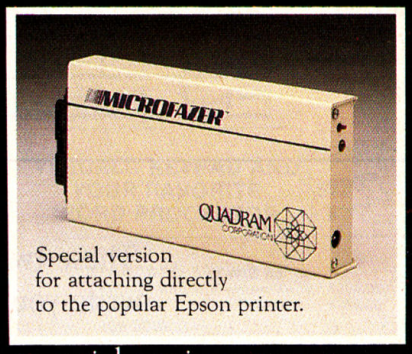
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Practically Pascal

Part II

These two handy Pascal file routines can help you write your own address book—or add them to your library of useful utilities.

by John Stephenson

Professional programmers try to write routines in a general fashion, hoping the routines will be usable in more than one application. Although this seems like extra work, a routine usable in two applications saves considerable effort, while a routine usable in many applications saves enormous effort. Chores like input validation, searching, sorting, and data conversion are examples of typical cross-application tasks. Programmers collect routines that expedite these tasks into a library, much like a craftsman assembles a set of fine tools. This helps them write future applications more efficiently.

Many of these utility routines can be purchased. Ones sold with a source (text file) included are the most useful. Those sold as code files are inconvenient because they cannot be customized for specific applications or examined for programming techniques. Relying on sourceless code files to produce your programs is somewhat dangerous, since you can never be certain about what is happening or what subtle bugs may be introduced. Truly bug-free code, even in commercial quality software, is a very rare thing.

Two files from my routines library will be used to implement Program AddressBook. You may wish to incorporate them into your own library. They are called Support.Text and Input.Text, and are listed in Listing 1 and Listing 2.

Support.Text's most useful part is Function Prompt, which processes command lines passed to it as a string, then returns a user-pressed character among a specified legal set of characters. It also contains simple independent routines for clearing single lines on the screen, executing a delay loop, flashing a status message, and converting lowercase to uppercase.

"Procedure INPUT may be a good starting point for an input processing unit."

Input.Text is a rather lengthy file containing Procedure INPUT, which controls user input, and its subprocedures. Essentially, it prompts you to input at a specified location on the screen and keeps you within a specified field. It prohibits the input of non-printable characters (i.e., control characters), that might have disturbing effects. Finally, it justifies the input within the field boundaries. Procedure INPUT (Listing 3) has no provision for assigning default values to null responses (a null string will be returned).

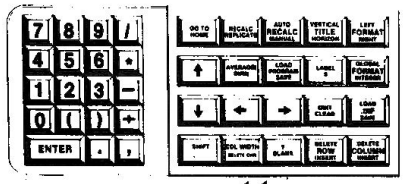
Procedure INPUT deals exclusively with string data. If input of other types of data is required, then the string returned by Procedure INPUT would have to be processed and validated by appropriate data conversion routines, such as string to integer, string to date, string to Social Security number, and so on. Procedure INPUT may be a good starting point for the construction of an input processing unit. It consists of four steps that are implemented in the subprocedures: initializing, collecting characters into a buffer, assigning the buffered characters to the calling program's string variable, and justifying the input on the screen.

Procedure initInput performs initialization. The variable blankString is set to StringDefaultLength (80 characters) by assigning that value to the zero element. Normally this element is controlled only by the system. If range checking is not disabled momentarily with the compiler directive ($r-), an error would result. The fast built-in system routine FILLCHAR is used to load the string with all blanks and the response buffer with all question marks. CharIndex, which points to the next vacant position in the input buffer, is set to 1. EndInput, the Boolean variable used to indicate when the user is done entering characters, is set to false. BELLchar, BSchar, and CRchar

Address correspondence to John C. Stephenson, 9118 Smith Ave., North Bergen, NJ 07047.

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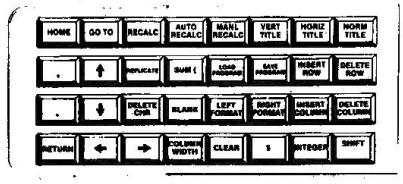
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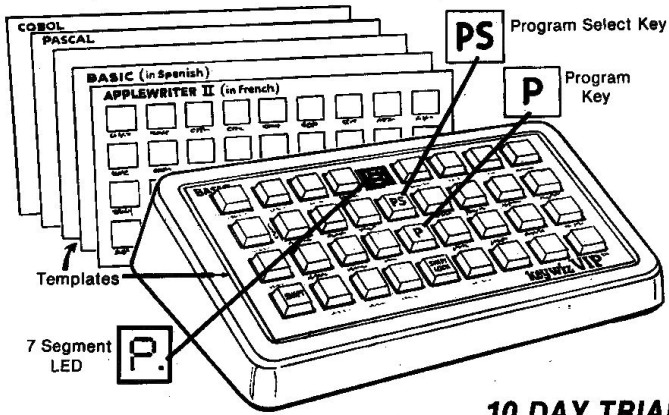
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D. TOUCH PROGRAM KEY AGAIN to stop programming.
E. REPEAT A-D for all 31 keys
F. TOUCH SHIFT LOCK KEY ON VIP
G. TOUCH PROGRAM KEY ON VIP and repeat steps B-E.
H. TOUCH PROGRAM SELECT KEY
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. Decimal point appears indicating shift.
P. LED exhibits "P" and decimal point indicating that you are programming a key in shifted mode.
2 LED indicates that you are into the second keyboard of 62 keys.
3 4

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Circle 305 on Reader Service card.

Listing 1.
Support.Text file.

```
procedure clearLine(linenumber:integer);
          { PROCEDURE TO CLEAR A SINGLE LINE ON THE SCREEN DISPLAY }
const
        ClearToEndOfLine= 29;
        firstLine       =  0;
        lastLine        = 23;
begin
if(lineNumber<firstLine) then lineNumber:=firstLine;
if(lineNumber>lastLine) then lineNumber:=lastLine;
gotoxy(0,lineNumber);
write(chr(ClearToEndOfLine));
end;
procedure delay (time:integer);
            { PROCEDURE TO PERFORM A DO NOTHING LOOP TO KILL TIME }
var
        wait1,
        wait2           : integer;
begin
for wait1:=time downto 0 do for wait2:=wait1 downto 0 do begin end
end;
procedure message(s:string);
const
        messageLine     = 0;
begin
clearLine(messageLine);
write (s);
delay (48);
clearLine(messageLine);
end;
procedure upperCase (var ch:char);
       { PROCEDURE TO CONVERT ANY LOWER CASE CHAR TO AN UPPER CASE CHAR }
begin
if((ch>='a')and(ch<='z')) then ch:=chr(ord(ch)-ord('a')+ord('A'))
end;
procedure shiftString (var s:string);
    { PROCEDURE TO CONVERT ANY LOWER CASE CHARS IN A STRING TO UPPER CASE }
var
        i:integer;
        c:char;
begin
i:=0;
while (i<length(s)) do
        begin
        i:=i+1;
        c:=s[i];
        upperCase(c);
        s[i]:=c;
        end;
end;
function prompt (promptString:string; allowed:charSet): char;
                { FUNCTION TO PROMPT FOR A CHAR AMONG A SPECIFIED
                        SET, AS INDICATED BY A PROMPTLINE }
const
        promptLine      =  0;
var
        ch              : char;
begin
clearLine(promptLine);
write(title,' ',promptString);
repeat
        read(ch);
        upperCase(ch)
until (ch in allowed);
prompt:=ch;
end;
```

are assigned their ASCII values. AllPrintables is assigned the set of characters from a blank space to z. Finally, the field area is filled with marker characters (dots).

Function choice returns a character generated from the keyboard for a specified set. In the case of procedure INPUT the specified set consists of allPrintables plus the CRchar and the BSchar. Function choice uses the built-in procedure UNITREAD instead of the built-in procedure READ to avoid system filtering; specifically, the Apple Pascal Read procedure converts the CR character into a space character, an unwanted conversion in procedure INPUT.

Procedure addIt places a character into the buffer and updates charIndex, taking care not to allow input beyond the limit specified by the parameter FIELDSIZE (passed to procedure INPUT by the calling program). Procedure backUp removes a character from the buffer and decrements charIndex, taking care not to allow impossible deletions beyond the first character. Both these procedures call procedure echo to update the screen display. Procedure endIt recognizes the CRchar as end of input and sets endInput to true, which causes termination of procedure INPUT's character gathering While loop.

Finally, charIndex is assigned to the calling program string variable's length byte, and the fast built-in procedure MOVELEFT transfers the character buffer into the string's text bytes. Procedure cleanUp justifies the input on the screen before control is relinquished.

Coding

Listing 3 shows the fully-implemented program. The program is explained proceeding from the beginning of the listing to the end.

PhoneRecord is a Boolean record; that means the memory space reserved for it may be interpreted in two distinct ways. Anytime the program mentions a PhoneRecord by calling its contents SIZE, it is referring to an integer, because SIZE has been defined in the record as an integer type. Anytime the program mentions a PhoneRecord by referring to its contents as PERSONS, it is referring to a PhoneEntry, because PERSONS has been defined in the record as a PhoneEntry type.

PhoneBook is an array of PhoneRecords. Due to the dual nature of PhoneRecords, elements of the PhoneBook array may be either integers or PhoneEntries, depending on what name the program calls them. But, how is the program to know what name to call them?

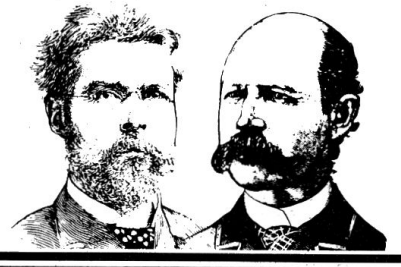
Two methods can be used: convention and tag fields. A tag field is an additional field in each record that acts as a signpost, informing the program about the type of contents that will follow. A tag field was not employed in PhoneRecord. Instead, the convention that the zero element of PhoneBook would be handled as a SIZE record and the remaining elements would be handled as PhoneEntry records was adopted. By this convention, the number of valid entries held in the array is stored conveniently in front of the entries themselves.

Since it is easy to remember that the zero element of the array has a special purpose, the added clarity of tag fields is not necessary. Specifically, book↑[0].size contains the active array size and book↑[?].persons contains the name and address information about the ?th person. Refer to Procedure howMany to see how the file size is displayed on the screen.

Procedure paintScreen and procedure Display display the current work record on the screen. Notice the use of the constants Indent and displayAt to regulate the horizontal and vertical positions of the display. By simply changing these constants, the display position could be easily adjusted.

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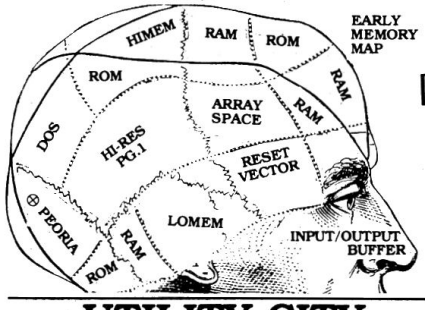
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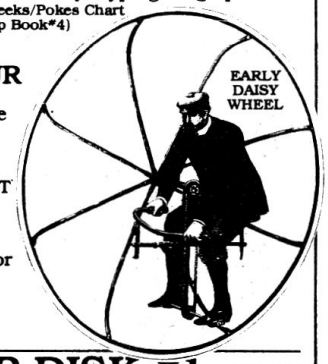
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Listing 2. Input.Text file.

```
procedure INPUT (var yourstring:string;
                 x,y,fieldsize:integer;
                 justify:justification);

{
        AN INCLUDE FILE FOR CONTROLLING USER INPUT

        The type defined below must be declared in the calling program:
        justification = (DontJustify,RightJustify,LeftJustify);

        Procedure INPUT places fieldsize markings on the CRT at XY
        coordinates and allows up to fieldsize characters input as a string.
        If justify=RightJustify then the user repsonse is right justified
        in the fieldsize area.  If justify=LeftJustify then the user
        response is left justified in the fieldsize area.  If justify=
        DontJustify then the user response is removed from the CRT.
}

const
        marker = '.';
        StringDefaultLength = 80;
type
        charSet = set of char;
var
        charCounter     : integer;
        response        : packed array [1..StringDefaultLength] of char;
        BELLchar,
        BSchar,
        CRchar,
        next            : char;
        allPrintables   : charSet;
        charIndex       : 0..StringDefaultLength;
        endInput        : boolean;
        blankString     : string[StringDefaultLength];

        function choice (allowed:charSet):char;
        { Press a key until it's among the allowed character set. }
        var
        CH              : packed array [0..1] of char;
        begin
        repeat unitread(2,CH,1,0,12) until (CH[0] in ALLOWED);
        CHOICE:=CH[0]
        end   {function CHOICE};

        procedure echo (C:char);
        { Display character on the screen }
        begin gotoxy(X+charIndex-1,Y); write(C) end;

        procedure backUp;
        { Perform a rubout }
        begin
        if not(charIndex>fieldSize) then echo(marker);
        if ((charIndex)>1) then
                begin
                charIndex:=charIndex-1;
                echo (marker);
                end
        else write(BELLchar);
        end;

        procedure endIt;
        { Process end of input condition }
        begin charIndex:=charIndex-1; endInput:=true end;

        procedure addIt;
        { Add a character to the input buffer }
        begin
        if(charIndex<=fieldSize) then
                begin
                echo(next);
                response[charIndex]:=next;
                charIndex:=charIndex+1;
                end
        else write(BELLchar);
        end;

        procedure cleanUp;
        { Justify the input buffer in the field area }
        var I,J:integer;
        begin
        case justify of
          DontJustify:
                begin
                blankString:=copy(blankString,1,fieldsize);
                gotoxy(X,Y);
                write(blankString)
                end;
          LeftJustify:
                if (fieldsize>charIndex) then
                        begin
                        blankString:=copy(blankString,1,fieldsize-charIndex);
                        gotoxy(X+charIndex,Y);
                        write(blankString);
                        end;
          RightJustify:
                if (fieldsize>charIndex) then
```

Listing continued.

Procedure openFile reads the address book data from disk via the built-in procedure RESET, which automatically loads the buffer BOOK with the entire phoneBook array. If no file is found, then Procedure openFile creates a blank address book file on the disk via the built-in procedure REWRITE. Procedure SaveFile writes the address book data to disk via the built-in procedures SEEK and PUT, which automatically saves the buffer, including any changes. The mechanism of reading a buffer of data from disk at the beginning of a program, maintaining it wholly in RAM during updates, and writing it back to disk at the end of the program is efficient and convenient for small buffers. The alternative is to perform frequent disk accesses during the program, slowing down processing.

"As it turns out, the skipping search works well."

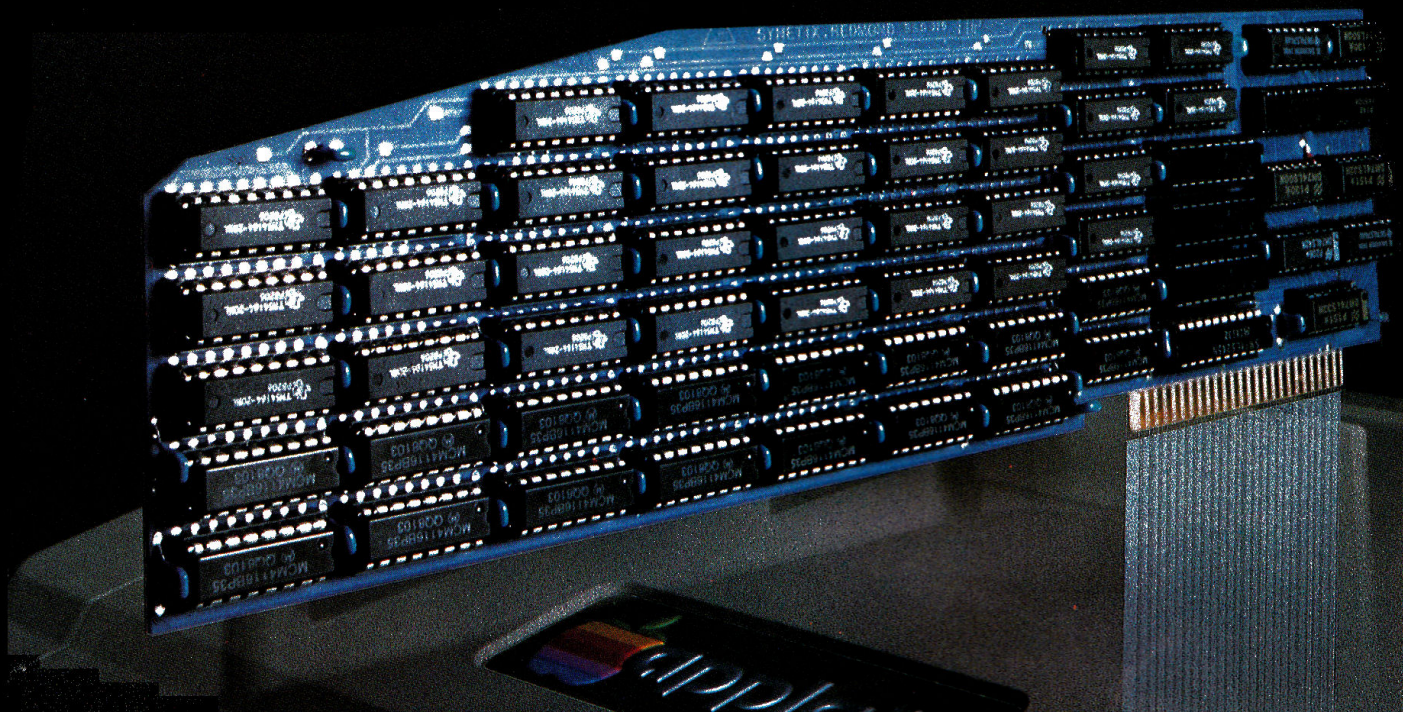
Function Locate returns a true value if an element in the phoneBook array is found corresponding to a user-entered name. The match must be exact, but a useful enhancement would be adding a substring search. Additionally, Locate returns the index of the found element.

The search algorithm in Function Locate skips through the array in little jumps and then backtracks in single steps. This algorithm could be changed without affecting the rest of the program, as long as Function Locate's parameter line remains unaltered. Perhaps someone has implemented a binary search and someone else a brute force sequential search. Because the entire buffer is held in RAM and is small, differences in algorithmic performance are slight. As it turns out, the skipping search works well.

The procedures Add, Delete, and Search make use of the variable EntryIsIn to define their logic. The address book entry on display can be in one of three states: blank, changed, or filed. The state is stored in the variable En-

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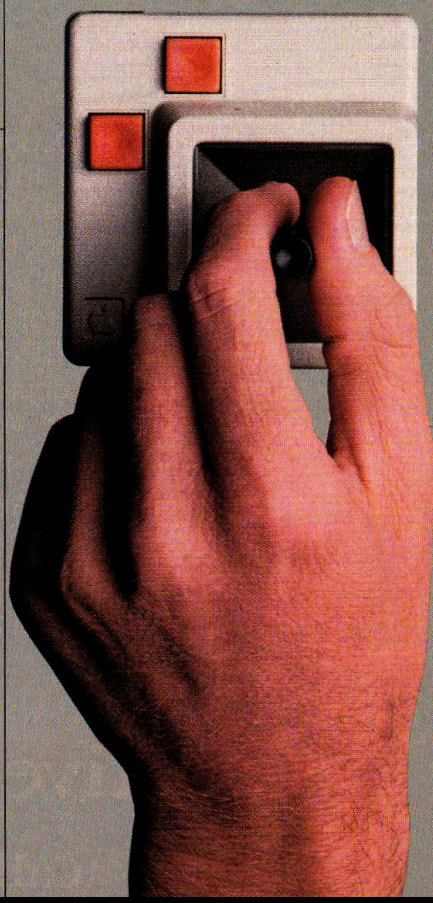
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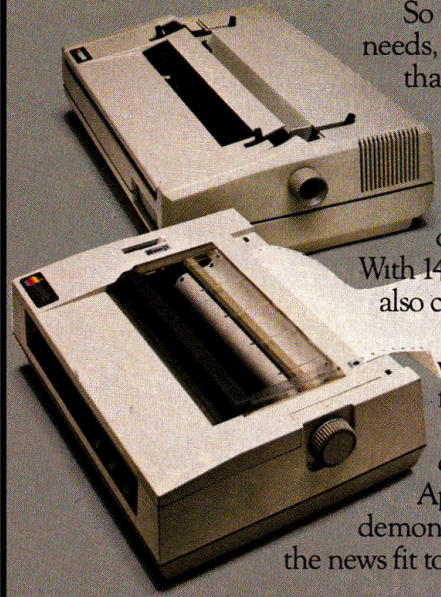
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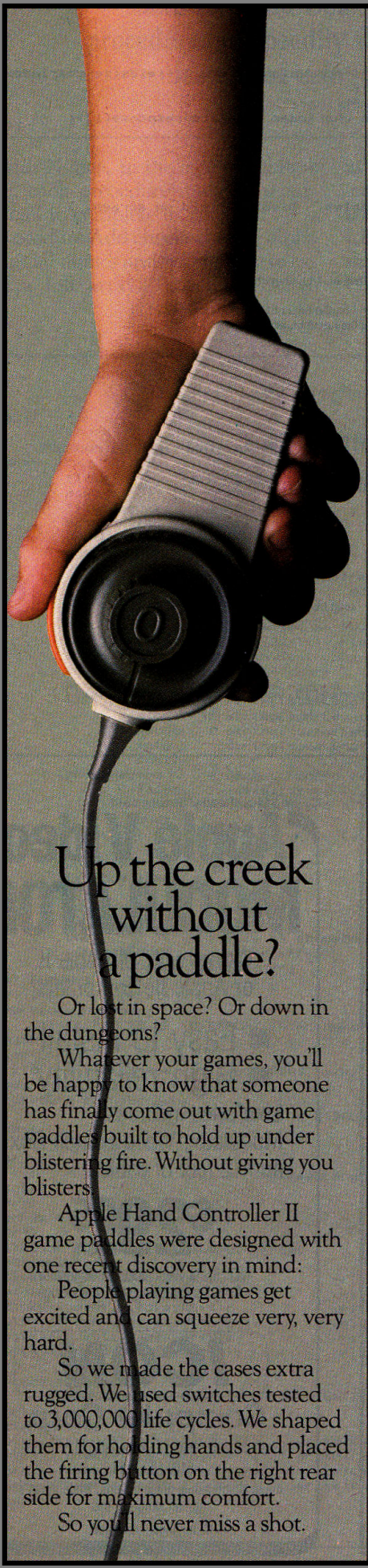
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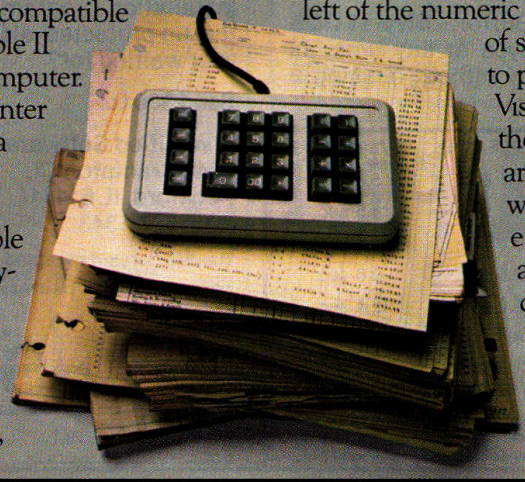
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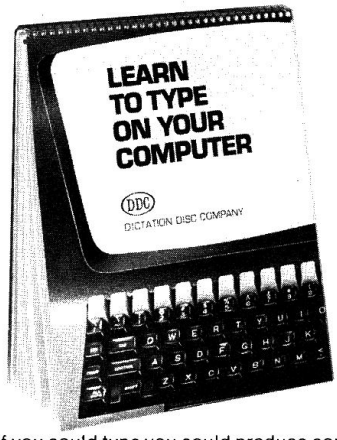
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Listing continued.

```
                        begin
                        blankString:=copy(blankString,1,fieldsize-charIndex);
                        gotoxy(X,Y);
                        write(blankString);
                        for i:=1 to charIndex do write(response[i]);
                        end;
          end {case justification};
        end;

        procedure initInput;
        { Initialize data and variables.  Display field on screen. }
        var
                I:integer;
        begin
        {$r-}
        blankString[0]:=chr(StringDefaultLength);
        {$r+}
        fillchar(blankString[1],StringDefaultLength,chr(32));
        fillchar(response[1],StringDefaultLength,'?');
        charIndex:=1;
        endInput:=false;
        BELLchar:=chr(7);
        BSchar:=chr(8);
        CRchar:=chr(13);
        allPrintables:=[' '..'z'];
        gotoxy(X,Y);
        for I:=1 to fieldsize do write (marker);
        end;

                                { PROCEDURE INPUT }
begin
initInput;
while not(endInput) do
        begin
        gotoxy(x+charIndex-1,y);
        next:=choice (allPrintables+[CRchar,BSchar]);
        if (next=BSchar) then backUp
        else if (next=CRchar) then endIt
        else addIt;
        end;
{$r-}
yourString[0]:=chr(charIndex);
{$r+}
if (charIndex>0) then moveleft(response[1],yourString[1],charIndex);
cleanup;
end {procedure INPUT};
```


WHAT ARE YOU WAITING FOR???

Are you tired of waiting for DOS to load and save files? Are you tired of waiting for DOS to finish so you can type again? Are you tired of waiting for your printer? When you buy Diversi-DOS™, you won't have to wait any more! Here's why:

1. DOS speed-up: Apple DOS 3.3 takes 18 disk revolutions to read a single track, whereas Diversi-DOS reads or writes a track in just 2 revolutions. This speeds up file processing tremendously (see table).

2. Keyboard Buffer: Diversi-DOS allows you to type at any time, as fast as you can, without missing a single character.

	APPLE DOS	DIVERSI-DOS
SAVE ‡	27.1 sec.	5.9 sec.
LOAD ‡	19.2 sec.	4.5 sec.
BSAVE*	13.6 sec.	4.1 sec.
BLOAD*	9.5 sec.	2.6 sec.
READ**	42.2 sec.	12.4 sec.
WRITE**	44.6 sec.	14.9 sec.
APPEND**	21.3 sec.	2.3 sec.

* Hi-res screen ‡ 80-sector BASIC program
** 52-sector text file

3. Print Buffer: Diversi-DOS can use a RAM card (16K-128K) to temporarily save characters before they are printed. Thus, your computer won't have to wait for your printer to finish.

4. DDMOVER: Diversi-DOS can now be moved to a RAM card for increased memory with BASIC programs.

Diversi-DOS, the QUADRUPLE utility, requires a 48K Apple II or II+ with DOS 3.3. A simple, menu-driven installation program is included on the un-protected disk. So what are your waiting for?

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"Both Add and Delete use the built-in procedures to speedily shift array elements, instead of using a For loop."

tryIsIn. Notice, in the case of a blank state, each procedure makes a recursive call to complete its task.

Procedure Add checks that an alpha begins all names and will not try to extend a full array. Procedure Delete asks for confirmation before eradicating valid data. Both Add and Delete use the built-in procedures MOVELEFT and MOVERIGHT to speedily shift array elements, instead of using a For loop.

Listing 3. Implementation.

```
{$S+}
                                program addrBook;
   { PROGRAM TO MANIPULATE AN ELECTRONIC ADDRESS BOOK AND STORE IT ON DISK. }
const
        title           = 'PHONE BOOK [1.C]  ';
        maxList         = 100;
        fileName        = 'PhoneBook.Data';
        nameLength      = 30;
        addrLength      = 50;
        numberLength    = 15;
        noteLength      = 50;
        indent          =  5;
        displayAt       =  8;
type
        { justification type needed by the include file INPUT.TEXT }
        justification   = (DontJustify,RightJustify,LeftJustify);
        entryState      = (blankState,changedState,filedState);
        charSet         = set of char;
        phoneEntry      = packed record
                name    : string[nameLength];
                addr    : string[addrLength];
                number  : string[numberLength];
                note    : string[noteLength];
                end;
        phoneRecord     = packed record case boolean of
                false   : (size:integer);
                true    : (persons:phoneEntry);
                end;
        phoneBook       = packed array [0..maxList] of phoneRecord;
var
        entryIsIn       : entryState;
        fileModified,
        quit            : boolean;
        command         : char;
        mainSet         : charSet;
        book            : file of phoneBook;
        currentEntry    : phoneEntry;
        currentIndex    : integer;
{$I SUPPORT    .TEXT}
{$I INPUT      .TEXT}
procedure howMany;
          { PROCEDURE TO REPORT TOTAL NUMBER OF ENTRIES IN DATA ARRAY }
begin
clearLine(1);
writeln ('[ File now has ',book^[0].size,' entries. ]');
end;
procedure paintScreen;
                    { PROCEDURE TO DISPLAY AN ENTRY FORM }
const
        dashLength      = 60;
var
        dashes          : string[dashLength];
begin
{$r-}
dashes[0]:=chr(dashLength);
{$r+}
fillchar(dashes[1],dashLength,'-');
page(output);
gotoxy(indent,displayAt);               write(dashes);
gotoxy(indent,displayAt+2);             write('Name:     ');
gotoxy(indent,displayAt+4);             write('Address:  ');
gotoxy(indent,displayAt+6);             write('Phone:    ');
gotoxy(indent,displayAt+8);             write('Note:     ');
gotoxy(indent,displayAt+10);            write(dashes);
end;
procedure display;
      { PROCEDURE TO DISPLAY THE CONTENTS OF CURRENT  ADDRESS BOOK ENTRY }
begin
paintScreen;
gotoxy(indent+10,displayAt+2);    write(currentEntry.name);
gotoxy(indent+10,displayAt+4);    write(currentEntry.addr);
gotoxy(indent+10,displayAt+6);    write(currentEntry.number);
gotoxy(indent+10,displayAt+8);    write(currentEntry.note);
end;
```

Listing continued.

Circle 56 on Reader Service card.

AMPERGRAPH

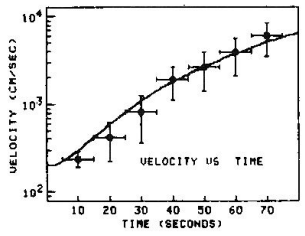
AMPERGRAPH is a powerful, easy-to-use graphics utility for the Apple II Plus. AMPERGRAPH adds twenty-two Applesoft commands that allow effortless generation of professional-looking plots of scientific or financial data. All of the nedessary scaling and screen formatting is accomplished with just a few, simple Applesoft lines.

Unlike most other plotting systems for the Apple II which are stand-alone systems, the AMPERGRAPH utility provides extended BASIC graphics language macros that you can use directly in your own Applesoft programs. The additional commands are &SCALE, &LIMIT, &AXES, &GRID, &FRAME, &LOG X, &LOG Y, &LABEL AXES, &LABEL, &VLABEL, &CENTER LABEL, &CENTER VLABEL, &DRAW, &PENUP, &CROSS, &OPEN SQUARE, &CLOSED SQUARE, &OPEN CIRCLE, &CLOSED CIRCLE, &ERROR BARS, &DUMP (to dump the graph on a Silentype printer) and &*DUMP (to link with AMPERDUMP, see below).

AMPERGRAPH uses the Applesoft ampersand machine language jump vector to link to a relocatable 9K routine which normally resides above the second page of high-resolution graphics in the Apple II Plus.

SAMPLE AMPERGRAPH PROGRAM LISTING:

```
10 &SCALE, 0, 80, 80, 13000
15 LX$ = "TIME (SECONDS)":LY$ = "VELOCITY
   (CM/SEC)"
20 &LOG Y:&LABEL AXES, 10, 10
25 LABEL$ = "VELOCITY VS. TIME":&LABEL, 30.
   200
30 FOR T = 0 TO 80:&DRAW, T, 150 + T12:NEXT T
35 FOR T = 10 TO 70 STEP 10
40 &CLOSED SQUARE, T,
   (150 + T12)*(.8 + .4*RND(3) )
45 &ERROR BARS, 5, T12/2
50 NEXT T:&DUMP
```



AMPERDUMP

AMPERDUMP is a high-resolution graphics dump utility which was written specifically to take advantage of the graphics features of the Epson MX-80 and MX-100 printers (MX-80 must have the Graftrax conversion). AMPERDUMP offers many features which are not available in other graphics dump routines:

- Three horizontal magnifications (2.33, 4.66 and 6.99 inches wide)
- Nine vertical magnifications with the MX-80 (0.88, 1.77, 2.64, 3.78, 4.25, 4.45, 5.31, 5.87, and 7.96 inches high); and three vertical magnifications with the MX-100 (2.64, 5.31, and 7.96 inches high)
- Horizontal and vertical magnifications can be specified independently to produce 27 different plot size formats with the MX-80, and 9 different formats with the MX-100
- Normal / Inverse dumps
- Fast
- Adjustable horizontal tab
- Easy to use
- Compatible with AMPERGRAPH
- Relocatable

The AMPERGRAPH and AMPERDUMP graphics utilities require and Apple II Plus (or Apple II with language card) with 48K and DOS 3.3. The AMPERDUMP utility requires and Epson MX-80 with Graftrax, or an MX-100, and one of the following interface cards: Epson, Apple, Grappler, Interactive Structures, or Mountain Computer.

AMPERGRAPH and AMPERDUMP are available from your dealer for $30.00 each, or order direct. Include $1.50 for shipping and handling; Wisconsin residents add 4% sales tax.

madWest SOFTWARE

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Acceptance—Testing and Installing

Program AddrBook must be tested for conformance to the original definition composed in the planning stage. All options and screens must be demonstrated. Testing these options should not be performed by the project programmer, but by people who will put the product through its paces as close to the live environment as possible. Of course, any professional programmer will test personally all modules before releasing them. But, the best tester is the knowledgeable user who takes demonic glee in making other people's systems fail. Challenge a sadistic friend to find something wrong with a perfect program.

Checking for predicted outputs tests Program AddrBook. These tests should be independent and self-contained. For example, is the entered data accurately displayed on the screen? Is it inserted in correct alphabetical order? Does the printed report correspond with the screen listing report? And so on. In a formal situation, tests are written recipe style and summarized in a pass/fail checklist.

If a test uncovers a bug, then assume its fix will have a rippling effect on the rest of the program. The fix may churn up other bugs previously undetected. Test repeatedly to combat this. Whatever bugs are missed during testing will eventually emerge with unpleasant results during live operation. Valid data could be lost.

After it survives thorough testing, prepare Program AddrBook for release by creating a turnkey disk. Initialize a fresh disk and name it PHONE:, or whatever name seems meaningful to you. Transfer the files SYSTEM.APPLE, SYSTEM.PASCAL, SYSTEM.MISCINFO, and SYSTEM.LIBRARY to the new diskette. Transfer the .CODE file created by the compiler from your Program AddrBook .TEXT file to the new diskette, but call it SYSTEM.STARTUP. Now boot the new diskette and Program AddrBook will run automatically.

Program AddrBook won't replace the address book some people carry around, but it might be a handy substitute for the desktop variety. ■

Listing continued.

```
procedure clearEntry;
                { PROCEDURE TO CLEAR THE CURRENTLY DISPLAYED ENTRY }
begin
entryIsIn:=blankState;
fillchar(currentEntry,sizeof(phoneEntry),0);
page(output);
display;
end;
procedure openFile;
            { PROCEDURE TO OPEN OR CREATE A DISKETTE PHONEBOOK FILE }
var
        io              : integer;
        ch              : char;

        procedure abort (ioErr:integer);
        { PROCEDURE TO HANDLE ABNORMAL TERMINATION CONDITIONS }
        begin
        page(output);
        writeln;
        writeln ('Trouble looking for ',fileName);
        writeln ('I/O error #',io,'.  Program terminated.');
        writeln ('Consult Pascal manual.');
        exit(program);
        end;
begin
clearLine(0);
writeln('Loading ',fileName,' from prefixed disk.');
{$I-}
reset(book,fileName);
io:=ioresult;
if(io<>0) then
        if(io<>10) then abort(io)
        else
                begin
                ch:=prompt('Create new phone file? Y/N ',['Y','N']);
                if(ch<>'Y') then exit(program);
                writeln;
                writeln ('Creating new phone file.');
                rewrite(book,fileName);
                io:=ioresult;
                if(io<>0) then abort(io);
                fillChar(book^[0],sizeof(phoneBook),0);
                seek(book,0);
                put(book);
                close(book,lock);
                reset(book,fileName);
                end;
{$I+}
clearEntry;
end;
procedure saveFile;
                { PROCEDURE TO SAVE THE ADDRESS BOOK TO DISKETTE }
begin
clearLine(1);
write('Saving file.  ');
seek(book,0); put(book); close(book,lock);
clearLine(1);
writeln ('File now saved.');
end;
function locate (key:string; var index:integer):      boolean;
                { FUNCTION TO SEARCH FOR A NAME IN THE ADDRESS BOOK.
                   RETURNS TRUE IF FOUND OR FALSE IF NOT FOUND.
        RETURN INDEX OF ITS ALPHABETIC POSITION IN THEARRAY OF ENTRIES.  }
var
        jumping,
        foundIt,
        stillLooking    : boolean;
        jumpSize,
        limit,
        position,
        anchor          : integer;
begin
foundIt:=false;
position:=1;
stillLooking:=true;
jumpSize:=3+(book^[0].size div 7);
if(book^[0].size<1) then { the file is empty, so }
        begin
        stillLooking:=false;
        jumping:=false;
        end
else jumping:=true;
while(jumping) do
        begin
        position:=position+jumpSize;
        if(position>book^[0].size) then
                begin
                { reset position to end of array and stop skipping forward }
                position:=book^[0].size;
                jumping:=false;
                end;
        if(key=book^[position].persons.name) then
                begin
                { found a match }
                jumping:=false;
                stillLooking:=false;
                foundIt:=true;
                end
        else if(key<book^[position].persons.name) then
                begin
```

Listing continued.



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A-S/M II's system requirements: 48K Apple][with ROM or RAM card or 48K Apple][+ with DOS 3.3 and Disk II.

Dealer inquiries invited.

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Circle 63 on Reader Service card.

Listing continued.

```
                { may have passed it }
                jumping:=false;
                end
        else if((key>book^[position].persons.name)
                and(position=book^[0].size))then
                begin
                { it gets added to the end of the file }
                jumping:=false;
                position:=book^[0].size+1;
                stillLooking:=false;
                end;
        end;
anchor:=position;
while((stillLooking=true) and (foundIt=false)) do { check skipped entries }
        begin
        if(position=1) then { beginning of array reached, so }
                stillLooking:=false
        else { check previous entry } position:=position-1;
        if(key=book^[position].persons.name) then foundIt:=true
        else if(key>book^[position].persons.name) then
                begin
                position:=position+1;
                stillLooking:=false;
                end;
        if(position=(anchor-jumpSize)) then stillLooking:=false;
        end;
locate:=foundIt;
index:=position;
end;
procedure getKey;
                                { USER INPUTS NAME KEY }
const
        prompt  = 'KEY ON WHAT NAME: ';
var
        key     : string;
begin
clearLine(1);
write (prompt);
input (key,length(prompt)+1,1,nameLength,leftJustify);
shiftString(key);
currentEntry.name:=key;
entryIsIn:=changedState;
end;
procedure modifyName;
var
        temp    : string;
begin
input(temp,indent+10,displayAt+2,nameLength,leftJustify);
shiftString(temp);
currentEntry.name:=temp;
entryIsIn:=changedState;
end;
procedure modifyNumber;
var
temp:string;
begin
input(temp,indent+10,displayAt+6,numberLength,leftJustify);
shiftString(temp);
currentEntry.number:=temp;
entryIsIn:=changedState;
end;
procedure modifyAddress;
var
temp:string;
begin
input(temp,indent+10,displayAt+4,addrLength,leftJustify);
shiftString(temp);
currentEntry.addr:=temp;
entryIsIn:=changedState;
end;
procedure modifyNote;
var
temp:string;
begin
input(temp,indent+10,displayAt+8,noteLength,leftJustify);
shiftString(temp);
currentEntry.note:=temp;
entryIsIn:=changedState;
end;
procedure add;
                { PROCEDURE TO ADD A NEW ENTRY TO THE ADDRESS BOOK }
var
        newIndex        : integer;
        c               : char;
        found           : boolean;
        procedure checkName;
        var
                nameOK  : boolean;
                procedure abortAdd;
                begin
                message('Invalid name.  Add operation aborted.');
                clearEntry;
                exit(add);
                end;
        begin
        repeat
                if (length(currentEntry.name)<1) then abortAdd;
                nameOK:=(currentEntry.name[1] in ['A'..'Z']);
                if not(nameOK) then delete(currentEntry.name,1,1);
        until(nameOK);
        end;
```

Listing continued.

Circle 328 on Reader Service card.

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- Software reset to clear Buffer.
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- Automatic Buffer Size Recognition.
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- Pause while printing-delayed.
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- Change name of the 'HELLO' program after a disk has been initialized
- Define the 'HELLO' file type (Basic, Binary, Exec.)
- Alphabetize the catalog and remove old entries.

UTIL requires an Apple II with Applesoft, DOS 3.3, 48K and one drive. The price is $39.95. N.Y.S. residents add sales tax. Send check or money order to:

KANE COMPUTING
184 PINEBROOK BLVD.
NEW ROCHELLE, N.Y. 10804

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Listing continued.

```
begin
case entryIsIn of
    changedState:
        begin
        checkName;
        found:=locate(currentEntry.name,newIndex);
        if not(found) then
                begin
                if(book^[0].size=maxList) then
                        begin
                        clearLine(0);
                        writeln('FILE FULL - CAN NOT ADD!');
                        exit(add);
                        end;
                book^[0].size:=book^[0].size+1;
                if(newIndex<book^[0].size) then
                    moveright(book^[newIndex],book^[newIndex+1],
                            sizeof(phoneRecord)*(book^[0].size-newIndex));
                book^[newIndex].persons:=currentEntry;
                currentIndex:=newIndex;
                end
        else
                begin
                book^[newIndex].persons:=currentEntry;
                currentIndex:=newIndex;
                end;
        message('Record added.');
        entryIsIn:=filedState;
        fileModified:=true;
        end;
    blankState:
        begin
        getKey;
        found:=locate(currentEntry.name,newIndex);
        if not(found) then
                begin
                display;
                modifyAddress;
                modifyNumber;
                modifyNote;
                add;
                end
        else
                begin
                entryIsIn:=filedState;
                display;
                end;
        end;
    filedState:
        begin
        clearEntry;
        add;
        end;
    end{case};
end;
procedure delete;
                { PROCEDURE TO DELETE AN ADDRESS BOOK ENTRY }
var
        c               : char;
        newIndex        : integer;
        found,
        ok              : boolean;
        function confirmed: boolean;
        var
                yesno   : char;
        begin
        yesno:= prompt('OK to delete?  Confirm Y/N',['Y','N']);
        if (yesno='Y') then confirmed:=true else confirmed:=false;
        end;
        procedure erase;
        begin
        moveleft(book^[currentIndex+1],book^[currentIndex],
                sizeof(phoneRecord)*(book^[0].size-currentIndex));
        book^[0].size:=book^[0].size-1;
        message('Record deleted.');
        fileModified:=true;
        clearEntry;
        end;
begin
if (length(currentEntry.name)<1) then exit(delete);
case entryIsIn of
    changedState,
    filedState:
        begin
        found:=locate(currentEntry.name,newIndex);
        if not(found) then
                begin
                message('No such name to delete!');
                if(entryIsIn=filedState) then halt;
                exit(delete);
                end
        else
                begin
                currentIndex:=newIndex;
                if(book^[currentIndex].persons<>currentEntry) then
                        begin
                        currentEntry:=book^[currentIndex].persons;
                        display;
                        end;
```

Listing continued.

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IC

Listing continued.

```
                    if(confirmed) then erase;
                    end;
            end;
        blankState:
            begin
            getKey;
            delete;
            end;
        end{case};
end;
procedure search;
        { PROCEDURE TO SEARCH FOR A DISPLAY A RECORD BASED ON LAST NAME }
var
        newIndex        : integer;
        found           : boolean;
begin
case entryIsIn of
    changedState:
        begin
        found:=locate(currentEntry.name,newIndex);
        if(found) then
                begin
                currentEntry:=book^[newIndex].persons;
                currentIndex:=newIndex;
                entryIsIn:=filedState;
                display;
                end
        else
                begin
                if((found=false)and(entryIsIn=filedState)) then halt;
                message('Not found.');
                clearEntry;
                display;
                end;
        end;
    filedState:
        begin
        clearEntry;
        search;
        end;
    blankState:
        begin
        getKey;
        search;
        end;
    end{case};
end;
procedure modify;
          { PROCEDURE TO MODIFY THE CONTENTS OF AN ADDRESS BOOK ENTRY}
var
        temp            : string;
        modifySet       : charSet;
        quit            : boolean;
        command         : char;

begin
modifySet:=['E','N','A','P','Q','R'];
quit:=false;
temp:='';
command:=
    prompt('MODIFY E(ntire rec N(ame A(ddr P(hone R(emark Q(uit',modifySet);
case command of
       'E': begin
            modifyName;modifyAddress;modifyNumber;modifyNote;
            quit:=true;
            end;
       'N': modifyName;
       'A': modifyAddress;
       'P': modifyNumber;
       'R': modifyNote;
       'Q': quit:=true;
        end (case);
add;
end;
procedure list;
         { DISPLAY CONTENTS OF ADDRESS BOOK IN SEQUENCE ON THE SCREEN }
var
        cancelListing:  boolean;
        selection:      char;
        index:          integer;

        procedure endList;
        begin
        message('End of book reached.');
        index:=1;
        end;

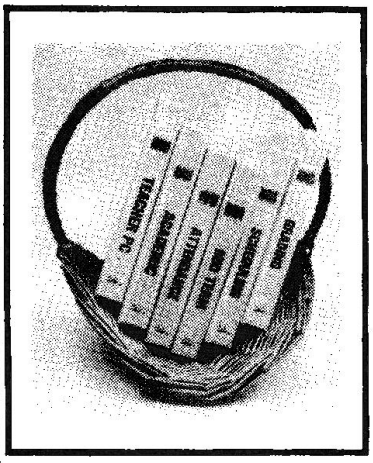
        procedure listNextItem;
        begin
        if ((book^[0].size=0)or(index>book^[0].size)) then endList
        else
                begin
                currentEntry:=book^[index].persons;
                entryIsIn:=filedState;
                display;
                index:=index+1;
                end;
        end;
begin
page(output);
index:=1;
```

Listing continued.

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xxx  PRINT "PLEASE ENTER THE DATE."; : & INPUT,DATE$
```

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Listing continued.

```
cancelListing:=false;
listNextItem;
repeat
        selection:=
            prompt('<space> for next item or Q(uits',['Q',chr(32)]);
        if (selection=chr(32)) then listNextItem
        else cancelListing:=true;
until (cancelListing);
end;
procedure quitProgram;
                                { EXIT PROGRAM CLEANLY }
var
        yesNo   : char;
        saveIt  : boolean;
begin
quit:=true;
if(entryIsIn=changedState) then
        begin
        yesNo:=prompt('Save entry below?  Y/N ',['Y','N']);
        if(yesNo='Y') then add;
        end;
end;
procedure print;
            { SEND PART OR ALL OF ADDRESS BOOK TO LINE PRINTER AS
                            NAME ..... NUMBER
                                LIST. }
var
        P       : interactive;
        select  : char;
        procedure printSection(key:char);
        const
                dot     = '.';
        var
                continue,
                match   : boolean;
                where   : integer;
                tempstring:string[nameLength];
                keystring:string[1];
        begin
        keystring:=' '; keystring[1]:=key;
        match:=locate(keystring,where);
        if (where <= book^[0].size) then
            if(book^[where].persons.name[1]=key) then
                begin
                writeln(P,'< ',key,' >');
                continue:=true;
                while ((continue)and(where<=book^[0].size)) do
                        if (book^[where].persons.name[1]=key) then
                                begin
                                fillchar(tempstring[1],nameLength,dot);
                                tempstring:=book^[where].persons.name;
                                {$r-}
                                tempstring[0]:=chr(nameLength);
                                {$r+}
                                write(P,tempstring,' ');
                                write(P,book^[where].persons.number);
                                writeln(P);
                                where:=where+1;
                                end
                        else continue:=false;
                end;
        end;
begin
{$I-}
rewrite(P,'printer:');
{$I+}
if(IORESULT<>0) then message('Cannot rewrite printer!')
else
        begin
        writeln(P,' ');
        select:=
        prompt('"A"-"Z" for section or <space> all.  "0" quits',[' '..'Z','0']);
        if (select in ['A'..'Z']) then printSection(select)
        else if(select=' ')then for select:='A' to 'Z' do printSection(select);
        end;
close(P);
end;
                                { MAIN PROGRAM }
begin
fileModified:=false;
currentIndex:=0;
quit:=false;
mainSet:=['A','C','D','L','M','P','Q','S'];
openFile;
repeat
    howMany;
    command:=
      prompt('A(dd C(lear D(elete L(ist M(odify P(rint Q(uit S(earch',mainSet);
    case command of
            'A': add;
            'C': clearEntry;
            'D': delete;
            'L': list;
            'M': modify;
            'P': print;
            'Q': quitProgram;
            'S': search;
    end {case};
until (quit);
if (fileModified) then saveFile;
end.
```

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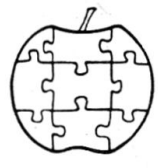
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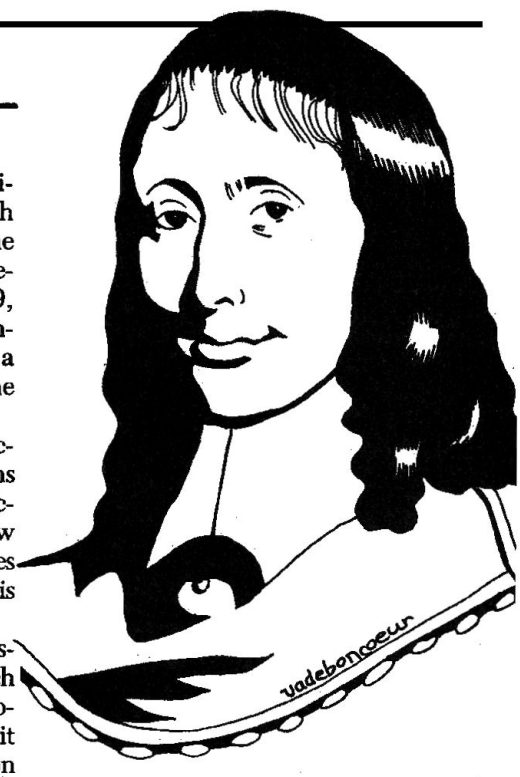


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A Pascalian Puzzle

Once the toast of France, Blaise Pascal lives on as Appledom's leading eponym. Surely, you and your computer can outwit a man dead for 321 years!

by Swain Pratt
Microcomputing Staff



Computer-involved people all recognize Pascal as the name of a programming language. They are often surprised, however, to discover that Pascal, unlike Basic, Cobol and others, is not an acronym, but a man—indeed, a man of rare genius.

The Frenchman Blaise Pascal (1623–1662) was both brilliant mathematician and fervent religious apologist. At the age of 12 he undertook to teach himself geometry, and within four years was writing original papers on conic sections that astonished mature mathematicians. He went on to become one of the fathers of modern algebra and is credited with the invention, at age 18, of the first mechanical calculating machine.

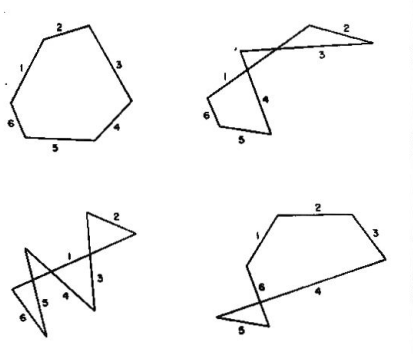


Figure 1. Examples of hexagons, with sides numbered consecutively.

A breakdown of health and a religious conversion brought Pascal much physical and spiritual pain during the last half of his life. He nonetheless remained active until his death at 39, leaving a treasury of mathematical invention and copious notes for a religious treatise, later published as the classic *Pensées*.

Since Pascal was a master of structure and form in mathematics, it seems most appropriate that a highly structured programming language now bears his name. A couple of examples may illuminate the quality of his mathematical thinking and insight.

At about the age of 16, Pascal discovered and proved a theorem which became one of the cornerstones of projective geometry. Simply stated, it says: If all six points of a hexagon lie on a conic, the three points of intersection of the three pairs of opposite sides always lie on one (straight) line, now called the Pascal Line. (The sides of the hexagon may be extended if necessary.)

For those of you whose high school geometry is rusty, here's a quick review. A hexagon may be defined as a plane figure formed of six points (no three of them on a line) and the six lines joining them in any order. (See examples in Fig. 1.) If the sides are consecutively numbered, pairs of "opposite" sides are defined as sides 1 and 4, 2 and 5, 3 and 6.

A conic is the boundary curve of any plane section (cross-cut) of a conic surface. (See Fig. 2.) Figure 3 shows several illustrations of Pascal's Theorem. (The last example—the degenerate case of two straight lines—actually was discovered by the Greek geometer Pappus, about 300 A.D.)

A Triangle's Secrets

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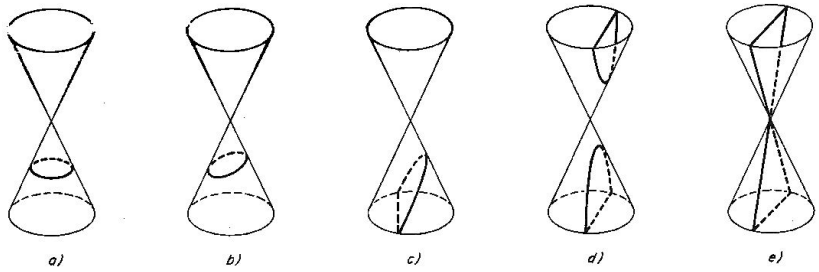


Figure 2.
Conic Sections
a. Circle: cut at right angle to central axis of cone.
b. Ellipse: cut at any angle, but passing completely through cone.
c. Parabola: cut is parallel to a straight line in cone's surface.
d. Hyperbola: cut passes through both nappes of cone.
e. Two straight lines: cut passes through both nappes and *vertex of cone.*

the triangular number array in Figure 4 occupied him extensively and today is often referred to as Pascal's Triangle. Even if you've never seen it before, a thoughtful inspection should reveal how each row is derived from the one above it. Once you discover that secret, you can add as many rows as you please. (But to write any given row without the preceding row to look at requires more knowledge.)

Other properties of Pascal's Triangle are less obvious. For example, the sum of the numbers across each row is a power of two, so you have the binary scale—the mathematical basis of the digital computer. Each row read as a decimal number (from the sixth row on, you must first perform a carrying operation on the double-digit numbers) is a power of 11!

Even more remarkable is a discovery Pascal made (spurred by analysis of a gambling game!) while investigating the mathematical laws of probability. These laws involve Combinations, the study of the possible ways to choose, or combine, a given number of objects—or events—out of a total number available.

For example, in how many ways can a one-, two-, three-, four- or five-person committee be chosen out of a group of five people? The answers are, respectively, 5, 10, 10, 5 and 1—the last five numbers in the sixth row of Pascal's Triangle. (You can verify this by letting the letters A, B, C, D and E stand for the five people and listing the possible combinations, taking one-at-a-time, two-at-a-time and so on.

Finally, Pascal discovered that the Triangle clearly displays a link between Combinations and the algebraic expansion (raising to powers) of the binomial a + b. (See Fig. 5.)

A Pascal-Inspired Puzzle

Figure 6 presents a triangular puzzle for your amusement. The object is simply to find the total number of routes by which PASCALSTRIANGLE can be spelled out, starting at all the Ps and ending at the only E—the center of the bottom row. The solution is a number that should be quite familiar

"...so you have the binary scale—the mathematical basis of the digital computer."

Pascal's Triangle

```
                1
              1   1
            1   2   1
          1   3   3   1
        1   4   6   4   1
      1   5  10  10   5   1
    1   6  15  20  15   6   1
  1   7   ?   ?   ?   ?   7   1
```

Powers of 11	Powers of 2
$1 = 11^0$	$1 = 2^0$
$11 = 11^1$	$2 = 2^1$
$121 = 11^2$	$4 = 2^2$
$1331 = 11^3$	$8 = 2^3$
$14641 = 11^4$	$16 = 2^4$
$161051 = 11^5$	$32 = 2^5$
$1771561 = 11^6$	$64 = 2^6$

Figure 4. Pascal's Triangle, through the 8th row. The sum *of the numbers in each row yields the power table of 2 (on the right). Each row read as a decimal number (with necessary carrying from the 6th row on) is a power of 11 (on the left).*

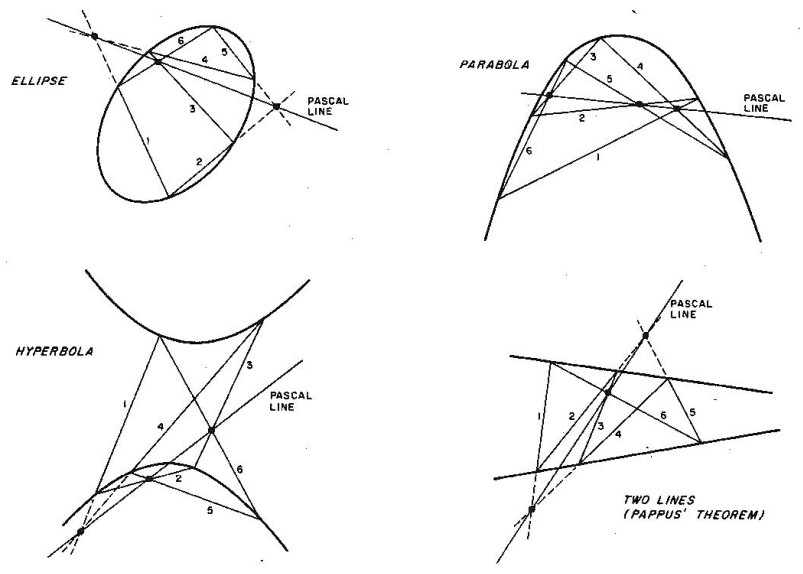


Figure 3. Illustrations of Pascal's Theorem.

to microcomputer users.

A related puzzle might also intrigue you. How many different routes are there from the upper left corner square of a checker board to the lower right corner square, moving only horizontally to the right and vertically down? (Do not move diagonally or backwards.)

If you wish to send in detailed solutions, *inCider* will print a few of the most elegant in a future issue. (Professional mathematicians and math teachers, please restrain yourselves—we know *you* can do it!) It would be interesting—and appropriate—to see if anyone can write a Pascal program to solve these puzzles on the Apple, though that would be a bit like using your car to go mail a letter across the street.

How astonished Blaise Pascal would be if he could see today's descendants of his calculating machine. And how pleased he might be that his name lives on in a programming language! ■

$$(a+b)^0 = 1$$
$$(a+b)^1 = a+b$$
$$(a+b)^2 = a^2+2ab+b^2$$
$$(a+b)^3 = a^3+3a^2b+3ab^2+b^3$$
$$(a+b)^4 = a^4+4a^3b+6a^2b^2+4ab^3+b^4$$
$$(a+b)^5 = a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$$
$$(a+b)^6 = a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab^5+b^6$$

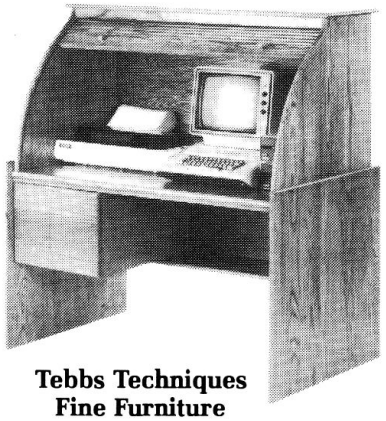
Figure 5. The expansion of the binomial a + b through the 6th power. The first and last terms of each expansion have coefficients of 1, which are not written. Put in those 1's, take away the a's and b's, and you have the rows of Pascal's Triangle.

```
                    P
                  P A P
                P A S A P
              P A S C S A P
            P A S C A C S A P
          P A S C A L A C S A P
        P A S C A L S L A C S A P
      P A S C A L S T S L A C S A P
    P A S C A L S T R T S L A C S A P
  P A S C A L S T R I R T S L A C S A P
P A S C A L S T R I A I R T S L A C S A P
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Figure 6. PASCALSTRIANGLE puzzle.

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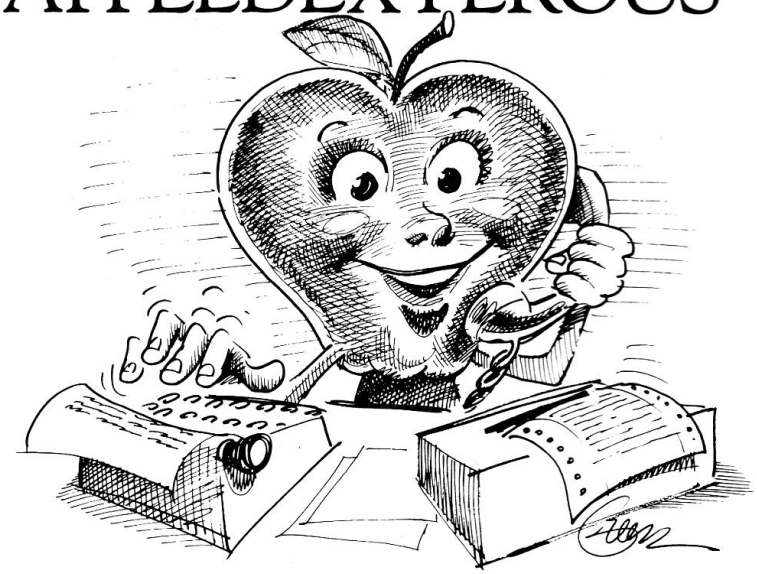
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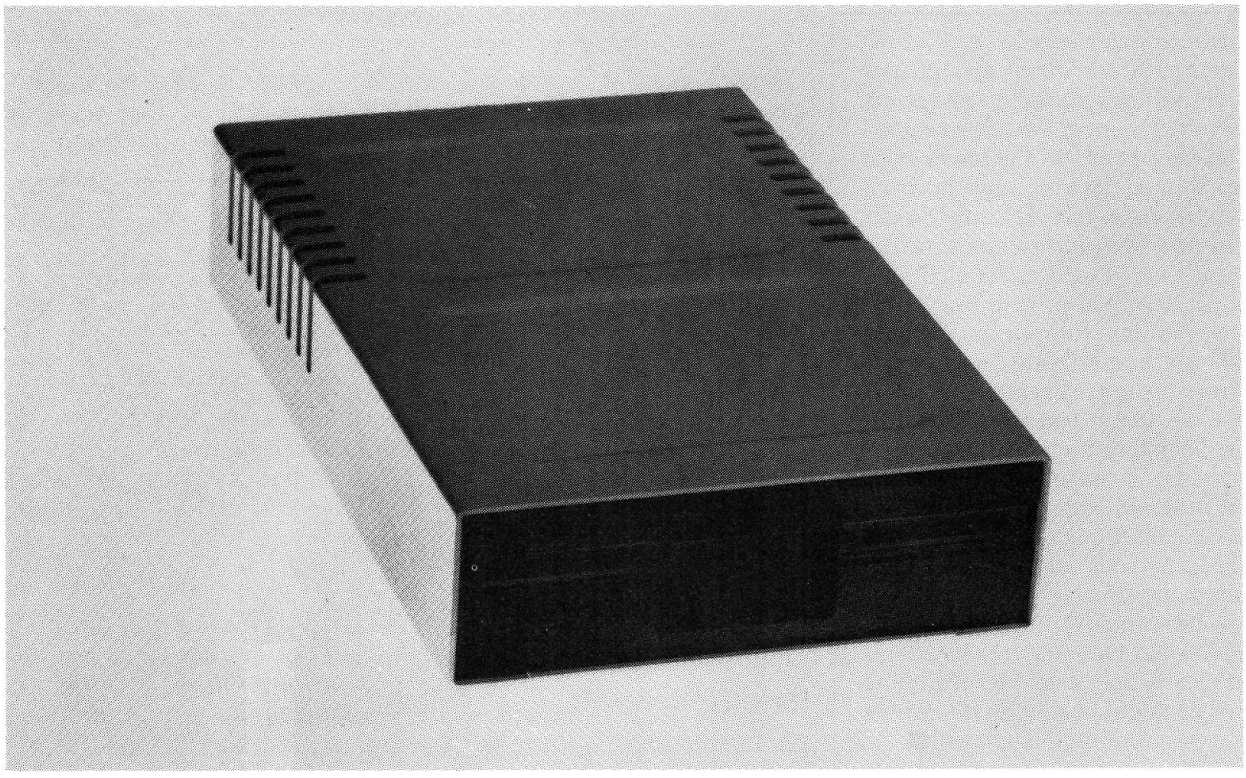


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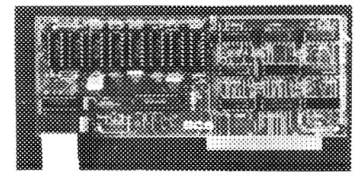
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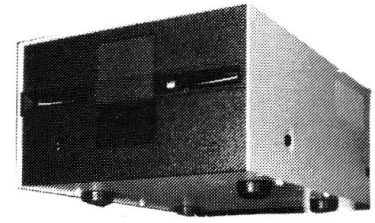
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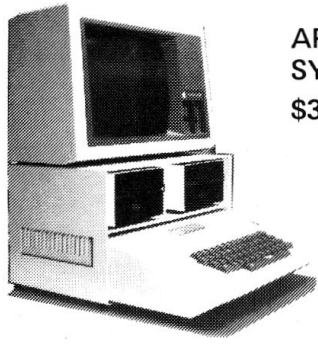
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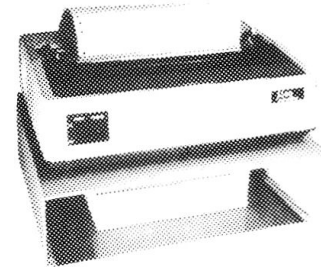
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Bank Street Writer

A look at a home word processor for the entire family.

by Hartley G. Lesser

Hey, Dad, this is great!" With this excited pronouncement, my ten-year-old son offered his unsolicited opinion of Broderbund Software's new Bank Street Writer, advertised as a home word processor. Quite truthfully, I was amazed by his statement. I have had several word processors lying about in my computer room for weeks at a time. My son has rarely booted one up, and he quickly lost interest with the few he did boot up. Not so with Bank Street Writer.

What makes this word processor different? And what prompted my son to try the software? For starters, the packaging of the software leads one to believe that the product can be used by the entire family. Norman Rockwell would have been pleased with the painting reproduced on the package cover—a healthy, wholesome American family is depicted. Mom, dad, and little sister are all smiles, and the little girl is happily pounding away on an Apple computer. Could the next great American novel be hiding within their daughter, merely awaiting the arrival of Bank Street Writer? I wonder.

Perhaps such a thought seems a bit far-fetched, but I have never seen a youngster take to a word processor so quickly. For a ten-year-old to sit down and type for two straight hours is amazing. When I asked Kirk how he had managed such a task, his simple answer was, "I liked using it. And I understand the manual."

Let's take a closer look at Bank Street Writer. Upon opening the box, you'll find a 28-page manual and two program disks. That's right, two disks. You automatically receive a backup copy of the program disk. For those with "technifear," the manual is written in a clear and informative style. But don't be surprised if you find yourself neglecting the manual when using Bank Street Writer. Many of the screen prompts are self-explanatory.

The manual first explains how to boot up the Bank Street Writer and then deals with accessing the utility program, which is reached by pressing the escape key when the program is loading. This is the only area of the Bank Street Writer that my son needed assistance to complete. Communication between the program and the disk drives and printer are read into the main memory from the utility program, as are the passwords created to protect your files. More on this a little later on.

There are four selections from the utility program: standard value modification, listing of data disk files and their current passwords, conversion of Bank Street Writer binary files to text files for telecomputing use or use in another program (and vice-versa), and quitting the utility program. By selecting 1, you are presented with the first of two screens for changing the basic values of the program. Each screen is accessed by a press of the spacebar.

To change a value, the letter of the item to be changed is entered. You may then input the new value, press return, and continue to the next item that requires modification. When completed, all of the new values are saved on the program disk. Parameters for the printer slot, (which is the data disk drive), margins for both rough and final drafts of your text, top and bottom margins, headers and page numbers, line feed on carriage returns, form feed character shift modification or keyboard enhancer card and choice of cursor type and keyclick, are all modifiable by the user.

The standard values that arrive on the disk are fairly universal. Once a change has been made to adapt the program to your system, re-entry into the utility program for further changes will be rare. I explained this to my son; he smiled and informed me that I could continue to manage the utility program—he'd do all of the writing!

It's advisable to have initialized data disks ready. These may be formatted in any manner you wish, or you can access the INIT program from Bank Street Writer. However, to access this utility, you should become familiar with the method of operation of the word processor.

To accomplish the latter, Broderbund provides a tutorial program with

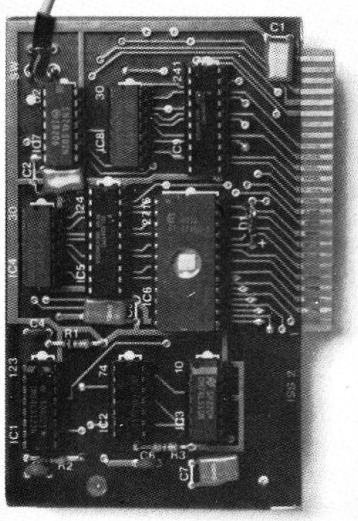
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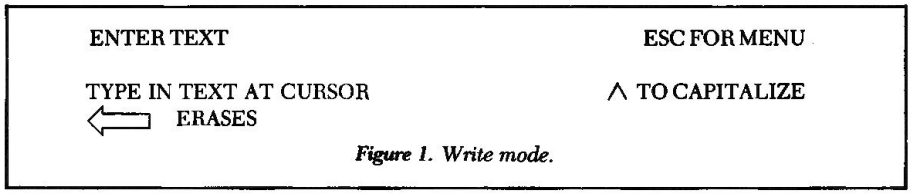


Figure 1. Write mode.

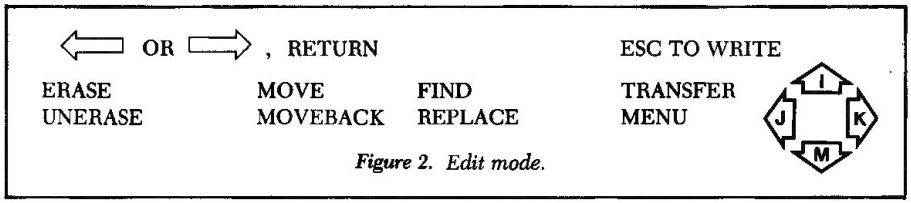


Figure 2. Edit mode.

the disk. To enter the tutorials, remove the disk from the drive, turn it over, re-insert, and reboot your system. You're all set to go. A new menu is presented.

Lesson one deals with the method of entering text in the Write mode. Lesson two teaches cursor movement and the manner in which text should be corrected. Lesson three explains the commands ERASE and UNERASE, and Lesson four discusses the MOVE and MOVEBACK commands. The final lesson teaches you about using FIND and REPLACE. On-screen prompts guide the user deftly through each lesson. Errors cannot be made because the tutorial won't allow you to progress unless each lesson is followed accurately. One slight drawback is that after the tutorial begins, you must finish the work; there's no other exit, other than turning off the computer. Each tutorial faithfully duplicates the conditions found on the main program. Overall, the tutorials are excellent. Not a single screen is wasted. And once through the tutorial, there should be little problem in running the Bank Street Writer.

Bank Street Writer's manual was written for the Apple II or Apple II Plus computer. If you are running this word processor on a new Apple IIe, the differences are explained in the word processor's opening screen and in the tutorial. Most importantly, Bank Street Writer is 100% compatible with the IIe, either with or without the standard 80-column text card inserted.

When using the Apple II without shift modification, the shift-N produces the desired effect. To produce all capital letters, shift-N must be pressed again. Leaving the capital letter mode requires a third keypress of shift-N. When trying this maneuver on an Apple II, I found that I sometimes left an n or N on the screen and did not enter the capital letter mode. It takes a little time to become familiar with these combination keypresses.

After removing the program disk and rebooting for the actual program, the first screen should look like Figure 1. This is the Write mode. Bank Street Writer operates just like a typewriter: what you type is what you'll get on the screen. To manipulate your text, you'll need to enter the Edit mode by simply pressing the escape key. Your second screen for the Edit mode should look like Figure 2.

Note that the arrows point in four directions on this screen. These are the cursor movement arrows, that move your cursor in whatever direction the keypress indicates. For example, if you wanted to move your cursor towards the top of the page, strike the I key. This cursor movement is *only* accessible from the Edit mode.

If you are operating the IIe, however, these keys *do not* control your cursor movement. Instead, use the cursor direction keys located on the bottom row of your IIe keyboard, which are to the right of the closed apple key. An appropriate symbol ap-

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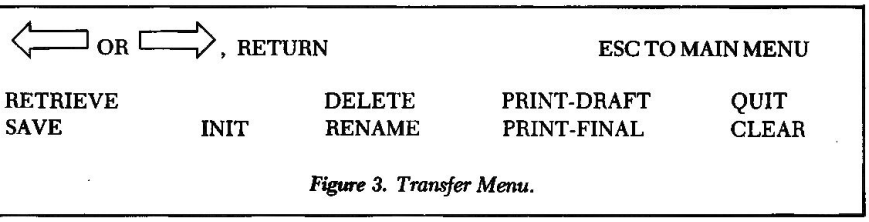


Figure 3. Transfer Menu.

I	= Cursor moves up 1 line
J	= Cursor moves 1 space to the left
K	= Cursor moves 1 space to the right
M	= Cursor moves 1 line down
B (for Beginning)	= Cursor moves to the start of the document
E (for End)	= Cursor moves to the end of the document
U (for Up)	= Cursor moves up 12 lines
D (for Down)	= Cursor moves down 12 lines

Figure 4. Cursor movement key presses.

pears in the upper right corner of the screen, which simply displays the cursor arrows without the letters I, J, K, and M inside. When this symbol appears, you'll know you can use the cursor movement keys on you IIe easily.

Another important difference is that those using the Apple II will be using their right and left arrows to select the appropriate Edit mode. For example, if ERASE is highlighted on screen, and you want to find a word, either press the left arrow key twice, or the right arrow key twice, to highlight the desired mode. Striking the spacebar drops the highlighter from the top row of selections to the bottom row, or vice-versa.

The IIe functions differently. Here, you must press either your open apple or closed apple keys to move the highlighter to the desired mode. The spacebar works in the same manner as for the Apple II. Again, these are differences not noted in the manual, but they are indicated by on-screen prompts in the upper left corner of the screen and in the tutorial.

The third mode is accessed by selecting TRANSFER MENU, followed by a return keypress. The screen looks like Figure 3. Again, depending upon which Apple you're using, the left and right arrows, or the cursor movement keys, as well as the spacebar, move the highlighter to the desired selection, or prompts. Movement between the three modes is simply a matter of pressing the escape key.

If you own the Apple II, screen prompts will remind you to use the left and right arrows and spacebar to highlight the option required. If you're using a IIe, then the open and closed apple keys and the spacebar are utilized.

Once in the Write mode, the computer becomes a typewriter. Up to 38 characters can be typed on a single line, and there is no allowance made for an 80-column board. Cursor movement about the page is controlled by the left arrow key (which erases previously typed text), the spacebar (for moving the cursor right), and the return key. Each move in the Write mode leaves blank character space(s). The word processor wraps each line automatically, and the final printed product is determined by whatever parameters are set up when accessing the printing program.

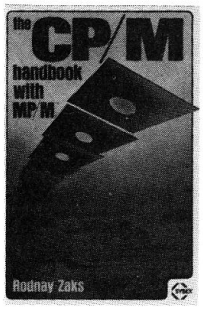
Use of the rept key on the Apple II in conjunction with a letter repeats a character. Merely holding down the letter causes automatic repetition on the IIe. Control-I indents 8, 16, 24, or 32 spaces, and control-C centers all text that precedes a return. Control-S tells how many characters you have remaining in the current file. For computers with 64K bytes RAM, this is about 3200 words, and for the standard Apple II without the RAM or language cards, about 1300 words. Not a great deal of storage space, to be sure, but adequate for most tasks. Save the file, clear the memory, and you can continue writing a long document. When it comes time to print, simply print them one at a time. These operations are accessed through the Edit mode.

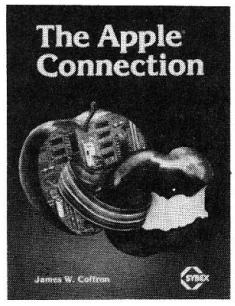
All alterations and movements throughout your document that don't destroy text are handled through the Edit mode. This requires the press of the escape key from Write mode. For the Apple II, eight key presses are required for cursor movement. Refer to Figure 4. These key movements are easy to remember because they are displayed in hi-res in the upper right corner of the screen. When this illustration is on screen, these key movements are available for use. For those using the IIe, the cursor movement keys on the lower row of the keyboard manipulate the cursor, as well as the B, E, U and D keys.

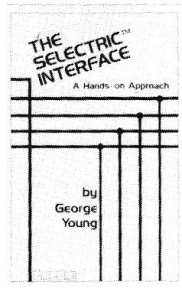
For those who have used a sophisticated word processor, the key presses needed with Bank Street Writer seem awkward at first. Example: You are in the Write mode and happily typing your fifth paragraph, and you realize that a mistake has been made in the second paragraph. In order to edit the mistake, you must leave the Write mode by pressing escape and enter the Edit mode. You must then manipulate the cursor to the specific area, make your deletions, press escape to re-enter the Write mode, and type in the correction. This becomes frustrating if a simple correction is needed just two lines or so above where you are typing. You cannot simply move your cursor upwards in the Write mode and change the error. This extra step takes a little time to get used to. However, once you have operated under these conditions for a while, it almost becomes second nature.

If you have a paragraph of text that needs to be erased, press return to access the Erase mode. You are informed at the top of the screen to move the cursor to the first character of the block of text to be erased. Press return, and you're told to move the cursor to the end of the text to be deleted. Press return again. As you move the cursor to this point, the text to be deleted becomes inverse, black-on-white. When you reach the end of the deletion, press return, and a final query

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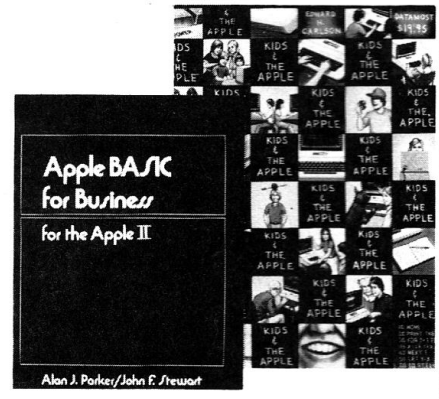
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"This FIND and REPLACE mode enables one to change name and address only on a form letter, saving the need of retyping the letter time after time."

appears on screen. Are you sure you want to delete this text? If so, answer Y and the text disappears. Answer N and the inverse text is converted back to normal. A maximum of 15 lines can be deleted before you must repeat the procedure to continue erasing. Unerase does exactly the opposite, and is only available for the most recently erased segment of text.

MOVE and MOVEBACK transport the text into different areas within the body of your document. Again, the specific mode must be highlighted, followed by a press of the return key. The text to be moved is again highlighted after you mark both the start and end of the segment and can be transferred a maximum of 15 lines. Moving the material beyond 15 lines requires another MOVE command and a repeat of the process. MOVEBACK returns your text to its original setting and only works on the most recent segment.

A word consisting of up to 29 characters can be found or replaced by Bank Street Writer. Highlight REPLACE and you're asked to enter the word to be found. Press return and you're asked to replace the word with the new word. Bank Street Writer then finds each requested word, highlights the word in the text, and asks if this word is to be replaced. If you answer Y, the new word is inserted, the old word is deleted, and the next occurrence of your selected word is located in your document. An answer of N moves to the subsequent occurrence.

Although certainly not as handy as a word processor with a glossary function, this FIND and REPLACE mode enables one to change name and address only on a form letter, saving the need of retyping the letter time after time.

Again, most of these modes are found on more expensive word processors, and for the initial price of only $69.95, they certainly make this product a viable entry into the text crafting market.

Whenever a document has to be saved or retrieved from your data disk, or you wish to initialize a data disk, rename your previously saved document, clear memory or delete an unwanted file, the TRANSFER MENU must be accessed from the Edit mode. This is the function found to the right of the screen.

The submenu appears when in Transfer mode, and the function you desire must again be highlighted. Press return to enter that process. To initialize your disk, make certain that you know which drive you have designated as a data drive. This was accomplished when we discussed the utility program. Here are two methods of making certain you know which is which:

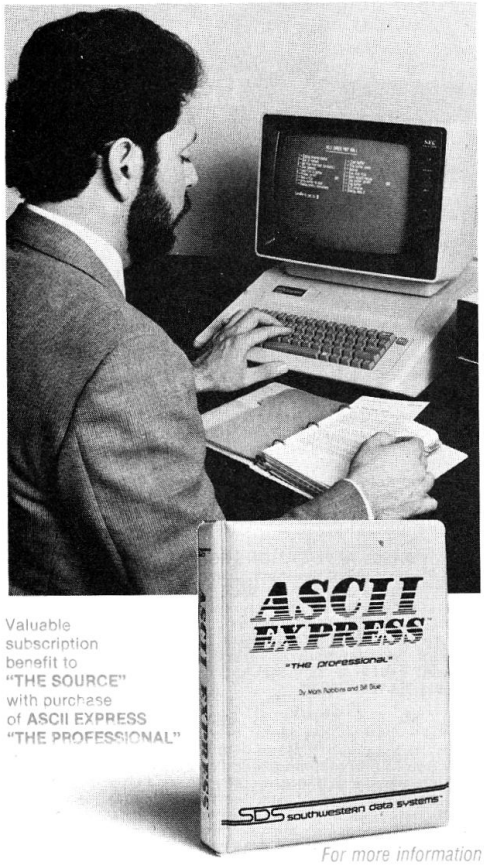
- Turn off the program, reboot, and press the escape key to enter the utility program. Select 1 to have another look at the parameters set.
- After accessing INIT, remove your program disk from drive #1, insert your data disk, and follow the on-screen directions. If drive #2's light comes on and whirrs and clacks away, then your data disk drive has been set

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to 2. An error message arrives on screen, and you can try again by simply reinserting your program disk in drive #1 and your data disk in drive #2. If drive #1 came to life, then you're safe. You have an initialized disk.

SAVE and RETRIEVE access your data disk. You're asked for a filename and then queried for a password. This password may be used when saving your file. This is fine for limiting access to personal files; however, this procedure may be easily defeated by simply renaming the document with the original name—the password lock will no longer be in place. Document names cannot be longer than eight characters. In either mode, you'll be asked if you wish a data disk catalog and a simple "Y" or "N" should be input. QUIT is another selection made from this mode.

PRINT FINAL is the function highlighted when you want to control how your text is formatted on paper. You're asked how many characters you want per line, with a range of from 40 to 126 characters. Spacing may be set at either single, double, or triple spacing. If the document is a continuation of a previous document, then it will be chained, using the same headers and continuation of page numbers.

You can also decide if pages are to be numbered. For printers using single sheets, a pause is allowable between pages. The last page may be ejected, giving you a fresh sheet of paper for your next task. A page heading of up to 38 characters may also be input. This heading appears on all of the pages. You can print the entire document or parts of the document. A handy feature allows you to see where each page of the current text ends. This is helpful in formatting the pages, so that they don't break in awkward places. During the printing process, press the escape key to halt the printing.

PRINT DRAFT prints your text *exactly* as you see it on your screen, at 38 characters per line. A few of the same questions as in PRINT FINAL mode are asked. To change values, the utility program may be accessed.

To close things up, there is a handy index/glossary at the back of the manual, which not only offers the meanings for some of the words used throughout the book, but also indicates the pages where these references are made.

What is, or isn't, Bank Street Writer? This is not a word processor adapted for major business undertakings. For those used to a highly sophisticated word processor, such as Zardax or WordStar, Bank Street Writer may seem primitive. But keep in mind that the entire Bank Street Writer package costs only $69.95. It's quite a value as far as I'm concerned.

"Bank Street Writer is perfect for the home. It introduces word processing to the novice but does have some sophisticated features."

Bank Street Writer is perfect for the home. It introduces word processing to the novice but does have some sophisticated features. I think children aged eight and up will find Bank Street Writer perfect for their needs (school reports, etc.), and the first-time word processing user will find report creation simple and rewarding. For those who disagree, recall your first experience with a more complex word processor, and the amount of time and frustration spent learning the system. Bank Street Writer is usable immediately!

Bank Street Writer requires an Apple II, II Plus, or IIe, 48K bytes RAM, one disk drive, 16 sector controller, Applesoft in ROM or RAM and extra memory of 16K RAM or language card utilized by program. It is produced by Broderbund Software, 1938 Fourth St., San Rafael, CA 94901. ■

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Input Insult:
Getting Around the Problem

Has your Apple been rejecting sincere attempts to communicate? You can sidestep these input problems using the GET command and a few tricks of the trade.

by M. Max McKee

When was the last time your EXTRA got IGNORED? I don't know about you but I don't have enough as it is. Thank goodness it's my Apple talking; I don't think I could handle the rejection otherwise!

The INPUT statement has been a problem since day one with the Apple, and unfortunately none of the manuals really help us get around the problems with entering commas, colons and quote marks into strings. And when disk storage and access is involved, it really starts to get frustrating. Talk about rejection: BAD RESPONSE TO AN INPUT STATEMENT. If you've already had your EXTRA IGNORED. . . well, it's just hard on your ego.

With INPUT you simply can't use commas and colons, and if you plan to send the data to disk with any intention of retrieving it later, you'd better not embed any quote marks. Within a program:

```
100 INPUT "ENTER DAY & DATE: ";DT$
```

would probably prompt the user to respond:

```
FRIDAY, APRIL 15
```

and the Apple would print:

```
FRIDAY
EXTRA IGNORED?
```

Similarly, retrieving from disk files data which has embedded commas or colons will produce the same result. And, if quote marks were used within a string, we get the fatal error: BAD RESPONSE TO AN INPUT STATEMENT. Very frustrating when we're just trying to use the Apple for text manipulation without wanting to create a complete database word processing system.

Getting around those problems is the answer. That is to say, by using the Apple's GET instead of INPUT, it is possible to monitor each character as it is entered (very nice for limiting input to all numbers or all alphabetic characters, for example) and to build a string one character at a time. Instantly, the EXTRA IGNORED problem within a program is solved, and with one simple addition you can take care of disk access as well. Placing a "throwaway" quote mark—CHR$(34)—in front of the built-up string before sending to disk guarantees that upon disk access the Apple will look at the string requested (via the INPUT statement) as a literal. It will return the entire string but will dump the lead quote. Voila! No EXTRA IGNORED.

The only problem remaining is getting quote marks back from disk without an error. Since GET will monitor each character entered by the user, it is a simple matter to change the ASCII value of the quote from CHR$(34) to CHR$(98) before adding it to the string. Result: Apple DOS doesn't see it as quote marks related to INPUT but returns a character which to us looks exactly the same. Try it.

```
PRINT CHR$(34);PRINT CHR$(98) (return)
```

Listing 1 has been set up as a complete program, but its major purpose is to provide you with a short subroutine called GETLOOP which will handle all data input problems.

GETLOOP is located between statements 50 and 98 and requires a GOSUB 5900 prior to GOSUB 50. The defined function at 5910 sets up FN BY(Z) as a dummy variable that looks at the screen to see the actual character placed there by the PRINT N$ statement in 94.

When the program is run, you will be asked how many characters you want allowed during input. (This control function can be removed by deleting lines 5040–5050, 58 and 82.) It is there to show a simple way in which the user can be limited. If you don't want the user to have any choice in the matter, just change 5040 to ML$ = "###".

Entry into GETLOOP places the cursor at the left side of the screen at VTAB 1 (unless otherwise specified) and then sets the string NN$ to null. Statement 58 prints as many periods as specified by line length and repositions the cursor at the first dot.

Whatever the user types is handled through the GET N$ in 62 and PRINT N$

M. Max McKee is president of Multi Data Service Corp., 407 Terrace St., Ashland, OR 97520.

Program listing. No-problem Apple input.

```
0  REM NO-PROBLEM APPLE INPUT
10  GOSUB 5910
20  GOTO 5000
50  REM GETLOOP*******************
54  HTAB 1:SV =  PEEK (37) + 1:NN$ = ""
58  FOR I = 1 TO ML: PRINT ".";: NEXT : HTAB 1: VTAB SV
62 H =  LEN (NN$):V = SV +  INT (H / 40): VTAB V: GET N$:OV = V - 1:OH =
     PEEK (36)
66  IF N$ =  CHR$ (27) THEN 50
70  IF  NOT H AND N$ =  CHR$ (8) THEN 54
74  IF N$ =  CHR$ (8) THEN NN$ =  LEFT$ (NN$,H - (H > 1)): HTAB H - 1 +
    SH: ON (H > 1) + 1 GOTO 54,62
78  IF N$ =  CHR$ (34) THEN N$ =  CHR$ (98)
82  IF H = ML THEN  IF N$ <  > CHR$ (13) THEN  PRINT  CHR$ (7);: GOTO 6
    2
86  IF N$ =  CHR$ (21) THEN  HTAB SH + H + 1: VTAB  PEEK (37) + (H + SH <
    40): GOTO 98
90  IF N$ =  CHR$ (13) THEN  CALL  - 958: PRINT :NN$ =  CHR$ (34) + NN$:
    RETURN
94  PRINT N$;
98 NN$ = NN$ +  CHR$ ( FN BY(Z) - 128): GOTO 62
5000  REM MAIN*********************
5010  TEXT : HOME
5020  HTAB 8: INVERSE : PRINT " NO-PROBLEM APPLE INPUT "
5030  NORMAL : VTAB 3
5040  INPUT "DESIRED LINE LENGTH? (1-238) ";ML$: IF  NOT  VAL (ML$) THEN
    5000
5050 ML =  VAL (ML$): IF ML > 238 THEN 5000
5060  VTAB 5: PRINT "TYPE ANYTHING! (EVEN , : " CHR$ (34)")"
5070  VTAB 7: GOSUB 50
5100  REM SAVE STRING TO DISK****
5110 D$ =  CHR$ (4)
5120  VTAB 14: HTAB 13: FLASH : PRINT "SAVING TO DISK": NORMAL : PRINT
5130  PRINT D$;"OPEN TESTSAVE"
```

Listing continued.

in 94. If the right arrow is pressed (see statements 70–74), the routine advances the cursor and adds whatever was underneath it to the growing string NN$. If the left arrow is pressed (statement 86), the cursor moves left and subtracts one character from the length of NN$. If the quote is pressed (statement 78), the routine converts its ASCII value from 34 to 98. If the length of NN$ equals the allowable string length specified by ML, the Apple beeps control-G (statement 82) and returns for another character. If return is pressed, the "throwaway" quote is added to the front of NN$ (statement 90) before exiting GETLOOP.

To demonstrate the power of this type of subroutine, I've added an escape key function at 66. If you press escape anytime during input, the line is blanked out and starts over. This could just as well tell the Apple to access a routine to answer the telephone or reinitialize your favorite adventure

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"This could just as well tell the Apple to access a routine to answer the telephone or reinitialize your favorite adventure game disk."

Listing continued.

```
5140  PRINT D$;"WRITE TESTSAVE"
5150  PRINT NN$: PRINT D$;"CLOSE"
5200  REM READ BACK FROM DISK****
5210  VTAB 14: CALL  - 958: HTAB 9: FLASH : PRINT "READING BACK FROM DIS
      K": NORMAL
5220  VTAB 16
5230  PRINT D$;"OPEN TESTSAVE"
5240  PRINT D$;"READ TESTSAVE"
5250  INPUT NN$
5260  PRINT D$;"CLOSE"
5270  PRINT NN$
5280  VTAB 14: HTAB 4: INVERSE : PRINT " AS RETURNED FROM DISK TEXTFILE
      ": NORMAL
5290  VTAB 22: HTAB 12: PRINT "TRY AGAIN? (Y/N)";: GET CH$: PRINT CH$: IF
      CH$ = "Y" THEN 5000
5300  IF CH$ <  > "N" THEN 5290
5899  END
5900  REM DEFINE FUNCTION********
5910  DEF  FN BY(Z) =  PEEK ( INT (OV / 8) * 40 + 1024 + (OV - ( INT (OV
      / 8) * 8)) * 128 + OH)
5920  RETURN
6000  REM VARIABLE NAMES*********
6010  REM SV=SET VERTICAL
6015  REM N$=SINGLE CHAR. GET
6020  REM NN$=NN$+N$ (STRING)
6030  REM ML=MAXIMUM LINE LENGTH
6040  REM H=HORIZONTAL (CURRENT)
6050  REM V=VERTICAL (CURRENT)
6060  REM OH=OLD HORIZONTAL
6070  REM OV=OLD VERTICAL
6080  REM D$=CTRL-D
6090  REM CHR$(27)=ESC KEY
6100  REM CHR$(34)=QUOTE
6110  REM CHR$(98)=QUOTE TO DISK
6120  REM CHR$(8)=LEFT ARROW
6130  REM CHR$(21)=RIGHT ARROW
6140  REM CHR$(13)=RETURN KEY
```

game disk—and then gleefully return for the next letter of input! Try, for example, having statement 66 disallow the letter E:

```
66 IF N$ = CHR$(69) THEN PRINT
   CHR$(7);:GOTO 62
```

I give up. Why would anyone want to do that?

As soon as the user presses return, this short program saves the string to a disk file called TESTSAVE (statement 5130) and then immediately retrieves it. This is merely to demonstrate that any character can be sent to disk using GETLOOP to build the string. Note that NN$ is saved using the standard print statement (at 5150) and is retrieved using the standard input statement (at 5250). A sequential file is used here, but random access works equally well with as many fields of input as desired.

Experiment. I think you'll like it and all of those days of rejection will be no more. ■

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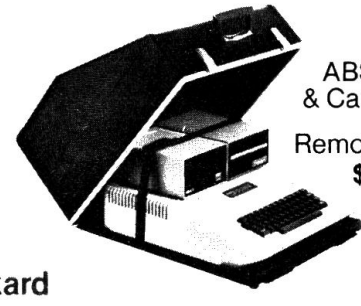
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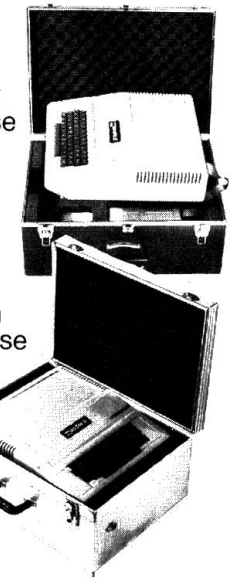


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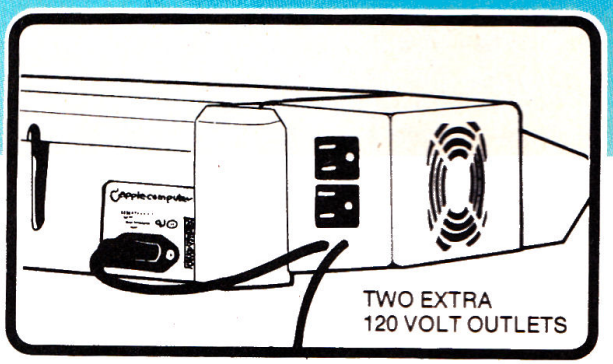
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DEALER INQUIRIES INVITED

Franklin Ace 100

While Franklin mints near-copies of the Apple, the argument rages over which machine offers better price-performance. The following candid comparison of the Apple II Plus and the Franklin Ace will put it all into perspective.

by Timothy Daniel

"There is much difference between imitating a good man and counterfeiting him."

When Ben Franklin wrote those words in 1738 neither he nor anyone else could have predicted the age of microcomputing. Yet Franklin's sage counsel has stood the test of time, witness the appearance of Franklin Computer Corporation's Ace 100, a computer that looks like the Apple II Plus and is said to be completely compatible.

The question of imitation versus counterfeiting might best be answered by comparing the Apple and Franklin side by side. Both computers have a box-like shape with the Franklin being slightly bigger. One major cosmetic difference is the Franklin has a different keyboard (see Photo 1). The Apple has 52 keys compared to 72 keys on the Ace 100. Franklin hasn't incorporated 20 new characters though; most of the additional keys are part of a numeric keypad. What is unique to the Ace are two bracket keys, (/) and [/], and keys labeled PAUSE, BREAK and alpha-LOCK. The resulting layout looks more like a conventional typewriter than it does the Apple. For example, if you type (SHIFT 8) you'll get *, the same as a Smith-Corona portable! The Apple, however, returns a (for that combination.

The numeric keypad, which is designed to aid data entry, is supplemented by dedicated −, +, *, = and . keys. When combined with the two bracket keys this part of the keyboard is ideally suited for use with several spreadsheet programs.

The presence of an alpha-Lock is explained by the Ace 100's upper/lowercase capability, compared to the Apple II Plus keyboard that generates only uppercase letters. The shift is used to toggle between two different characters, like the 8/(key. Because of the lack of a lowercase keyboard many Apple programs use a shift key modification. Unless the shift key is depressed the software converts the uppercase character into a lowercase one. The biggest drawback is the need for a hardware modification and some additional software. (Both the Franklin

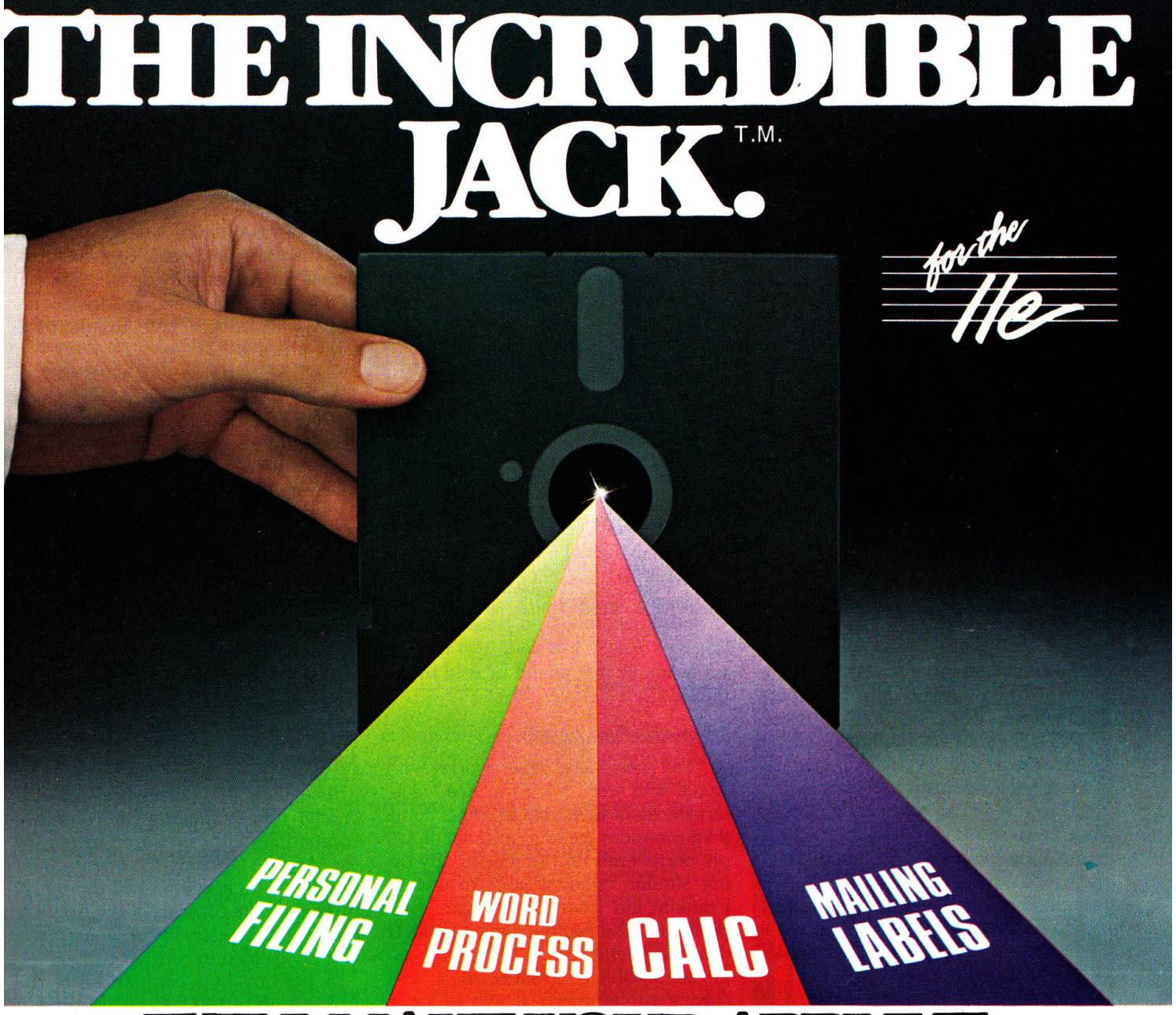


Photo 1. The shape and general layout of the Franklin Ace 100 closely resemble that of the Apple II.

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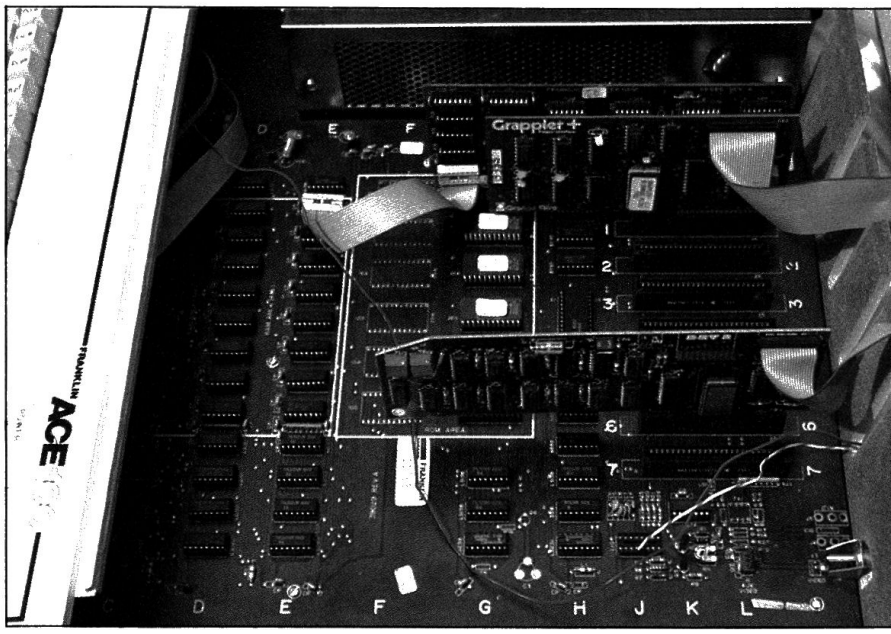


Photo 2. Peripherals that work with an Apple can be used with the Ace 100. A Micro-Sci disk drive controller and Grappler printer interface are shown here. The cable in the foreground runs from the keyboard to the game connector and serves as a substitute for the Apple shift key modification.

and recent versions of the Apple allow you to display upper- and lowercase characters.) With the Ace 100 you don't need a shift key modification. To input and display "Franklin" as part of a Basic program just type it normally. Of course, you can also use the alpha-lock and get "FRANKLIN". With the alpha-lock on, the Ace 100's keyboard output resembles the Apple, all uppercase, and you still use the shift key to differentiate between two characters on one key, 1 and ! for example.

Looking Inside

With exception of the Franklin's keyboard, the Ace 100 has circuitry that is almost identical to the Apple II Plus, in both component choices and layout. You'll find eight peripheral slots, game connector and power supply junctions, just like in the Apple. There are only three obvious differences—an absence of input and output jacks for a cassette interface, extra space in the middle of the Franklin circuit board designated "ROM AREA" and a fan on the Ace 100 power supply.

If you expect to do anything more than run prepackaged software on your Franklin, be prepared to buy or borrow additional documentation. The *Apple II User's Guide* by Lon Poole can be very helpful, in addition to Apple's *DOS Manual* and *Reference Manual*. Franklin representatives have told me that a "technical" or service manual will be available but wouldn't say when or if it would be sold to the public.

Hardware Compatibility

"Any peripheral that works with Apple will work with the Ace." The seriousness of such a claim comes home if you consider the huge number of Apple peripherals on the market. By using similar circuitry and firmware, Franklin has insured hardware compatibility. You can plug in an Apple II disk drive controller or any of the Apple compatible controllers, use a Z-80 card, a printer interface card, joysticks and so forth. (See Photo 2.)

There seem to be only three exceptions to Franklin's compatibility claim. Don't expect to use software stored on cassette tape, or use speech software that requires the cassette interface. Nor will you want to use the Ace 100 with a color monitor; only black and white graphics will be shown. A minor hardware change eliminated the Ace 100's ability to generate color video.

The third exception comes from the difference in keyboards—no shift key. The lack of technical documentation forces you to do without or to probe blindly around the keyboard for a suitable signal. There are several such tie points available, but none seem to provide one exactly like the Apple modification.

Software Compatibility

"Any program that runs on the Apple will run on the Franklin Ace 100." This can be done because the monitor and Basic ROMs are almost identical to the Apple ROMs. A large variety of machine language and Applesoft programs run successfully on the ACE 100 and there is no problem in implementing Apple's Integer Basic, thanks to the 64K of RAM.

The ACE 100 is sold with 64K of RAM while the typical Apple comes with 48K. Franklin accomplishes this 16K difference in the same manner that Apple does when it upgrades a machine to 64K. All you do is add a memory card to peripheral slot 0. The Franklin 16K add-on resembles the Apple language card as well as third party memory boards and uses a strap that runs to the RAM section of the main board. By removing the memory card and transferring one of its 4116 RAM chips to the socket where the strap once was, I turned my 64K Ace 100 into a 48K Ace 100.

Firmware

The Ace 100 firmware plays a crucial role in making the computer compatible with software written for the Apple. Officials at Apple claim that Franklin accomplished this by reproducing the contents of the Apple II Plus ROM. The legality of such a tactic will be decided in court.

A byte by byte comparison of the Apple Autostart ROM and its Franklin equivalent showed that slightly more than 200 bytes differed, about 10 percent of the ROM. The Franklin's monitor does not provide for writing or reading memory on tape, a logical omission when you remember that the Ace 100 has no cassette I/O. Other changes stem from the difference in the two computers' keyboards. None of the changes affect using the monitor or running machine and Applesoft programs. The Ace 100 comes with a firmware Basic that bears a remarkable resemblance to Applesoft Basic. The only difference seems to be the lack of Save or Load for cassette storage.

Documentation

Franklin must have operated under the assumption that less is better when they prepared documentation for the Ace 100. The 24 page *Operator's Reference Manual* covers only unpacking,

Franklin Update

Shortly after I wrote this review of the Ace 100, Franklin Computer Company announced the availability of the Ace 1000, a model designed to supersede the Ace 100. The major differences between the 1000 and 100 seem to be in the different cabinet (the 1000 features a pop-off top), the location of the reset switch (it is not located near the main keyboard on the Ace 1000) and the inclusion of all 64K of RAM on the main circuit board (the 100 uses an extra board for 16K of its memory). From the user's point of view the Ace 100 and the Ace 1000 are said to be identical.

There seems to be some confusion about the color capability of an Ace 1000. Several distributors and at least one Franklin sales representative claim that the Ace 1000 has color capability. Other distributors and a Franklin technical representative stated that the Ace 1000 is not capable of generating color video but that a modification circuit should be available by late 1982. In the absence of any definite commitment from Franklin, at least one outside supplier is offering a color modification kit.

As of mid November Franklin was not making a service manual available to the public. Despite several verbal promises the only software patch available at this writing is for AppleWriter. Potential Franklin owners would be well advised to deal with a knowledgeable distributor. The manufacturer does not seem well equipped to handle user problems or questions, either by phone or mail. ■

cabling (internal and external) and loading a program. Despite its short length the manual has two pages of errata. Once you get past installing disk drives, the 16K board, plugging the computer in and loading the first program from disk, you are on your own. Information about programming is nonexistent.

The exceptions to Franklin's software claim come from the Ace 100's hardware limitations—programs should not require a cassette interface or color video. Unfortunately the Ace 100's improved keyboard is often useless and in some cases is a hindrance when used with word processing that has ingenious programming to get around the Apple lower/uppercase problem. Franklin's solution is to provide patches for popular word processing software. The *Owner's Reference Manual* is accompanied by a modification for AppleWriter, and Franklin plans to offer similar patches for other popular programs.

Advantages and Disadvantages

The biggest selling point for the Ace 100 is its price, about $250 less than a 64K Apple. Strict cost comparisons are, of course, unfair due to the differences in features, documentation and support. The Ace keyboard will be preferred by experienced typists, thanks to its conventional layout, excellent tactile feedback, offset reset key and numeric keypad. Franklin's inclusion of a fan was a wise move, especially if you intend to fill several of the peripheral slots.

The Ace 100's deficiencies center around Franklin's implication that all Apple hardware and software is compatible. This just isn't so, as shown by the lack of color video and cassette interface. The business user who wants VisiCalc may not need these frills, but the game enthusiast could be disappointed by their absence.

The second set of disadvantages arises from the lack of documentation and support. Franklin, a relatively new firm, will sell only a fraction of the computers that Apple does, so you cannot expect extensive technical references or user support.

Ace 100 hardware advantages, fan, upper/lowercase and keypad, can be added to an Apple, although you'll spend quite a bit more if you go that route. The disadvantages associated with the Ace 100, once recognized, are not extreme and perhaps will be solved with time. Meantime, Franklin provides an attractive alternative for cost conscious users with well defined needs.

As for the question of imitation versus counterfeiting, Apple versus Franklin, Ben said, "Don't value a man for the quality he's of, but for the qualities he possesses." ■

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Poking Perfection Part II

In March we showed how graphics commands could improve your text screen. Now here's a formatter to help you put on the finishing touch.

by A. E. Doughty

Does the design of your text screen leave something to be desired? Does your text screen suffer from the *top left corner blues*, with all text originating in the top left corner? Or do your text screens suffer from the continuous *scrolls*, with every new text line appearing at the bottom of the screen?

If you answered yes to any of these questions—fear not, relief is at hand! The Apple II Text Screen Formatter was designed to cure these and many more screen programming ailments.

The Apple II text screen consists of 24 rows of 40 columns, producing a grid of 960 character positions on the screen. Figure 1 shows a chart of the Apple II text screen, with the 24 rows numbered 0 through 23, and the 40 columns numbered 0 through 39. Each grid location on the screen corresponds to a single byte of the random access memory (RAM) in the computer.

Row 0/column 0 grid location corresponds to the RAM byte address 1024, and row 23/column 39 corresponds to the address 2039. Consecutive grid locations on the same row are stored consecutively in the RAM, but consecutive lines are not stored sequentially. Figure 2 shows how the Apple II RAM sequences the screen lines.

Notice the RAM stores the screen rows 0, 8, 16, 1, 9, 2. . . and so on to the end of the screen. The column headed RAM in Figure 1 indicates the byte address for the column headed 0 of each line. To access the adjacent columns on the same line, add the column number to this byte address.

Each screen RAM location can be poked with a text character (refer to Table 1 for the text character values that can be used), thus the statement:

```
POKE 1469,65
```

will place a flashing A on the screen in row 11 at column 19 (almost in the center of the screen). The cursor is not positioned at this screen location. To position the cursor at any grid location on the screen use the HTAB(column) and VTAB(row) statements. Figure 1 shows the row and column numbers to be used in the HTAB(n) and VTAB(n) statements.

"Each grid location on the screen corresponds to a single byte of RAM."

Sometimes it is expedient to access the screen RAM using the Poke statement, but it is inconvenient to use the RAM byte address directly. The following short program will allow the user to access the screen RAM using the row and column numbers from the Apple II Text Screen Formatter:

```
10 HOME : DIM ROW(24): SPEED = 240
20 FOR K = 0 TO 7
30 ROW(K) = 1024 + K*128
40 ROW(K + 8) = ROW(K) + 40
50 ROW(K + 16) = ROW(K) + 80
60 NEXT K
```

This routine simply places the RAM address of each screen row into the array called ROW.

Now add the following lines to the above routine, and observe what the program does:

```
99 J = 32
100 FOR K = 39 TO 0 STEP - 1: POKE
(ROW(0) + K),J: NEXT K
200 FOR K = 23 TO 0 STEP - 1: POKE
(ROW(23 - K)),J: NEXT K
300 FOR K = 0 TO 39: POKE
(ROW(23) + K),J: NEXT K
400 FOR K = 23 TO 0 STEP - 1: POKE
(ROW(K) + 39),J: NEXT K
```

Another interesting effect can be obtained by changing line 99 to:

```
99 FOR J = 1 TO 191
```

and adding line 500:

```
500 NEXT J
```

The Apple II Text Screen Formatter

On the Apple II Text Screen Formatter, the large star represents the geometric center of the screen, and the four smaller stars represent the geo-

Address correspondence to A. E. Doughty, 11715 145 Ave., Edmonton, Alberta, Canada T5X 1M2.

Figure 1. Chart of the Apple II text screen.

Text Character	Value to be Poked into Video RAM for: Reverse	Flashing	Normal	Text Character	Reverse	Flashing	Normal
@	0	64	128	space	32	96	160
A	1	65	129	!	33	97	161
B	2	66	130	"	34	98	162
C	3	67	131	#	35	99	163
D	4	68	132	$	36	100	164
E	5	69	133	%	37	101	165
F	6	70	134	&	38	102	166
G	7	71	135	'	39	103	167
H	8	72	136	(	40	104	168
I	9	73	137	)	41	105	169
J	10	74	138	*	42	106	170
K	11	75	139	+	43	107	171
L	12	76	140	,	44	108	172
M	13	77	141	–	45	109	173
N	14	78	142	.	46	110	174
O	15	79	143	/	47	111	175
P	16	80	144	0	48	112	176
Q	17	81	145	1	49	113	177
R	18	82	146	2	50	114	178
S	19	83	147	3	51	115	179
T	20	84	148	4	52	116	180
U	21	85	149	5	53	117	181
V	22	86	150	6	54	118	182
W	23	87	151	7	55	119	183
X	24	88	152	8	56	120	184
Y	25	89	153	9	57	121	185
Z	26	90	154	:	58	122	186
[	27	91	155	;	59	123	187
\	28	92	156	<	60	124	188
]	29	93	157	=	61	125	189
^	30	94	158	>	62	126	190
—	31	95	159	?	63	127	191

Table 1. Text character values for screen formatting.

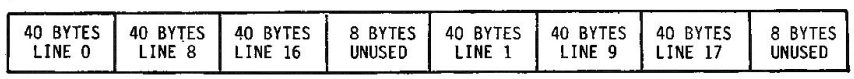


Figure 2. Map of Apple II video RAM.

metric center of each quarter of the screen.

The grid location row 1/column 1 shows the position of the cursor after a Home statement has been used. Note that the cursor is *not* positioned at the extreme top left corner of the screen.

Shaded columns numbered 0, 16 and 32 represent the automatic Tab positions used when the comma (,) separator is used in Print statements—thus the statement:

PRINT "A","B","C"

will cause an A to be printed in column 0 (the first shaded column), and a B to appear in the second shaded column, and a C to be printed in column 32. Notice that there are 16 columns in the first and second fields, but only 8 in the third. If the length of the printed character string or value exceeds the field width, it will overflow to the next field and the next available Tab position will be the next shaded column.

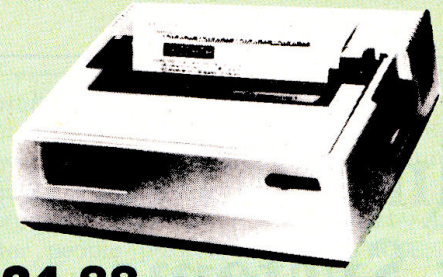
The column headed RAM represents the RAM addresses for column 0 of each line. To access subsequent columns on the same line, add the column number (0–39) to this byte address.

Each screen RAM location can be poked with the text character value required (refer to Table 1 for the values to be poked), but the cursor is not repositioned at that RAM location.

Figure 1 represents a worksheet that can be used in the design of screen layout, before programming is started. Once the design of the screen layout is satisfactory to the programmer, then the coding can be started and the program written using the appropriate statements and location values.

The Apple II Text Screen Formatter is copyrighted by the author, but original purchasers of this magazine may photocopy this chart for personal use. The Apple II Text Screen Formatter may *not* be copied, by any means, for distribution or sale to third parties. ■

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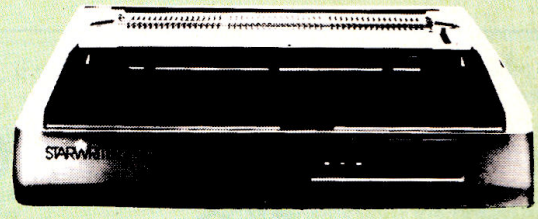


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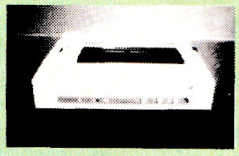
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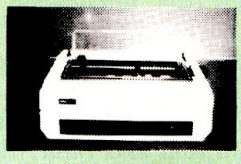
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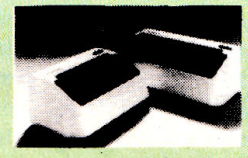
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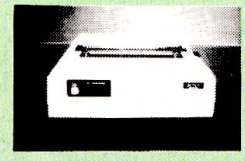
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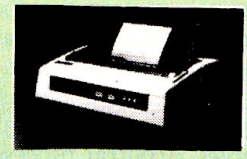
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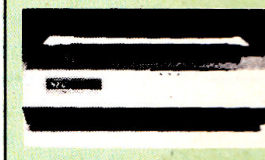
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CP/M The Lingua Franca of Operating Systems

The popular operating system from Digital Research offers portability and compatibility to markedly expand your computer horizons.

by John Davidson

As the computer user upgrades from cassette tape recorder program storage to floppy or hard disk, things get complicated. More programs and files can be accessed more quickly, but filing, handling, and retrieval problems arise even more quickly.

The computer operating system (OS for short) is a "program" that handles this housekeeping. It is not a "language" like Basic, Pascal, or ADA. Neither does it, alone, do useful and interesting things such as word processing (like WordStar), spreadsheet calculation (like SuperCalc), or database management (like dBASE II). It does provide a working "environment" (great buzz word) for both languages and applications programs. Some operating systems are interwoven with specific languages such as Basic for a simpler and more economical package at the cost of versatility. CP/M is not, and most if not all of the microcomputer languages in use today are available to run with it.

To write a file (either data or a program) to a floppy disk, somewhere there must be a record of which sectors on which tracks on the disk already hold data and which are available. Thus, the operating system keeps a directory on each disk showing the contents of the disk and the actual track and sector locations on the disk where each program or file is stored. This directory is both for the OS's own use and to be able to provide a program list for the user. From this information the operating system can also tell what locations are still open for new material.

Because disk rotation is painfully slow in the microsecond terms of the central processor, the order of use of these sectors is important. With sequential disk writes, for example, the central processor must access a sector, store the data from memory onto the sector, and then wait for the next sector to be used to come under the drive's read-write head. If the sector ordering were poor, perhaps only one sector could be written per disk revolution, the processor would spend most of its time waiting, and disk operations would be slow. The operating system assigns this sector sequence during disk write operations. Obviously, the read sequence must follow the write sequence, good or bad, or there will be a big mess!

In addition to the primary function of file handling, the operating system usually cares for other computer system details such as interfacing peripherals—your page printer for example.

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Much of the work of the operating system is "transparent to the user," as they say. Thus, in CP/M, to run a program written in Basic you just type the file name of your Basic and the name of your application program. CP/M locates the Basic on the disk and loads it, finds the application program, loads that, and then, with a Run instruction as its parting shot, transfers control to Basic. To go one step further, you might be using an accounting program that asks Basic (through file opening commands) to get CP/M to access still other files of data. Through all this you need not (and probably don't) know the actual locations of any of these files on the disk. In fact, you can pour another cup of tea while CP/M sets things up and gets them going.

Why is CP/M so popular and ubiquitous on today's microcomputers? In a word—

Portability

CP/M enables very different microcomputers to exchange disks. A program written on, say, an Apple with CP/M will generally run without modification on a CP/M-equipped Osborne or Altos computer and vice versa, *as long as the author of the program has not circumvented CP/M and accessed the host computer directly, and if you can solve or get around the format*

compatibility problem that is rampant with the 5¼-inch disks. (In fact, the program may even run on some Olympia word-processing typewriters!) This makes easy program exchange between computer people possible—a real benefit, witness the users' groups. More importantly, it provides a large base of apparently identical computers for software writers, encouraging the production of many widely-varied programs, thus convincing more people to install CP/M and the circle continues.

This portability is possible because the CP/M system actually consists of several relatively independent parts. Only one of these parts—the Basic Input/Output System or BIOS—deals with the host computer's hardware. Only the BIOS must be changed to move CP/M from one type of computer to another. The rest of the operating system remains the same. Thus the running program only has to tell CP/M to send a message, say, to the printer. A routine in the BIOS provides the address of your printer and directs the message properly.

There is another reason CP/M is so widespread—

Compatibility

Often when an operating system is revised or replaced, programs running under the old system must have modifications to run under the new system. Sometimes it can't be done.

CP/M operating systems are "upward compatible." A program prepared to run on an older CP/M (say, version 1.4) should work fine on a newer one (say version 2.2). "Downward compatibility"—running a CP/M 2.2-based program on a CP/M 1.4 system with fewer features—may be a problem. This is usually a moot point because you aren't apt to trade in your new operating system for an older one, and your main concern is to protect the program collections that you are building up.

Compatibility is of particular interest just now. Most of the CP/M-compatible programs on the market and in use today were prepared for version 2.2. CP/M Plus (version 3.0) has just been announced. If you get it, your 2.2 programs should run just fine on the Plus. On the other hand, if you cling to your 2.2, beware when the Plus applications programs come out.

A ROSE by Any Other Name Than ROSE.COM Won't Run

Files on a disk are referred to by their titles—names of up to eight characters, a period, and an "extension" of up to three more characters. The extension normally suggests the nature of the file—PROG.COM, PROG.ASM, PROG.HEX, PROG.DAT, and PROG.DOC, for example. In this group, PROG.ASM is the assembly language listing used by the assembler (ASM.COM, another program entirely, mentioned below) to create PROG.HEX, a hexadecimal machine language file that is converted by LOAD.COM (another separate program) into the actual machine language code to form PROG.COM. PROG.COM is the actual command file or "runnable" program. PROG.DAT would be data used by the PROG program, and PROG.DOC would be an ASCII text file—English language instructions on the use of PROG. All these files could occupy the same disk.

There are conventions governing the use of extensions. Some are arbitrary, but others are mandatory. For example, only a .COM (command) file can be directly executed by CP/M, and the assembler will only work on .ASM files. CP/M allows wild cards—the asterisk (*) and the question mark (?)—for some uses. The asterisk substitutes for anything in the field, either name or extension, while the question mark substitutes for any single character. Thus, DIR PROG.* would provide a listing of all the files mentioned above, and ERA PROG.D?? would eliminate the data and documentation files.

A> Means "Talk to Me"

As CP/M loads, it announces itself by displaying its name, its memory size, and its version number. Then it prompts with A>, meaning "Your wish?" (A is the disk drive presently in use.) It is looking for a command, again a string of up to eight characters, followed by a carriage return. It checks what you type in against its list of inherent commands and, with a match, executes immediately. No match sends CP/M to the disk directory looking for a command file (a file with the .COM extension) of the name you entered. This can be either your program or one from the original CP/M disk. If the disk has no .COM file of the name you entered, CP/M repeats your keyboard entry with a question mark, followed by another A>. This time A> means "Want to try that again?" (Computers are so patient.)

Inherent Commands

CP/M has a limited repertoire of inherent or "direct" commands that are built into the system:

- ERA (erase) deletes files and frees disk space for other use. It doesn't actually erase the file but notes on the disk directory that the program is no longer to be listed, and its space is available. I mention this detail because once in a while a file will be erased in error. With CP/M's method of erasure, you can sometimes retrieve most or all of an erased file if it hasn't been overwritten, and if the rescue is important enough for the special procedures that must be used.
- DIR (directory) lists the names of all the files or programs on the disk you are using. It does not show you where they are on the disk or how long they are. These features are available elsewhere, but they won't fit into the resident operating system.
- REN (rename) changes the name of a file or program.
- SAVE writes a program from main computer memory into a disk file. This command is not often used. Reading a program from disk does not destroy the disk file, so unless the program has been changed it needn't be saved again. Most of the programs that create files (such as Basic) have their own save commands within the language.
- TYPE lists out ASCII text material such as .DOC (documentation) or .ASM (assembly) files on the screen. Typing command files is more exciting but not generally recommended—CP/M will throw random bytes about the system, reposition the cursor, "ring" the bell, erase the screen, and so forth.
- USER is a hand-me-down from larger systems. Basically, it allows up to 16 people (or 16 different projects) to share the system and the disks at dif-

ferent times without running into each other. Thus, user 3 running DIR will not see and cannot access files or run programs belonging to user 7. This does *not* allow simultaneous use of the computer by several different people. For that, you need major software and hardware changes.

Transients Aren't All Itinerants

There is a second set of CP/M commands, *transients*, that is furnished on your master CP/M disk. As opposed to direct commands, these transients are .COM file programs that must be copied onto each disk from which they are to be used. They are not sacred, and, with the exception of SYSGEN (assuming that you want to have more than one system disk), they are not essential; but they are useful. Similar programs (usually called *utilities*) are available from users' groups and independent vendors.

The CP/M transients provided by Digital Research include the following:

- MOVCPM changes the amount of memory the system makes available to your transient program. The official Digital Research system comes configured for 20K of memory. MOVCPM can then be used to change CP/M to any size that your hardware can accommodate.
- SYSGEN transfers "the system," the actual CP/M operating program, to a disk, either from another disk if it is already configured for the memory size you want, or from main memory if you have changed the memory size with MOVCPM. The CP/M system must be present on every disk used to start up the computer.
- LOAD converts a .HEX listing (see below) to a .COM file ready for execution.
- STAT is a multipurpose gem. It tells you about disk space and program lengths. It sets files to "read only," as protection from change or erasure (if everything is working properly—no guarantees if your system malfunctions). It sets files to "system," making them invisible to the DIR command but available to all users working with user numbers. And it does many natty things for you in redirecting computer inputs and outputs among various devices (such as several different printers or a modem) if your hardware is elaborate enough to use it.
- PIP (Peripheral Interchange Program) does neat tricks in moving files around between disks and devices, and, if told to, in modifying them in beneficial ways in the process: adding line numbers, changing or checking format, and so forth. Its most common use is to copy a file from one disk to another and then verify the copy.
- ASM is an 8080 assembler. It takes 8080 assembly language mnemonics for a program and converts them to hex code that LOAD can, in turn, transform into a working machine language .COM file (if there are no

Bibliography for CP/M 2.2:

- Seven manuals in a one-volume set:
An Introduction to CP/M Features and Facilities
ED: A Context Editor for the CP/M Disk System, User's Manual
CP/M Assembler (ASM), User's Guide
CP/M Dynamic Debugging Tool (DDT), User's Guide
CP/M 2.2 Alteration Guide
CP/M 2.2 Interface Guide
CP/M 2.2 User's Guide
Digital Research, PO Box 579, Pacific Grove, CA 93950
Free from the vendor with CP/M

Aside from CP/M itself, these manuals are the Bible for the system. Very complete, but somewhat difficult to use for working reference.

- *Osborne CP/M User's Guide*
by Thom Hogan
Osborne/McGraw-Hill, 630 Bancroft Way, Berkeley, CA 94710
$15.95 from your bookseller

A simple but comprehensive guide, with sample commands and clear explanations.

- *CP/M Summary Guide*
Bruce A. Brigham, Editor
The Rosetta Stone, PO Box 35, Glastonbury, CT 06025
$7.95 ppd. from the publisher

Command set notes. Little explanation, but valuable to have at hand when using CP/M. Also covers CBasic, Microsoft Basic, TEX, MAC, and Despool.

- *Using CP/M (A Self-Teaching Guide)*
by Judi Fernandez and Ruth Ashley
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The subtitle tells it all.

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"While this set of utilities won't conquer the (computer) world, it is certainly a good, adequate start until you find out exactly what paths in computing you want to take."

mistakes in the assembly code, of course). Note that 8080 code almost always works with a Z-80 processor, but *not* vice versa. Like any good assembler, ASM can use "labels" for jumps and calls (similar to target line numbers for Goto or Gosub in Basic). It handles "pseudo-operations"—assembly statements that don't result in object code directly, but tell the assembler such details as where you want the program to be located in memory or that you want a certain amount of memory space reserved for data.

● DDT (Dynamic Debugging Tool) is, of course, for killing bugs in machine language programs. While use of this type of DDT is not controlled by the Environmental Protection Agency yet, some types of program bugs have developed a resistance to it. Even so, it has many useful features. It displays machine language files in both hex and ASCII codes at the same time. It disassembles the program—recreates the assembler file from the machine language (without the labels, comments and explanations, alas). It traces the program—runs it one step at a time, telling you after each step what has happened. And it does hex math. Want to know what FA03h minus B021h is, fast? DDT's H command will tell you. DDT has more features, but this gives you the idea.

● ED (editor) creates or modifies text or assembler files. For the writers among us, forget it! ED doesn't know the difference between a noun and a verb. Of course, I jest. We've had spelling checkers around for a while, but I know of no computer program, large or small, that can handle English grammar in the real world. Even in its own realm, however, I find ED barely usable, and then only if nothing else is available. I consider it distinctly user-hostile with its intricate command set, its inability to handle its own program buffering in and out of the disk files, and its unwillingness to display the text except on explicit command. Perhaps if I had spent a couple of hundred hours more with it. . .

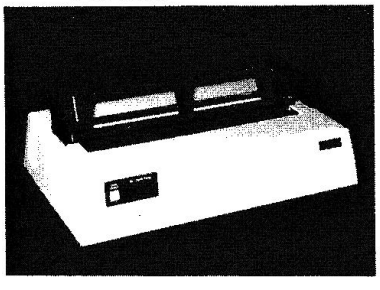
● SUBMIT allows you to place a number of sequential keyboard commands in a disk file and then have the computer execute them in turn, automatically. There are tricks you can do with SUBMIT, but its biggest benefit is to keep you from going glassy-eyed staring at the screen while waiting for one command of a repetitive series to finish so you can key in the next.

While this set of utilities won't conquer the (computer) world, it is certainly a good, adequate start until you find out, from hands-on experience and experimentation, exactly what paths in computing you want to take and what features you really need. We hope that, in the coming months, *inCider* will be able to provide you with hints and guidance in this search. ■

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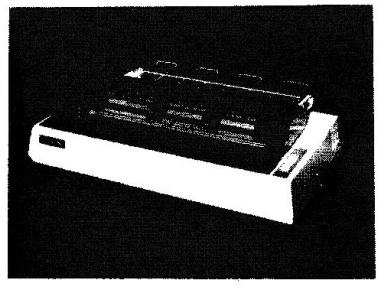


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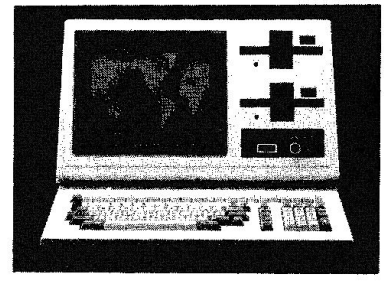


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Bent on Business

by Gregory R. Glau

Ah, Payday!

Ah, Payday!—that most dreaded time, when the businessman hunts under rocks and bushes, in trees and shrubs, digging here and begging there, all to gather enough cash to pay the help. To add insult to injury, many of us do our payroll by hand, committing math errors in taxes and FICA and union dues, losing pennies in this account and nickles in that, and then having to spend dollars to find the darn things again!

But one day, as if riding a white horse, along comes an Apple to the rescue. But what's that? You want to use your Apple to figure your payroll, but you don't want to spend $400 for payroll software? You want to do it yourself?

Well, I did, too. So I sat down and wrote a payroll program. The basic math, files and printouts weren't too difficult to handle. What I couldn't figure out was how to separate all the data by quarters.

You see, accountants don't want just the totals. They want to know how much each employee earns in each three-month period. And not just how much the worker receives, but the amount of FICA (Social Security) removed, the amount of federal taxes taken out, the dollars deducted for state taxes. . . and insurance, and dues, and anything else that alters the payroll.

And it all has to balance!

Well, for about a year I cheated. After all, I could get various totals,

Greg Glau owns and runs a heating and air conditioning firm. Address correspondence to him at PO Box 1627, Prescott, AZ 86302.

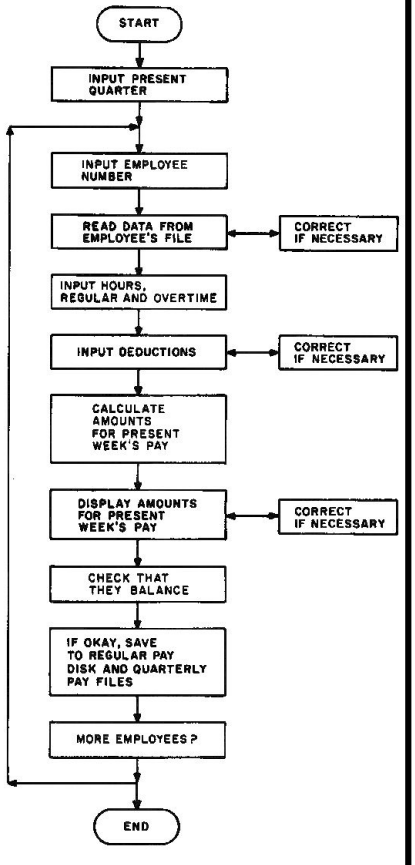


Figure 1. Payroll program flow.

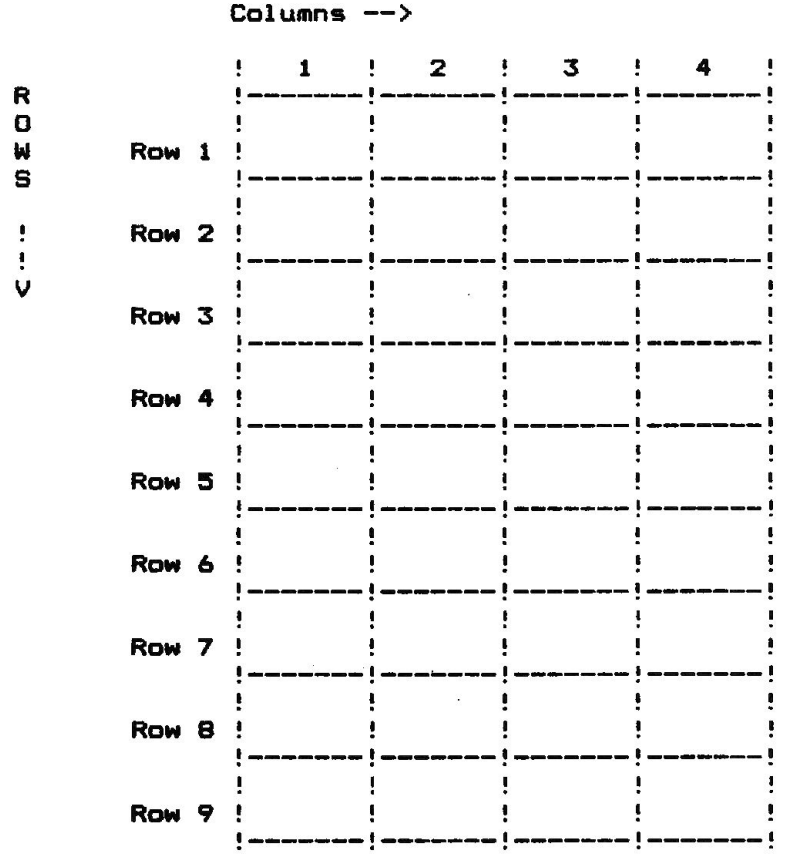


Figure 2. Blank array QT.

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```
17400 REM ADD TO TOTALS
17410 QT (QR,1) = QT (QR,1) + R: REM REGULAR PAY
17420 QT (QR,2) = QT (QR,2) + O: REM OVERTIME
17430 QT (QR,3) = QT (QR,3) + T: REM TOTAL PAY
17440 QT (QR,4) = QT (QR,4) + S: REM SOCIAL SEC
17450 QT (QR,5) = QT (QR,5) + F: REM FEDERAL TAX
17460 QT (QR,6) = QT (QR,6) + A: REM AZ TAX
17470 QT (QR,7) = QT (QR,7) + I: REM INSURANCE
17480 QT (QR,8) = QT (QR,8) + M: REM MISC.
17490 QT (QR,9) = QT (QR,9) + B: REM NET PAY
```

Listing 1. Adding weekly figures to QT for quarterly totals.

```
2090 PRINT "ENTER THE QUARTER YOU WANT
     TO SEE:"
2100 INPUT QR
2110 IF QR > 4 THEN 2090
2120 IF QR < 1 THEN 2090
2130 GOSUB 4000: REM DISPLAY
```

Listing 2. To specify the quarter to be displayed.

Listing 3. Displaying data for the chosen quarter.

```
4080 PRINT "2. OVERTIME PAY    "; QT(QR,2)
4090 PRINT "3. GROSS PAY       "; QT(QR,3)
4100 PRINT "4. SOC SECURITY    "; QT(QR,4)
4000 REM DISPLAY SECTION
4010 HOME: PRINT
4020 PRINT N$, S$
4030 PRINT
4040 PRINT "THIS DATA IS FOR QUARTER ";QR
4070 PRINT "1. REGULAR PAY     "; QT(QR,1)
```

Listing continued.

so it was pretty simple to get the figures for individual quarters by subtracting. But it was silly—all those manual calculations with my Apple sitting there, watching. And probably laughing at me the whole time.

The problem was that I didn't understand double-dimension arrays. I couldn't remember the difference between a column and a row, and then that bit about DIMensioning. It just didn't seem worth the trouble.

But, to handle payroll properly, I had to, and so this month I'll share my experience. Hopefully, it will be of help to you. If you are already sharp on arrays, then send some suggestions along to me—okay?

The basic flow of our payroll program is shown in Figure 1. Our people are paid on a weekly basis, which simplifies things. If they are getting vacation pay this week, we enter them twice and print a separate vacation check.

The program handles one employee at a time (not feasible, I realize, for large applications). This way everything that happens to the figures appears on the screen, so we're more likely to notice an error before everything gets SAVEd. When done with the figuring and saving, the program prints a summary and the payroll checks.

Arrays in Pay

The easiest way for me to understand the quarterly totals concept was to draw a little chart, like Figure 2, to represent a blank array, named QT. It's like an orderly cluster of empty boxes, waiting to be filled. I remember that a column in a double-dimension array is similar to the columns in old buildings—it goes up and down. Rows, on the other hand, are like rows of letters—they go across.

The array filled in with the variables that represent payroll dollars is illustrated in Figure 3. As you can see, the printout of an array is what we would call a table.

In Basic array notation, the first numeral designates the column and the second the row. So, QT(3,4) means the "box" in column 3, row 4

of array QT. It helps to remember that C comes before R in the alphabet, so the first figure is the column (C) and the second is the row (R).

The nine variables shown in Figure 4 hold weekly totals in nine financial categories for each employee. We also save things like the employee's name, Social Security number, and so on. All we have to do to code the program is to insert the data into the proper "boxes" in the array.

One of the early lines in the program, 100 DIM QT (4,9), "dimensions" the array—a fancy term to say saves room for the array in the Apple's memory. It sets up QT as four columns wide (for the quarters) and nine rows deep (for the financial categories).

Once the nine weekly amounts are computed, the routine in Listing 1 adds them to the QT array, yielding quarterly totals. You'll notice that the numbers for the variables like regular pay, insurance, and so on, match the list in Figure 4.

We input the quarter we're working on early in the program as the variable QR. As QR changes we keep track of the same nine items, but for different quarters. QT (1,1) is the regular pay for the first quarter, and QT (4,1) is the regular pay for the fourth quarter.

This approach also overcomes the limits of your Apple's screen. You can only display 24 lines of 40 characters each at a time. There's no way to get four quarters' worth of payroll data on the screen at once for viewing or correcting. However, there is room for one quarter. With the double-dimension array QT, you can select the quarter to see.

1. Regular pay.....R
2. Overtime pay.....O
3. Gross pay.....G
4. Social Security (FICA) deducted.....S
5. Federal Tax deducted.....F
6. Arizona Tax deducted.....A
7. Insurance deducted.....I
8. Miscellaneous deducted.....M
9. Net pay.....B

Figure 4. Payroll program variables.

Listing continued.

```
4110 PRINT "5. FEDERAL TAX     "; QT(QR,5)
4120 PRINT "6. ARIZONA TAX     "; QT(QR,6)
4130 PRINT "7. INSURANCE       "; QT(QR,7)
4140 PRINT "8. MISC. DED       "; QT(QR,8)
4150 PRINT "9. NET PAY         "; QT(QR,9)
```

```
4190 PRINT "ANSWER 1 TO SAVE THIS DATA"
4200 PRINT "ANSWER 2 TO CORRECT THIS DATA"
4210 PRINT "ANSWER 3 TO SEE OTHER QUARTERLY
     DATA FOR THE SAME EMPLOYEE."
4220 INPUT Q
```

Listing 4. Choice of action after the quarter is displayed.

```
Item          1st Qtr.  2nd Qtr.  3rd Qtr.  4th Qtr.
=============================================================

Regular Pay..QT(1,1)   QT(2,1)   QT(3,1)   QT(4,1)
Overtime Pay.QT(1,2)   QT(2,2)   QT(3,2)   QT(4,2)
Gross Pay....QT(1,3)   QT(2,3)   QT(3,3)   QT(4,3)
Social Sec...QT(1,4)   QT(2,4)   QT(3,4)   QT(4,4)
Federal Tax..QT(1,5)   QT(2,5)   QT(3,5)   QT(4,5)
Arizona Tax..QT(1,6)   QT(2,6)   QT(3,6)   QT(4,6)
Insurance....QT(1,7)   QT(2,7)   QT(3,7)   QT(4,7)
Misc. ded....QT(1,8)   QT(2,8)   QT(3,8)   QT(4,8)
Net Pay......QT(1,9)   QT(2,9)   QT(3,9)   QT(4,9)
=============================================================

     For example:

      QT (1,1) is the regular pay for Quarter 1.

      QT (3,3) is the gross pay for Quarter 3.

      QT (4,9) is the net pay for Quarter 4.
```

Figure 3. Quarterly payroll array QT.

"Arrays will save you a lot of programming time, when you're working with many numbers."

The code that displays the quarterly totals is also used to change them if needed. The first step is to request the employee's number and load this person's data from the quarterly pay disk. Then the program goes on to the sequences in Listing 2 and 3.

The lines in Listing 4 enable the user to view another quarter's information. When you answer "3" to indicate that desire the program returns to line 2090 to ask which quarter you want. You input your answer, which becomes QR, and then return to line 4000 for the display section. Thus can you "flip" through the four quarters of a year's salary information, one quarter at a time.

Of course, the program has routines to print out this information for an individual employee, or for all employees. These routines access this same array, and print it much as shown here.

The Point

The point is, of course, that by changing only one variable—the column number in the array—you can control similar information efficiently. In this particular application, we keep track of nine categories of information per employee, for each of four quarters, or 36 separate amounts. And we have almost instant access to those figures.

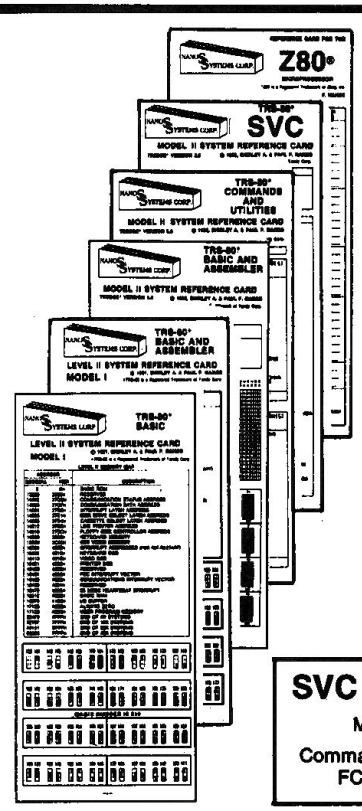
The array is much simpler than a long list. If, in a payroll program, you had 20 employees and wanted to keep track of those same 36 items, your list would be 20 people times 36 items, or 720 amounts long. With an array to handle the same chores you work with only 36 figures.

Just remember that an array is a cluster of numbers or characters. You can also have a string array for alphanumeric characters—perhaps to store words or phrases.

Double-dimension arrays, also called matrices (singular, matrix) in some circles, have two dimensions, with values or characters going in two directions, as in a table. Single-dimension arrays are also possible. They extend in only one direction—basically like a list.

The next time you have to create a file, try using an array. Once you get the idea, arrays will save you a lot of programming time, especially when you're working with many numbers, as in a payroll program.

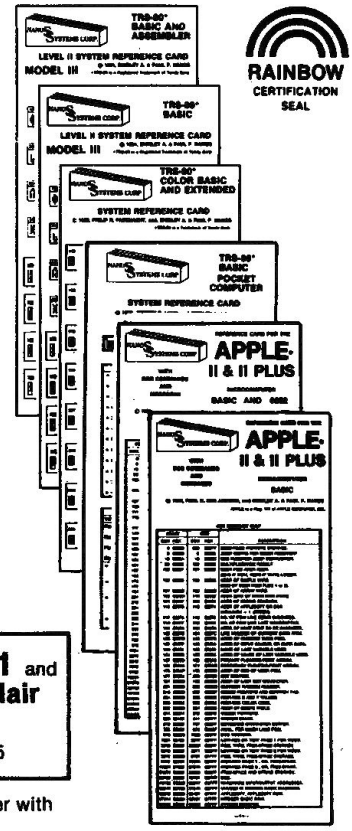
Now then, if we only had enough money. . . ■



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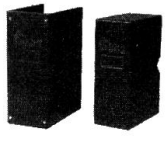
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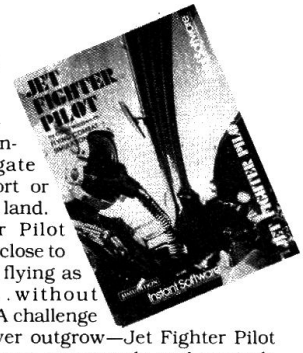
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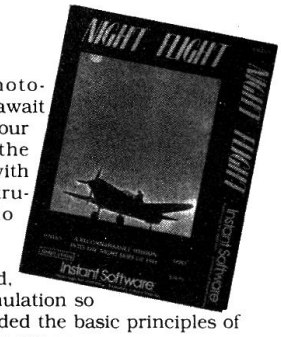
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Fudge It!

by Don Fudge

A renowned expert discusses the union of audio and video effects on the Apple.

Sights and Sounds Together

This column is about graphics and sounds together. I've included several sound routines for you to key in and use. Hi-Res Secrets, and Action Sounds and Hi-Res Scrolling (from Avant-Garde), both contain lots more sound routines if the need should arise. But just by examining the enclosed machine language routines you may learn enough about sounds to assemble some good ones of your own. It's the simplest type of machine language routine there is, except for the delay routine.

Let's look for a second at what other popular computers have for graphics and sounds. The VIC-20 offers character graphics and can produce three simultaneous notes (a chord) and sound effects with its sound generator. Almost any imaginable sound effect is possible with the noise generator. Poke statements access this hardware.

The Atari 400 has sprite graphics they call player/missile graphics (sprites are hi-resolution programmable objects that can be moved by changing coordinates) and four independent sound generators that use your TV's speaker. There are 16 hi-res colors and 16 luminescence levels available in various combinations. Its sound effects are great.

The Commodore 64 has sprite graphics, collision detection, scaling up, and more. The sound generators are excellent—they allow simultaneous notes (chords), sound effects, imitation of musical instruments, and so on. POKEs access all sprites and sounds. Volume, waveform, control, attack/decay, sustain/release, and frequency are all POKE-controlled.

With Apple and IBM, however, sounds are less dynamic since there is no real sound-creation hardware outside of "clicking the speaker." The IBM has sound interrupts, but with Apple you've got only location $C030 (the speaker address) to use. Sound becomes a matter of clicking Apple's trusty speaker at various frequencies, frequency control depending on delay loops.

Apple's Speaker and Tone Routines

You can access the speaker by way of Basic or machine language. PEEK(-16336), from Basic, yields a click, and if you put P=PEEK(-16336) inside a For...Next loop, you get a buzz. For decent tones you need at least a *tone routine* to CALL. Find Listing 1 and key in the Tone routine now.

In line 100 you POKE in the machine language tone generator via line 61000. In line 200 you use the routine by specifying a duration of 0–255 (as D) and a pitch of 0–255 (as P), and then GOSUBing to 60000 to POKE in your pitch and duration and run the tone generator with a CALL 770. Do a CALL-

Address correspondence to Don Fudge at Avant-Garde Creations, PO Box 30160, Eugene, OR 97403.

```
100  GOSUB 61000: REM  LOAD TONE
     ROUTINE
200 D = 140:P = 114: GOSUB 60000:
     P = 102: GOSUB 60000:P = 128
     : GOSUB 60000:P = 255: GOSUB
     60000:D = 255:P = 172: GOSUB
     60000: PRINT "LIST OUT THIS
     PROGRAM!": END
60000  POKE 768,P: POKE 769,D: CALL
     770: RETURN
61000  FOR I = 770 TO 790: READ D
     : POKE I,D: NEXT : RESTORE :
      RETURN
61010  DATA   173,48,192,136,208,
     5,206,1,3,240,9,202,208,245,
     174,0,3,76,2,3,96
```

Listing 1. Tone routine.

```
*302L

0302-   AD 30 C0    LDA   $C030
0305-   88           DEY
0306-   D0 05        BNE   $030D
0308-   CE 01 03     DEC   $0301
030B-   F0 09        BEQ   $0316
030D-   CA           DEX
030E-   D0 F5        BNE   $0305
0310-   AE 00 03     LDX   $0300
0313-   4C 02 03     JMP   $0302
0316-   60           RTS
0317-   00           BRK
0318-   00           BRK
0319-   00           BRK
031A-   00           BRK
031B-   00           BRK
031C-   00           BRK
031D-   00           BRK
031E-   00           BRK
031F-   00           BRK
0320-   00           BRK
```

Listing 2. Machine language Tone routine.

```
*8B6.8E2

08B6- 20 BF
08B8- 08 20 BF 08 20 BF 08 A9
08C0- 00 85 FF A9 FF 85 FE A9
08C8- 00 8D 30 C0 EE 30 C0 CE
08D0- 30 C0 A6 FF CA D0 FD C6
08D8- FE F0 05 E6 FF 4C C7 08
08E0- 60

*8B6L

08B6-   20 BF 08     JSR   $08BF
08B9-   20 BF 08     JSR   $08BF
08BC-   20 BF 08     JSR   $08BF
08BF-   A9 00        LDA   #$00
08C1-   85 FF        STA   $FF
08C3-   A9 FF        LDA   #$FF
08C5-   85 FE        STA   $FE
08C7-   A9 00        LDA   #$00
08C9-   8D 30 C0     STA   $C030
08CC-   EE 30 C0     INC   $C030
08CF-   CE 30 C0     DEC   $C030
08D2-   A6 FF        LDX   $FF
08D4-   CA           DEX
08D5-   D0 FD        BNE   $08D4
08D7-   C6 FE        DEC   $FE
08D9-   F0 05        BEQ   $08E0
08DB-   E6 FF        INC   $FF
08DD-   4C C7 08     JMP   $08C7
08E0-   60           RTS
08E1-   00           BRK

to BSAVE type: MULTIPLE LASER
(CALL2230),A2230,L44
```

Listing 3. Multiple Laser.

```
10  HIMEM: 37475
20  POKE 232,99: POKE 233,146
30 D$ =  CHR$ (4): PRINT D$"BLOAD
     BOOM": PRINT D$"BLOAD EXPLO
    DE": PRINT D$"BLOAD RND1"
40  HGR : ROT= 0: SCALE= 1
50  HCOLOR= 3: HPLOT 0,99 TO 279,
    99
60  FOR Q = 10 TO 99: HCOLOR= 3: HPLOT
    Q,Q TO Q - 8,Q - 8 TO Q - 6,
    Q - 10
70 P =  PEEK ( - 16336) + PEEK (
    - 16336) - PEEK ( - 16336)

80  HCOLOR= 0: HPLOT Q,Q TO Q - 8
    ,Q - 8 TO Q - 6,Q - 10: NEXT

110  FOR A = 1 TO 5: XDRAW A AT Q
    ,Q: FOR W = 1 TO 20: NEXT : XDRAW
    A AT Q,Q
120  IF A = 1 THEN  CALL 2048
130  NEXT
```

Listing 4. Demo.

151 and 302L <return> to see the tone generator disassembly. Notice that the pitch and duration, POKEd into 768 ($300) and 769 ($301), control the looping and delaying. See Listing 2 and Tables 1a–c.

But these tones take the full attention of the 6502 (Apple's CPU). You can't really have graphics action during a tone. Or can you? Well, not if you build it as in Listing 2. However, if you use the graphics commands *in place of* do-nothing delay loops in sound routines, the deed can, in effect, be accomplished. Of course, the game must be in machine language so STA $C030 commands happen 60–10,000 times a second. Simultaneous tones and action are then a perceived reality. To the computer it's click-move shape-click-move shape-and so on. But to your ears and eyes it's all happening at once.

Sound Routines

At the conclusion of this column you'll find the sound routines Explosion (Listing 9), Helicopter (Listing 10), and Dive Strafing (Listing 11). Another sound routine, Multiple Laser, appears in Listing 3. BSAVE information accompanies the listings. Do a CALL-151 before keying them in. There's also an explosion shape table called Boom, with five vector shapes in it (Table 2).

Unless the Basic program you run is quite short, you might like to POKE103,1:POKE104,64:POKE16384,0 in your boot program and run it *before* running your sound-using program. This prevents sound routines from clashing with program memory by starting your Applesoft program at $4000.

Multiple Laser

Now key in MULTIPLE LASER(CALL 2230) (Listing 3) and do a CALL 2230 in immediate mode in Basic. Now try a CALL 2239. The sound just went from four laser blasts to one laser blast. Let's see why. Type CALL-151 and do an 8B6L <return>. The 2230 is decimal equivalent to hex 8B5, while 2239 equals $8BF. From $8B6 to $8BE is simply GOSUBing (via JSR) the single laser sound at $8BF, which returns (RTS) at $8E0. So three GOSUBs and one CALL are essentially what this Multiple Laser routine contains. CALL-151 and 8B6G or 8BFG are ways

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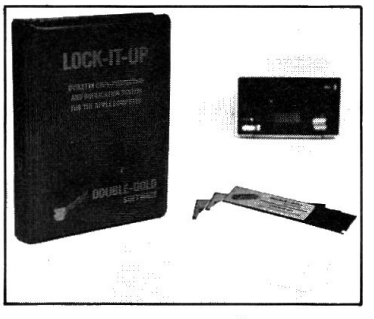
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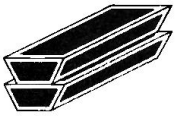
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to CALL 2230 and 2239 from the monitor.

Now, let's check out the program's construction. LDA means load the accumulator from either memory or from an immediate specified value (# means immediate value follows). STA means store the accumulator in the address given. INC means increment (add one to) the following memory location. DEC means decrement (subtract one from) the following memory location. DEX means decrement the X register, which is used as a counter here. LDX means load the X register from the memory location given. (No immediate mode LDX is given here, but that's valid also.)

BNE means branch to the given location if the last operation produced results not equal to zero. BEQ means branch to the given location if the last operation produced a zero result. JMP means jump to the given location. RTS is like Basic's RETURN—if you run a routine with a monitor G command, RTS sends you back to the monitor. If a JSR happened prior to the RTS, you'll be sent back to the command following the JSR when you hit the RTS. (I use LISA 2.5G for assembling and recommend it highly.)

Notice that from $8D2 to $8D5 is a delay loop. The BNE keeps sending us up to $8D4 until the DEX we do there results in zero. This delay loop gets more and more time consuming, because the value in $FF keeps getting larger due to $8DB INC $FF. This yields a sound that goes from high to low, because the frequency of clicking the speaker ($C030) goes down as the delays increase. The 255($FF) put into $FE is the routine length variable. A number like $7F (127) would make the laser much faster. Try it and see:

8C4:7F <return>
8B6G <return>

"This yields a sound that goes from high to low, because the frequency of clicking the speaker goes down as the delays increase."

A Plane Crash Demo

Now let's get sound and action together. Check out the Demo listing (Listing 4). It produces a simple representation of an airplane crashing. The plane is hplotted in white and erased (prior to updating its X and Y coordinates and redrawing it) by hplotting in black.

The Boom file (Table 2) is five increasingly larger explosion vector shapes that can be drawn or redrawn. Line 110 of Demo displays all

Pitch(P)

G = 255	G' = 128	G' = 64	G''' = 31	G'''' = 15
Ab = 243	Ab = 121	Ab'' = 60	Ab''' = 29	Ab'''' = 14
A = 231	A' = 114	A'' = 56	A''' = 28	A'''' = 13*
Bb = 217	Bb' = 108	Bb'' = 53	Bb''' = 26	Bb'''' = 12
B = 203	B' = 102	B'' = 50	B''' = 25*	
C = 192	C' = 96	C'' = 47	C''' = 23	
C# = 182	C#' = 90	C#'' = 45	C#''' = 22	
D = 172	D' = 85	D'' = 42	D''' = 21	
Eb = 162	Eb' = 80	Eb'' = 40	Eb''' = 20*	
E = 154	E' = 76	E'' = 37	E''' = 18	E'''' = 11
F = 146	F' = 72	F'' = 35	F''' = 17	F'''' = 10
F# = 137	F#' = 67	F#'' = 33	F#' = 16	F#' = 9

Table 1a. *Pitch*

Duration(D)

Whole note = 240
Half note = 120
quarter note = 60
Eight note = 30
Sixteenth note = 15
Thirty-Second note = 8
Sixty-Fourth note = 4
One hundred and twenty-eighth note = 2

Table 1b. *Duration*

Rests(R)

The formula for a whole rest is:
Line # FOR R = 1 TO 500:NEXT R

Whole rest = 500
Half rest = 250
Quarter Rest = 125
Eighth rest = 62
16th rest = 31
32nd rest = 16
64th rest = 8
128th rest = 4

Table 1c. *Rests*

```
*9263.9353

9263- 05 00 0C 00 1E
9268- 00 39 00 62 00 A1 00 40
9270- 61 1C 3F 3F 17 97 36 BD
9278- 15 17 0D 2D 0C 64 24 04
9280- 00 9B 92 6E 92 05 60 4C
9288- 64 60 E1 C4 08 18 0C 1C
9290- DC 9F 17 DF 97 97 92 BA
9298- 6E 12 06 00 DB DB 93 DE
92A0- DB 12 8D 69 49 09 D6 DF
92A8- 12 4D 89 6A 68 61 40 E1
92B0- 44 61 40 40 C4 18 44 40
92B8- E0 E3 FB E3 1B 96 E3 BD
92C0- 1B 97 92 06 00 C0 40 C0
92C8- 68 40 40 69 49 4C 61 09
92D0- 96 92 92 52 09 96 92 FB
92D8- 9B 92 DF 93 95 97 92 DA
92E0- DF DC FB C0 C0 18 96 92
92E8- FB 1B C7 C0 C0 E3 C0 C0
92F0- C0 40 45 48 08 44 08 18
92F8- 44 C0 C0 40 4C 48 48 48
9300- 48 48 05 00 C0 C0 C0 40
9308- C0 40 1B DC C3 DB D8 1B
9310- 96 92 92 1B 96 92 1A DF
9318- 92 12 96 92 92 6A 49 89
9320- 92 6A 40 40 40 48 B1 92
9328- 92 6A 49 49 41 48 56 49
9330- 44 40 40 4E 09 44 40 E0
9338- C0 40 40 40 63 40 40 40
9340- C4 C0 C0 C0 C0 DB DE 63
9348- 40 48 09 F8 DB DB DB E3
9350- C0 DB 3B 00
*
```

to BSAVE type: BOOM,A37475,
L243 (use HIMEM:37475)

Table 2. Boom.

these vector shapes (with a slight delay in the drawn mode) sequentially. Explode (Listing 5) is a sound routine at 2048 and Rnd1 (Listing 6) is a random number generator at $890 called by Explode in 0815.

The BSAVE information for Explode is A2048,L45. For Rnd1 it's A2192,L64. HIMEM is set to 37475 since that's where Boom BLOADs, and program strings from Demo would overwrite part of Boom if we didn't protect it in this way. Also, locations 232 and 233 must always contain low and high bytes of the shape table (Boom) starting address, if you're going to use Applesoft shapes. In line 20 convert 37475 into those two numbers, specifically 99 and 146, by the following:

NEW <return>
?PEEK(104) <return>
37475A <return>
CALL-151 <return>
4003.4004 <return>

Use the 4003.4004 if ?PEEK(104) got a result of 64. If it got 8, then use 803.804. You'll see either 4003-63 92 or 803-63 92, depending on the PEEK(104) result. (I again recommend POKE103,1:POKE 104,64:POKE16384,0 in the Hello program that runs before Demo). The 63 92 means $9263 is the hex address that 37475 is equivalent to. Converting the low byte ($63) to decimal yields 99 since $6 \times 16 + 3 = 99$ and converting the high byte ($92) to decimal yields $9 \times 16 + 2 = 146$.

After keying in Boom (Table 2), Explode (Listing 5) and Rnd1 (Listing 6), key in and run Demo (Listing 4) and notice how it works. The plane seems to dive slowly to earth and crash. You can still tell that the engine noises happen between shape movements; and the explosion sounds happen quite apart from the blow-up shape displays, if you're observing carefully. Yet this type of sound/action sequence is not all that uncommon. What are in truth separate sound and action events pass, for all practical purposes, as simultaneous sound and action.

Machine Language to the Rescue

What would a program look like that produced absolutely indistinguishable sound/action sequences? Well, first of all it would be in machine language. It might use extra hardware peripherals, like the music peripheral cards that give simultaneous notes on-screen and musical chords through speakers. One sound/action sequence that comes immediately to mind is the laser-quarks in Death Race '82, my second machine language arcade game. See Listing 7.

I've included these assembly instructions from Death Race '82's source codes so you can see how I interwove sound-creation instructions with laser-quark movement algorithms. We'll ignore lines 1–10 and 15–27, which deal with action. Lines 11–14 create the neat little hornet-

```
*800.82D

0800- A0 7F 84 09 C6 09 EA F0
0808- 23 A9 08 85 FF C6 FF F0
0810- 1B A5 FF 85 06 20 90 08
0818- A9 00 EE 30 C0 EE 30 C0
0820- CE 30 C0 C6 08 F0 02 D0
0828- EF 4C 04 08 60
*800L

0800-   A0 7F       LDY   #$7F
0802-   84 09       STY   $09
0804-   C6 09       DEC   $09
0806-   EA          NOP
0807-   F0 23       BEQ   $082C
0809-   A9 08       LDA   #$08
080B-   85 FF       STA   $FF
080D-   C6 FF       DEC   $FF
080F-   F0 1B       BEQ   $082C
0811-   A5 FF       LDA   $FF
0813-   85 06       STA   $06
0815-   20 90 08    JSR   $0890
0818-   A9 00       LDA   #$00
081A-   EE 30 C0    INC   $C030
081D-   EE 30 C0    INC   $C030
0820-   CE 30 C0    DEC   $C030
0823-   C6 08       DEC   $08
0825-   F0 02       BEQ   $0829
0827-   D0 EF       BNE   $0818
0829-   4C 04 08    JMP   $0804
*L

082C-   60          RTS
```

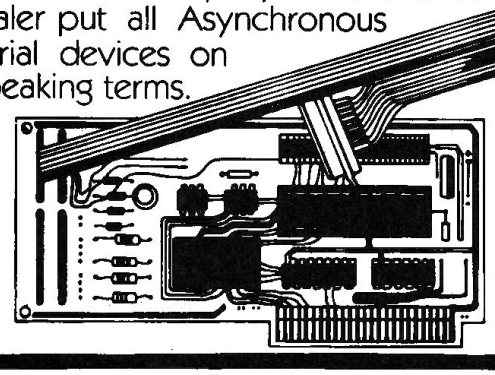
Listing 5. Explode

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like buzz the laser-quarks make as they zip across the hi-res screen. Notice that I stick $FF into Y, the temporary counter, and decrement Y until it reaches 0, all the while clicking the speaker once per loop. Once line 14 (BNE) finds a 0 in the Y register, the program continues on. The effect is totally convincing. The laser-quarks appear to be making the sound you hear as they zip across the screen. The idea that the speaker clicks and action sequences are actually separate will never enter your head—it all happens too fast.

Another example is the void-boundary dots in Zero Gravity Pinball, my first arcade game. The redrawing of void-boundary dots is periodically enhanced by sound effects. In Listing 8, Dots1, you'll find a disassembly rather than assembly source codes. Sometimes an algorithm is so simple to write I don't even bother to save the source. I just BSAVE the machine language routine once assembled, knowing that I can rewrite the assembly code in a few minutes by checking out the disassembly. You'll see what I mean shortly.

Dots1 hplots dots, spaced four coordinates apart, with accompanying sound effects. I could have drawn all the dots involved in a tiny fraction of a second without sound effects or delays, but the result would have been less interesting. The disassembly alone will enable you to key Dots1 in and test it. 10HGR:POKE-16302,0:HCOLOR=3:CALL32768 is all that's needed to RUN it.

```
890.8D0

0890- AE E1 08 E8 BC 00 D0 B4
0898- 4E E8 BC 00 D0 B4 4F 8E
08A0- E1 08 A2 08 18 A5 4E 2A
08A8- 2A 2A 2A 29 01 85 07 A5
08B0- 4F 29 01 18 45 07 F0 01
08B8- 38 26 4F 26 4E CA D0 E4
08C0- A5 4F 38 E5 06 90 03 4C
08C8- C2 08 18 65 06 85 08 60

890L

0890-   AE E1 08    LDX   $08E1
0893-   E8           INX
0894-   BC 00 D0     LDY   $D000,X
0897-   84 4E        STY   $4E
0899-   E8           INX
089A-   BC 00 D0     LDY   $D000,X
089D-   84 4F        STY   $4F
089F-   8E E1 08     STX   $08E1
08A2-   A2 08        LDX   #$08
08A4-   18           CLC
08A5-   A5 4E        LDA   $4E
08A7-   2A           ROL
08A8-   2A           ROL
08A9-   2A           ROL
08AA-   2A           ROL
08AB-   29 01        AND   #$01
08AD-   85 07        STA   $07
08AF-   A5 4F        LDA   $4F
08B1-   29 01        AND   #$01
08B3-   18           CLC

08B4-   45 07        EOR   $07
08B6-   F0 01        BEQ   $08B9
08B8-   38           SEC
08B9-   26 4F        ROL   $4F
08BB-   26 4E        ROL   $4E
08BD-   CA           DEX
08BE-   D0 E4        BNE   $08A4
08C0-   A5 4F        LDA   $4F
08C2-   38           SEC
08C3-   E5 06        SBC   $06
08C5-   90 03        BCC   $08CA
08C7-   4C C2 08     JMP   $08C2
08CA-   18           CLC
08CB-   65 06        ADC   $06
08CD-   85 08        STA   $08
08CF-   60           RTS
08D0-   20 58 FC     JSR   $FC58
08D3-   A9 C2        LDA   #$C2
08D5-   20 ED FD     JSR   $FDED
08D8-   A9 01        LDA   #$01
```

Listing 6. Rnd1.

"The idea that the speaker clicks and action sequences are actually separate will never enter your mind—it all happens too fast."

To delete sounds do an 8074:60. And 8001:A0 produces a variation on the sound effect. All that's really happening here is hplotting and speaker clicking. The JSR $8071's take the program to the hplot/sound routine at $8071 where JSR $F457 (the Applesoft Hplot routine) plots the point having coordinates stored in the registers (horizontal low in X, horizontal high in Y, and vertical in the accumulator). So, INC $FF four times and then LDA $FF means that vertical coordinate data is being quadra-incremented before being used for plotting again.

In the $8071 subroutine, the speaker clicks an increasing number of times as the action progresses. The INC $07 sees that each use of the subroutine increments the loop counter ($7) and BNE $8078 makes sure you keep looping though the speaker-clicker lines until the temporary loop counter ($6) is decremented to 0.

The Dots1 routine also includes looping for hplot purposes, such as 8036–8038 CMP (compare) and BCC (branch if less than), which loops back to $8008, and the 806C–806E CMP and BCC, which loops back to $803E. See how a quick explanation can turn a bunch of meaningless codes into simple routines?

```
!L  1           SEC
    2           SBC #$5
    3           CMP YZ
    4           BCS L88
    5           CLC
    6           ADC #!10
    7           CMP YZ
    8           BCC L88
    9           BCS L90
   10 QUIT      RTS
   11 L88       LDY #$FF
   12 DDDD      STA $C030
   13           DEY
   14           BNE DDDD
   15           LDX XZ
   16           LDY #$0
   17           LDA YZ
   18           JSR HPOSN
   19           LDX #$D5
   20           LDY #$9
   21           LDA $F9
   22           JSR XDRAW
   23           INC $EB
   24           LDA $EB
   25           CMP U
   26           BCS QUIT
   27           JMP MOVBUL
```

Listing 7. Death Race '82.

Zero Gravity Pinball

Other algorithms simulating sound caused by on-screen action are the bumper and spinner hitting routines in Zero Gravity Pinball. When bumpers are hit by the ball, they light up and/or change color and then I CALL (with a JSR usually) a sound routine so the ball appears to have caused the game's "electronic switches" to light up the bumper and create the sound. What really happens is that I check the collision counter for a collision of the ball with any on-screen object, find a collision and so jump to the collision subroutine. This determines *where* on the screen the ball is, so the program can determine *which* object was hit. (Four spinners, four buzzers,

four bumpers, four corner-bumpers, one black hole, two force fields, ten flippers, and four voids are all possible collision sources.) Appropriate action can then be taken, including the introduction of randomness.

```
8000-  A9 28     LDA  #$28
8002-  85 07     STA  $07
8004-  A2 66     LDX  #$66
8006-  86 FF     STX  $FF
8008-  A0 00     LDY  #$00
800A-  A6 FF     LDX  $FF
800C-  A9 04     LDA  #$04
800E-  20 71 80  JSR  $8071
8011-  A0 00     LDY  #$00
8013-  A6 FF     LDX  $FF
8015-  A9 00     LDA  #$00
8017-  20 71 80  JSR  $8071
801A-  A0 00     LDY  #$00
801C-  A6 FF     LDX  $FF
801E-  A9 BF     LDA  #$BF
8020-  20 71 80  JSR  $8071
8023-  A0 00     LDY  #$00
8025-  A6 FF     LDX  $FF
8027-  A9 BB     LDA  #$BB
8029-  20 71 80  JSR  $8071
*L

802C-  E6 FF     INC  $FF
802E-  E6 FF     INC  $FF
8030-  E6 FF     INC  $FF
8032-  E6 FF     INC  $FF
8034-  A5 FF     LDA  $FF
8036-  C9 B3     CMP  #$B3
8038-  90 CE     BCC  $8008
803A-  A9 14     LDA  #$14
803C-  85 FF     STA  $FF
803E-  A0 00     LDY  #$00
8040-  A2 02     LDX  #$02
8042-  A5 FF     LDA  $FF
8044-  20 71 80  JSR  $8071
8047-  A0 00     LDY  #$00
8049-  A2 00     LDX  #$00
804B-  A5 FF     LDA  $FF
804D-  20 71 80  JSR  $8071
8050-  A0 01     LDY  #$01
8052-  A2 14     LDX  #$14
8054-  A5 FF     LDA  $FF
*L

8056-  20 71 80  JSR  $8071
8059-  A0 01     LDY  #$01
805B-  A2 16     LDX  #$16
805D-  A5 FF     LDA  $FF
805F-  20 71 80  JSR  $8071
8062-  E6 FF     INC  $FF
8064-  E6 FF     INC  $FF
8066-  E6 FF     INC  $FF
8068-  E6 FF     INC  $FF
806A-  A5 FF     LDA  $FF
806C-  C9 AB     CMP  #$AB
806E-  90 CE     BCC  $803E
8070-  60        RTS
8071-  20 57 F4  JSR  $F457
8074-  A5 07     LDA  $07
8076-  85 06     STA  $06
8078-  A9 00     LDA  #$00
807A-  8D 30 C0  STA  $C030
807D-  EE 30 C0  INC  $C030
8080-  CE 30 C0  DEC  $C030
*L

8083-  C6 06     DEC  $06
8085-  A5 06     LDA  $06
8087-  D0 EF     BNE  $8078
8089-  E6 07     INC  $07
808B-  60        RTS
```

Listing 8. Dots1.

Bumpers and buzzers merely light up and make noise. Spinners, on the other hand, need to simulate rotation, accompanied by noises that enhance the effect. The spinner must be drawn and erased at various points in the rotation until motion is perceived by the player. Appropriate sounds are interwoven into the animation sequence.

Balls that hit the "void" disintegrate immediately with an explosion routine not unlike the one in Demo. (Even though space has no noise in it because it's a vacuum, if Star Wars and Battlestar Galactica and Buck Rogers can have space sound, then so can Zero Gravity Pinball!) Again, the use of machine language is critical in achieving effective sound/action simultaneity.

Speech Synthesis

You may have noticed the spoken words in Intellivision's newest games. This addition to usual game sound effects can enhance the realism of the game and create extra excitement and intrigue.

Apples can also generate spoken words. Appletalker, an old Bob Bishop cassette from Softape, has you talk to your Apple via the cassette input port. It digitizes the sounds and saves the resultant data in Appletalker tables. These could be played back and even stored on tapes or disks, to be used in your own programs. There is, however, one serious drawback (apart from the fact that the sound quality is low). Each word takes up an enormous amount of memory.

Programs often act like water—they conform to the shape of their container. If you have a 16K Atari,

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```
*1560.15AB

1560- A9 07 85 06 A0 00 A9 09
1568- 85 FE A9 00 8D 30 C0 EE
1570- 30 C0 CE 30 C0 A2 FF CA
1578- D0 FD A2 FF CA D0 FD A2
1580- FF CA D0 FD B6 21 C8 CA
1588- D0 FD B6 21 CA D0 FD B6
1590- 21 CA D0 FD B6 21 CA D0
1598- FD C6 FE F0 03 4C 6A 15
15A0- A9 45 20 A8 FC C6 06 D0
15A8- BD 60

to BSAVE type: EXPLOSION
(CALL5472),A5472,L75
```

Listing 9. Explosion.

you'll have a lot of 14–15K programs. If you have a 48K Apple, you'll use most of that RAM space. Memory always seems to be at a premium—hence 16K, 64K, and 128K RAM cards, hard disks drives, and so on.

How many games have room for 1000-byte words or 4000-byte phrases? Not many, There was a *CALL-A.P.P.L.E.* article entitled "Apple Free Speech" in September of 1981 that included a Maxtalk program by B.C. Detterick. He stated that extending the sample time would enable a whole word to fit into 512–768 bytes (two to three pages) of memory. By sample, he meant a sample of the audio coming in through your Apple's cassette input port, by way of a microphone. As the length of the sample to be digitized increases, the sound quality decreases. The two-to-three-page words above stretch the limits of this scheme; clearer words take a lot more memory.

Fortunately, speech synthesizer chips have made massive memory usage an obsolete methodology for speech synthesis. Texas Instruments has not only made good RAM and ROM chips, but also good sound generation, video display processor, and speech synthesizer chips. As a result, the Echo II (a peripheral card with speech synthesizer), for instance, need only be plugged into a peripheral slot, a couple of magic commands given, and words typed or strings read are spoken. I've tried the Echo II—it's quite impressive, except for the Gs sounding too much like Bs (or was it vice versa?).

Needless to say, this approach, rather than memory-hogging digitization, is the key to future computer speech. In goes a string, out comes a pronounced word. This method is more than a idea; speech synthesizers are already used in toys, exhibits, and devices to help speechless people "talk" and retarded people learn.

Is Compiling the Answer?

In a game called Lazer Maze by Jim Spain, lines (lazers—24th century spelling) are drawn between reflection baffles after a combatant has fired his lazer into a mirror maze. You try to guess where the lazer beam will come out, which is also where the alien combatant will be waiting. A special eerie space sound starts each turn, and after the lazer beam is fired an appropriate sound is heard every time a beam bounces off a reflective baffle. Ultimately, either the alien is hit, with accompanying explosion, or the alien heaves a throwing bomb that blows you up.

Both explosion sound effects included in this column are used in this game. The lazer sound (CALL2239 after BLOADing MULTIPLE LASER (CALL2230)) also appears in this column. Feel free to use any of my sound effects in your own games. Just CALL them from Basic at the CALL number given, or JSR to them from machine language.

This lazer beam drawing with the lazer sound routine works reasonably well in Basic, but compiling it (into Lazer Maze) makes it work very well indeed. The lines draw faster and the calculation routines execute faster. We used a Speedstar compiler from Southwestern Data Systems (S.D.S.).

But the sound effects don't change with compiling at all, except for the throwing bomb. You see, a compiler speeds up programs by circumventing the Applesoft Interpreter. Once compiled, the program merely jumps around from one machine language routine to another. But the lazer sound in Lazer Maze already was in machine language, so there was no way (and no need) to speed it up. Compiling just changed CALL to JSR, in effect.

The reason the bomb-throwing sounds speeded up is that this routine was in Basic, structured so that as the bomb moved across the screen the speaker would click. When the bomb moved two to three times as fast due to compiling, the delays between clicks became two to three times as short, transforming the clicking into a buzzing. There are many types of sound effects created in Basic that could be improved by compiling.

Hi-Res Secrets' Sounds

Another way to improve the quality of sound effects is by using the Ampersand (&) command from Applesoft Basic. Hi-Res Secrets provides an example of this, as well as many tone, sound and noise routines. There are even a violin sound producer and a music program that turns the Apple's keyboard into a "piano."

The key (no pun intended) to the latter is in interpreting which key is being pressed by examining the char-

```
*15AC.15F8

15AC- A0 23 20 B4
15B0- 15 88 D0 FA A9 01 85 FF
15B8- A9 45 85 FE A9 00 8D 30
15C0- C0 EE 30 C0 CE 30 C0 A6
15C8- FF CA D0 FD C6 FE F0 05
15D0- E6 FF 4C BC 15 A9 12 85
15D8- 08 A9 20 85 06 A9 03 85
15E0- 07 8D 30 C0 EE 30 C0 CE
15E8- 30 C0 C6 06 D0 02 C6 07
15F0- D0 F8 C6 08 D0 E3 60
15F8-

to BSAVE type: HELICOPTER
(CALL5548),A5548,L76
```

Listing 10. Helicopter.

```
*14D6.155F

14D6- A9 FF
14D8- 85 07 A9 FF 85 09 A9 80
14E0- 85 FE A9 00 8D 30 C0 EE
14E8- 30 C0 CE 30 C0 A0 03 A6
14F0- 09 CA D0 FD A2 64 CA D0
14F8- FD 88 F0 03 4C EF 14 E6
1500- 09 A9 00 8D 30 C0 EE 30
1508- C0 CE 30 C0 A0 03 A6 07
1510- CA D0 FD A2 64 CA D0 FD
1518- 88 F0 03 4C 0E 15 C6 FE
1520- F0 05 E6 09 4C E2 14 20
1528- 3C 15 20 3C 15 20 3C 15
1530- 20 3C 15 20 3C 15 20 3C
1538- 15 20 3C 15 A9 FF 85 FF
1540- A9 9B 85 FE A9 00 8D 30
1548- C0 EE 30 C0 CE 30 C0 A6
1550- FF CA D0 FD C6 FE F0 05
1558- E6 FF 4C 44 15 60

to BSAVE type: DIVE STRAFING
(CALL5334),A5334,L137
```

Listing 11. Dive Strafing.

acter you just got with the Get command, then looking at the relative position of the key on the keyboard and assigning a frequency value according to the tone forthcoming. I set C at 192, D at 172, and E at 154, for example. (See Tables 1a–c for more pitch, duration, and rest values.) Four and a half octaves were possible. By adjusting the machine language tone generating routine in Listing 2, longer, higher and lower tones are possible.

Since such keys as the comma and semicolon are among those used as note keys, saving the composed tunes as string array textfiles can't be easily accomplished. So, I convert to ASCII numbers first. To reduce space requirements, I could have, with a bit more work, BSAVEd binary files full of the hex equivalents of these ASCIIs.

An Overview

I'll close with an overview of future graphics and sounds potentials. The Commodore 64 introduction of standard 64K, the VDP (video display processor) chip, and sound effects hardware, all for under $600, is certainly a token of things to come—a token to be taken seriously. Soon all micros will be expected to have sprite graphics (which the VDP provides) and dynamic sound effect hardware as standard equipment. The fact that Apple and IBM lag behind in these two respects is, I believe, only a temporary result of their trying to appear sophisticated and business-like to the business market. But the IBM is already *the* business computer amongst the larger-sized machines, and thousands of companies have already found that the Apple can be a serious business computer if applied correctly to the task and supplied with appropriate software.

IBM and Apple seem to have serious reservations about being state-of-the-art graphics and sound machines. I can only conclude that they're equating sound and graphics with arcade games, and feel that area is for Atari, Intellivision, Coleco, and perhaps the Commodore 64.

This is a serious error. I can already see some Apple owners looking longingly at the graphics and sounds of the less expensive competitors. Will these people have to shell out the 600 bucks and learn a new Basic and modification of 6502 assembly to satisfy their smoldering desires? Will Apple get busy fast on a new machine? Or will, perhaps, a new peripheral board for less than half the price of a Commodore 64 appear to solve the whole problem? There are a few companies presently offering such hardware, but at such a user-unfriendly stage that for the most part only hobbiest hackers will be attracted. What I'm wondering is whether or not a *mass market* quality product will soon appear. Suffice it to say that neither you nor I believe that *any* Apple owner really wants to jump to another computer to get something the Apple is quite capable of doing itself—with a little help.

Remember, there are close to 500,000(?) Apple owners. I hear a different figure every time, but at this writing, January 1983, there appear to be about 20,000 Commodore 64 owners. That ought to say something, especially when you consider the huge mountain of software and peripherals available for the Apple. I can't help but feel that regardless of what the people at Apple Computer do, the innovative, loyal Apple users (and software producers) will see the deluge of new, cheap machines (it's coming, it's coming!) as a delightful challenge, and anything *but* a cause for alarm. I welcome your comment on this subject.

Coming Soon

In next month's column I'll explain scrolling and more. Bye for now! ■

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Book Reviews

What's Where in the Apple: A Complete Guide to The Apple Computer

by William F. Luebbert

Micro Ink
34 Chelmsford St.
Chelmsford, MA 01824
Softcover, $24.95

There are two ways to travel—you can take the eleven countries in seven days tour, spending your time at the usual tourist haunts or you can take a leisurely trip, searching out special places far from the beaten track. William Luebbert has written a guidebook for the second kind of traveler. And with his *What's Where in the Apple* you can explore a side of your computer that few people ever see.

The book is divided into three parts: Part I, the first 150 pages, provides an overview of the Apple hardware and firmware and outlines methods that even a beginning programmer can use; Part II is an atlas with over 2000 numerically ordered listings of specialized locations in the Apple memory; Part III is a gazetteer and contains the same information as the atlas except that the list is in alphabetical order.

You don't need to be a machine language expert to make use of *What's Where in the Apple*. In fact, you can use a high level language like Basic in conjunction with PEEK, POKE and CALL. On the other hand, if you are a serious machine language programmer, why go to all that trouble when all you have to do is take advantage of the operations built into the Applesoft or Integer Basic compiler, or the computer's monitor?

After introductory chapters on PEEK, POKE, CALL and machine language programming, the book discusses in great detail the Apple's memory, starting with page zero and going through the system monitor and page FFFF. *What's Where in the Apple* answers questions such as where old strings go, or why OUT OF MEMORY messages occur, or how the Apple stores information on a disk.

What's Where in the Apple guided me through several problems the first week I owned it. I learned a new (and better) way to include short machine language routines in a Basic program. The book also explained why a high-resolution display mysteriously failed in the middle of a program. It wasn't the hardware; my program had outgrown its space and encroached on the graphics memory. In both cases I probably could have solved the problem on my own but instead I relied on Luebbert's advice and avoided much frustration.

While the first part of the book has been the most useful to me, I am slowly becoming familiar with the atlas and gazetteer sections. As I gain confidence integrating machine language with Basic, I find myself borrowing routines from the Apple's firmware. The atlas and gazetteer listings include the address in hexadecimal and signed decimal format, the common name for the function or location, use, and descriptions that affect CPU registers. A typical entry is: $002D (45) [SECT P1 DOS RWTS (READ-WRITE TRACK-SECTOR) PARAMETER FOR CURRENT DISK SECTOR. The publisher also offers a software version of the atlas and gazetteer. You can get a disk for $14.95 that includes the listings and a retrieval program.

"You don't need to be a machine language expert to make use of What's Where in the Apple."

This book is lacking in several areas. The 20 pages devoted to elementary machine language programming, though very well done, are no substitute for a full treatment of the subject. Nor is *What's Where in the Apple* a guide for beginning Basic programmers or a replacement for Apple's hardware oriented reference manual.

It is easy to justify passing by *What's Where in the Apple* and buying a new game. But if you want to write your own game you had better think twice; the $24.95 for this book is cheap compared to the time you could invest learning its lessons on your own.

Like tourist guides, *What's Where in the Apple* isn't for everyone or a substitute for experience and patience. Isn't it nice though, to know that someone has been there before you and is willing to make your trip a little easier? *What's Where in the Apple* could be just the ticket for any serious-minded Apple programmer. ■

Timothy Daniel
Oxford, OH

Apple Fortran

By Brian D. Blackwood and George H. Blackwood

Howard W. Sams & Co., Inc., Indianapolis, IN 46268; Softcover, $14.95

As stated on the back cover of this 236 page book, this is a "detailed language manual" for the Fortran programming language as supplied by Apple Computer Inc. for use on the Apple computer. This is not a book for you if you have no interest in learning how to write programs in Fortran.

Chapters include an interesting introduction to computers in general, Apple Fortran, the rules of Fortran, how to input data from keyboard and disk, and how to output data to disk, printer and monitor screen. There are also several chapters on the various structures of Fortran and how they are implemented on the Apple computer.

The authors have done a very good job of giving step-by-step examples of how to write, compile, run and save Fortran programs on the Apple computer. Each programming concept is presented in the form of a short program. A chapter (nine pages long) is devoted to the use of the Apple Pascal Operating System, which is used by Apple Fortran and is supplied on disk with the Fortran system. The instructions are very easy to use because information can be found in a few pages rather than having to search in several books. The last chapter in the book (eight pages long) is on using two or three disk drives. As stated by the authors, programming is much

easier when using two or three disk drives because disks are placed in the proper drives and left there for the duration of the programming session.

The authors do not assume any knowledge of Fortran on the part of the reader. Although prior programming experience would be a great help, no programming background is required to write programs in Fortran if you follow the steps in this book. By typing in and running the program examples you can get a feel for how to write your own programs.

The book lacked two important additions: 1) a list of error codes and their meanings so the *Apple FORTRAN Language Reference Manual* does not need to be referenced while writing programs; and 2) a more complete index that lists AND, OR, NOT, .LE., etc. as separate entries. Also, a few of the program listings

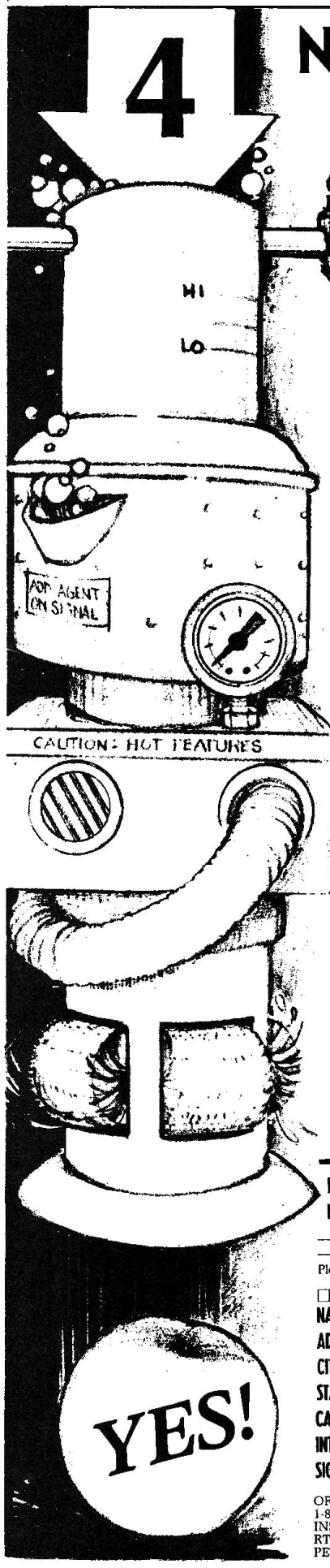
"...no programming background is required to write programs in Fortran if you follow the steps in this book."

were printed lighter than the text and that makes them hard to read when typing the programs into the computer. The book is bound to lie flat (good), but the binding is a size too small for the thickness of the book and that crumples the pages (bad).

In conclusion, this is a handy book for both experienced and novice programmers because it concentrates information about the statements and operations of Apple Fortran, as well as information about the use of the Apple Pascal Operating System, into one easy-to-understand and easy-to-use volume.

It should be noted that the Apple language card or other plug-in memory expansion card is required in addition to the Apple Fortran System to write programs in Fortran. ■

John Davison
Ft. Walton Beach, FL



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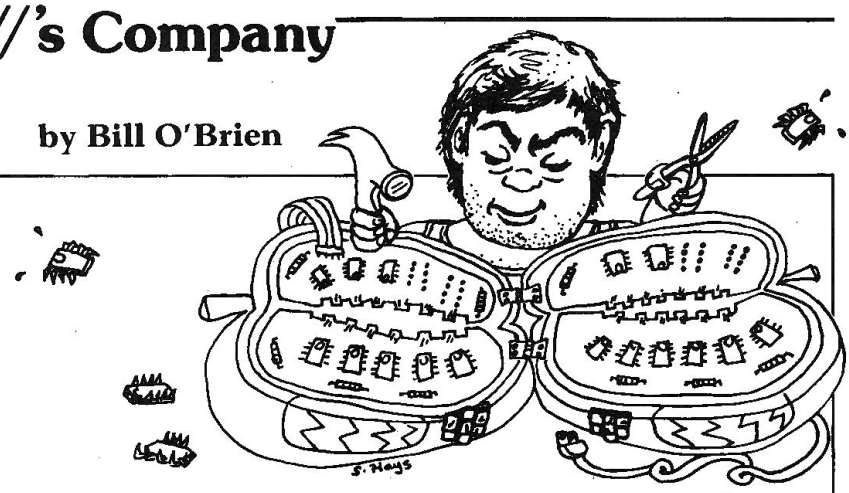
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by Bill O'Brien



Chips Ahoy!

When Apple reintroduced the III a year and a half ago, I thought it would be nice to make sure they had really removed all of the bugs, especially the heat build-up failures the original versions were prone to. The day I set it up, I borrowed a hair dryer from the love-of-my-life and went to work. With the III on, I heated the bottom, then shut it off, wrapped it in plastic, and stuck it in my refrigerator overnight. (Keep in mind I strongly recommend you *don't* do anything even remotely similar.) The next day I removed the Apple, and after sampling its light flaky crust (wait a minute, that was the pie), plugged it in and it worked. I felt great. It had passed the fire and ice test, and I hadn't even used Shell oil!

As I said, that was a year and a half ago. Sometime last week, my III developed a problem. While I was pounding out the prose that constitutes this column, it started to display strange watery lines down the edge of the screen, or, when in a perky mood, it told me my volume wasn't found when I tried to save to disk. At other times, I would get an SOS ERROR $01, or there would be lovely vertical rules (|) attached to some of the screen characters.

Most normal people, given these circumstances, would take the beast to the local repair shop and be done with it. I could hardly be classified as normal. Besides, repairs to an Apple III can, at times, be expensive.

What to do? While I pondered weak and weary, through this maze of problems dreary, a thought sprang to mind. Why not take the III apart myself?

Kidding aside, though, while not overly difficult, it's not the kind of thing someone who's never delved into a computer should tackle unaided. I'm checked out to service a few computers and some printers, and I've always been a tinkerer of sorts. Most importantly, I'm only about 30 percent clutz. Anything over that is really unacceptable. Keep in mind that if you do any gross damage, and the machine is under warranty, *you may well void your warranty*. Check on it first, or you may be stuck trying to find a *very* sympathetic service tech.

Down and Out

To start I made sure there were no disks in the drive and turned the III off. Then I removed the power cord. That's *essential*. If you don't, and you should happen to turn the computer on in the middle of dismantling it. . . well, do you remember the bicentennial fireworks display? Unplug all the other cables (video, disk drive, printer) and remove the monitor from atop the machine. Heft the III and move it to your work area. I use the floor. It's spacious, flat, and my dog only walks on it to and from her water dish (otherwise she walks on me).

On either side of the top cover (the piece that sits like a hat on the III and covers the internal disk drive) there are regular head screws. They don't come out, but by applying a screwdriver with the appropriate blade width, you can twist them enough to release the cover. *Make sure the disk drive door is closed before you remove it.* Next it would be wise to remove any boards inside, like the UPIC or the Profile interface. Now lean the III back on the rear panel so the keyboard points to heaven.

Before your wondering eyes should appear a silver bottom with screws far and near. Many screws. Many, many screws. And they've all got to come out. Actually, there are two panels, one thin, the other wide; the thin one hides the power supply and should be left *untouched*. While you're twirling your Phillips head screwdriver, be sure to support the bottom panel so it doesn't swing out all of a sudden. Yes, even the two screws on the little metal mounds must come out.

Carefully, ever so carefully, move the bottom panel away from the casing, making sure you don't disconnect any of the wires you see. With your left hand disconnect the power connector (the only connector on the left side). This is the shortest of all the cables inside, and you'll have a little more leeway to get at the rest once it is removed.

With the power cable gone, ease the bottom panel out a little further. At the rear, on the right side, you'll see three more cables. Two of them are blue ribbon-type connectors, the other is a black two-wire cable with a white connector on the end. That's the next one out. It's the speaker cable, and if you haven't pulled it out just by moving the bottom plate a little further than you should, just keep pulling—carefully.

Next are the ribbon cables. The furthest back comes from the disk drive and the other from the keyboard. They have keyed connectors, which means that, unless you exercise phenomenal cunning and craft, you won't be able to plug them in backwards. Slipping thumb and forefinger back where they sit, and using a gentle rocking motion, remove them. (*Caution:* Do *not* pull by the cables!)

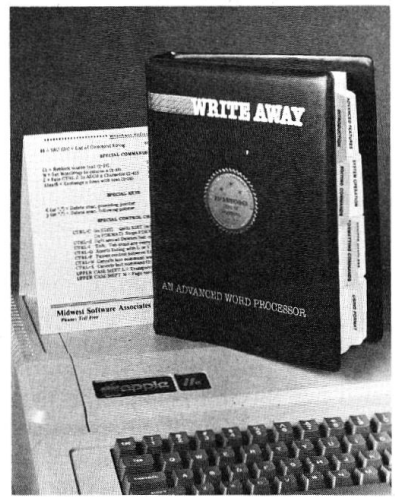
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Now separate the motherboard fully from the case. The bottom metal panel should come along with it; they're very good friends.

Keep in mind that micro-electronics is just a later branch of magic. As such, you will find that your III is affected by the four elementals: water, earth, wind, and fire. In other words, *be careful* during this whole process about static charges, cats, dogs, heat, cold, and little children.

Chipping Away

Having proceeded confidently thus far, I laid the motherboard out on the floor, set up suitable barricades to keep out the German Shepherd tide, and scrutinized the board. There was no obvious problem, at least not from a medium altitude vertical pass. I switched on a lamp and, magnifying glass in hand, I went over it again from a different point of view.

There was still no sign of gross damage, but I did notice a few things. Spanning three or four parallel trace lines was some beige-colored crud that looked fried on, and two of the chips had patches of green stuff on their legs.

Rousting around in my desk drawer, I extracted my chip pullers. Almost everyone's seen the typical, steel, thong-like kind that Apple supplies with the Language System for the II. Those are great for grabbing 74LS125s and other bitty chips, but the damage they can do to a 2732 or 8051, or even a 6502 (if you can stretch them that far), is considerable. For those larger devices, you need a more substantial chip puller.

You're also going to need patience and understanding to get the RAM board off. Many tiny wire fingers are held firmly in place by the connectors on each side of the board, and easing them out is a matter of time and the most gentle of hands. Push a little here, push a little there, and eventually it comes off. If you rush the job, you'll definitely damage something (I speak with the voice of experience!).

With the RAM board off, everything on the motherboard is exposed. Notice that all of the chips are identified by alphabetic and numeric characters silkscreened around the board's edge.

Starting at the upper left corner, I began removing chips, one at a time, noting the direction they faced. That's important, because you don't want to wind up with pin number 1 in hole number 8. If you should reseat the chip backwards, the hole with the voltage will not be aligned with the pin that needs it, in which case whether the chip was originally bad or not becomes a moot point.

It might be helpful to refer to Figure 1, a diagram of a typical IC pin arrangement. There is usually a painted dot, or a circular impression, to identify pin 1.

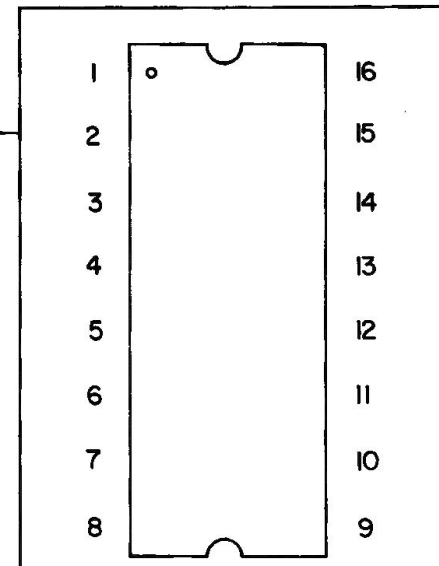


Figure 1. Typical IC pin arrangement.

After I removed a chip, I checked it for bent or broken pins, inspected the socket, and put it back, *immediately*. Yes, the Apple III motherboard has the individual chip numbers etched next to each socket, but I'm a good good friend of Murphy and I've learned to take no chances.

Across each row I worked, pulling, inspecting, replacing. The brown crud disappeared with a dose of alcohol on a cotton swab. I bypassed the two chips with the green stuff for later on and worked my way to the end of the board. By the time I was done, I had uncovered a surprise.

I've had my III for a year or so, and there have been times when it has misbehaved just a little bit. On those occasions I just removed the motherboard, pressed on all the chips and back it went to working fine. Now, after pulling all the ICs, I understood what the problem was all along. Two of the chips had pins bent up underneath, probably from when they were installed. After a few months, this just-barely-touching arrangement was ruined by oxidation, imperfect contact was made, and the machine behaved strangely. Pressing the chips down into the sockets restored whatever contact there was to be had and all was well for a while. This time I put them on the straight and narrow path!

Straightening Up

Which brings up another important topic—unbending IC pins. Also, depending on the finesse of whoever installed it, the leg might not just be folded up under the chip, it might also be mangled. If that's the case, you've got to reform it.

Keep in mind the pins are *very* fragile. In doing a few of them, I've found that prayer works best. For those less devout, I would recommend small needle-nosed pliers with a good, flat grip between the jaws. This is one of those times when the usual 99 cent variety won't work too well. By pulling at the distorted pin with *slow*, *even* pressure, you can straighten even the most recalcitrant back to almost normal.

I'd suggest that before you try this procedure for real, you buy a few 49 cent chips and mangle the pins. Practice on them for a while until you get the hang of it, because some of the chips in the III are not readily available, and Murphy dictates that these are the ones you'll destroy. Keep in mind, also, that the pins you've just straightened will be weaker than the rest of them, so when you resocket the chip, be extra careful. If you thought straightening them out the first time was risky, the second or third time is really walking on thin ice.

Wearing Off the Green

Remembering that green stuff on two of the chips, I went back and pulled them. There was also green on the sockets. It puzzled me for a while,

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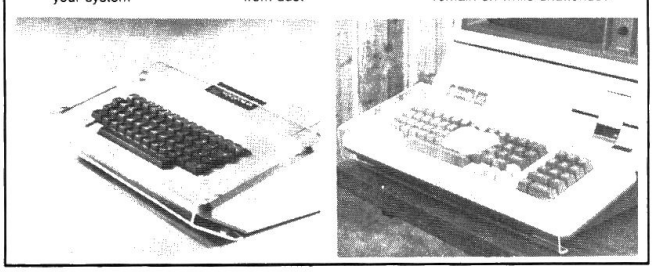
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Row	Bits							
7	b7	b6	b5	b4	b3	b2	b1	b0
6	b7	b6	b5	b4	b3	b2	b1	b0
5	b7	b6	b5	b4	b3	b2	b1	b0
4	b7	b6	b5	b4	b3	b2	b1	b0
3	b7	b6	b5	b4	b3	b2	b1	b0
2	b7	b6	b5	b4	b3	b2	b1	b0
1	b7	b6	b5	b4	b3	b2	b1	b0
0	b7	b6	b5	b4	b3	b2	b1	b0

Figure 4. Bit composition of RAM diagnostic display.

until I remembered I had received a clock for the III from an aftermarket manufacturer to review.

The clock setup involves a battery pack, so that turning the III off won't remove the time and date values. The battery compartment is clearly marked, showing the proper orientation. However, I decided to install the kit while watching TV. Three of the four AA cells went in great, but the fourth one, just as I was slipping it into the case, jumped up and turned itself around in my hand—without my noticing it. You have to be careful with batteries; they're very sneaky that way.

To the clock manufacturer's credit, the battery case didn't want to close with the battery installed backwards. To the credit of my own pigheadedness, I made it close. I was about to install the case in the III when I heard the bubbling noise. It took about 250ns for me to realize where the sound was coming from. I disconnected the pack from the wiring to the motherboard (a masterstroke of design, making a connector midway in the wires!) and opened up the case. My rebellious battery had paid dearly for its treachery.

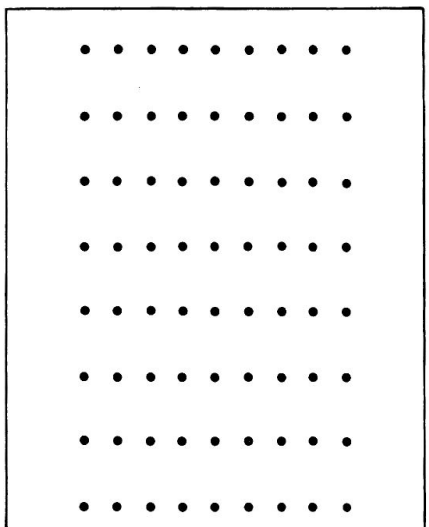


Figure 2. RAM diagnostic display indicating no problems.

Unfortunately, I paid a little also. The analog card on the internal disk drive was wiped out, and the 74LS125 on the outboard drive was zapped as well. You thought you were the only person who did things like that? Total repair price, about $71. But imagine what would have happened if the III had been *on* at the time.

That surge of churlish voltage was probably the cause of the green stuff, since I hadn't noticed it before and I'd had the board out at least twice. I've seen that type of residue on tubes in old TV sets that have gone up in a cloud of acrid fumes.

Surprisingly enough, when I put the III back together, it worked. There were no stray lines and no vertical rules. I guess that means I fixed it, or at least earned myself a reprieve.

Disclaimer

I want to emphasize again that, unless you're *familiar* with working on hardware and know how to be *careful*, don't dismantle your Apple III. There are more than enough competent service persons in the world who know what's happening under the hood. The Level 1 service centers are authorized to repair your machine on a board level. If they find a board that doesn't work, they'll swap it out and charge you good old dollars. If you think you can get a better deal from Apple directly, ask the dealer to send the broken machine on to them for "repair and return." Apple will fix it on a time and materials basis, which may or may not work out to be cheaper.

MORE ABOUT RAM

How often do you turn your III on? Once a day? Twice? Did you ever wonder what that pattern of dots is in the upper left corner of the screen? It's a display of the results of a RAM test that triggers every time your machine is turned on. You can also induce it by holding down the open apple and control keys while pressing the reset button. That dumps you unceremoniously into the Apple III's monitor. Type F6E6G, press return and, Voila!, a RAM diagnostic display.

If everything's all right, you see all dots, as represented in Figure 2. But if you have a RAM chip that's senile, one or more of the dots is replaced by an inverse 1 (a black 1 in a white box).

If the positioning of the dots in the display corresponded to the rows and columns of RAM in your III, that would be even better.

Look again at Figure 2. Doesn't look like much, does it? Now check out Figure 3, the arrangement of the

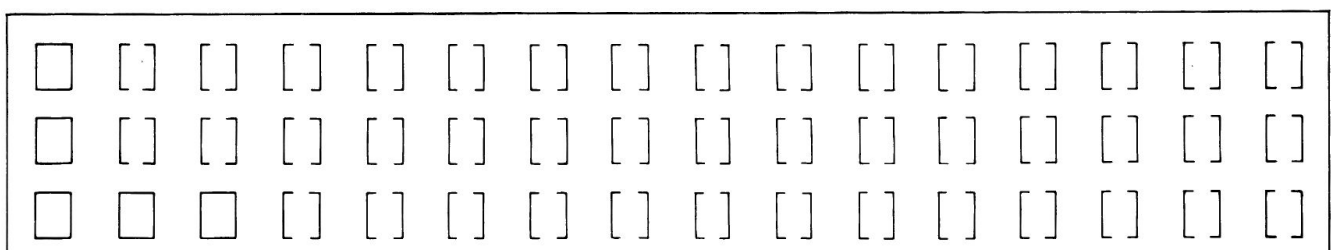


Figure 3. Chip arrangement on RAM board.

chips on the RAM board. They don't look similar at all do they? In the display there are 8 rows by 8 columns of dots—a total of 64. There are 3 rows by 16 columns of RAM chips. That's only 48. But, wait a minute! The bottom RAM row is made up of 32K chips, so each counts for two of the 16K variety. Thus, we have the equivalent of 64 RAM chips, even though to count there are only 48.

Also, there are 8 dots across each row. And a byte is 8 bits long. But the RAM is arranged in rows of 16 chips. Now, suppose the RAM is arranged in rows of 16 bits. Each row of chips counts off 8, ending one byte. The next one begins where the first left off. Starting with that as a basic postulate, let's take another look at our RAM test display, this time as it is composed of bits. See Figure 4. Since the 32K chips have twice the capacity of the others, they must account for 2 rows of the dot display, and since we've postulated that each RAM row is 16 bits of data, the row of 32K RAM is displayed by 4 rows of dots. That leaves 4 rows of dots, which are amply represented by the remaining 2 rows of RAM chips. If we are right, the only problem now is to associate rows of dots with rows of RAM.

The Apple III hardware bulletin confirms our hypothesis, and offers as help the RAM map in Figure 5. "Board" refers to the alphabetic legend along the side of the motherboard. B fills two positions because, as we mentioned, it's a row of 32K chips.

Find Figure 6. If our display turned up so, we could check our chart in Figure 4, see that the 1 referred to bit 4 of row 6, then refer to the hardware bulletin RAM map (Figure 5) and discover that row 6 was motherboard reference B and that bit 4 was the fourth chip in from the left. That chip would have to go!

That wasn't so bad, was it? If you were practiced at Apple III dissection, you could repair your ailing machine for the cost of the new chip and about a half hour of your time. Just make sure the new chip has the same speed rating as the old. Slower chips are a disaster.

HELP WANTED

I'd like to ask your assistance with the mail. A lot of you folks are not just writing in to tell me you're enjoying this column. You also want answers! I have two choices in dealing with these requests. I can answer in this column, which means a time gap before you get help. I can also mail an answer directly. This option seems the best, but even a multi-decinaire (someone who has a few $10 bills lying around) could not afford all that postage. So, if you ask a question that needs a speedy reply, keep in mind these four magic letters—SASE (Self-Addressed Stamped Envelope). Tuck one in with your letter.

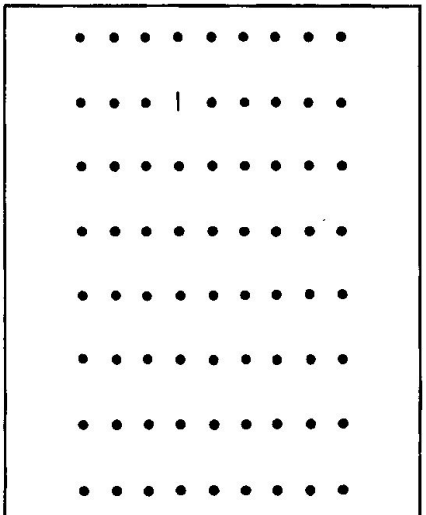


Figure 6. RAM diagnostic display indicating a faulty chip.

Board	Row	Chips								Row	Chips							
D	1	b7	b6	b5	b4	b3	b2	b1	b0	2	b7	b6	b5	b4	b3	b2	b1	b0
C	3	b7	b6	b5	b4	b3	b2	b1	b0	0	b7	b6	b5	b4	b3	b2	b1	b0
B	4	b7	b6	b5	b4	b3	b2	b1	b0	5	b7	b6	b5	b4	b3	b2	b1	b0
B	6	b7	b6	b5	b4	b3	b2	b1	b0	7	b7	b6	b5	b4	b3	b2	b1	b0

Figure 5. RAM map.

LOOSE ENDS

To that nice person in Kansas City: No, 99 percent of the stuff I get I've got to return after I'm done with it. I don't have a neat pile of spare equipment. There are probably more reviewers than there are fingers and toes on all the inhabitants of Italy, Texas. It would be quite costly for the manufacturers to give away that much merchandise.

Don't feel bad, though. It's a common assumption that columnists have a stash and a half of freebies. Anyway, don't rush into writing for *that* reason; it's a good way to go broke.

Time to go. I haven't yet decided what to do for next month's column. It's a toss-up whether I'll think up a topic tonight, or go out to my favorite Chinese restaurant. (There's this great one in Fort Lee!) Whichever, live long and program, and see you next time.

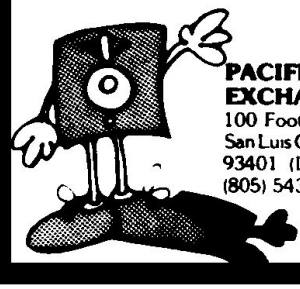
Ciao bene, AppleAmerica! ■

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Remark Reminder Made Easy

by David Schroeder

Listing. Remark Extraction program.

```
SOURCE FILE: REMSCAN
----- NEXT OBJECT FILE NAME IS REMSCAN.OBJ0
0300:              1          ORG  $300
0300:              2 ;;;;;;;;;;;;;;;;;;;;
0300:              3 ;                  ;
0300:              4 ; REMARK EXTRACTION ;
0300:              5 ;       PROGRAM    ;
0300:              6 ;                  ;
0300:              7 ; BY DAVE SCHROEDER ;
0300:              8 ;    JULY 1981     ;
0300:              9 ;                  ;
0300:             10 ;;;;;;;;;;;;;;;;;;;;
0300:             11 ;
0300:             12 ; STORES POINTERS FOR START OF BASIC PROGRAM
0300:             13 ; $FC HOLDS SINGLE (01) OR DOUBLE (02)
0300:             14 ; SPACE INFORMATION.
0300:             15 ;
0300:A5 67        16          LDA  $67
0302:85 06        17          STA  $06
0304:A5 68        18          LDA  $68
0306:85 07        19          STA  $07
0308:20 FB DA     20          JSR  $DAFB
030B:20 FB DA     21          JSR  $DAFB
030E:A5 FC        22          LDA  $FC
0310:C9 02        23          CMP  #$02
0312:F0 04        24          BEQ  CHECK
0314:A9 01        25          LDA  #$01
0316:85 FC        26          STA  $FC
0318:             27 ;
0318:             28 ; CHECK TO SEE IF AT THE END
0318:             29 ;
0318:A0 01        30 CHECK    LDY  #$01
031A:B1 06        31          LDA  ($06),Y
031C:D0 09        32          BNE  TEST
031E:20 FB DA     33          JSR  $DAFB
0321:20 FB DA     34          JSR  $DAFB
0324:4C 00 00     35          JMP  $0000
0327:             36 ;
0327:             37 ; IS IT A REMARK STATEMENT
0327:             38 ;
0327:C8           39 TEST     INY
0328:C8           40          INY
0329:C8           41          INY
032A:B1 06        42 TEST1    LDA  ($06),Y
032C:F0 07        43          BEQ  NEXT
032E:C9 B2        44          CMP  #$B2
0330:F0 13        45          BEQ  PRTREM
0332:C8           46          INY
0333:D0 F5        47          BNE  TEST1
0335:             48 ;
0335:             49 ; NO - GET NEXT LINE
0335:             50 ;
0335:A0 00        51 NEXT     LDY  #$00
0337:B1 06        52          LDA  ($06),Y
0339:AA           53          TAX
033A:C8           54          INY
033B:B1 06        55          LDA  ($06),Y
033D:85 07        56          STA  $07
033F:8A           57          TXA
0340:85 06        58          STA  $06
0342:18           59          CLC
0343:90 D3        60          BCC  CHECK
```

Listing continued.

REMSCAN is a relocatable machine language program that displays the line numbers and the text of Rem statements in an Applesoft Basic program. It is useful in the documentation of long and involved Applesoft programs. REMSCAN must be BRun. You can select double spacing of the list by poking location $FC(252) with a 2.

Looking at the program, lines 16–26 store the pointer to the beginning of the Basic program in locations $06–07, check spacing and generate two carriage returns. Lines 30–35 check the second byte of the tag field for zero, which marks the end of the Basic program. Then REMSCAN checks for a $B2, the code for a REM. When found, lines 64–99 take the REM's binary line number and convert it to a formatted five-digit BCD number. The rest of REMSCAN performs the printing of the information.■

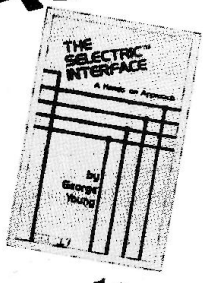
```
00010 - ***START OF PROG***
05000 - ***DRAW HANDS***
05035 - ***WIPE HANDS***
05065 - ***MOVE HANDS***
05139 - ***DRAW CLOCK***
05400 -     ***TEXT ON HGR***
05500 - ***SPACE ROUTINE***
05600 - ***QUIZ INPUT***
05700 - ***PROBLEM TEXT***
```

Figure 1. Sample output.

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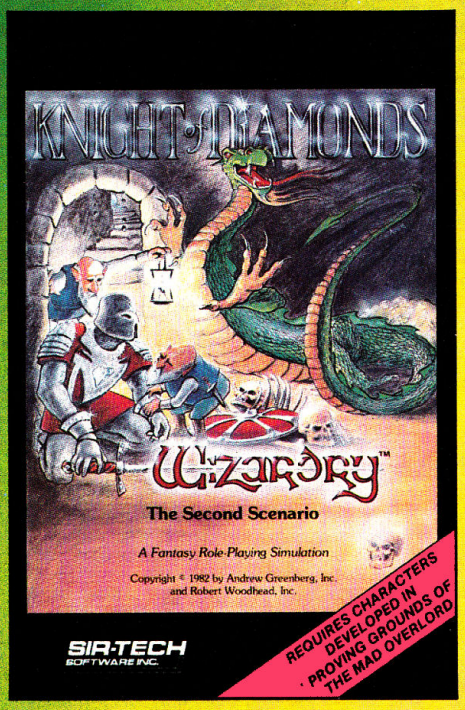
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Listing continued.

```
0345:                   61 ;
0345:                   62 ; GET LINE NUMBER AND FORMAT FOR 5 DIGITS
0345:                   63 ;
0345:84 1B              64 PRTREM   STY  $1B
0347:A0 03              65          LDY  #$03
0349:B1 06              66          LDA  ($06),Y
034B:85 09              67          STA  $09
034D:88                 68          DEY
034E:B1 06              69          LDA  ($06),Y
0350:85 08              70          STA  $08
0352:A9 09              71          LDA  #$09
0354:85 19              72          STA  $19
0356:A9 00              73          LDA  #$00
0358:85 1A              74          STA  $1A
035A:8D 00 02           75          STA  $200
035D:8D 01 02           76          STA  $201
0360:8D 02 02           77          STA  $202
0363:F8                 78          SED
0364:A2 00              79 CONVERT  LDX  #$00
0366:A1 19              80          LDA  ($19,X)
0368:2A                 81 CONVERT1 ROL  A
0369:48                 82          PHA
036A:A0 02              83          LDY  #$02
036C:B9 00 02           84 DOUBLE   LDA  $200,Y
036F:79 00 02           85          ADC  $200,Y
0372:90 02              86          BCC  DOUBLE1
0374:29 7F              87          AND  #$7F
0376:99 00 02           88 DOUBLE1  STA  $200,Y
0379:88                 89          DEY
037A:10 F0              90          BPL  DOUBLE
037C:68                 91          PLA
037D:E8                 92          INX
037E:E0 08              93          CPX  #$08
0380:D0 E6              94          BNE  CONVERT1
0382:C6 19              95          DEC  $19
0384:A9 07              96          LDA  #$07
0386:C5 19              97          CMP  $19
0388:D0 DA              98          BNE  CONVERT
038A:D8                 99          CLD
038B:                  100 ;
038B:                  101 ; $200-$202 HOLDS LINE NUMBER IN BCD
038B:                  102 ; PRINT IT, A DASH, AND THE REMARK
038B:                  103 ;
038B:18                104          CLC
038C:90 02             105          BCC  PRINT
038E:F0 A5             106 STEP     BEQ  NEXT
0390:AD 00 02          107 PRINT    LDA  $200
0393:69 B0             108          ADC  #$B0
0395:20 ED FD          109          JSR  $FDED
0398:AD 01 02          110          LDA  $201
039B:AE 02 02          111          LDX  $202
039E:20 41 F9          112          JSR  $F941
03A1:20 57 DB          113          JSR  $DB57
03A4:A9 AD             114          LDA  #$AD
03A6:20 ED FD          115          JSR  $FDED
03A9:20 57 DB          116          JSR  $DB57
03AC:38                117          SEC
03AD:A5 06             118          LDA  $06
03AF:65 1B             119          ADC  $1B
03B1:85 19             120          STA  $19
03B3:A5 07             121          LDA  $07
03B5:69 00             122          ADC  #$00
03B7:85 1A             123          STA  $1A
03B9:A0 00             124          LDY  #$00
03BB:B1 19             125 TEXT     LDA  ($19),Y
03BD:F0 08             126          BEQ  LINE
03BF:09 B0             127          ORA  #$B0
03C1:20 ED FD          128          JSR  $FDED
03C4:C8                129          INY
03C5:D0 F4             130          BNE  TEXT
03C7:A6 FC             131 LINE     LDX  $FC
03C9:20 FB DA          132 LINESP   JSR  $DAFB
03CC:CA                133          DEX
03CD:D0 FA             134          BNE  LINESP
03CF:F0 BD             135          BEQ  STEP

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

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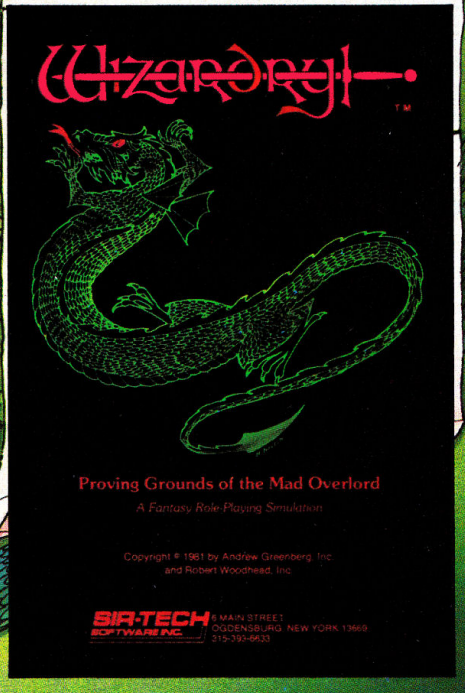
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A Quick Renumber Fix

by Mark J. Yannone

Apple's Renumber program can sometimes produce the unexpected. Although it does what it is supposed to do—renumber the lines of your program according to your instructions—it can cause difficulties if corrections are not made to the program.

Problems appear if your program contains mathematics that involve multiplying by constants. If the integer part of a constant that appears immediately to the right of an asterisk is the same in value as an "old" line number, then the constant is changed when the line number is changed.

For example, this is what a program listing would look like before and after being renumbered with the faulty program:

BEFORE

```
 3 PRINT "This is a test."
13 REM Here is the multiplication.
40 A = CD * 13
45 PRINT A
```

(The constant is the same as an "old" line number.)

AFTER

```
10 PRINT "This is a test."
20 REM Here is the multiplication.
30 A = CD * 20
40 PRINT A
```

(The 13 became a 20.)

One (unacceptable) solution to the problem is to put the fickle constant inside parentheses—A = CD*(13). Fortunately, there is a permanent solution.

Here it is, courtesy of Apple Computer Inc. After booting a copy of System Master (which contains the Renumber program), just type:

```
LOAD RENUMBER
POKE 4789, 172 (RETURN)
POKE 4790, 171 (RETURN)
UNLOCK RENUMBER
SAVE RENUMBER
LOCK RENUMBER
```

Good luck! ■

Mark J. Yannone is a college student majoring in business. When he's not studying he likes to write, program his Apple II, garden and bike. His address is 2202 N. Laurel Ave., Phoenix, AZ 85007.

Move It!

by Marc Baime

What did you say? You can't remember the length of the binary file you saved last week and you need to load it and transfer it to a new disk. I've got just the program to help you.

Its name is Binary Transfer Utility or BTU, for short. This relatively simple program prompts you for the name of the binary file you would like to transfer. You enter the file name and press return. The program loads your binary file and displays the location and length of your file in decimal format. The program then prompts you for a new file name. Once you have entered the new name and pressed return, it saves your file under the new name.

Program Line Explanations

- 50–170 prints out a short explanation of what the program does.
- 190 waits for a key press before continuing.
- 200 clears the screen.
- 210–220 prompts you for your binary file name.
- 225 checks to make sure you entered something and sends you back to line 210 if you have not.
- 230 causes your Apple II to monitor input and output.
- 240 loads your file.
- 250–267 determines the length and location of the file that was just loaded. Your Apple II helps to do this in the following manner. When you BLOAD a binary file into your Apple II, the *address* that the file is loaded into is placed in decimal location 43635 (high byte) and decimal location 43634 (low byte). The Apple II stores the *length* of your file in decimal location 43617 (high byte) and decimal location 43616 (low byte). 250 gets (by using the Peek command) the decimal high byte value (H1) and the decimal low byte value (L1) of the file location. 260 multiplies the high byte value by 256 to get the actual decimal value of the

Marc Baime works as a programmer/analyst. In addition to computing on his Apple II he enjoys tennis, movies and good friends. Write to him at 52-08 Fox Run Drive, Plainsboro, NJ 08536.

```
0  REM  BINARY TRANSFER UTILITY
10  REM  WRITTEN BY MARC BAIME
20  REM  52-08 FOX RUN DRIVE
30  REM  PLAINSBORO,NEW JERSEY
40  REM                 08536
45  HOME
50  PRINT "THIS IS A UTILITY THAT WILL TRANSFER A"
60  PRINT "BINARY FILE FROM ONE DISK TO ANOTHER."
70  PRINT "IT WILL TELL YOU THE BLOADED LOCATION"
75  PRINT "OF THE FILE AND THE LENGTH OF THE FILE."
77  PRINT "**************************************"
80  PRINT "AFTER THE FILE HAS BEEN LOADED THE PRO-"
90  PRINT "GRAM WILL ASK FOR A NEW FILE NAME AND"
100  PRINT "AFTER YOU ENTER THE NEW NAME, THE FILE"
110  PRINT "WILL BE SAVED UNDER THAT NEW NAME."
120  PRINT "**************************************"
130  PRINT
140  PRINT
150  PRINT
160  INVERSE : PRINT "TO CONTINUE PRESS ANY KEY!"
170  NORMAL
190  GET CO$
200  HOME
210  PRINT "PLEASE ENTER THE NAME OF THE FILE THAT"
220  INPUT "YOU WOULD LIKE TO TRANSFER. ";FILE$
225  IF  LEN (FILE$) = 0 THEN  GOTO 210
230  PRINT  CHR$ (4);"MON C,I,O"
240  PRINT  CHR$ (4);"BLOAD ";FILE$
250 H1 =  PEEK (43635):L1 =  PEEK (43634)
260  LET FLOC = ((H1 * 256) + L1)
265 H2 =  PEEK (43617):L2 =  PEEK (43616)
267  LET LE = ((H2 * 256) + L2)
270  PRINT "FILE ";: FLASH : PRINT FILE$
275  NORMAL
280  PRINT "LOCATED AT DECIMAL LOCATION   ";FLOC
320  PRINT "THE LENGTH OF THE FILE IS "
330  PRINT "DECIMAL     ";LE
340  PRINT
350  PRINT "PLEASE TYPE THE NAME OF THE NEW FILE"
360  PRINT "IN WHICH YOU WOULD LIKE TO SAVE THIS"
370  PRINT "FILE AND PRESS RETURN. IF YOU DON'T"
375  INPUT "WANT TO CONTINUE JUST PRESS RETURN. ";NFILE$
377  IF  LEN (NFILE$) = 0 THEN  PRINT  CHR$ (4);"NOMON C,I,O": HOME : PRINT
     "BYE-BYE!": END
380  PRINT  CHR$ (4);"BSAVE ";NFILE$;",A"FLOC",L"LE
385  PRINT  CHR$ (4);"NOMON C,I,O"
390  PRINT "YOUR BINARY FILE HAS BEEN SAVED UNDER"
400  PRINT " IT'S NEW NAME. "
410  END
```

Listing 1. BTU.

file location high byte, and the decimal value of the low byte is added to it. (Variable FLOC then contains the decimal location of the file.) 265 and 267 perform the same type of operation to obtain the decimal length of the file.

- 270–340 prints out the decimal location and length of the file.
- 350–375 prompts you for a new file name to save the file under. The new file may be stored on the same disk or on a new disk. At this point you could place a new disk in your drive. If you decide that this file is not worth the effort of saving, you can simply press return.
- 377 notes that you have entered no file name; i.e. NFILE$ has a length of zero, and the program is ended.
- 380 BSAVEs your file if you enter a file name.
- 385 shuts off input-output monitoring.
- 390–410 prints out a good-bye message and ends the program.

If you have a 32K Apple or a 16K Apple, lines 250 and 265 in the program will need to be changed. Change the following lines on a 32K machine:

```
250 H1 = PEEK (27251): L1 = PEEK (27250)
265 H2 = PEEK (27233): L2 = PEEK (27232)
```

A 16K Apple will need the following changes:

```
250 H1 = PEEK (10867): L1 = PEEK (10866)
265 H2 = PEEK (10849): L2 = PEEK (10848)
```

Perhaps you can think of some ways to improve the BTU program. I hope you find this utility makes taking a byte out of your Apple much easier. ■

A-(Hex)Hunting We Will Go!

by David Schroeder

Program Listing. Hex-Asc Dump.

```
SOURCE FILE: HEX-ASC
----- NEXT OBJECT FILE NAME IS HEX-ASC.OBJ0
0300:              1          ORG  $300
0300:              2 ;
0300:              3 ;HEX-ASC DUMP
0300:              4 ;
0300:              5 ;      BY
0300:              6 ;
0300:              7 ;DAVID SCHROEDER
0300:              8 ;
0300:              9 ;
0300:             10 ;THIS PROGRAM WILL ALLOW
```

Listing continued.

Welcome to the Apple Island Monitor Safari! Today's challenging hunt involves hacking our way through a jungle of numbers to find an elusive DOS command table. Ready. Set. Go!

Dave Schroeder works as a systems engineer. His non-professional interests include music, electronics, math puzzles and numbers. Address correspondence to him at Williamstowne Court, Apt. 6, Cheektowaga, NY 14227.

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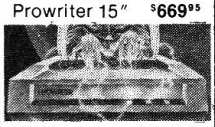
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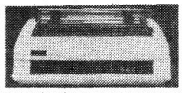
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Listing continued.

```
0300:                  11 ;THE USER TO SEE BOTH THE
0300:                  12 ;HEX AND ASCII REPRESENT-
0300:                  13 ;ATIONS OF CORE IN 8 BYTE
0300:                  14 ;CHUCKS. WHEN 'BRUN' IT
0300:                  15 ;SETS UP THE CTRL-Y FEATURE
0300:                  16 ;OF THE MONITOR. THE PROGRAM
0300:                  17 ;IS RELOCATABLE AND REQUIRES
0300:                  18 ;ONLY 166 BYTES OF MEMORY.
0300:                  19 ;
003C:                  20 A1L      EQU  $3C
003D:                  21 A1H      EQU  $3D
003E:                  22 A2L      EQU  $3E
003F:                  23 A2H      EQU  $3F
0060:                  24 T1L      EQU  $60
0061:                  25 T1H      EQU  $61
0062:                  26 T2L      EQU  $62
0063:                  27 T2H      EQU  $63
FDED:                  28 COUT     EQU  $FDED
F94C:                  29 PRBL3    EQU  $F94C
FDA3:                  30 XAM8     EQU  $FDA3
03F8:                  31 CTL.Y    EQU  $03F8
03F9:                  32 VECTLO   EQU  $03F9
03FA:                  33 VECTHI   EQU  $03FA
C000:                  34 KEYBRD   EQU  $C000
C010:                  35 KYSTRB   EQU  $C010
0300:                  36 ;
0300:                  37 ;SET UP THE JUMP FOR THE
0300:                  38 ;CTRL-Y. IF YOU SET UP
0300:                  39 ;A1 AND A2 THEN YOU CAN
0300:                  40 ;JUMP TO THE REAL START
0300:                  41 ;
0300:A9 4C             42          LDA  #$4C
0302:8D F8 03          43          STA  CTL.Y
0305:A9 60             44          LDA  #$60
0307:85 06             45          STA  $06
0309:20 06 00          46          JSR  $0006
030C:BA                47          TSX
030D:CA                48          DEX
030E:86 06             49          STX  $06
0310:A0 01             50          LDY  #$01
0312:84 07             51          STY  $07
0314:A0 00             52          LDY  #$00
0316:B1 06             53          LDA  ($06),Y
0318:AA                54          TAX
0319:C8                55          INY
031A:B1 06             56          LDA  ($06),Y
031C:8D FA 03          57          STA  VECTHI
031F:8A                58          TXA
0320:18                59          CLC
0321:69 21             60          ADC  #$21
0323:8D F9 03          61          STA  VECTLO
0326:90 03             62          BCC  RETURN
0328:EE FA 03          63          INC  VECTHI
032B:60                64 RETURN   RTS
032C:                  65 ;
032C:                  66 ;SAVE ADDRESSES FROM
032C:                  67 ;THE CTRL-Y
032C:                  68 ;
032C:                  69 ;REAL PROGRAM STARTS HERE
032C:                  70 ;
032C:A5 3E             71          LDA  A2L
032E:85 62             72          STA  T2L
0330:A5 3F             73          LDA  A2H
0332:85 63             74          STA  T2H
0334:A5 3D             75          LDA  A1H
0336:85 61             76          STA  T1H
```

Listing continued.

Well, if you're like me, hex digits start looking the same after the first hundred scroll by on the screen.

Instead of hand-scanning the cells for a keyword, a small program could be written to search memory for it. I, however, adopted the approach of extending the monitor display to include not only the hexadecimal value of each location, but also its ASCII equivalent. Nonprintables and control codes are displayed as periods.

I chose this approach because it lends itself easily to application in other projects, such as manual repair

Listing continued.

```
0338:A5 3C      77          LDA  A1L       ;MAKE LOW BYTE A
033A:29 F8      78          AND  #$F8      ;0 OR AN 8
033C:85 60      79          STA  T1L
033E:A5 60      80 LOOP     LDA  T1L
0340:85 3C      81          STA  A1L
0342:A5 61      82          LDA  T1H
0344:85 3D      83          STA  A1H
0346:20 A3 FD   84          JSR  XAMB
0349:           85 ;
0349:           86 ;AFTER DISPLAYING THE
0349:           87 ;8 LOCATIONS TAB TO
0349:           88 ;COLUMN 30 FOR ASCII
0349:           89 ;
0349:A9 1D      90          LDA  #$1D
034B:85 24      91          STA  $24
034D:A9 BA      92          LDA  #$BA
034F:A2 02      93          LDX  #02       ;PRINT A COLON
0351:20 4C F9   94          JSR  PRBL3     ;AND A SPACE
0354:A0 00      95          LDY  #00
0356:B1 60      96 DISP     LDA  (T1L),Y
0358:10 0A      97          BPL  PRINT
035A:29 60      98          AND  #$60
035C:D0 04      99          BNE  GETCH
035E:A9 AE     100          LDA  #$AE
0360:D0 02     101          BNE  PRINT
0362:B1 60     102 GETCH    LDA  (T1L),Y
0364:20 ED FD  103 PRINT    JSR  COUT      ;PRINT OUT ASCII
0367:C8        104          INY
0368:98        105          TYA
0369:C9 08     106          CMP  #08
036B:D0 E9     107          BNE  DISP
036D:          108 ;
036D:          109 ;
036D:          110 ;HERE WE CHECK FOR A KEY
036D:          111 ;PRESSED.  IF ITS A CTRL-S
036D:          112 ;DON'T READ IT. IF IT'S A
036D:          113 ;CTRL-C THEN ABORT. ALL
036D:          114 ;OTHERS FAIL.
036D:          115 ;
036D:          116 ;
036D:AD 00 C0  117          LDA  KEYBRD
0370:C9 93     118          CMP  #$93      ;A CTRL-S
0372:F0 07     119          BEQ  CONTIN
0374:C9 83     120          CMP  #$83      ;A CRTL-C
0376:8D 10 C0  121          STA  KYSTRB
0379:F0 1C     122          BEQ  DONE
037B:EA        123 CONTIN   NOP
037C:          124 ;
037C:          125 ;INCREMENT LINE POINTER
037C:          126 ;UP BY 8 MEMORY LOCATIONS
037C:          127 ;
037C:18        128          CLC
037D:A9 08     129          LDA  #08
037F:65 60     130          ADC  T1L
0381:85 60     131          STA  T1L
0383:90 0A     132          BCC  LPCHK
0385:18        133          CLC
0386:A5 61     134          LDA  T1H
0388:69 01     135          ADC  #01
038A:85 61     136          STA  T1H
038C:90 01     137          BCC  LPCHK
038E:60        138          RTS
038F:          139 ;
038F:          140 ;CHECK TO SEE IF WE
038F:          141 ;ARE FINISHED YET
038F:          142 ;
038F:A5 63     143 LPCHK    LDA  T2H
0391:C5 61     144          CMP  T1H
0393:F0 03     145          BEQ  LPCK2
0395:B0 0C     146          BCS  LOOP1
0397:60        147 DONE     RTS
0398:18        148 LPCK2    CLC
0399:A5 62     149          LDA  T2L
039B:09 07     150          ORA  #07
039D:C5 60     151          CMP  T1L
039F:F0 02     152          BEQ  LOOP1
03A1:90 F4     153          BCC  DONE
03A3:18        154 LOOP1    CLC
03A4:90 98     155          BCC  LOOP

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

of Basic programs that have crashed without backup. After setting it up using the BRun command, it lies dormant until I am ready to use it.

The program, dubbed HEX-ASC, is written in machine code and is completely relocatable. It is very small and requires only 165 bytes of memory to operate.

When the program is BRun, it sets up the control-Y vector. Then, after entering the monitor (CALL-151), you use it by employing the monitor's control-Y feature. The following example shows how to get the mixed display for the memory range $300 through $380.

]CALL – 151
*300.380[CTRL-Y][RETURN]

If you want to stall the scrolling to avoid long unwanted memory scans, use control-S, and then any key, except control-C, to start it again. In this way you can abort the listing at any time.

The most important feature of the code is its relocatability. Lines 44–64 are the key to this feature, as they calculate and store the address of the start of the routine in VECTHI and VECTLO, which in this case is the monitor control-Y jump vector. This routine puts a return in the zero page, jumps to it, and picks off the address of the next executable opcode (minus 1) from the stack.

Lines 71–84 set up the monitor call to print out the hex values of the first eight locations. The ASCII section is printed out by lines 90–107. The keyboard is monitored in lines 117–123, and the rest handles looping and exiting conditions.

By the way, if you want to find the DOS command tables, try the following commands from the monitor.

*6880.6908[CTRL – Y][RETURN]
(32K Apple II+)

*A880.A908[CTRL – Y][RETURN]
(48K Apple II+)

I am sure you will find this program useful as you dig through your Apple's memory. I would be interested in hearing from other users how they have used this routine or developed other patches to the monitor. Happy Hunting! ■

The Cosmic Balance

Are you tired of shoot 'em up, fast-action arcade games? Are you ready for a game that requires some real thinking and planning? Cosmic Balance places you completely in charge of a single ship or fleet of space ships; as a matter of fact, you design each ship from the ground up. In this way, every game can be different.

Cosmic Balance offers the option of two-player or solitaire modes. In the latter, your Apple takes charge of the opposing ship or fleet. At the start of each game, you may select one of six possible scenarios, each with a different mission and type or number of opponents. The first, Deepspace Encounter, pits your ship, the Enterprise, against the starship Reliant. This is probably the best scenario to start with because both ships have been created for you.

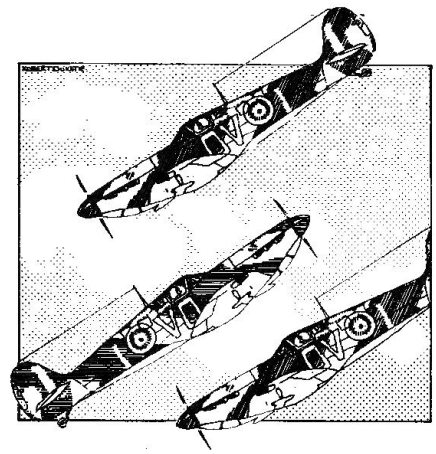
All other scenarios have three phases you must perform. In the setup phase, you must either design your ship(s) or select previously saved ones from the disk. After indicating the technological level of your ships (i.e., how advanced the weaponry is) and selecting the size of each, you must outfit them with engines, protective armor, marines, etc. Finally, you install weapons around the perimeter of each ship and indicate the specific 45-degree arcs or angles that each will cover.

The amount of each option you select depends primarily on the space you have left in the ship. Once this space has been exhausted, you may reduce any of your previous allocations in order to build up other neglected areas of the ship. Building an effective, battle-worthy ship will require some practice. (The program does show an efficiency rating while you are designing each ship, and that helps.)

Once all ships have been designed or selected from the disk, play begins. The remainder of the action is divided into the orders and the execution phases. In the orders phase, you issue commands that will be carried out for the next 16 seconds. You may change your ship's course and speed, recharge depleted shields, launch fighters, charge and fire weapons, or learn about the course of your opponent(s).

Weapons may be set to fire in three ways: when the target is within a specified range, when a particular second of the turn is reached (1–16), or at the last instant—the optimal distance within the weapon's arc of fire. The target for each weapon must also be indicated.

This process must be completed for each ship in the fleet. When you are through, the execution phase commences. You indicate which ship will be centered in the screen and the scale (0–5) of the map on which the action will be displayed. The turn is shown on the hi-res screen, and as each weapon is fired, the execution pauses and you are told whether your ship hit its target and how much damage it caused. At the end of the turn, you re-enter the orders phase



again and play continues.

The game ends when one of the players is destroyed, one escapes the battle space, or the time limit is reached. At the end of each game, points for each side are awarded according to performance, and you are allowed to examine any of the surviving ships. If you wish, Cosmic Balance also lets you save games in progress at any time.

Cosmic Balance offers an amazing degree of control over the ships. Effective control requires several careful readings of the manual and a great deal of practice. This is not the sort of game you simply pop into the drive and play, nor is it one that is easily mastered. In the solitaire mode, your Apple is a formidable opponent. I was only able to defeat it once or twice in the first six games. You should expect to take at least an hour to complete even the simplest scenario, a one-on-one encounter. This is due to the complexity of both the setup and orders phases. Estimated time for play in the two-person mode should probably be doubled.

A helpful hint: Be *sure* to record your weapon placements before leaving the setup/design phase. If you don't know where your weapons are placed and what arc of fire each covers, you won't hit a thing.

It would have been helpful if the manual had provided a brief description of the ships supplied on the disk. Since all scenarios (except Deepspace Encounter) require you to design the enemy fleet, information on which ships fit which scenario is essential.

If you enjoy thinking games that require skills other than good eye/hand coordination, you will probably like this one. Cosmic Balance is distributed by Strategic Simulations Inc., 465 Fairchild Drive, Suite 108, Mountain View, CA 94043. It is available for the Apple II Plus, Apple III, or Apple II with Applesoft ROM card, and requires 48K and a single disk drive. ■

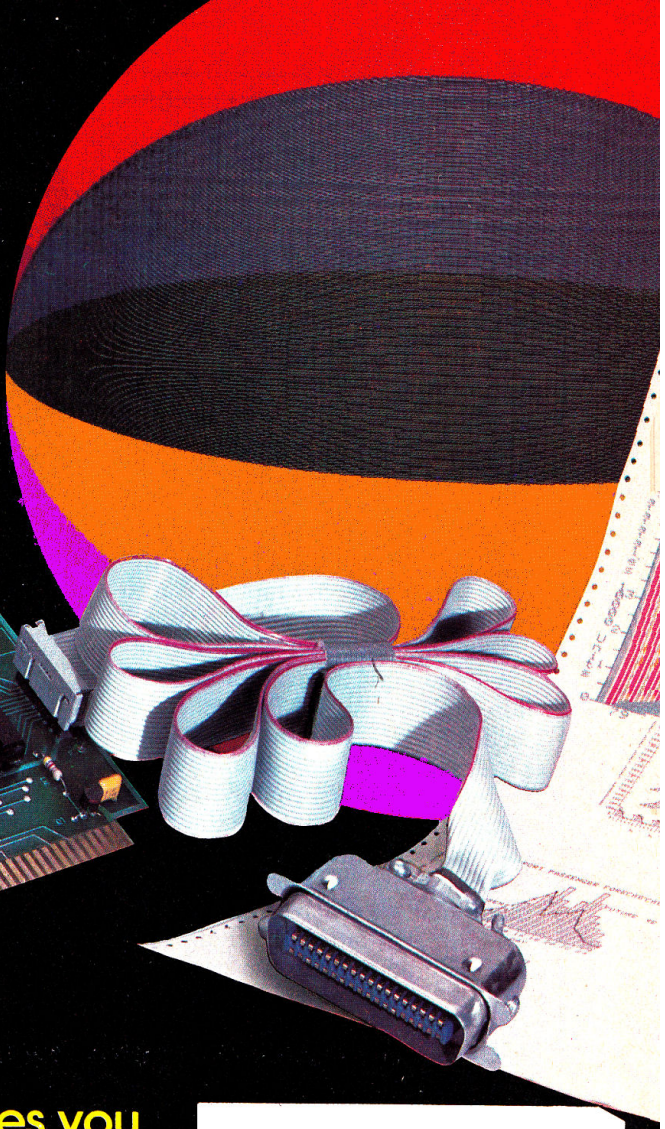
Dr. Steven Schwartz
Pittsburgh, PA

Spitfire Simulator

As a child of 12 I sent away a cereal boxtop for a toy cardboard cockpit. Thus began a lifelong fascination with the world of flight simulators. Personal computers have increased my interest. Bruce Artwick's 1980 program, (A2–FS1) Flight Simulator, was the beginning of my keyboard adventures in computer flight. Next came an ad in a trade magazine for a color Space Shuttle Landing Simulator from Harvey's Space Ship Repair in New Mexico. I was one of the first to attempt landing the Co-

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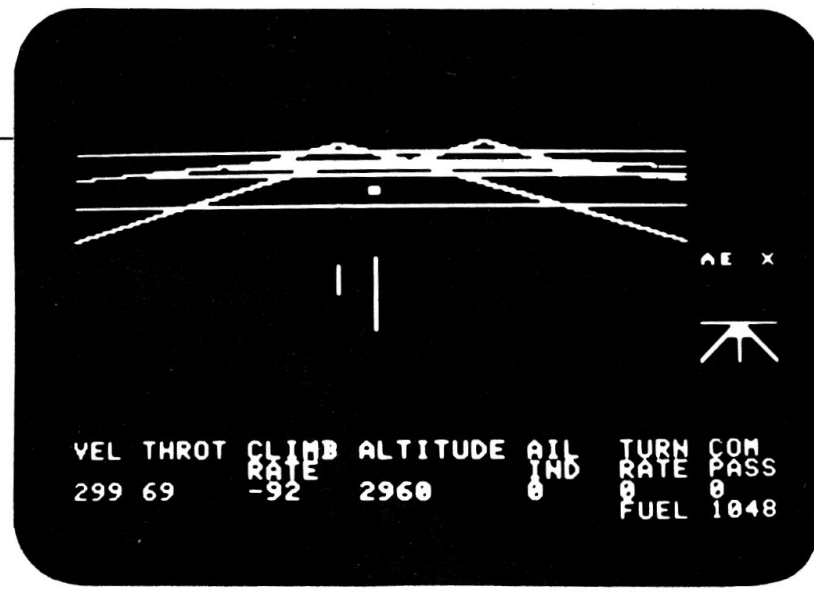


Figure 1. Spitfire Simulator landing scene.

lumbia on that narrow desert strip, but the graphics animation was slow.

In 1981, when Ted Kurtz, president of Mind Systems Corporation, introduced his Airsim-1 program, I quickly became a computer ace at aerobatics and spent countless hours in my video cockpit learning to land at six airports. The self-centering joystick actually kept the slow plane flying a true course. My rapture was so complete that I drew an artist's chart of the New England coast and offered it to Mind Systems for distribution to fellow Airsim-1 pilots. In return for my efforts they sent me a preliminary disk of Spitfire Simulator for testing. I am not employed by the company, but remain an enthusiastic user of their simulation products.

The Spitfire was a fast, nimble plane that earned respect from her pilots in the Battle of Britain. Ted Kurtz's product will also gain your respect. However, before you grab the joystick and fly, take the time to read the entire documentation. Complete flying lessons are included.

After booting the disk, you need to adjust your joystick and all trim controls to their center position. The screen bursts to life with a monochrome, out-the-window view of an aerodrome in southeast England. To the left is the headquarters building and radio tower. The runway center stripe is barely visible at this worm's-eye view. Below the window are easily understood digital instruments and an artificial horizon indicator for rapid aid in visualizing your altitude in relation to the horizon. High sensitivity can be selected for the aileron and elevator, or coupled together (X) for steady flying.

Simple one-key inputs select the flying modes. R enables the versatile radar that can be enlarged or reduced as a navigation aid, L levels the plane for a safe landing, and F lowers the flaps to decrease your landing speed. The gunsight, brakes, and throttle as well are all triggered by single key strokes. Why can't all programs be as simple and functional?

Control-T is the magic button that transports your plane to any x, y, z coordinate on the grid. The z coordinate gives you a choice of altitude. This feature saves face and gasoline when you wander too far from home.

But, the fun part of Spitfire Simulation is in the flying. You're in another time, another place, as you peer out your narrow canopy window at the scene ahead. With full throttle activated and 1280 units of fuel, pull back gently on the stick and at 180 mph your plane pierces the air, the runway an arrow pointing you on your way. Hit the 1 key and the flat landscape becomes a 3-D perspective grid with two mountain peaks looming in the distance. With new-won confidence you do a 180° roll towards the training field dead ahead. Careful now—resist the desire to land. You need more flight time to learn the controls. Later on you can use practice landings, without having to worry about turns or leveling the wings.

Try an inside loop after gaining altitude. The Spitfire is sluggish on the climb, but very fast diving out. For added fun turn and buzz the aerodrome radio tower, and watch it whiz by in fast machine code animation.

The ultimate thrill is your first landing. At 3000 feet switch on R, radar, for a birds-eye-view of the approach. If you're pleased with your progress, key back the scene, S, and hit O for a detailed picture of the runway (Figure 1). Hitting the L key levels the wings. Now, cut back your throttle and check the climb rate angle for a smooth descent. This is the time when the speedy (360 mph) Spitfire is almost too fast. Take a needed breather with pause, control-P, key, then continue landing with control-C. Lower the flaps, F, as you approach the runway and get ready to decrease throttle speed. Check your approach angle with G, the gunsight's cross hairs. At 300 feet pull back for a perfect flare landing, throttle to O and apply brakes, the period key, for a smooth stop in the middle of the runway. Whew!

Landing with Spitfire Simulator is very much like the real thing. It takes lots and lots of practice. My first touchdown ended in an ego-shattering noise and a screen that went crazy. If your landing speed is too fast or angle too steep a crash lies ahead.

Eventually, with diligent practice, you become master of your computer cockpit and can tackle something really challenging. How about loading scene 2 of the Airsim-1 disk and trying to land your hot Spitfire on Martha's Vineyard? All the scenes from Mind Systems' early Airsim-1 Flight Simulator can be used with the Spitfire plane.

If landing a speedy fighter plane on a postage stamp field isn't enough of a challenge, advance into the three-dimensional world of pursuing enemy targets built into the Spitfire program. Begin the battle by letting the computer choose your opponent, or, if you prefer, select one of eight targets by keying your choice in. To

conserve computer memory for the targets, a simple horizon replaces the grid during the battle. The tracer guns (wing cannon) are activated with either paddle or joystick buttons. Tease the enemy by flying around his stick-figure 3-D fuselage before engaging him in combat. Score a hit and the enemy becomes a sticker on your video scoreboard. You have the advantage, as the enemy never shoots back. If you score a number of kills and still find your way back to the base with enough fuel for a safe landing, you're rewarded with a bonus score. With empty tanks you cannot use the control-T, transport, feature to magically return to the aerodome, for the Spitfire then handles like a winged bomb, making a landing impossible.

This type of program is relaxing at the same time as it teaches about flying. I find satisfaction in learning to set a course from Boston to New York and then maneuvering through a fuel-saving flight and a safe landing. Testing greater speeds and heights makes this program very rewarding.

The joystick handles nicely as long as you don't make rapid jerky moves. A self-centering joystick is a real necessity.

I wish there were more graphical landmarks and ground features, but I realize this takes memory. Maybe a 64K or 128K version could be offered.

The manual is well written and follows a natural scheme of events. Once you learn the simple key controls they become automatic. The hardest skill to learn is controlling your plane during landing. There isn't a shortcut; you have to hang in there and practice. The simplified graphics cut down on the realism, but, when the "ground" rushes up to meet you at 300 mph and you are working feverishly to do the right things, you forget that this is make-believe. I have run this program for many months and have yet to become bored.

Recently I watched a color flight simulator on an IBM computer and was caught drooling on the merchant's machine. But, with the experiences packed into the Mind Systems package, I have enough to keep my interest going until Ted figures a way to put color into his programs. Spitfire Simulator surely beats that static cereal box cardboard cutout. My interest in flying has been honed and refreshed, all without costing me megabucks or accidents.

Simulators are lots of fun. . . I hope they keep coming. Happy landings!

Spitfire Simulator is available from Mind Systems Corporation, PO Box 506, Northampton, MA 01061. The price is $40. It requires an Apple II or II Plus with 48K of RAM, DOS 3.3, one disk drive, Applesoft in RAM or ROM, and game paddles or joystick. A modified version of Spitfire Simulator that will run on the Apple IIe is available after February 14, 1983. ■

Philip H. Rapp
San Diego, CA

Know Your Apple

Muse Software has recently introduced a program intended to provide beginning level information for the novice Apple II user. Don't look for programming hints or application data in this package; as a matter of fact, a portion of the manual shows how to unpack and connect the computer, disk drive and monitor.

When the disk is booted (by following the instructions given in the manual), the title page appears. Press any key and a five item menu is displayed alongside a high-resolution drawing of the Apple II, Disk II and monitor. An arrow-shaped selector appears to the left of the menu and is used to designate the item desired. The selector is moved by pressing the spacebar. Once the desired selection is made, press return and the lesson begins.

From within a lesson, you may press return to proceed to the next frame, "–" to review previous frames, or control-C to interrupt the lesson and display the menu. At the end of each lesson, press R to repeat the lesson or M to display the menu. Five lessons are available:

- The Monitor lesson discusses the ability of the monitor to display words, shapes, and data. Areas covered include prompts, the cursor, text display, and low and high resolution graphics. The graphics demonstrations show the colors available and display an animated truck running into a tree. The difference in modes is readily apparent, since the same animated sequence is used for both. Finally, the lesson switches back and forth between the two graphics modes to reinforce their difference.
- The Disk drive lesson displays a high resolution graphics picture of a drive and disk, then discusses disks and their various parts. An interesting drawing that shows the relative size of fingerprints, dust specks and human hair is included in the cautions for handling disks. Another set of drawings demonstrates how data is stored on disks and illustrates the concepts of track and sector. DOS and proper handling of the disk drive are also discussed.
- Back Of The Apple is a short lesson that describes the location and function of the various connectors and switches located on the back of the Apple.
- Inside The Apple discusses chips, slots, power supply and the input/output port. An enlarged diagram of the motherboard then appears on the screen and the text is displayed in a box on the upper left of the screen. This section of the lesson describes the video out, auxiliary video, cassette I/O, lowercase adapter area, and the speaker.
- Keyboard is a high-resolution graphics lesson that demonstrates the functions of various keys. I was particularly happy to see zero and O discussed, since that is an area of confusion for many new Apple owners.

Know Your Apple is an interesting method of learning more about the Apple II computer. Operationally, the program is simple and effective. One problem, however, is the difficulty in exiting the program. None of the menu choices provide a way out.

Know Your Apple is billed as a program that helps the new Apple owner become acquainted with his/her computer. And it does an excellent job of presenting valuable material for the newcomer. Both the

manual and the program make the new guy on the block feel at home. I wish this program had been available when I purchased my Apple computer. Know Your Apple is published by Muse Software, 347 N. Charles St., Baltimore, MD 21201 and sells for $34.95. ■

Leslie R. Schmeltz
Bettendorf, IA

Sargon II

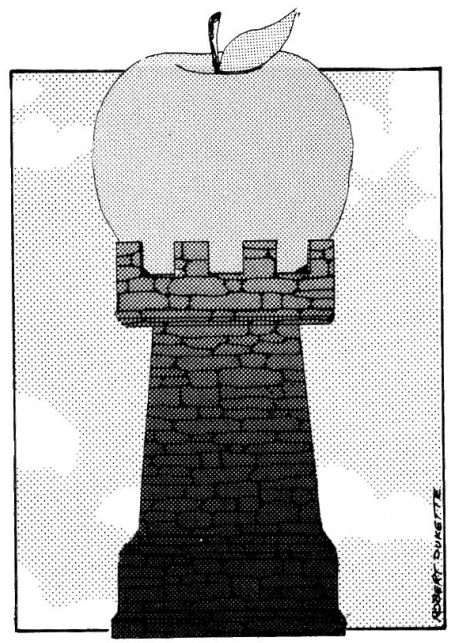
It's hard to be humble, but believe me, I found a way. I dropped down to my local Apple dealer the other day and bought Sargon II, the latest computer chess program from Hayden Software. It can play at seven levels (0–6) of expertise—well, I played it at level 1 and got creamed. So far, I've played it about 15 times and have beaten it twice. Sometimes it's a little difficult to believe in human superiority. We are superior, aren't we?

Why buy a chess playing program? For one thing, you get an always willing opponent. The only other person I ever get to play chess with is my son. Trying to work around homework, Boy Scouts, and other pursuits, we're lucky to get in a game a week. Secondly, you get an opponent that (I almost said "who") plays well enough to challenge your skills and help you to improve them. For my son, it has already begun to improve his game.

To use Sargon II you need at least a 24K Apple II with monitor, and a disk drive or cassette recorder. It is available for the Apple on tape or disk. The program appears to be completely compatible with the Apple IIe. A friend of mine has one and I've played (and lost) on it using my copy of Sargon II. Having lived through some upward compatibility nightmares with mainframes, I truly appreciate Apple's concern in this area. There are also versions for other computers. Since I haven't tried the tape version, I'll be referring here to the disk version exclusively.

When you boot the Sargon disk, you are presented with a choice of New Game, Change Board or Exit. Exit is obvious. Change Board allows you to set up a situation which I'll discuss later. After choosing New Game, you indicate whether you elect to play black or white and the level of play (0 to 6) in increasing order of expertise.

Level 0 is for beginners, and the program does not look ahead at all, only considering its own best countermove. Each higher level is characterized by the minimum number of "half moves" the program considers before deciding on its countermove; for example, at level 1 it considers three: its move, your response and its response. This is a minimum, and



Sargon II will look deeper, especially in the end game when there are fewer initial moves to consider.

The documentation does not give minimum half moves for the other levels. It does estimate average time for a move at each level, ranging from 20 seconds at level 1 to 4 hours at level 6. It also says that a single move can take anywhere from ⅓ to three times as long. That's right, 12 hours! I wonder what one does between moves at level 6. Wash the car? Panel the living room?

During play you have two screens available, between which you can flip by using the escape key. One screen displays a list of your and the program's moves and the other displays the board. Moves are entered in algebraic chess notation where files are lettered A–H and ranks are numbered 1–8, as shown in Figure 1.

The manual really didn't make clear to me that you can play the entire game with the board displayed. For me, at least, this is the best way to play since it emulates a traditional chess game. I indicate my move, the piece moves, Sargon II's piece moves, etc. The list of moves isn't of great interest except as an occasional reference; it would be nice as a printed listing to record past games.

Two useful playing features are control-R, to take back a move, and control-K, to allow Sargon II to assess your situation and advise a move. If you want to set up a situation or simply take back a move, you have that option with control-R. You must do this from the Move List screen, however; the manual clearly warns that you will get knocked off and have to reboot the disk if you try it from the board.

To set up, you use indicated keys to access any square on the board, empty it, leave it as is, or fill it with any piece. To ensure proper castling, you also must indicate whether the piece has ever moved. You then indicate approximate move number, color and level of play.

Sargon II is a good chess playing program. I consider it well designed, with many good features. I have two minor complaints about the documentation and two suggestions for enhancements.

The manual left me with the impression that it was preferable or even necessary to enter moves from the Move List screen. It says, "You can enter a move with the board displayed, but the listing of that move will not appear unless you flip." I had played several times and was somewhat irritated at the artificial, unchesslike bother of flipping to the other screen to enter my move and then back to the board each time. I was pleasantly surprised when I accidentally entered my move while the board was displayed and

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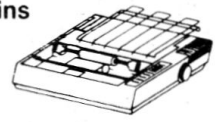
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saw the piece move. Once you know that, it seems more like real chess. I love surprises, especially pleasant ones, but the manual ought to have made this clear.

Also, the manual doesn't tell exactly how to castle on the queen side. The writer apparently thought it obvious that, since king side castle is done by entering E1,G1, then queen side would be E1,C1. It wasn't obvious to me, however, and I'd have appreciated having the manual tell me. I tried several ways to castle queen side before I stumbled upon the correct way.

I suppose no one writes a program but what someone wants to suggest improvements. I'd like two on this one, and I wrote to the publisher suggesting them. To date I haven't heard anything, but it really hasn't been very long.

If you have to stop a game part way through, it would be useful to be able to save the game "as is" on disk to pick up later. As it is, you can note the positions manually and set up the game as described above. It would be more convenient to save it. I suppose the manufacturer would face some security problems, but I can't imagine they'd be very difficult to solve. After all, it need only be a data file to tell Sargon II where to pick up the game.

Also, I'd like the ability to print out the moves of a game so I could archive games for future reference and analysis. This may not be important to all chess players, but many do like to record games, and it seems unusual to have to do it manually when you're playing against a computer.

Even without these enhancements, it seems to me that Sargon II was well worth my $34.95, and that anyone who enjoys chess will find it a worthwhile addition to the things they can do with their Apple. ■

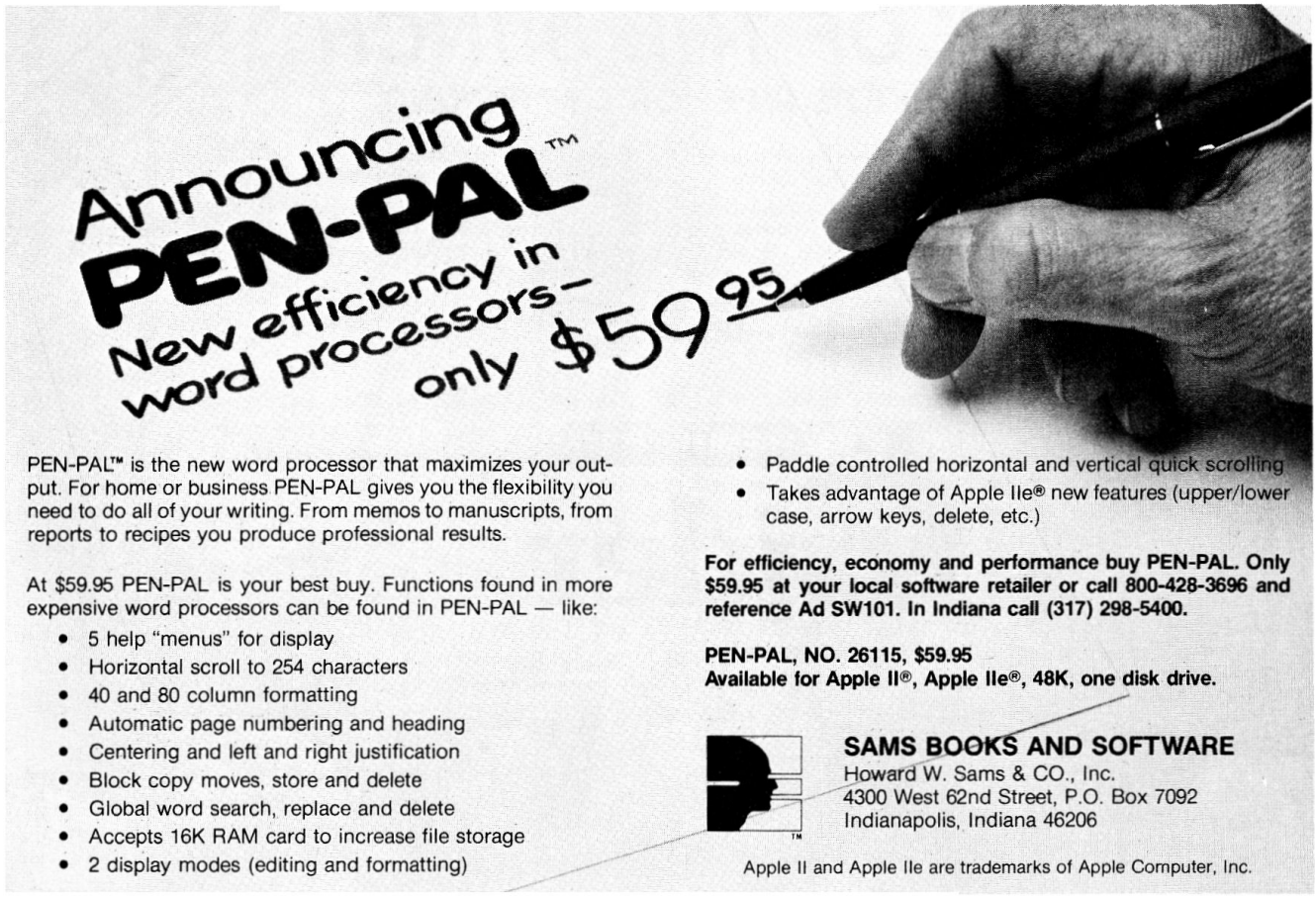
Ronald W. DelPorto
Erie, PA

Wargle

Wolves! Nasty, snarling, dangerous creatures, or so Hayden Software would have us believe. Wargle, the new arcade game from Hayden (600 Suffolk St., Lowell, MA 07662), abruptly introduces the gamer to an entire pack of these fearsome critters. Nine of them to be exact, each with but one desire—to consume you.

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in their hunt for you.

Quite a task at hand. Either you kill them, or they kill you.

To aid in your evasion and annihilation of the wolves you have what is called a wargle. On screen, this is a rather thick-looking arrow. Anything else on screen is a wolf—or an even deadlier canine, a werewolf. Your wargle can fire missiles at the wolves. This capability is heartening, especially when you learn that these missiles may be fired from either the front or back of your wargle. However, only one missile may be in flight at a time, so don't depend on rapid-fire—there isn't any.

After booting the disk, you're offered a main menu. Here you're informed as to the current level in play. Following are four letter categories to select for input: P for play, L to select another level, K for the key definitions you wish to use in the game, and H for recording your high score to disk. You're also told that a bonus wargle is received for every 1000 points accrued.

I'm right-handed, so I found defining the I, J, K and M keys for up, left, right and down movement the most convenient. To fire forwards, I selected the spacebar, and for firing backwards, the return key. Escape became my pause key, and R the keypress for resuming play. The capability of allowing each player the opportunity to redefine these keys is a welcome addition to the game, as the configuration best suited for any player may be used. You are then asked if you wish to make these changes permanent, at which point they are saved to disk if you answer with a Y. Even after your particular key mode has been saved, it can be changed at any time.

Six levels of play are available: Novice, Introductory, Intermediate, Official Wargle, Advanced Wargle and Tournament Wargle. I tried the latter and was totally finished in about six seconds. All five of my wargles became wolf fodder. A great deal of practice at the Novice or Introductory level is recommended before advancing to the higher levels of the game. After selecting your desired level from the main menu, press P to start the game.

The island city is represented by a bordered group of 84 squares. Your wargle begins play in the lower right corner of the screen, with the nine wolves lined up in the center of the city area. Once they start moving toward the lower edge of the screen, it's time for you to develop the finger dexterity needed to stay ahead of the pack, so to speak. Move you must, else your missile firing capability isn't activated. To linger in one spot is also certain death early in the game.

You'll note a rather disturbing occurrence as you play. As you wipe out the wolves, the remaining beasts tend to move faster. And when seven of them have been vaporized, the last two become extremely cunning. After all, they have the same idea in mind as you—to stay alive.

Please watch out for the smaller square representations that move about the city. These are the werewolves. One missile hit is required to turn them into ordinary wolves, at which point a second missile strike is needed to finish them off. No small matter, believe me. They are appropriately agile.

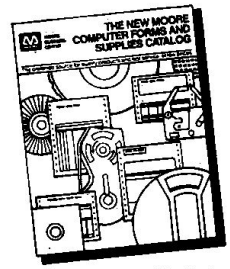
There are seven levels of play, each more difficult than the preceding one. Each level requires a different approach. On some levels, an aggressive attack plan is in order. Other levels require maneuverability. Whichever level you happen to be engaged in, never feel confident that you've figured out a particular wolf's course of action. Many of these beasties will suddenly change their patterns midgame and leave you gasping for help.

A four-page manual accompanies the game disk, with exact instructions

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on how to play Wargle and a small section on revealing hints for higher scores. Wargle is a fine arcade game, compatible with the IIe, and one of Hayden's better attempts in this vein. The price ($34.95) seems a little steep, but I would not want to do without Wargle in my software library. Very enjoyable. ■

Hartley G. Lesser
inCider staff

Academic Skill Builders

Finding quality educational software for the Apple II is a major problem facing parents and educators today. As the Apple II appears in more and more schools, bewildered teachers are scanning catalogs of software and trying to sort out useful materials from ineffective teaching tools. A new math skill-building package from Developmental Learning Materials should make the job easier, at least for primary level teachers.

Academic Skill Builders is a package of six games which combine the excitement of arcade games with basic math drills. Proficiency in primary math skills comes with practice; and of all the primary subjects, mathematics has been the area where practice has traditionally been equated with drudgery. This package of math games turns math drills into sheer pleasure for children.

The first game, Alien Addition, is presented in a format similar to Space Invaders; a gun platform is displayed at the bottom of the high-resolution color graphics screen. Using the arrow keys, the player positions the gun underneath attacking alien flying saucers. Each saucer displays an addition problem, using numbers 0 through 9. To fire the weapon the player must input the correct answer to one of the problems, position the gun underneath the appropriate saucer and hit the space bar.

Boxes at the bottom of the video screen tally the number of hits and misses. If the aliens land a ship at the bottom of the screen, the gun is destroyed, a new gun appears, and the battle continues. After one to five minutes, the display ends and a text screen displays the hit and miss score for the current game as well as low and high game scores. This gives a parent or teacher a chance to monitor progress.

Minus Mission follows a similar format. This time a player's roving gun shoots dripping slimes, each containing a subtraction problem. After choosing the right answer, the player can position the gun and fire. As with the addition game, there is a time limit; and there are opportunities to make periodic progress evaluations.

Addition and subtraction skills are combined in Alligator Mix, the most entertaining game in the set. As the game begins, a lone alligator swims toward the bottom of the video screen, and a number is displayed inside his stomach. As the alligator sits, an apple, containing an addition or subtraction problem, floats in its direction. When the number in its stomach answers the problem correctly, the player hits the space bar, the alligator's mouth opens, and it swallows the apple. If the answer doesn't match the problem, the player can use the space bar to snap the alligator's mouth shut.

The trick to this game is swallowing only the right apples. They come at the alligators quickly, forcing the player to make rapid calculations. Once the first alligator is filled, a second appears, then a third, fourth and a fifth. Each alligator level allows the player less time to decide whether or not the apple contains the right problem for the answer. As with the other games, there is a time limit after which the performance of the player is measured.

Meteor Multiplication and Demolition Division are games that put a little more pressure on the player and present more of a challenge on the eye/hand skill level. In the multiplication game, the player controls a space station, surrounded by eight converging meteors, at the center of the screen. Each meteor contains a multiplication problem using numbers 0 through 9.

Using the number keys to supply the right answer and the arrow keys to turn the gun, the player selects an answer for one of the meteors, points the weapon and hits the space bar to shoot. If a meteor is left undestroyed by a well-aimed right answer, it will destroy the space station.

In Demolition Division the player commands five anti-tank gun emplacements that are protected by stone walls. An enemy tank, containing a division problem, approaches each emplacement. The player must select answers to the problems and position them at the appropriate gun, then hit the space bar to fire—before the tank can fire enough rounds to destroy a gun. As with the other games, the action stops, allowing the player to monitor the number of hits and misses.

Skills are combined again in the sixth and final game, Dragon Mix. A friendly dragon protects a city, and three flying saucers, each containing a multiplication or division problem, attack. The answer to one of the problems is displayed inside the dragon. The player must shoot and destroy the problem whose solution is inside the dragon. If the shot misses, the saucers blast part of the city. Again, the game will pause from time to time to give a player or teacher a chance to check the scores.

Kids, and parents too, found Meteor Multiplication, Demolition Division and Dragon Mix sometimes a bit fast-paced. A parent commented that he and his child found it difficult to destroy all the meteors approaching the space station in Meteor Multiplication. Without this reward, he said, interest waned quickly. Similar observations were made about the other advanced games; but even so, children and parents shared generally favorable impressions.

A comment was made that the games were noisy, but I don't think the sound effects were loud enough to be disruptive in a classroom. The sound effects actually enhance the entertainment value of the games, which, in turn, helps keep the child in front of the screen.

Another issue is whether or not these games make hyperactive stu-

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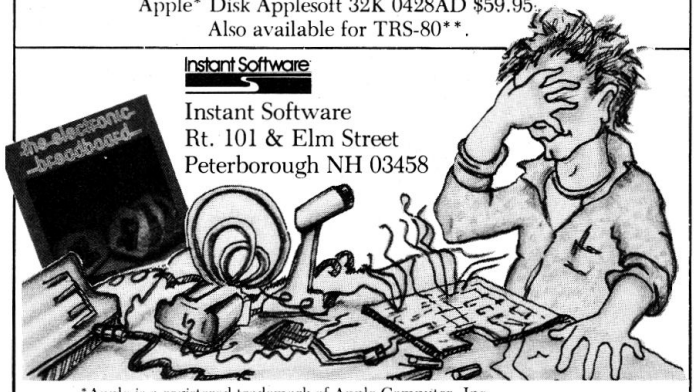
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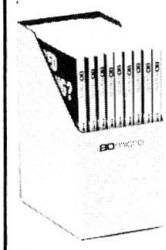
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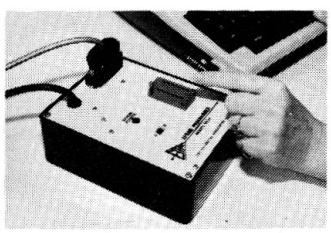
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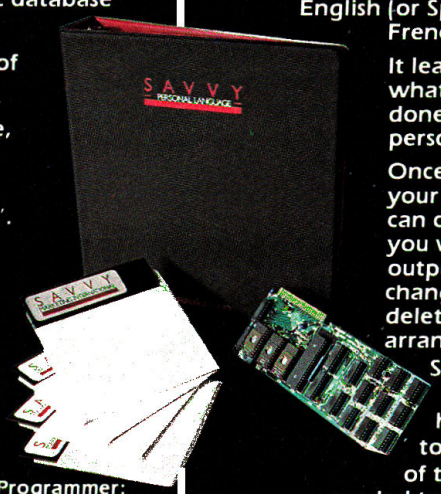
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dents unmanageable. The excitement level is high, but I think games like these channel high energy levels constructively.

A teacher's manual explains the reasoning behind the games and also makes valuable suggestions for interpreting results. Game experiences are recalled and skills are reinforced by use of special flash cards, which contain solutions for 52 of the most difficult problems. The teacher's manual suggests activities for the use of the cards in conjunction with the game software.

This software can be used by both parents and teachers to eliminate fear, dread and drudgery from primary grade math drills. Academic Skill Builders is available from DLM at One DLM Park, Allen, TX 75002. Price is $220. ■

Brian J. Murphy
Fairfield, CT

Casino

Gather round and ante-up, guys. Card sharks are not allowed at the Golden Apple Casino. This hi-res card disk opens up with chords from The Entertainer, and then opens a bank account of $1000 in your name. Quit at any time and it debits or credits your account with the results of your luck at the gaming tables. Your balance is always current when you boot the disk. The account file keeps a record of your account at each table.

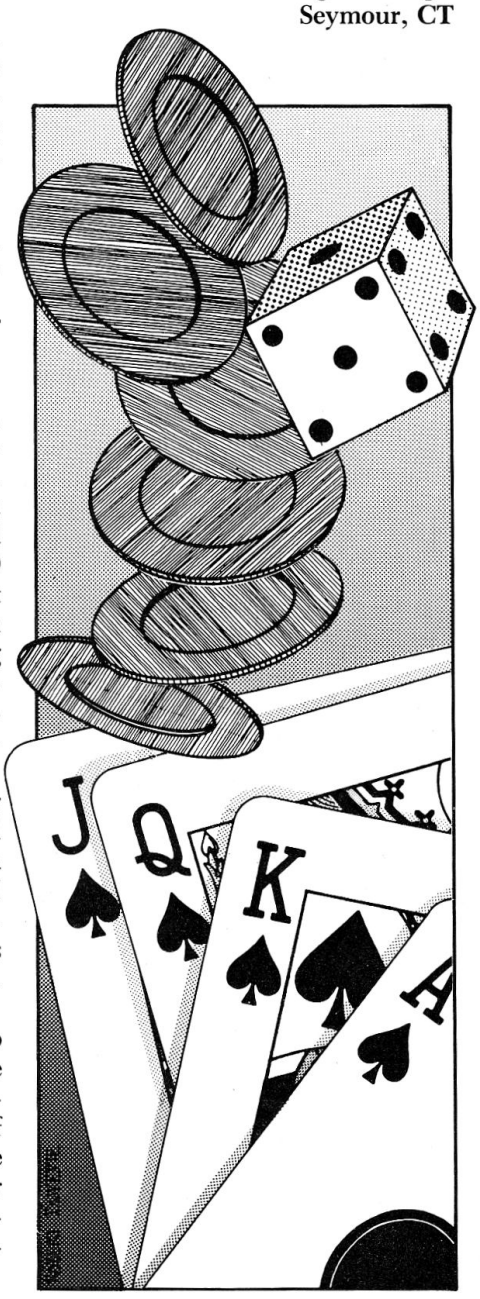
The main menu opens with your choice of: New Player, Individual Statistics, Top Five Scores, Delete a Player, Music On/Off, and so on. I entered and played 20 players at different gaming tables, rotating names and games, and it kept track of it all. Impressive!

There are five different games to play: blackjack, keno, poker, roulette and baccarat. You are offered the opportunity to look at a page or two of instructions on each game at any time before or during play. Just hit R for rules or Q for quit. The QUIT command will then save your current account to disk. Good thinking.

The large repertoire of music, while cute at first, can get on your nerves after awhile. The card games are all in hi-res and well done. I started with $1000 and managed to bankroll it to $140,000 in two long sittings!

Casino is an excellent game with save features, produced by Datamost, 9748 Cozycraft Ave., Chatsworth, CA 91311. Its price of $39.95 is a bit high. Try a demonstration, I think you'll like it. Good Luck! ■

George M. Engel
Seymour, CT



Jawbreaker

If there is one word I hate to use indiscriminately it's cute. But for some reason, cute is the only adjective I can think of to describe Jawbreaker, a new game for the Apple II from Sierra On-Line.

Jawbreaker is from the Pac-Man school of maze-type games. A set of chomping teeth is pitted against a barrage of sweets in a video candy store. Your choppers are controlled by either the keyboard or a joystick. The object is to munch as many treats as possible and to avoid attacking "smile faces" that periodically roll your way. Biting into a happy face can be a tooth-smashing disaster unless you first swallow an energizer.

The maze itself is interesting. It constantly shifts the openings between levels back and forth. Timing is critical. The action is quick and the graphics bright and entertaining. After finishing a level, your teeth are brushed and you're on to the next level. After completing a few levels, Jawbreaker provides an entertaining floor show. I have to admit I was amused.

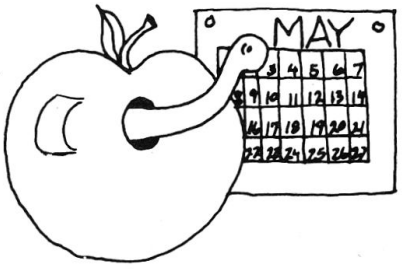
An interesting option is offered for those who choose the keyboard for input. Jawbreaker lets you decide which keys will be used for up, down, left, right and stop. Why don't we see this more often?

The game can be adjusted to your taste with ten different levels of difficulty. The lowest level, 0, is great for kids. It's slow enough for even the youngest to enjoy.

This may not be a game for serious arcaders, because the same four-level maze is displayed every time. Once you get the pattern down, it is not difficult to breeze right through. But for a family game, or for something to entertain the kids, Jawbreaker is hard to beat. Persons who find the majority of arcade games too violent will find nothing to fear in Jawbreaker. This game is so cute, it is hard not to like it. ■

Chuck Doherty
South Dartmouth, MA

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—the editors

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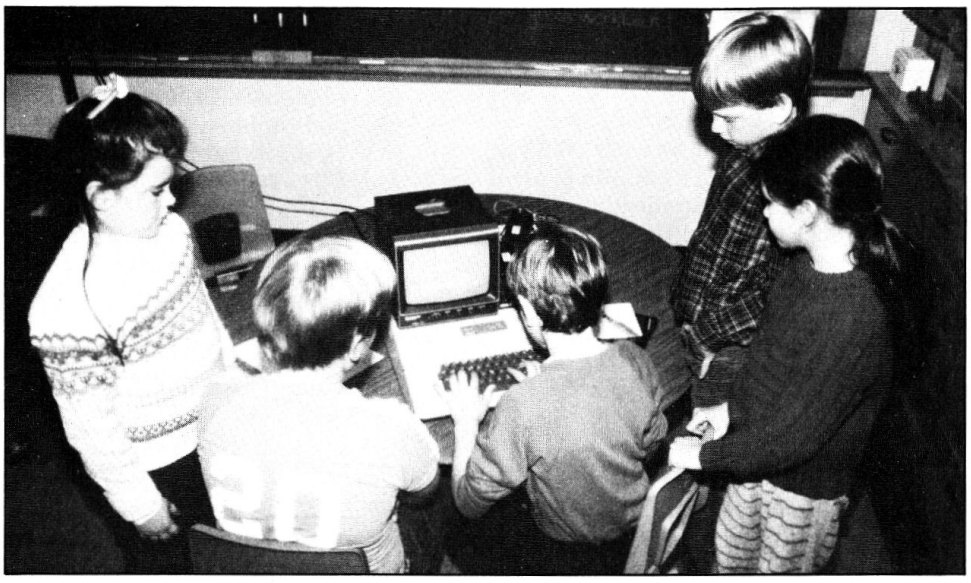
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New Software

edited by Tom Woods



MasterType combines the action of a space invader game with a series of typing lessons.

Fantasy Game

Sierra On-Line Inc., 36575 Mudge Ranch Road, Coarsegold, CA 93614, offers a fantasy game, The Dark Crystal, that is based on the motion picture of the same name. The player must replace a missing shard in the broken crystal in order to save the world. Price is $39.95. Reader Service number 441.

Algebra 5

Edu-Ware Services Inc., Box 22222, Agoura, CA 91301, offers Algebra 5, the fifth program in a series that is equivalent to a first-year course in algebra. Students can work sample problems, read a discussion of a concept, watch as an equation is solved, or study the rules that govern an operation. Algebra 5 covers irrational numbers, radical expressions, square roots, quadratic equations and quadratic inequalities. Price is $39.95. Reader Service number 442.

Music Maker

Apple II owners can create and play music with Music Maker. The user can enter dotted notes, triplets, quintuplets, staccato, regular or legato notes. The range of 50 tones—from F below low C to F# above high C—gives the notes necessary for virtually every melody ever written.

No special programming knowledge is necessary. The sound signal can be sent to the Apple's own internal speaker or routed to the cassette port where the output can be used to drive an external amplifier and speaker system. Price is $39.95. Contact subLOGIC Corporation, 713 Edgebrook Drive, Champaign, IL 61820. Reader Service number 443.

Chemistry Queries

Cross Educational Software, 1802 N. Trenton St., Box 1536, Ruston, LA 71270, offers four new chemistry question files that contain over 1600 questions on 70 topics. Chemistry 601 and 602 cover high school chemistry topics, while Chemistry 603 and 604 are more advanced. Each program contains multiple choice, matching and essay questions. Questions may be selected in any order and may be taken from several questions disks. Price is $49.95. Reader Service number 444.

The Filer

Central Point Software Inc., Box 19730-#203, Portland, OR 97219, offers the Filer, an Apple disk utility system for 35, 40 and 70-track drives. The Filer package contains a disk drive speed check, disk drive test, a 35-second copy program and a file manager. Options include: Copy Files, Copy Disk, Copy DOS, Delete, Lock and Unlock Files, and Change Booting Program. Price is $19.95. Reader Service number 449.

MasterType

Apple II users can learn touch-typing skills in a video space wargame format with Lightning Software's MasterType. MasterType combines the action of a space invader game with a series of 17 progressive typing lessons. Following each lesson a report of the number of words typed and number of words mispelled is displayed.

MasterType includes a manual that contains hints on how to win the game, finger charts for the keyboard, suggestions for successful touch-typing, and descriptions of the preprogrammed language. Price is $39.95. Contact Lightning Software, Box 11725, Palo Alto, CA 94306. Reader Service number 440.

Menu Maker

The Menu Maker, a utility for Applesoft programmers, helps create and edit disk program menus. Thirty items per menu and 15 submenus can be created. Editing capabilities include add, delete and change. Contact LRH Enterprises, 358 Ashley Blvd., New Bedford, MA 02746. Price is $19.95. Reader Service number 445.

Strategy Games

Mirror Images Software Inc., 1223 Peoples Ave., Troy, NY 12180, offers two new strategy games designed for the Apple II. Both are sold on the same disk for $34.95.

Hide and Sink is a strategy game of the high seas. The challenger is equipped with a naval fleet of vari-

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S.A.M.



S.A.M. programmed by Mark Barton.

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Requires 32K, disk. (S.A.M. takes up 9K; RECITER 6K.) Note: to produce the highest quality speech, S.A.M. automatically blanks the screen during vocal output; the display is preserved. S.A.M. can talk with the screen on, but the speech quality is reduced.

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Apple-Cillin II: $49.95. PA residents add 6% State Sales Tax.

XPS

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323 York Road
Carlisle, PA 17013

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ous vessels, which are hidden on a 10-by-10 sea grid. The fleet is pitted against the computer's fleet. Full color graphics display the status of both fleets, register hits and misses, and prompt players to make moves.

Hextay is a computerized board game inspired by the ancient Chinese game of Go. Players take turns placing their "stones" on the computer's screen board, one at a time. The object of the game is to dominate the board by surrounding opponents and removing their stones. Reader Service number 455.

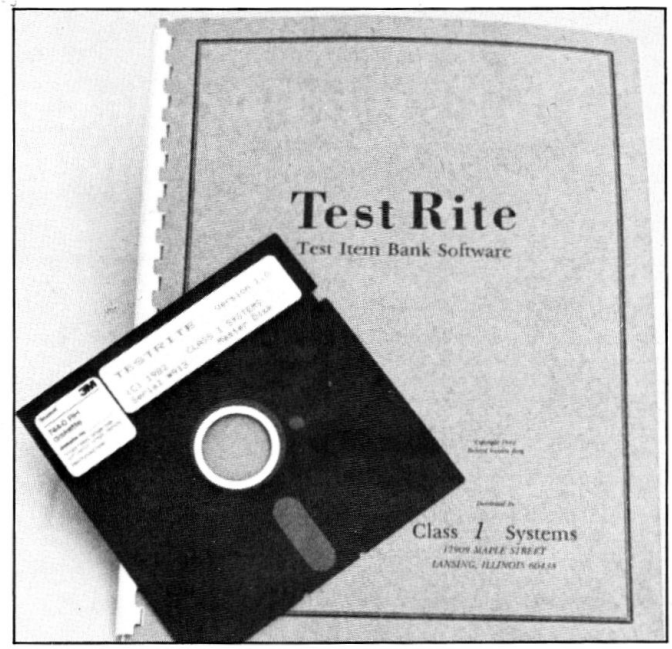
Customized Tests

TestRite is an educational program that stores test items and generates customized tests. It is suitable for use by teachers at all grade levels. Test items from any discipline may be entered, edited and printed into classroom tests and study guides. Large tests can be created by merging multiple files of questions. Every question may be printed in any of four formats: multiple choice, true/false, matching and completion. Price is $139. Contact Class 1, 17909 Maple St., Lansing, IL 60438. Reader Service number 447.

Word Weaver III

Synergistic Software, 830 North Riverside Drive, Renton, WA 98055, offers Word Weaver III, a new program for the Apple III that can be used for a variety of word processing functions.

Output can be printed with various shaped margins in geometric designs for advertising or greeting cards. Writers can orga-



TestRite, from Class 1.



Agri-Ledger accounting system from Small Business Computer Systems.

nize text by using global editing commands that provide replace, delete, move, kill and copy functions. Text can be displayed on the screen in 80 columns and printed output may be up to 185 columns in width. A single file can hold 15 to 20 pages of text on 128K machines, and files can be linked during printout. Price is $99.95. Reader Service number 454.

Agri-Ledger

Small Business Computer Systems Inc., 4140 Greenwood, Lincoln, NE 68504, offers Agri-Ledger, a menu-driven, double-entry accounting system for agricultural operations.

Designed for Apple computers, Agri-Ledger provides for income statements and balance sheets, budget reports, enterprise analysis and quantity fields. Cash flow templates are included for both farm and personal items. Price is $550. Reader Service number 451.

Bulk Mailer

Satori Software, 5507 Woodlawn Ave. N., Seattle, WA 98103, offers Bulk Mailer, a specialized data application program for the Apple II hard disk user. Bulk Mailer includes online access to 32,000 names, complete and fast zip sort, alphabetical sort, coding capability, and duplication/elimination search. The disk version of Bulk Mailer is $125. The Corvus version is $250. Reader Service number 450.

Millionaire

Millionaire, The Stock Market Simulation, is now available for use on the Apple II Plus. The object of this fantasy game is to be-

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"Apple Interactive Data Analysis." **Statistical analysis** package for production research work with large survey data files. Full range of analysis — from descriptive statistics to multiple regression. Complete data manipulation, transformation and case selection. Fast and accurate calculations. Up to 4,000 cases and 255 variables per file. $235.

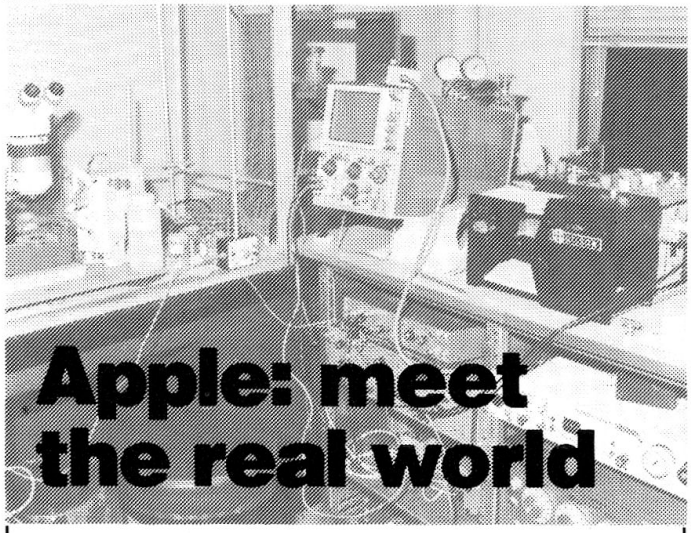
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come a millionaire in the stock market. Players can choose to buy and sell 15 different stocks, and information is provided to help players make informed decisions. Charts of overall market activity over an extended period of time and of selected industry segments can be displayed. Price is $79.95. Contact Blue Chip Software, 19824 Ventura Blvd., Suite 125, Woodland Hills, CA 91364. Reader Service number 457.

Pick That Tune

Pick That Tune contains 100 different songs divided into four categories: popular, country and western, children and TV. Players choose the number of notes they think they must hear to correctly identify the tune. Using a sound generator, Pick That Tune begins with the lowest bidder and then plays the number of notes each player has bid until the tune has been identified.

There are 16 different variations of the game. Top ten player files are automatically maintained for each of the game variations. Price is $29.95. Additional tune categories may be purchased separately. Contact Swearington Software, 6312 W. Little York, Suite 197, Houston, TX 77088. Reader Service number 446.

Save an Empire!

Zendar is an economic/defense game in which the player must take charge of a failing empire. The player must allocate aid and resources, annex other countries, make trade agreements, and defend the empire's borders from enemy attack. Zendar is $29.95 and will run on any DOS 3.3 Apple II system with 48K memory and Applesoft ROM. Contact subLOGIC Corporation, 713 Edgebrook Drive, Champaign IL 61820. Reader Service number 456.

Children's Games

Xerox Education Publications, 245 Long Hill Road, Middletown, CT 06457, offers two new programs for children. Stickybear Numbers helps young children develop number recognition and counting skills. Included with the program disk are a numbers poster and a 32-page hardbound book. Old Ironsides is a game of naval strategy and skill that includes a log book for recording battles, voyages and scores. Both programs are $39.95. Reader Service number 452.

Cross Assembler

The XASM-80 Cross Assembler is a software package that allows 8080 software development on an Apple II. The package consists of an editor and an assembler. The editor enables the user to create 8080 assembler source and text files. Files may be saved either on disk or used as input to the assembler. The assembler assembles 8080 source programs and generates a program listing and an object code. Cost is $45. Contact Allen Systems, 251 Fairfax Rd., Columbus, OH 43221. Reader Service number 453.

Cider Vinegar

Graphing Growth, February

I found an error in the "Graphing Growth" article (February 1983). When I ran it, it wouldn't save the data. By changing lines 1430 and 1590 to D$ = CHR$(4) it worked.

Karl Horning
1581 St. Charles
Lakewood, OH 44107

Applesoft Adviser, February

There is a problem in my February "Applesoft Adviser" article. The line 30 GOSUB 1000 was added in the magazine production process. Written in this way, the program also needs 999 END to make it work.

I wanted the listing to illustrate the use of a data input subroutine. So, between the opening lines of the listing and line 1000, I inserted GOSUB 1000 to indicate that this listing would be a part of larger program, and that the lines up to 999 would contain the rest of the program. I assumed that anyone following this format would take care not to allow the main program to run into the subroutine at line 1000.

To repeat, to get the program that was actually printed in the February issue to work, a new line, 999 END, must be added.

Dan Bishop
Custom Comp
PO Box 429
Buena Vista, CO 81211

Downgrade Your Apple, February

I was disappointed to read "Downgrade Your Apple" in February's *inCider*. Paragraph seven says, "After rushing home, I plugged it into the empty socket on the RAM board and powered up. The screen promptly filled with garbage. Something had to be wrong. No amount of plugging, switching or typing at the keyboard would make anything happen. It just did not work."

What your author is talking about is plugging an Apple old monitor ROM into a socket on our MPC AP-32 RAM card. That socket, as clearly stated in the accompanying manual, is for use with a 2716 EPROM. So naturally it did not work. If one puts the old monitor code in a 2716 EPROM, you may then have both monitors available. I have three monitors available in my Apple.

We make a claim in our ads that another monitor is available utilizing our RAM board. You have published, for all to read, that our product fails to perform as advertised.

J. Morton Stong
MPC Peripherals Corp.
9424 Chesapeake Drive
San Diego, CA 92123

Applesoft Adviser, March

The Datebook program in the March "Applesoft Adviser" column ran fine with no data in the 1000 to 7999 section, but I had problems when I tried to run it after adding appointments. On page 38, your Note states you must not use commas or colons in the Data statement. So I entered data with no commas between the time and the description of the appointment. Of course, it only works if you separate the two with a comma as shown in your example. In other words, your note was misleading.

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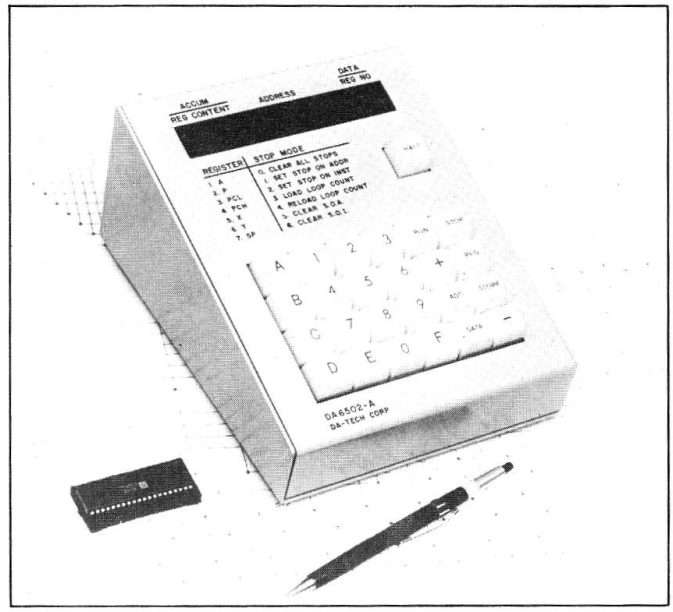
New Products

edited by Tom Woods

System Analyzer

A new interactive microprocessor in-circuit system analyzer designed to facilitate 6502 software development is offered by DA-TECH Corporation, 92 Steamwhistle Drive, Ivyland, PA 18974.

Designed for use by electronic designers and field personnel, the system analyzer allows the user to quickly examine various processor registers, read and modify memory locations, halt a program at a specific address, and work through a program one step at a time. The 6502 in-circuit system analyzer has an eight-digit hexadecimal display, divided into three sections. Price is $279. Reader Service number 466.



The in-circuit system analyzer from DA-TECH Corporation. It is designed to facilitate 6502 software development.

Fitness Logger

A miniature personal ambulatory blood pressure and ECG recording system using a pocket stereo recorder and an Apple computer is offered by Vitalcomp Inc., Chanhassen, MN 55317.

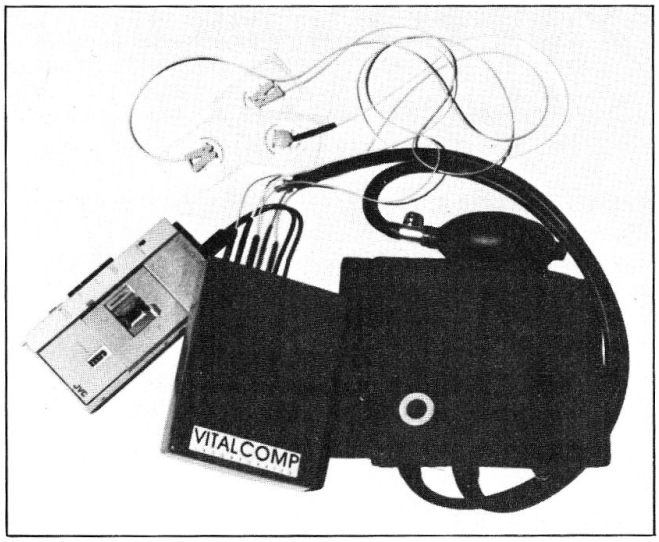
The Fitness Logger uses components such as a standard blood pressure cuff, ECG electrodes, an FM record module and an Apple interface card. An accompanying disk contains eight fitness and personal history programs and allows the body signals to be presented on the display in the ECG strip chart format: heart rate, blood pressure wave form, and computed systolic, diastolic and mean arterial pressure. This data can then be compared with past history in assessing personal fitness development. Price is $494.50. Reader Service number 474.

The Wizard

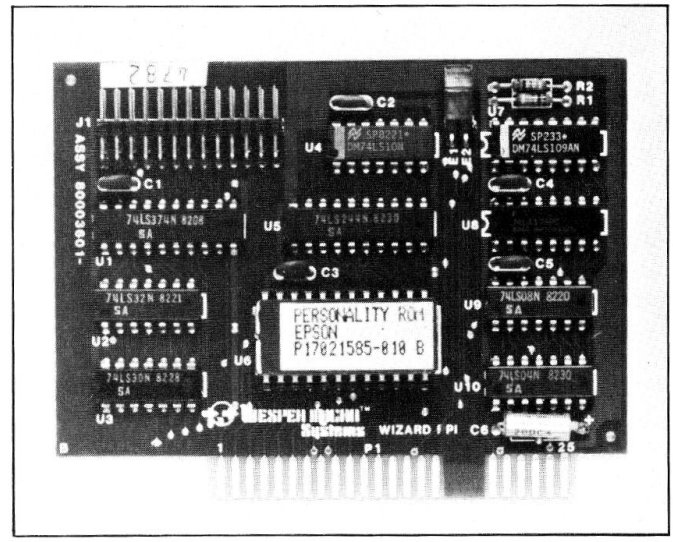
The Wizard-IPI printer interface card extends printer capabilities beyond simple text printing. Text formatting such as variable line length, left and right margins, page length, perforation skip, and text screen dump are supported. The Wizard-IPI can be run with most Apple expansion boards. Graphics firmware for the unit is contained in an on-board personality ROM, eliminating the need for any special software driver in the operating system. Price is $84. Contact Wesper Microsystems, 3188 Pullman St., Costa Mesa, CA 92626. Reader Service number 463.

Protect Your Apple

Trace Systems Inc., 1928 Old Middlefield Way, Mountain View, CA 94043, offers Station II, a security/protection system for the Apple II. Station II turns your Apple, monitor and disk drives into a single inte-



The Fitness Logger from Vitalcomp Inc. measures personal fitness development.



The Wizard-IPI printer interface card from Wesper Microsystems can be run with most Apple extension boards.

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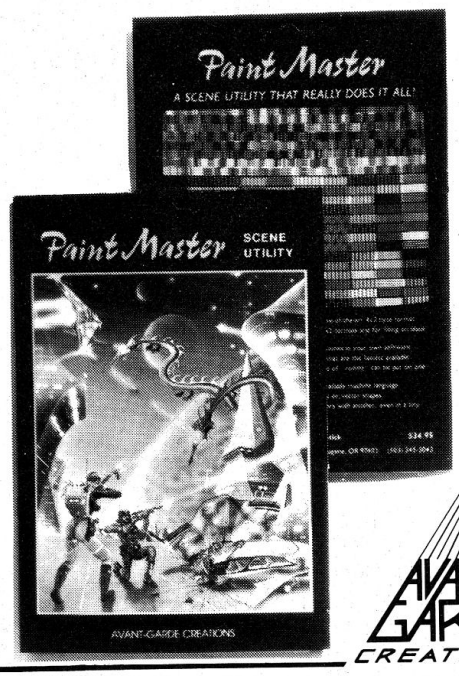
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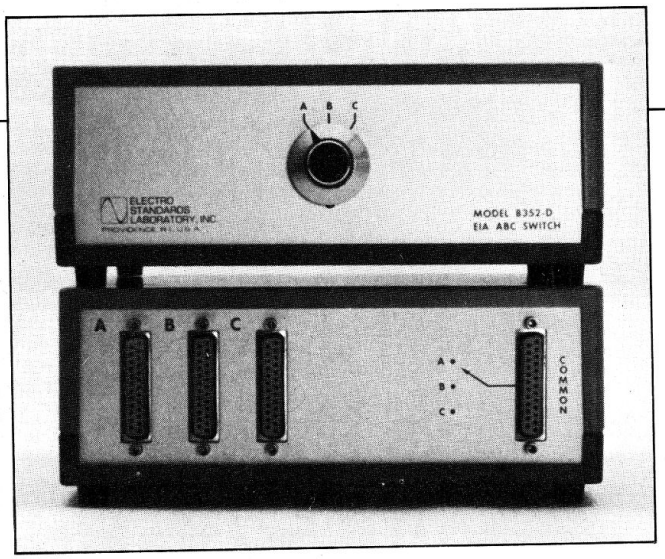
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The Model 8352-D A, B, C switches from Electro Standards Laboratory.

grated work station. Connecting these components into Station II's built-in power switch clears your desk of electrical cords and cables and helps protect the computer from power surges. When Station II is bolted to a desk, your Apple can be locked inside using the key provided. Price is $129. Reader Service number 462.

Discwasher

Discwasher disk drive cleaner uses a fiber grid cleaning system to dislodge and collect foreign matter from sensitive disk drives. The self-contained cleaning disk requires no fluids and is loaded into the drive like any disk. It is available in both 5¼-inch and 8-inch formats. Price is $19.95 for the 5¼-inch format and $24.95 for the 8-inch format. Contact HWH Enterprises Inc., 16 East 52 St., New York, NY 10022. Reader Service number 471.

A,B,C Switches

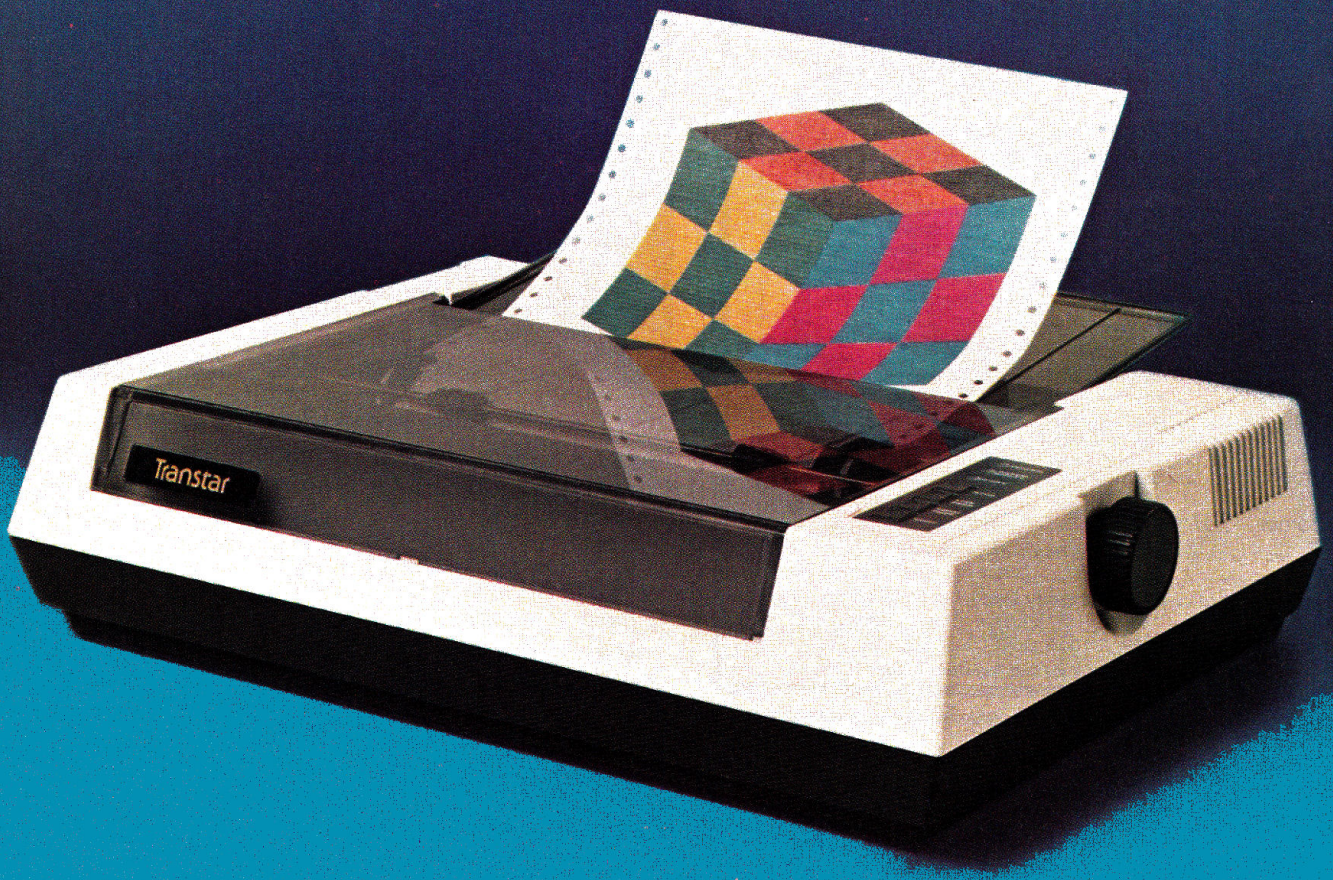
Electro Standards Laboratory Inc., Box 9144, Providence, RI 02940, offers Model 8351-D and Model 8352-D RS-232 A,B,C switches. Both models are designed to improve computer room efficiency by providing the capability to share one computer port among three peripherals. The products allow three terminals to use one I/O port, three CPUs to share one printer, or three terminals to share one modem. The 8351-D is $160, and the 8352-D is $180. Reader Service number 464.

Select-A-Port

TG Products, 1104 Summit Ave., Suite 110, Plano, TX 75074, offers Select-A-Port, an Apple II accessory. The Select-A-Port plugs into a single socket of the Apple and provides the computer with five switch-selectable sockets that can be used with joysticks, track balls and game paddles.

Three of the sockets are isolated by diodes to prevent device-to-device interference. The fourth socket modifies a joystick, track ball or paddle controller to operate as a second unit in a multiplayer game. And the fifth socket has no isolation circuitry and is designated for

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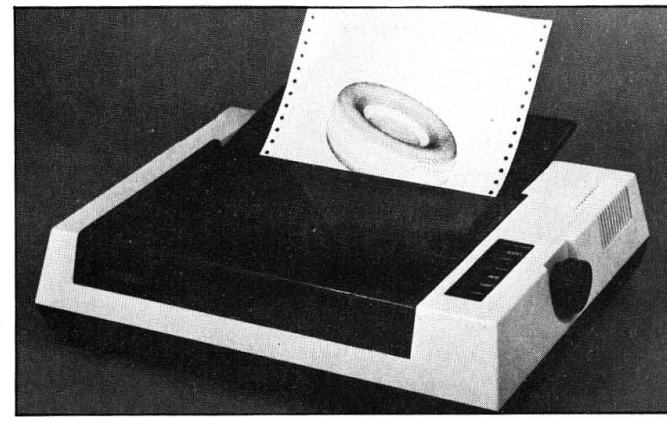
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The Transtar 315 color printer.

highly selective devices. Price is $59.95. Reader Service number 472.

Q-Pac

Microtek Inc., 9514 Chesapeake Drive, San Diego, CA 92123, offers Q-Pac for Apple II and II Plus users. Q-Pac is designed to work with VisiCalc and other programs that require additional memory; 80-column display; and disk emulation that operates about 100 times faster than standard disk drives.

Q-Pac consists of a 128K disk emulation system with on-board firmware; an 80-column screen card; and a software program used in conjunction with VisiCalc. Price is $699. Reader Service number 470.

Transtar Printers

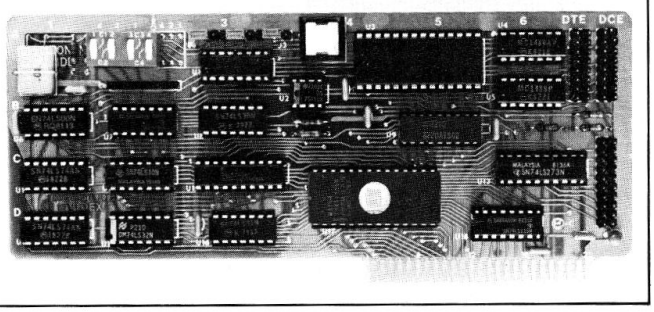
Transtar, Box C-96975, Bellevue, WA 98009, offers the Transtar 130, a daisy-wheel printer that is compatible with all word processing software. The 130 prints fully-formed characters, bidirectionally, at 16 cps. Cartridge ribbons are available in cloth, or single and multistrike mylar film. The 96-character plastic print wheels come in pica, elite and proportional styles. Price is $895.

Transtar also offers a color printer, Transtar 315. The 315 uses a four-hammer head with a rotating platen. Each of the four hammers prints only one of four primary colors so that any of the over 30 possible shades can be printed with a single pass of the printer head. Price is $599. Reader Service number 460.

Dirt Cheap

The Dirt Cheap video interface card connects the Apple II or Apple II Plus to a monitor or TV set with an rf modulator, and provides a 64-column display in addition to the Apple II's standard 40-column display.

Dirt Cheap permits user selection of normal or inverse text and features linear memory mapping and replaceable character sets. It understands most standard Applesoft and Integer Basic screen commands as well as Apple Pascal commands that work on an Apple II. Price is $89. Contact Advanced Logic Systems, 1195 Arques Ave., Sunny-



The PSIO dual function interface card.

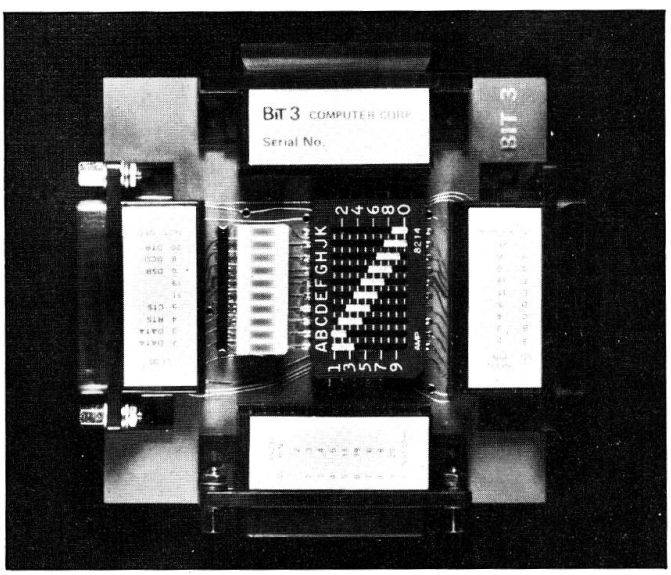
vale, CA 94086. Reader Service number 468.

Interface Card

Videx Inc., 897 N.W. Grant Ave., Corvallis, OR 97330, offers the PSIO dual function interface card. A printer and modem, or any other combination of parallel/serial peripherals, can be individually connected to and controlled by the PSIO. It is compatible with Basic and Pascal, and with the CP/M operating system, and includes a non-volatile ROM that remembers baud rate configurations and software selectable configuration options. Price is $299. Reader Service number 469.

Connector Matrix

The Bit RS-232 Connector Matrix permits mating of any two RS-232 connectors. It eliminates the need to fabricate special cables or resolder existing cable wiring to achieve a signal interface between two units. It is a tool for cable pin number cross connections, gender connector changes, and diagnostic troubleshooting. Price is $89. Contact Bit 3 Computer Corporation, 8120 Penn Ave. South, Minneapolis, MN 55431. Reader Service number 467.

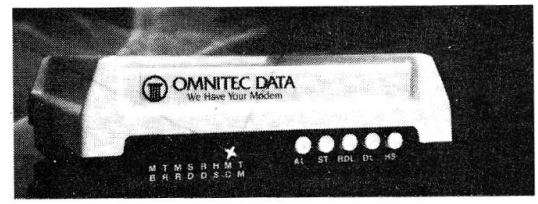


The Bit RS-232 Connector Matrix from Bit 3 Computer Corporation.

Circle 321 on Reader Service card.

- INTRODUCING -

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FOR THE APPLE II AND THE APPLE IIe



Ominitec Data announces "Omnilink 1200 Communications Package," which consists of a 300/1200 baud full duplex modem, Model 5212, a telecommunications card, and a software package called Softlink. This package is compatible with all major packet switching networks (eg. Tymnet, Telenet, and Uninet,) and regular phone lines. Uploading and downloading of files may be done at 1200 baud. Most other packages that support 1200 baud requires a hard disk, but this package will operate with any Apple II with 48K ram, one disk drive, and a monitor.

Omnilink also operates with a Videx 80 col. card, although it is not necessary. Before purchasing any other product of this kind, serious consideration should be given to this hardware and software.

A-C-C-E-S-S *VIDACCESS*

Start your own electronic network or online data base, or electronic mail system.

Vidaccess permits you to have your own online electronic database. This software used with the Omnitec modem enables other users to access your online service from other microcomputers at both 300 and 1200 baud. *Vidaccess* supports Xon/Xoff protocol for both uploading and downloading on other *Vidaccess*, A-C-C-E-S-S Systems, other online data bases, such as The Source, Compuserve, Dow Jones, Dialog, Delphi, and others.

As with *Vidaccess*, A-C-C-E-S-S also permits electronic mail, automatic send with a clock card, online data base access, auto-dial/auto-answer. As with *Vidaccess*, absolutely no prior computer or programming knowledge is required.

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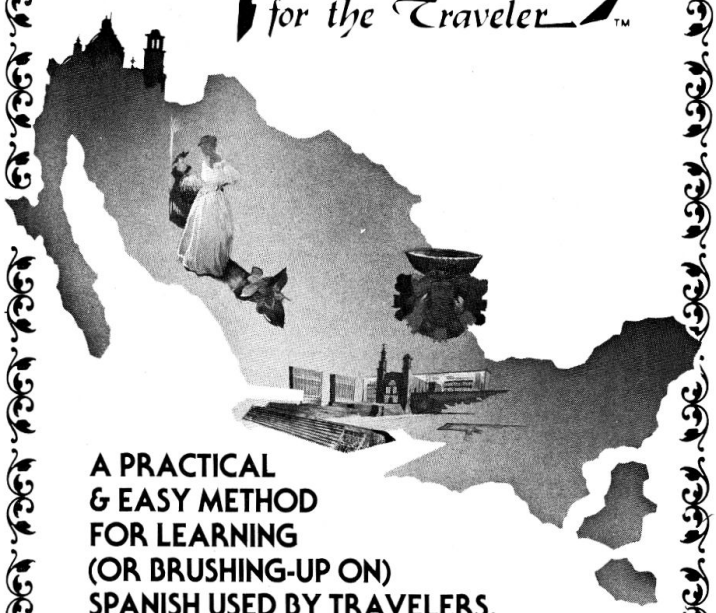
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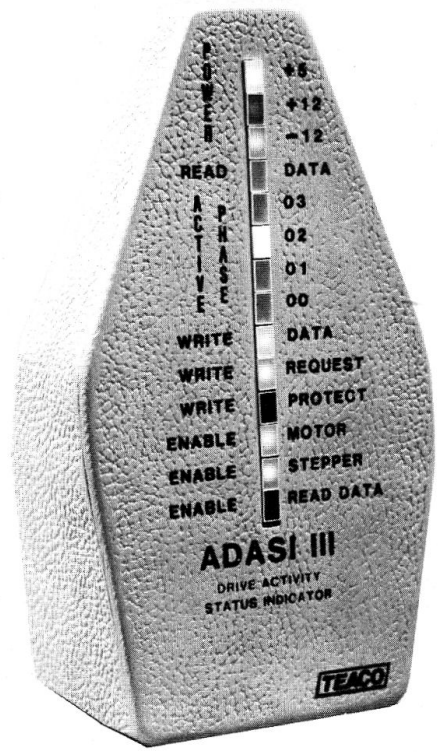
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ADASI drive signal monitors measure drive line status and computer power. They provide LED status indication of all lines connecting the floppy drive to the computer and indicate the power supply voltages to assure safe computer operation. They also display the status of all lines for system analysis. The ADASI I is designed for internal drive connection, and the ASASI II and III are designed for their respective drives and external connection. ADASI I is $59.50; models II and III are $139.50 and $149.50. Contact Terry Electronic Assembly Company, Box E, 2117 Ohio St., Michigan City, IN 46360. Reader Service number 473.

CP/M Card

The CP/M Card from Advanced Logic Systems and Digital Research is an interface card that plugs into any Apple IIe computer, permitting the user to run over 3000 CP/M-compatible application programs. The CP/M Card contains CP/M Plus, the most recent and powerful version of CP/M. The Card provides 128K of usable memory with CP/M Plus. Contact Advanced Logic Systems, 1195 East Arques Ave., Sunnyvale, CA 94086. Price is $399. Reader Service number 461.



The ADASI drive signal monitor from Terry Assembly Company Inc.

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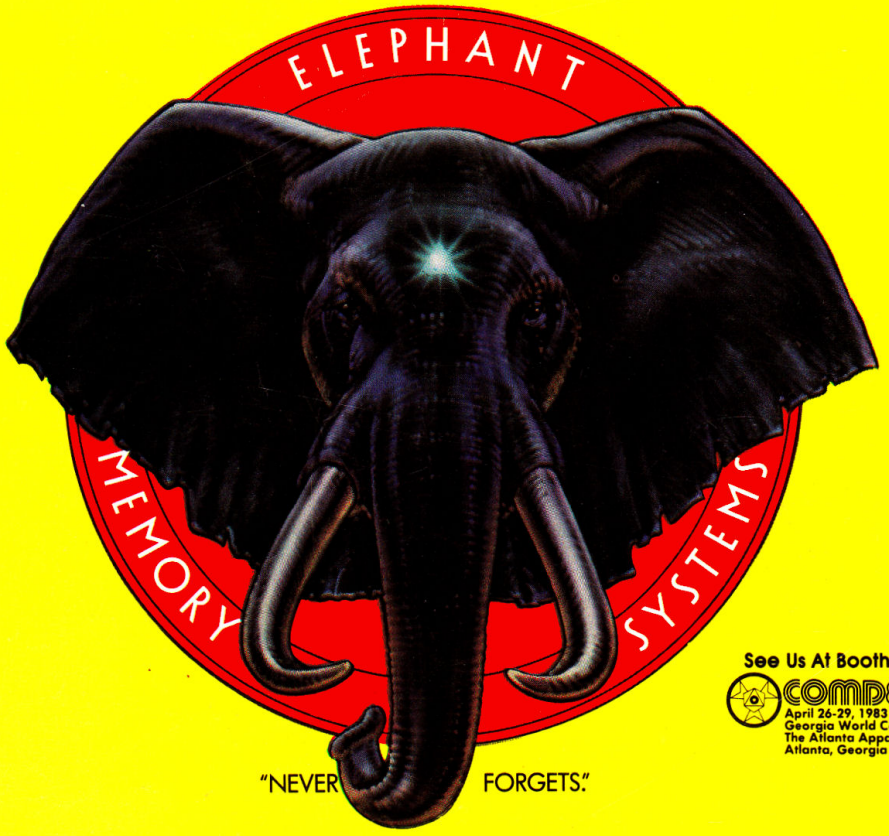
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